# Final Environmental Study Report (ESR)
# Volume 2 - Technical Appendices

City of Kitchener
Biehn Drive Municipal Class Environmental Assessment

November 2024

**Submitted by:**
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# Appendix A

Study Design

BT ENGINEERING

KITCHENER

# Study Design Report, Revision 1

## Biehn Drive Municipal Class Environmental Assessment

November 2021

**Submitted by:**

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BT ENGINEERING
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## Table of Revisions

| No. | Date | Revision |
|---|---|---|
| 1 | April 30, 2021 | Section 4.3.2.1.7 Cultural Environment revised to:<br><br>Potential Built Heritage Resources and Cultural Heritage Landscapes will be evaluated for the entire study area prior to the selection of preferred alternatives and summarized in the ESR. This review will identify all known or potential built heritage resources and cultural heritage landscapes (BHR/CHLs). If resources are present, a cultural heritage assessment report will be completed with the potential project impacts to BHR/CHLs identified and strategies will be provided to mitigate identified impacts. These mitigation measures will inform project planning and design.<br><br>An Archaeological assessment (AA) will be undertaken by an archaeologist licenced under the *Ontario Heritage Act*, who is responsible for submitting the report directly to the Ministry of Heritage Sport, Tourism and Culture Industries (MHSTCI). A Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition, and contacting MHSTCI to find out whether there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and determine whether additional archaeological assessment is necessary (e.g. Stages 2, 3, and 4). |
| 2 | June 7, 2021 | Section 5.0 and 5.1 to add Alternative 4. |
| 3 | June 7, 2021 | Section 1.1 revised to include a local and broader Study Area. |
| 4 | June 7, 2021 | Section 2.1 revised to:<br><br>Future development within the Doon South and Brigadoon communities requires a defined alignment for the extension of Biehn Drive to Robert Ferrie Drive as part of the area road network. In order to determine the road alignment, this Study will consider the natural, social environments and the future land use in the Study Area. The extension of Biehn Drive and the associated municipal servicing has been a longstanding part of the integrated plan for the Brigadoon neighbourhood. The planned extension will improve local access to Strasburg Road to safely and reliably accommodate all modes of transportation including vehicular, pedestrians, and cyclists, and provide access to potential future transit. By defining the future road and municipal servicing plans, the subsequent land use plans can be completed by developers. |
| 5 | June 7, 2021 | Section 2.2 revised to:<br><br>… The extension of Biehn Drive, in conjunction with the extensions |

| | | |
|---|---|---|
| | | of Robert Ferrie Drive and Strasburg Road, will result in a more balanced distribution of the existing neighbourhood traffic, increasing the traffic volumes along a short section of Biehn Drive while reducing the volumes that are currently using other neighbourhood streets. The EA will undertake community consultation and mitigating measures will be developed to reduce the impacts on the community and control traffic speeds… |
| 6 | June 7, 2021 | Section 2.3 revised to:<br>• Reduced traffic demand on other neighbourhood streets including Biehn Drive (to the north), Caryndale Drive and Marl Meadow Drive/ Teeplewood Drive resulting in reduced community disruption and improved road safety; |
| 7 | July 11, 2021 | Section 4.2.3.1.6 Natural Environment revised to include a detailed Terms of Reference (TOR). |
| 8 | November 2, 2021 | Section 6.0 Schedule updated. |

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# 1.0 Introduction

The City of Kitchener (City) has initiated a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The focus of the Study will be to consider alternatives for the alignment of the Biehn Drive extension, intersection locations and designs and municipal services while minimizing environmental, social, and cultural impacts of the project.

This report, the initial public document for the Municipal Class Environmental Assessment, presents a description of the work plan, preliminary alternatives, consultation plan and overall study process. It outlines the EA planning process and describes the key activities required to complete the Study. The Study Design will be circulated to various agencies and the Study's Technical Advisory Committee (TAC) and is available to the public on the City's website for review and comment.

***Note: At the time of release of the Study Design Report, the Province of Ontario has implemented restrictions on public gatherings to deal with the COVID-19 pandemic, and as such the distribution of materials is relying on web-based communications with the public. Subsequent stages of the study may revert to conventional public events to review the sequential planning decisions of the study.***

## 1.1 Study Area

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.

The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension.

Based on comments from the public at the Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods.

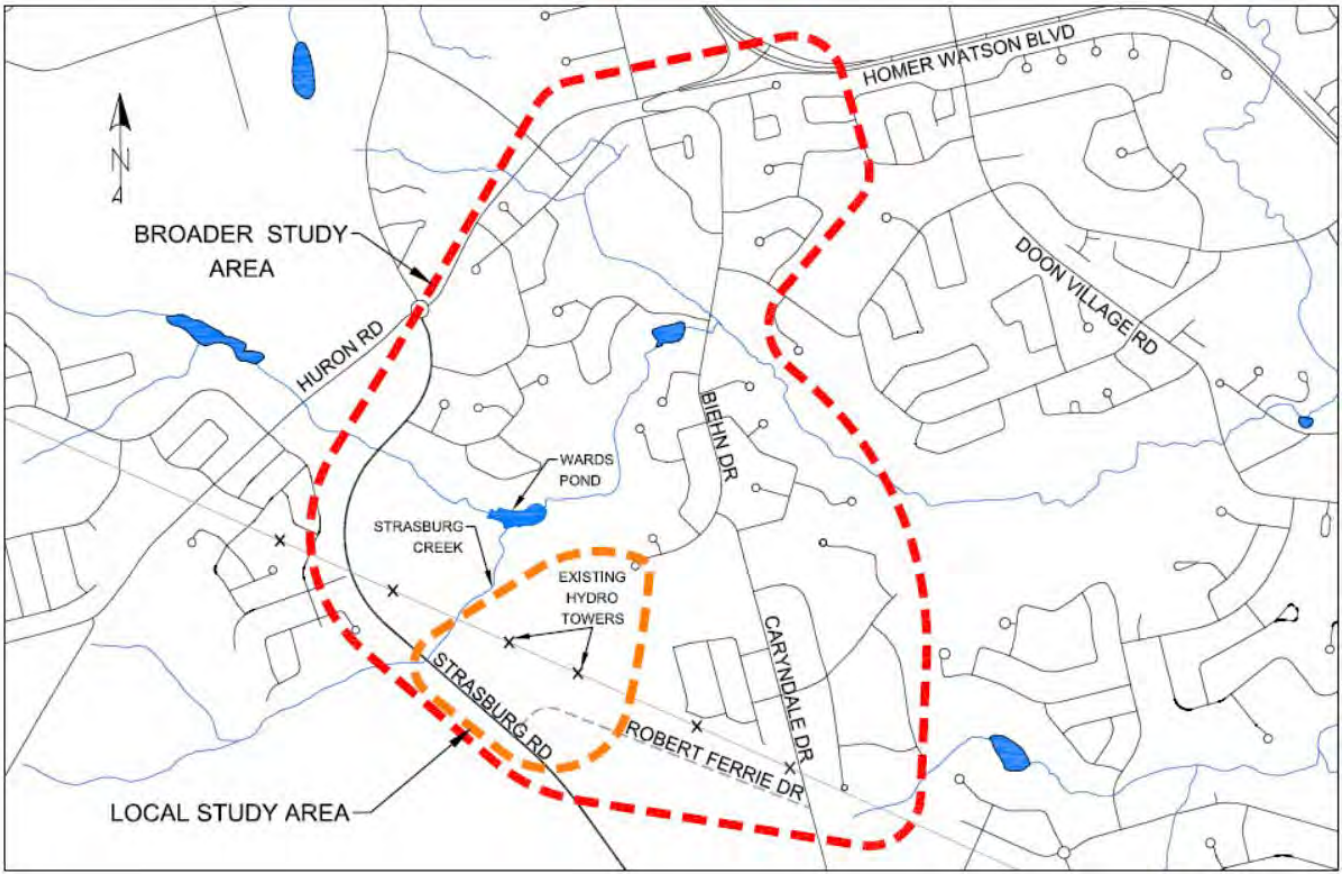


**Figure 1: Study Area**

## 1.2 Study Background

Since the mid-2000's the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener have planned for area development and evolving transportation needs. Several planning documents including the Official Plan and Transportation Master Plan (TMP) have identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension and ultimately to Strasburg Road. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan Amendment. This link would accommodate vehicles to and from the Brigadoon community, and would help mitigate cut-through traffic on local streets within the community. A collector road collects traffic from local roads within the community and provides connectivity to high tier arterial roads including Strasburg Road.

### 1.2.1 Background Studies

Background Studies have been completed within the Study Area to document the proposed land uses, transportation networks and existing issues. These reports are summarized in the following sections.

#### 1.2.1.1 Official Plan and Land Use

The City of Kitchener Official Plan (2014) documents the policies for growth, development, and land use within the City. Map 3 of the Official Plan identifies the land in the Study Area as Natural Heritage Conservation and Low-Rise Residential:

- Natural Heritage Conservation: This land use designation is used to protect and/or conserve natural heritage features and their ecological functions. This designation includes Provincially Significant Wetlands.
- Low-Rise Residential: This land use designation accommodates a range of low-density housing types including single detached dwellings, semi-detached dwellings, townhouses, low-rise multiple dwellings etc.

In addition to the general land use classifications, there is a Specific Policy Area (SPA) along the hydro corridor in the Brigadoon subdivision (SPA 45). This SPA states:

> *"Notwithstanding the Open Space land use designation and policies on the Hydro Corridor in the Brigadoon Subdivision (30T-88006) shared uses on hydro rights-of-way including open space links, parking lots or other uses accessory to adjacent land uses in accordance with Policy 14.C.1.37 and Policy 15.D.10.1 i) will be permitted."*

#### 1.2.1.2 City of Kitchener Transportation Master Plan

The Kitchener Integrated TMP (2013, IBI Group) identifies the need to extend Biehn Drive from its current terminus. The TMP recommended that Biehn Drive be extended westerly to Strasburg Road. This recommendation was modified in subsequent planning documents and EAs to recommend connection to the Robert Ferrie Drive extension instead, with the final determination to be defined by an EA (the current study).

#### 1.2.1.3 Region of Waterloo Transportation Master Plan

The Region of Waterloo's Moving Forward 2018 Master Plan (IBI Group, 2019) outlines the needs for active transportation, transit and Regional roads. This report identifies Biehn Drive as an Existing Local Route for Grand River Transit; however, the 2021 GRT System Transit Map no longer includes this link (Route 16 Stasburg-Belmont follows Biehn Drive from Old Huron Road to Black Walnut Drive).

#### 1.2.1.4 Kitchener Growth Management Plan (KGMP)

The Kitchener Growth Management Plan (KGMP) (2019) provides a framework to ensure that the City has "direct proper and orderly development within the boundary". The Plan prioritizes areas for development based on the supply of developable lands and existing infrastructure.

The extension of Biehn Drive, including a sanitary sewer, is identified in the Plan as a major remaining initiative for the Brigadoon community. There are two developments planned/proposed within this area (see **Figure 2**). A requirement for development of the lands, labelled 33 and 34 on **Figure 2,** is the extension of sanitary services and the Biehn Drive connection.

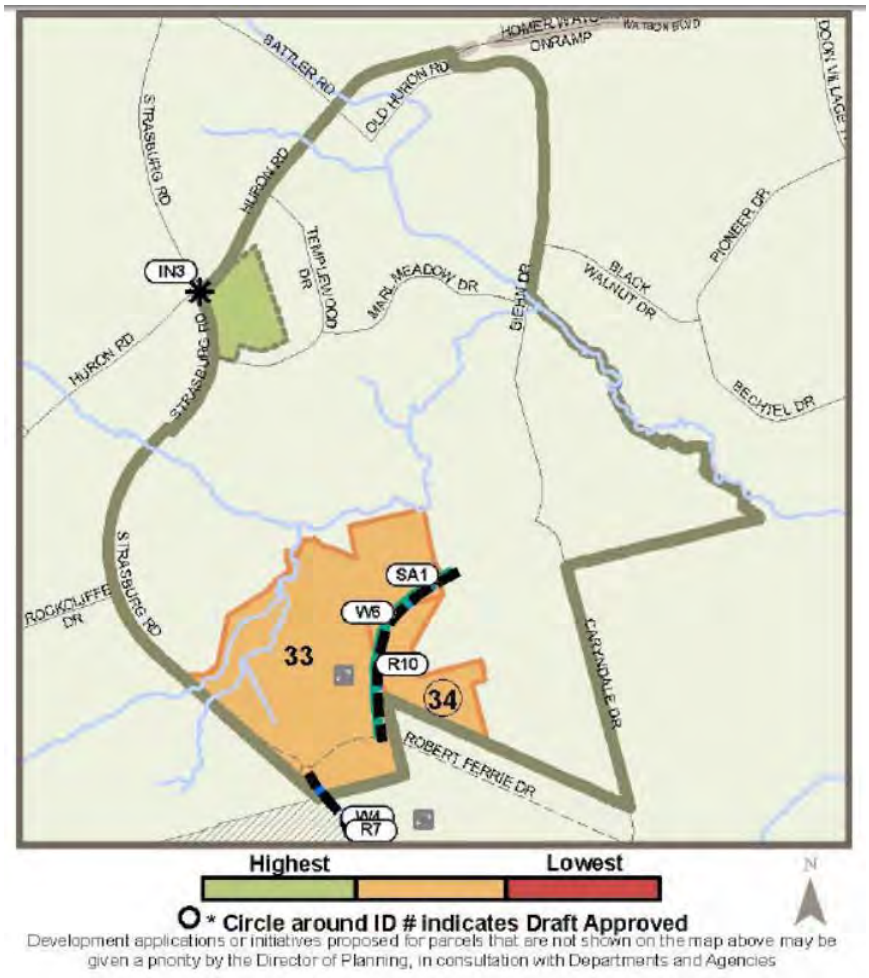


**Figure 2: Growth Area Subplan for Brigadoon (Kitchener Growth Management Plan, 2019)**

#### 1.2.1.5 Brigadoon Community Plan

The Brigadoon Community Plan (2004) documents the principles for the development of the Brigadoon Community. This plan identifies that the development of lands east and west of the

future Biehn Drive extension “shall require the construction of Strasburg Road and the Biehn Drive extension”.

#### 1.2.1.6 Sanitary Sewer Master Plan

The City of Kitchener is currently completing a Sanitary Sewer Master Plan.

#### 1.2.1.7 Integrated Stormwater Management Master Plan (ISWM-MP)

The City of Kitchener’s Integrated Stormwater Management Master Plan (ISWM-MP) (Aquafor Beach, 2016) identifies the prioritization of works for the City’s overall stormwater master plan. This report identifies that the Study Area is located within the Strasburg Creek subwatershed. This was identified as a Priority 4 subwatershed, which is an area where intensification should provide sufficient buffers to maintain the natural hydrologic cycle.

#### 1.2.1.8 Additional Reports

Additional background reports that will be reviewed as part of the study will include, as a minimum:

- City of Kitchener Standard Specifications
- City of Kitchener Standard Drawings
- Region of Waterloo and Area Municipalities Design Guidelines and Supplemental Specifications for Municipal Services
- Strasburg Road Extension Environmental Study Report
- South Strasburg Gravity Trunk Sanitary Sewer Project File
- East Side Lands Sanitary Servicing Environmental Study Report
- Doon South Pumping Station Draft Environmental Study Report
- Robert Ferrie Drive Extension Environmental Study Report
- Biehn Drive Extension and Need Justification Review
- Doon South Community Plan
- Huron Community Plan
- Southwest Kitchener Urban Area Studies - Community Master Plan
- Doon South - Brigadoon Transportation Network and Corridor Study
- Doon South Community and Broader Study Area Traffic Impact Study
- City of Kitchener Cycling and Trails Master Plan
- Huron Industrial Development Transportation Planning and Engineering Study
- Strasburg Creek Flood Control Environmental Study Report
- State of the Watershed (SOW) Report Upper Blair Creek
- Cumulative Effects Monitoring – Blair Creek Case Study
- Revised Final Stormwater Management Report Doon Creek – Robert Ferrie Drive Extension
- City of Kitchener Stormwater Management Facility Retrofit, Class EA and Preliminary Design Brief
- Upper Blair Creek (Kitchener) Functional Drainage Study Final Report

# 2.0 Need and Justification

## 2.1 Problem and Opportunity Statement

Future development within the Doon South and Brigadoon communities requires a defined alignment for the extension of Biehn Drive to Robert Ferrie Drive as part of the area road network. In order to determine the road alignment, this Study will consider the natural, social environments and the future land use in the Study Area. The extension of Biehn Drive and the associated municipal servicing has been a longstanding part of the integrated plan for the Brigadoon neighbourhood. The planned extension will improve local access to Strasburg Road to safely and reliably accommodate all modes of transportation including vehicular, pedestrians, and cyclists, and provide access to potential future transit. By defining the future road and municipal servicing plans, the subsequent land use plans can be completed by developers.

The Study will provide the opportunity to: improve accessibility to the local community by providing additional network links; define a multi-modal transportation plan to support travel within the local neighbourhoods and; allow development to proceed on lands that currently require the roadway plan to be defined prior to developing the land use plan.

## 2.2 Key Issues and Constraints

Key issues and constraints that will be addressed as part of this study include:

- **Impacts on the Existing Community:** The existing Brigadoon community is an established residential area with low ambient sound levels and low traffic volumes on Biehn Drive. The extension of Biehn Drive, in conjunction with the extensions of Robert Ferrie Drive and Strasburg Road, will result in a more balanced distribution of the existing neighbourhood traffic, increasing the traffic volumes along a short section of Biehn Drive while reducing the volumes that are currently using other neighbourhood streets. The EA will undertake community consultation and mitigating measures will be developed to reduce the impacts on the community and control traffic speeds. Measures may include traffic calming measures, pedestrians/cyclist facilities, and mitigation for noise impacts.
- **Natural Environment:** The EA will investigate the protection of surrounding terrestrial and aquatic habitat and will establish mitigation for any potential impacts to the natural environment. There is potential for Species at Risk (SAR) to be present in the adjacent woodlots and the Strasburg Creek Provincially Significant Wetland (PSW). Additionally, two cold-water systems (Strasburg Creek and Blair Creek) flow to the north of south of the Study limits. The provision of wildlife passage will be a key consideration for this work, as will mitigation of potential stormwater impacts to the Strasburg Creek system.

- **Transportation**: The EA will determine a preferred road corridor that will address long-term municipal infrastructure requirements and safely accommodate road users. In addition, the EA will need to consider the proximity to adjacent intersections on Robert Ferrie Drive and the need to accommodate trucks through the roundabout.
- **Active Transportation:** Active modes of transportation will need to be accommodated with separate facilities to provide the highest level of service and safety (multi use pathways, sidewalks, bicycle lanes and/or raised cycle tracks).
- **Planned/Proposed Development:** The extension of Biehn Drive will need to consider any proposed plans of subdivision and the potential network of future local streets.

### 2.3 Opportunities

The benefits from the completion of the EA study will include:

- Improved emergency service access to local community;
- Reduced traffic demand on other neighbourhood streets including Biehn Drive (to the north), Caryndale Drive and Marl Meadow Drive/ Teeplewood Drive resulting in reduced community disruption and improved road safety;
- Provision of active transportation linkages; and
- Establish the future road location which will allow planning and approvals for subdivisions.

## 3.0 Study Process

This Study will complete the remaining phases of the Municipal Schedule C Class EA Study which was initiated by the TMP. The Study will meet all requirements of the Municipal Class EA by establishing the need and justification for the project, considering all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and proactively involving the public in defining a Recommended Plan. The study will culminate in the filing of an Environmental Study Report (ESR) and provide environmental clearance to the City to proceed with the project, subject to permits and approvals that will occur during the future detail design stage of the project.

### 3.1 Guiding Principles

The study approach reflects the following the Ministry of the Environment, Conservation and Parks (MECP) five guiding principles for EA studies, namely:

- Consider all reasonable alternatives;
- Provide a comprehensive assessment of the environment;
- Utilize a systematic and traceable evaluation of net effects;
- Undertake a comprehensive public consultation program; and

- Provide a clear and concise documentation of the decision-making process and the public consultation program.

### 3.2 Environmental Assessment Act Requirements

The Environmental Assessment will follow the Class EA process, thereby meeting the requirements of the Municipal Class Environmental Assessment (2000 as amended in 2007, 2011 and 2015). The Study is being initiated as a Municipal Schedule C project based on the range on anticipated effects and capital cost of the project.

The Schedule C project will include two public meetings (a combined Community Café Event/Public Information Centre (PIC No. 1 and a second PIC) and conclude with the preparation of an ESR. The public will be provided with a 30-day ESR review period at the Study conclusion.

As the initial step in the Class EA process, this Study Design Report is being made available to the public. This is a discretionary Step of the Municipal Class EA process, as illustrated in **Figure 3** following Phase 2 of the Class EA process. This additional step is similar to the Step 1.2 activity in that it provides the context for a project where there has been a lag in time since the TMP was completed. The public and agencies will have this initial opportunity to comment on the proposed approach and previous TMP recommendations. The Class EA process does not have a public review period for TMP's following Phase 2, and this current study provides an opportunity for project specific comments.

### 3.3 EA Phases

The Municipal Class EA Process is illustrated in **Figure 3**. The following is the breakdown of tasks, by phase, for a Municipal Schedule C project:

**Phase 1: Identify the Problem (completed as part of the City's TMP)**

- Step 1: Identification and description of the problem or opportunity.
- Step 2: Discretionary public consultation.

**Phase 2: Alternative Solutions (Steps 1 to 8 completed as part of the City's TMP)**

- Step 1: Identification of alternative solutions to the problem.
- Step 2: Identify the study area and a general inventory of the natural, social and cultural environments.
- Step 3: Identification of the net positive and negative effects of each alternative solution.
- Step 4: Review and validation of alternative solutions.
- Step 5: Identification of reasonable design alternatives for the preferred solution.
- Step 6: Public consultation

- Step 7: Confirmation of design alternatives, finalization of Study Design for work program, and refinements to or addition of design alternatives to be carried forward to Phase 3.
- Step 8: Selection of the preferred solution
- Step 9: Study Design available on the City's website – added activity to initiate this current study.
- Step 10: Initial Community Café/PIC No. 1 added activity under this study to review/validate previous TMP recommendations and present preliminary design alternatives for public and agency comment before Phase 3 activities are initiated.

**Phase 3: Alternative Design Concepts for the Preferred Solution**

- Step 1: Identification of alternative designs.
- Step 2: Preparation of a detailed inventory of the natural, social and economic environments.
- Step 3: Identification of the potential impacts of the alternative designs.
- Step 4: Evaluation of the alternative designs.
- Step 5: Selection of preferred design.
- Step 6: Public consultation at PIC No. 2.

**Phase 4: Environmental Study Report (ESR)**

- Step 1: Completion of the ESR.
- Step 2: 30-day public review period.
- Step 3: Filing of the ESR and Notice of Completion.

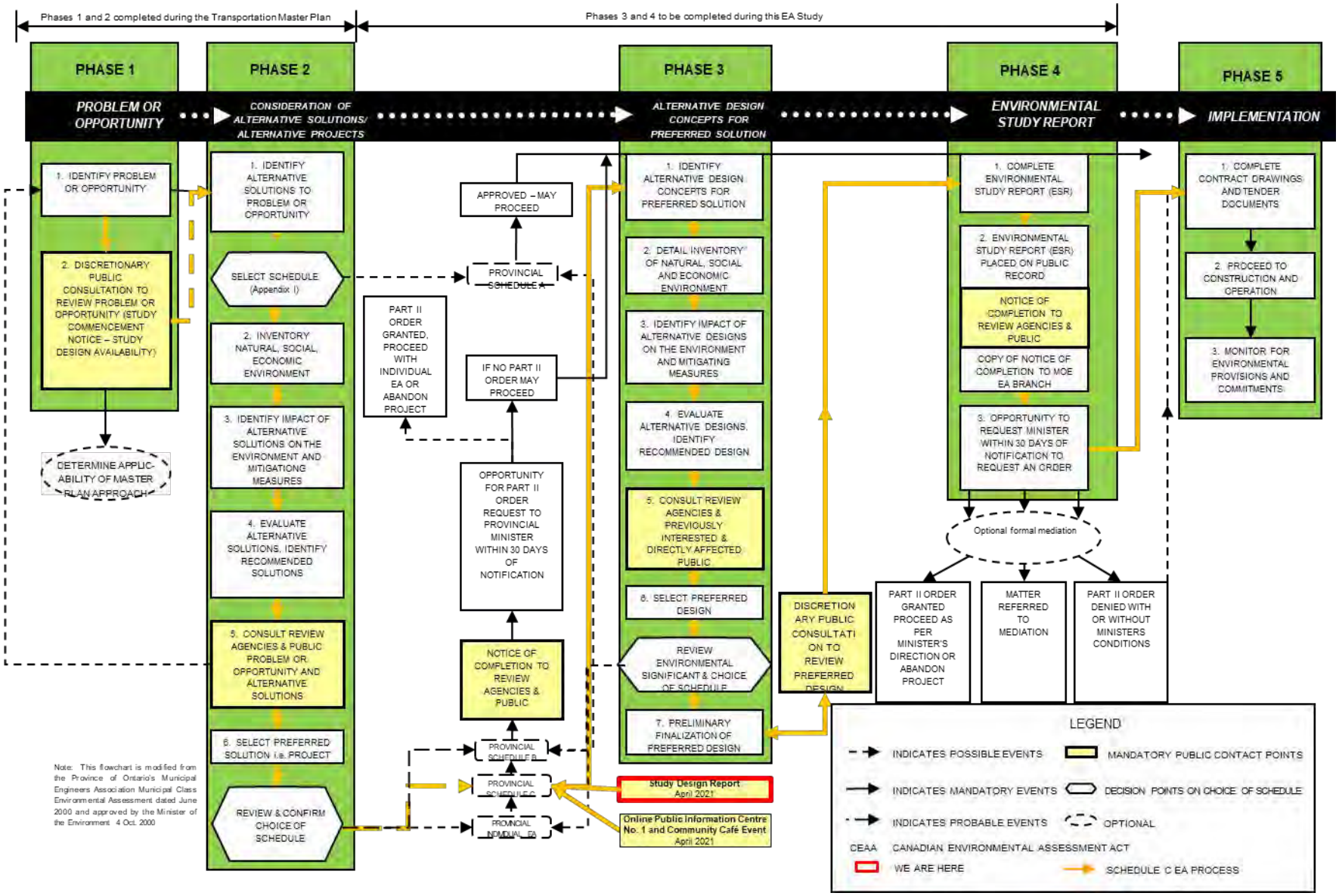


**Figure 3: Municipal Class EA Process**

# 4.0 Study Approach

Over the course of the study, input will be solicited from the public, stakeholders, agencies and Indigenous Communities. Input will be gathered through meetings, the project website, and discussions/communication with interested parties. The approach is to work collaboratively with interested parties to address issues and reach a consensus on the Recommended Plan.

## 4.1 Consultation Program

The Consultation Program identifies the opportunities for the Technical Advisory Committee (TAC) to discuss the Study with the public/stakeholders, agencies and Indigenous Communities. This Study will use several processes to engage with interested parties and provide an opportunity for input. The Consultation Program will include:

- Notices published in local newspapers, issued as media releases and directly mailed/emailed to the study mailing list at key points over the course of the study including:
    - Notice of Study Commencement at the study start-up
    - PIC No. 1/Community Café and PIC No. 2
    - Notice of Study Completion to announce the start of the 30-day public review period
- Communication and coordination with agencies/consultants to obtain background information for input into the study and to obtain required approvals/permits
- Study updates on the project webpage located on the City's website
- Project Team Meetings with City staff
- Meetings with affected property owners, local residents, businesses and Indigenous Communities

### 4.1.1 Public Consultation

The study will use several techniques to proactively involve the public including a Community Café event, PIC and meetings with external stakeholders. Meetings will be organized with the stakeholders and may include adjacent landowners and other affected businesses or associations. These meetings will include representatives from the City and the consultant team.

Two public meetings will be held. The first public meeting will be a combined Community Café event and PIC No. 1. This event will follow the principles of the World Café philosophy and will engage the public and stakeholders in discussion on their perspectives and interests in the study. The Community Café is a simple yet effective conversational method for fostering dialogue, accessing collective intelligence, and creating innovative possibilities for action. The

Café will be an informal event facilitating conversation by providing participants with a comfortable and welcoming environment.

The second public meeting will be PIC No. 2, which will present the evaluation of design alternatives and the Technically Preferred Alternative (TPA) for the Study Area. Council members will be provided PIC materials in advance of the meeting and the consultant will be available to present to Council in advance of the public meeting.

The public meetings will be an integral component of the study - seeking input and comments from the public and stakeholders. There will be an opportunity for the public to comment on the study at any time. All information will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* (2009). Anyone interested in the study will be added to the study mailing list upon request.

### 4.1.2 Agency Consultation

Agencies/Ministries will be contacted at the start of the study to inform them of Study Commencement and to circulate this Study Design. As the study progresses, meetings will be held with select agencies (as required) to review the study and obtain approvals in accordance with the Municipal Class EA. Agencies will include:

- Ministry of the Environment, Conservation and Parks
- Ministry of Natural Resources and Forestry
- Ministry of Indigenous Relations and Reconciliation
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Infrastructure Ontario
- Department of Fisheries and Oceans
- Grand River Conservation Authority
- Transport Canada
- Emergency Services
- School Boards/Bus Services
- Other Stakeholders (as identified)

### 4.1.3 Indigenous Peoples Consultation

The City of Kitchener has a constitutional duty to consult with Indigenous Peoples with traditional land use or interests within the Study Area. Clear, effective and timely consultation with Indigenous Peoples is essential to ensure the success of the project. This will include:

- Identification of interested/affected Indigenous Peoples early in the decision-making process;

- Distribution and notification of relevant project-related information, including the Class EA process, environmental inventories and potential alternatives/impacts;
- Early identification of concerns/issues;
- Understanding of potential risk and impacts of the Study on Indigenous Peoples interests;
- Development of mutually acceptable solutions involving Indigenous Peoples; and
- Ensuring regulatory compliance throughout the Class EA process.

Indigenous Peoples will be consulted throughout the duration of the Study.

## 4.2 Work Program

The major elements of the work program are described in the following sections.

### 4.2.1 Phase 1: Identify the Problem

This phase of the Study will include: establishing the Study scope, schedule and approach with the Project Team and agencies; issuing the Notice of Study Commencement; the collection and organization of background information; reviewing and documenting existing conditions; and the transportation analysis to identify operational, safety and traffic concerns.

In addition, the following Community Engagement tools will be undertaken to proactively engage stakeholders early in the Study:

- **Study Design**: This Study Design presents: the Problem/Opportunity Statement; the consultation plan; project schedule; and identifies the scope of the Study's technical requirements, design standards and proposed evaluation criteria. This document is available for public/agency review and will help establish the foundation for all remaining environmental planning and public consultation processes.

  After the first PIC and based on comments received, the draft Study Design Report will be finalized and placed on the City's website as the Final Study Design Report.

- **Community Café/ PIC No. 1**: This event will be a collaborative community involvement tool that goes beyond the conventional information exchange at public meetings. The event will focus on listening to the community in small group discussions (without the study team in the dialogue) to build consensus on the issues and desires of the community.

### 4.2.2 Phase 2: Alternative Planning Solutions

The consideration of all reasonable alternatives is a guiding principle for EA studies. The Biehn Drive extension, sanitary sewer alignment, cross section, and intersection alternatives will be generated through discussions with the City, agencies and the general public.

The analysis and evaluation process involves a 2-step decision-making process. Initially the study documents the analysis and evaluation of Alternatives to the Undertaking (alternative project types or alternative strategies to address the problem) followed by the subsequent assessment of preliminary design alternatives.

The City of Kitchener TMP previously identified the extension of Biehn Drive as a City Street Capacity Improvement. This TMP completed Phase 1 and 2 of the Class EA process, including the evaluation of Alternative Planning Solutions. The TMP recommended this project as the "implementation of new streets in southwest Kitchener Urban Areas Study Community Master Plan, including extension of Biehn Drive between Biehn Drive and Robert Ferrie Drive".

### 4.2.3 Phase 3: Alternative Design Concepts for the Preferred Planning Solution

Preliminary Design Alternatives will be generated for the Preferred Alternative Planning Solution (Biehn Drive Extension) based on an inventory of the natural, social and cultural environment and results of technical investigations.

#### 4.2.3.1 Environmental Inventories and Technical Investigations

Environmental inventories and technical investigations will be completed to assess the impacts of alternative design concepts. These investigations are described in **Sections 4.2.3.1.1** to **Section 4.2.3.1.7**.

##### 4.2.3.1.1 Transportation and Traffic

Transportation/traffic analysis will be completed using a Complete Streets approach considering the needs of pedestrians, cyclists, motorists, goods movement including farm vehicles (if applicable) and transit services. The traffic analysis will assess existing and future traffic demand to the end of the Official Plan horizon. The study will provide recommendations for: intersection control (roundabout vs. signalized), pedestrian crossings, spacing of intersections with local streets and roadway cross section requirements (lane requirements, sidewalks and/or multi-use paths, continuation of existing bicycle lanes or transition to raised cycle tracks and potential traffic calming measures).

The traffic report will also provide recommendations on the timing of the improvements. This analysis will be used to identify the preliminary design level of geometric needs of the various alternatives (i.e. storage lengths, auxiliary lanes, signal/traffic controls, etc.) and in addition, will be used to evaluate the impacts/benefits of the various competing alternatives for the horizon years.

##### 4.2.3.1.2 Sanitary Sewer

The Project Team will develop the design of the trunk sanitary sewer in conjunction with the alternative road extension alternatives. It is noted that some of the alternative alignments for

the trunk sewer may diverge from the road alignment alternatives. The Class EA process for extension of the sanitary sewer is a Schedule B process. However, the EA for the road and sanitary sewer will be combined into a single document and will be documented in an ESR. This EA is being undertaken concurrently with the Sanitary Sewer Master Plan.

The preliminary design tasks will include preliminary design of the trunk sanitary sewer, including confirmation of drainage areas and design flows; drainage design, including hydraulic design of the crossings; and stormwater management design, including 30% design of stormwater management facilities and Low Impact Development measures.

#### 4.2.3.1.3 Stormwater Management and Municipal Servicing

The Project Team will undertake a Stormwater Management (SWM) Plan and Report taking into consideration previously completed studies including the Strasburg Creek Flood Control Environmental Study Report and the Upper Blair Creek Functional Drainage Study. The work will include preliminary hydrologic and hydraulic modelling of the existing and proposed conditions and development of a SWM strategy in sufficient detail to satisfy regulatory concerns and obtain approvals in concept.

The preliminary design tasks will include: drainage design, including hydraulic design of the crossings; and stormwater management design, including 30% design of stormwater management facilities and Low Impact Development measures.

#### 4.2.3.1.4 Geotechnical and Hydrogeological

Geotechnical information and published geological data from the area will be reviewed. In addition, three boreholes will be advanced along the proposed extension alignment. A soil investigation program will be completed to determine a soil characterization.

Geotechnical information and published geological data from the area will be reviewed. A geotechnical assessment of the alternatives will be completed.

#### 4.2.3.1.5 Social Environment

An inventory of existing land uses within the Study Area will be undertaken. This will include documentation of agricultural/residential development (access, emergency services, trails, etc.) and utility corridor land uses. The inventory will also include consideration and identification of future land uses such as developments, right-of-way requirements, future transit and transportation facilities and development that could be implemented complying with existing planning documents. Any land use changes that have occurred will be documented.

In addition, an acoustical assessment for this project will be completed to determine the effects of the project beyond the local Study Area and will reflect traffic volume increases forecast along the existing Biehn Drive corridor. The assessment will determine existing daytime and

nighttime sound level contours and future sound levels associated with the road extension for areas within existing residential (noise sensitive) land uses.

#### 4.2.3.1.6 Natural Environment

The natural environmental team will review desktop/background information to identify any known natural features and complete field investigations in the spring and summer of 2021 to document existing conditions in the Study Area. A detailed Terms of Reference (TOR) is described below and will be submitted to the Grand River Conservation Authority for their review and comment. These TOR are based on a preliminary field visit conducted with the landowner.

A field visit was completed in the spring of 2021 with the landowner's environmental consultant (WSP) to determine what environmental inventories have been completed for the Study Area and to walk the proposed alignments for the Biehn Drive extension. Comprehensive surveys have been conducted over a number of years and the following information will be made available to BTE in support of the MCEA process:

- Wetland delineation GPS coordinates/shapefiles;
- Significant Wildlife Habitat (SWH) identified in the study area;
- Species at Risk (SAR) habitats and screening; and
- Ecological Land Classification (ELC) mapping.

Based on conversations with WSP and GRCA, the wetland delineation has not been field verified by GRCA staff. As such, a site visit will be scheduled for the summer of 2021 to stake the portion of wetland within the Biehn Drive extension Study Area in cooperation with WSP and GRCA. A digital file showing the approved wetland limits will be provided to GRCA and will form the basis for comparison of alternatives from a natural environmental perspective. Field work conducted in the summer of 2021 will also document the locations of Black Ash (*Fraxinus nigra*), a species soon to be listed under the *Endangered Species Act* (ESA) and identify future requirements for surveys during Detailed Design.

A Terrestrial and Aquatic Existing Conditions report will be prepared based on the 2021 field investigations and work previously completed by WSP in the Study Area. In addition to describing existing conditions, the report will quantify the anticipated extent of disturbance to the surrounding Provincially Significant Wetland (PSW) based on each alternative alignment of the roadway and/or sewer.

#### 4.2.3.1.7 Cultural Environment

Potential Built Heritage Resources and Cultural Heritage Landscapes will be evaluated for the entire study area prior to the selection of preferred alternatives and summarized in the ESR.

This review will identify all known or potential built heritage resources and cultural heritage landscapes (BHR/CHLs). If resources are present, a cultural heritage assessment report will be completed with the potential project impacts to BHR/CHLs identified and strategies will be provided to mitigate identified impacts. These mitigation measures will inform project planning and design.

An Archaeological assessment (AA) will be undertaken by an archaeologist licenced under the *Ontario Heritage Act*, who is responsible for submitting the report directly to the Ministry of Heritage Sport, Tourism and Culture Industries (MHSTCI). A Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition, and contacting MHSTCI to find out whether there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and determine whether additional archaeological assessment is necessary (e.g. Stages 2, 3, and 4).

#### 4.2.3.2 Evaluation of Alternatives

Preliminary Design Alternatives will be evaluated using a qualitative evaluation process. Through this process, evaluation criteria will be identified including potential factors such as roadway level of service, traffic safety, accessibility, property impacts, socio-economic environment, natural environment, cultural heritage, technical aspects/construction complexity and implementation.

The evaluation and analysis will identify all improvement alternatives and associated cost estimates including lifecycle costs, alternative construction/material options, proposed timeline and innovative solutions. This document will be presented to the public for input at PIC No. 2. Following the PIC, refinements will be made to the Technically Preferred Alternative (TPA) (if applicable) and the refined alternative will become the Recommended Plan.

### 4.2.4 Phase 4: Environmental Study Report (ESR)

The preparation of the draft and final EA report will follow the format and content for an ESR as required by the Municipal Class EA document. The ESR will document the study methodology, findings, public involvement and recommendations. The report will provide recommendations on the phasing of the proposed works and preliminary cost estimates. The public will be notified of the availability of the ESR for a 30-day public review period.

## 5.0 Preliminary Design Alternatives

This Section describes Preliminary Design Alternatives for the extension of Biehn Drive. As an initial step in the generation of alternatives this Study has identified the groups of alternatives below.

Three alternatives were presented at Public Information Centre (PIC) No. 1 and to residents at the Community Café event. Based on comments received from attendees at the Community Café, a fourth alternative has been added for the subsequent evaluation. Alternative 4 will use existing collector roads to move vehicular traffic within the Doon South and Brigadoon communities. The project will include an extension of Biehn Drive for a maintenance road for the new sanitary sewer extension and an active transportation link as per the Official Plan.

- Road Alignments (see **Figure 4**)
  - Alternative 1: Connect to Robert Ferrie Drive east of Hydro One transmission tower
  - Alternative 2: Connect to Robert Ferrie Drive west of Hydro One transmission tower
  - Alternative 3: Connect directly westerly to Strasburg Road
  - Alternative 4: Use Existing Collector Roads
- Sanitary Sewer Alignments
  - Following the future Biehn Drive alignment
  - Following a separate alignment
- Intersection Type:
  - Conventional signalized
  - Unsignalized
  - Roundabout control
- Cross Section:
  - Urban cross section with sidewalk/multi-use trail (MUT)
  - Semi-urban cross section with MUT
- Traffic Calming Measures
  - Chicanes
  - Medians
  - Narrower driving lanes
  - Median bulb-outs

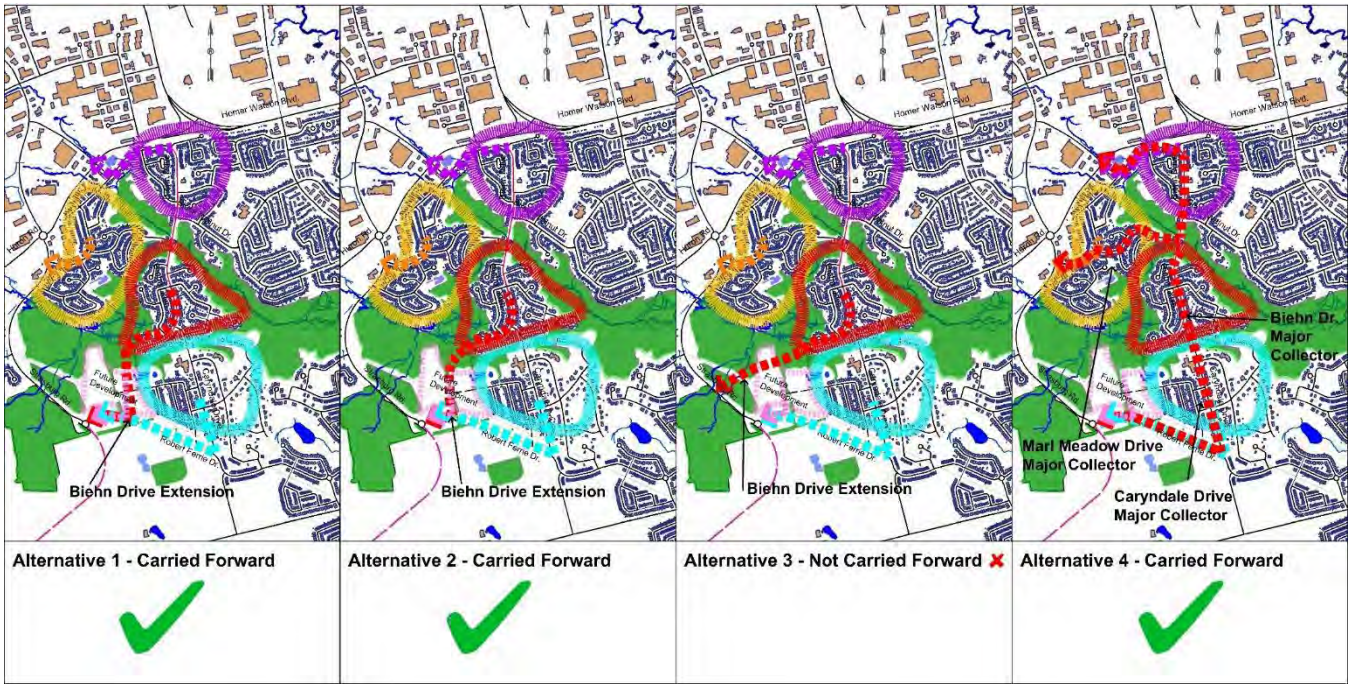


**Figure 4: Preliminary Design Alternatives**

## 5.1 Preliminary Coarse Screening of Alignment Alternatives

A coarse screening evaluation of the Preliminary Design Alternatives for the extension of Biehn Drive has been completed to compare the performance, effects and compliance with the City's planning documents, and screen out alternatives which do not address the objectives of the study or are significantly inferior to other competing alternatives.

The evaluation criteria ranking legend is provided below. The evaluation of alternatives is provided in **Table 1**.

| ✘ | - | ✓ |
|---|---|---|
| **Poor** | **Fair** | **Good** |

## Table 1: Evaluation of Preliminary Alignment Alternatives

| | Alternative 1: Connect to Robert Ferrie Drive east of Hydro Tower | | Alternative 2: Connect to Robert Ferrie Drive west of Hydro Tower | | Alternative 3: Connect to Strasburg Road | | Alternative 4: Use of Existing Collector Roads |
|---|---|---|---|---|---|---|---|
| **Transportation** | | | | | | | |
| Does this alternative satisfy forecast traffic demand, improve safety, and address all modes of transportation? | ✓ | This alternative would provide a north-south connection to Robert Ferrie Drive to accommodate all modes. This alternative will accommodate vehicles to/from the Brigadoon community and will reduce cut-through traffic on local roads. | ✓ | This alternative would provide a north-south connection to Robert Ferrie Drive to accommodate all modes. This alternative will accommodate vehicles to/from the Brigadoon community and will reduce cut-through traffic on local roads. | - | This alternative would provide an east-west connection to Strasburg Road to accommodate all modes. This alternative will accommodate vehicles to/from the Brigadoon community. | ✗ This alternative does not provide an east-west connection to Strasburg Road to accommodate vehicular traffic. This alternative will accommodate pedestrians/cyclists to/from the Brigadoon community. A maintenance road will also be constructed to provide access to the municipal services. |
| **Environment** | | | | | | | |
| Does the approach result in significant impacts to the natural environment? | - | This alternative will result in minor impacts to the woodlot/wetland. | - | This alternative will result in minor impacts to the woodlot/wetland. | ✗ | This alternative will result in significant impacts to the woodlot/wetland. | ✓ This alternative will have the smallest footprint in the woodlot/wetland. |
| **Affordability** | | | | | | | |
| Is the approach affordable to the City to implement? | - | No significant difference. | - | No significant difference. | - | No significant difference. | ✓ This alternative eliminates the collector road resulting in lower capital and maintenance/operation costs. |
| **Compliance with City Planning** | | | | | | | |

| **Documents** | | | | | | |
|---|---|---|---|---|---|---|
| Does this alternative comply with the recommendations of the City's planning documents (i.e., TMP, OP, KGMP) | ✓ This alternative complies with the recommendations of the City's planning documents. | ✓ This alternative complies with the recommendations of the City's planning documents. | ✱ | This alternative does not address the recommendations of the Official Plan or Growth Management Plan. This alternative was originally recommended in the City's Transportation Master Plan; however, this recommendation was modified in the Official Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible. | ✱ | This alternative does not address the recommendations of the Official Plan or Growth Management Plan. This alternative is being considered based on public input provided at Community Café / PIC No. 1. |
| Recommendation: | ✓ Carry forward for further evaluation | ✓ Carry forward for further evaluation | | | ✓ | Carry forward for further evaluation |

Based on the preliminary coarse screening of alternatives, it is recommended that Alternative 3: Connect to Strasburg Road not be carried forward. This alternative would have significant environmental impacts and does not comply with the recommendations of the City's Official Plan or Growth Management Plan. It is recommended that the extension of Biehn Drive only consider connections to the extension of Robert Ferrie Drive.

## 6.0 Study Schedule

A schedule for this Study is shown below in **Table 2**.

**Table 2: Study Schedule**

| Task | Date |
|---|---|
| Project Start-Up Meeting | January 2021 |
| Study Commencement Notice | Winter 2021 |
| Information Gathering | Winter 2021 |
| Environmental Review | Winter/Spring 2021 |
| Study Design | March 2021 |
| Public Information Centre No. 1/ Community Café | Spring 2021 |
| Analysis and Evaluation of Alternatives | Summer/Fall 2021 |
| Public Information Centre No. 2 | November 2021 |
| Preparation of ESR | Fall/Winter 2021 |
| Municipality Review of ESR | Winter/Spring 2021/2022 |
| 30-day Public Review Period | Spring 2022 |

## Glossary of Terms

| | |
|---|---|
| • **AADT** | Annual Average Daily Traffic – the average 24-hour, two-way traffic per day for the period from January 1st to December 31st. |
| • **Alignment** | The vertical and horizontal position of a road. |
| • **Alternative** | Well-defined and distinct course of action that fulfils a given set of requirements. The EA Act distinguishes between alternatives to the undertaking and alternative methods of carrying out the undertaking. |
| • **Alternative Project** | Alternative Planning Solutions, see above. |
| • **Bump-Up** | The act of requesting that an environmental assessment initiated as a class EA be required to follow the individual EA process. The change is a result of a decision by the proponent or by the Minister of Environment to require that an individual environmental assessment be conducted. |
| • **Canadian Environmental Assessment Act (CEAA)** | The CEAA applies to projects for which the federal government holds decision-making authority. It is legislation that identifies the responsibilities and procedures for the environmental assessment. |
| • **Class Environmental Assessment Document** | An individual environmental report documenting a planning process which is formally submitted under the EA Act. Once the Class EA document is approved, projects covered by the class can be implemented without having to seek further approvals under the EA Act provided the Class EA process is followed. |
| • **Class Environmental Assessment Process** | A planning process established for a group of projects to ensure compliance with the Environmental Assessment (EA) Act. The EA Act, in Section 13 makes provision for the establishment of Class Environmental Assessments. |
| • **Corridor** | A band of variable width between two locations. In transportation studies a corridor is a defined area |

| | |
|---|---|
| | where a new or improved transportation facility might be located. |
| • **Criterion** | Explicit feature or consideration used for comparison of alternatives. |
| • **Cumulative Effects Assessment** | Cumulative Effects Assessment assesses the interaction and combination of the residual environmental effects of the project during its construction and operational phases on measures to prevent or lessen the predicted impacts with the same environmental effects from other past, present, and reasonably foreseeable future projects and activities. |
| • **Detail Design** | The final stage in the design process in which the engineering and environmental components of preliminary design are refined and details concerning, for example, property, drainage, utility relocations and quantity estimate requirements are prepared, and contract documents and drawings are produced. |
| • **DFO** | Department of Fisheries and Oceans. |
| • **EA** | Environmental Assessment |
| • **EA Act** | Ontario Environmental Assessment Act, RSO 1990 c. E.18 (as amended July 21, 2020). |
| • **Environment** | • Air, land or water,<br>• Plant and animal life, including human life,<br>• The social, economic and cultural conditions that influence the life of humans or a community,<br>• Any building structure, machine or other device or thing made by humans,<br>• Any solid, liquid, gas, odour, heat, sound, vibration, or radiation resulting directly or indirectly from human activities, or<br>• Any part or combination of the foregoing and the interrelationships between any two or more of them, in or of Ontario. |

| | |
|---|---|
| • **Environmental Effect** | A change in the existing conditions of the environment which may have either beneficial (positive) or detrimental (negative) effects. |
| • **ESR** | Environmental Study Report. The final documentation for a Schedule C project, defining the project, consultation process, preferred solution, and mitigation measures. |
| • **Evaluation** | The outcome of a process that appraises the advantages and disadvantages of alternatives. |
| • **Evaluation Process** | The process involving the identification of criteria, rating of predicted impacts, assignment of weights to criteria, and aggregation of weights, rates, and criteria to produce an ordering of alternatives. |
| • **External Agencies** | Include Federal departments and agencies, Provincial ministries and agencies, conservation authorities, municipalities, Crown corporations or other agencies other than MTO. |
| • **Factor** | A category of sub-factors. |
| • **General Arrangement** | Structural plan of the bridge and proposed works including elevations and cross-sectional views of the bridge. |
| • **GRCA** | Grand River Conservation Authority |
| • **Individual Environmental Assessment** | An environmental Assessment requiring the submission of a document for approval by the Minister, pursuant to the EA Act and which is neither exempt from the EA Act nor covered by a Class EA approval. |
| • **MECP** | Ministry of the Environment, Conservation and Parks. |
| • **MHSTCI** | Ministry of Heritage, Sport, Tourism and Culture Industries. |
| • **Mitigating Measure** | A measure that is incorporated into a project to reduce, eliminate, or ameliorate detrimental |

| | |
|---|---|
| | environmental effects. |
| • **Mitigation** | Taking actions that either remove or alleviate to some degree the negative impacts associated with the implementation of alternatives. |
| • **MNRF** | Ministry of Natural Resources and Forestry. |
| • **MTO** | Ministry of Transportation Ontario. |
| • **NSA** | Noise Sensitive Areas |
| • **OP** | Official Plan |
| • **PIC** | Public Information Centre |
| • **Planning Alternatives** | Planning alternatives are “alternative planning solutions” under the EA Act. Identification of significantly different transportation engineering opportunities while protecting significant environmental features as much as possible. |
| • **Preliminary Design Alternatives** | Preliminary Design Alternatives are “alternative methods “ of carrying out the selected planning solution while maximizing social and transportation benefits while protecting significant environmental features as much as possible. |
| • **Project** | A specific undertaking planned and implemented in accordance with the Class EA including all those activities necessary to solve a specific problem. |
| • **Proponent** | A person or agency that carries or proposes to carry out an undertaking, or is the owner or person having charge, management, or control of an undertaking. |
| • **Public** | Includes the public, interest groups, associates, community groups, and individuals, including property owners. |
| • **Realignment** | Replacement or upgrading of an existing roadway on a new or revised alignment. |
| • **Recommended Plan** | That part of the planning and design process, during |

| | |
|---|---|
| | which various alternative solutions are examined and evaluated including consideration of environmental effects and mitigation; the recommended design solution is then developed in sufficient detail to ensure that the horizontal and vertical controls are physically compatible with the proposed site, that the requirements of lands and rights-of-way are satisfactorily identified, and that the basic design criteria or features to be contained in the design, have been fully recognized and documented in sufficient graphic detail to ensure their feasibility. |
| • **SAR** | Species at Risk |
| • **Screening** | Process of eliminating alternatives from further consideration, which do not meet minimum conditions or categorical requirements. |
| • **SDR** | Study Design Report. |
| • **Sub-factor** | A single criterion used for the evaluation. Each sub-factor is grouped under one of the global factors. |
| • **TAC** | Technical Advisory Committee. The TAC will include the approving agencies and Consultant. It will act as the decision-making body for the study recommendations. |
| • **TIS** | Traffic Impact Study |
| • **TMP** | Transportation Master Plan |
| • **TPA** | Technically Preferred Alternative |
| • **TPP** | Technically Preferred Plan |
| • **Traceability** | Characteristics of an evaluation process which enables its development and implementation to be followed with ease. |

# Appendix B

Record of Consultation

BT ENGINEERING

# Community Café Summary Report

## Biehn Drive Municipal Class Environmental Assessment

May 2021

**Submitted by:**
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
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## 1.0 INTRODUCTION

This report summarizes the results of the comments received at the online Community Café carried out by BT Engineering Inc. (BTE) in support of the Municipal Class Environmental Assessment (EA) Study for the extension of Biehn Drive in the City of Kitchener.

At the time of the Community Café, the Province of Ontario implemented restrictions on public gatherings to deal with the COVID-19 pandemic, and as such the meeting relied on web-based communications.

The Environmental Assessment (EA) and land use planning for this road link have been ongoing for several decades, and the previous Transportation Master Plan and current Official Plan have identified this project. The TMP completed Phases 1 and 2 of the Municipal Class EA. The current study is completing the subsequent Phases 3 to 5 of the Municipal Class EA and has been initiated by the City of Kitchener to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The Study will evaluate alternatives for the alignment of the Biehn Drive extension, intersection locations and designs, and municipal services while minimizing the environmental, social, and cultural impacts of the project.

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.

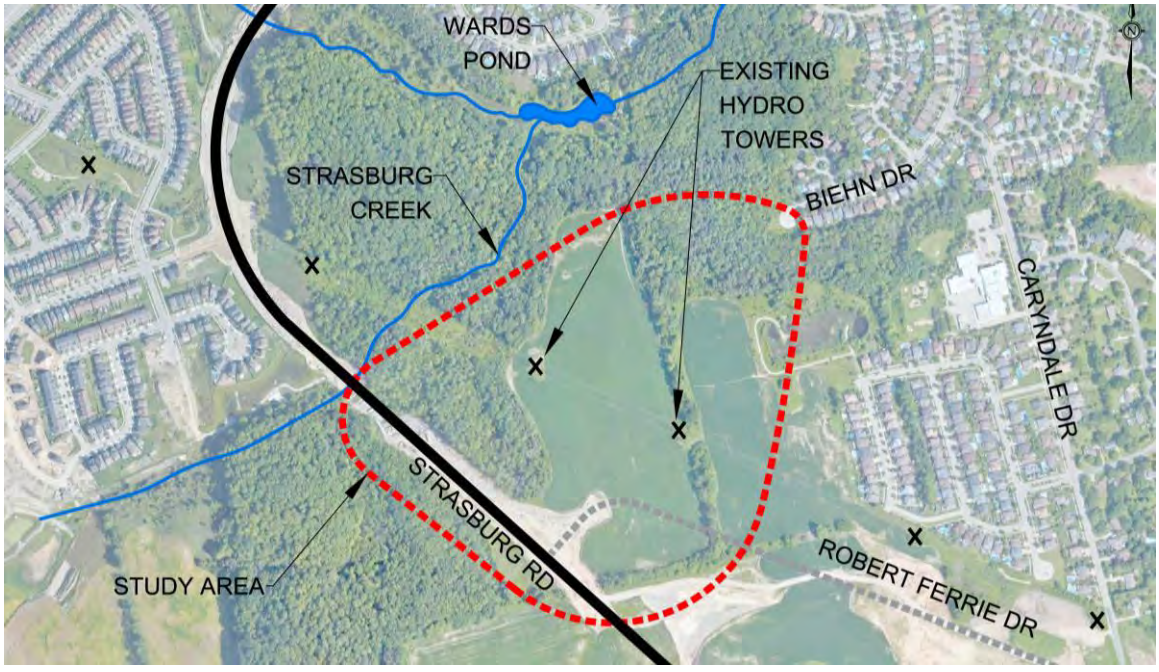



**Figure 1: Study Area**

The online Community Café event was held on April 20, 2021. Notices and invitations were sent out prior to the event and copies are included in **Appendix A**. The Community Café was conducted with key stakeholders and the public as part of the Environmental Assessment process. Thirty-two (32) people attended the Community Café event.

### 1.1 History of the Biehn Drive Extension

The Biehn Drive extension has been included in City planning documents since the late 1980's. It first appeared in the Brigadoon Community Plan in 1989 and was identified as a necessary connection between the Brigadoon Community and Strasburg Road.

Following this Community Plan, the road link was adopted into the City's Official Plan as Amendment No. 98 in 1991. The extension has been identified in every subsequent Official Plan, Transportation Master Plan and area planning study including:

- Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994)
- Kitchener Planning and Development Staff Report PD95/51 (1994)
- Updated Brigadoon Community Plan (2005)
- Kitchener Integrated Transportation Master Plan (2013)

In recent years, the extension of Biehn Drive was reviewed as part of the Robert Ferrie Drive Environmental Assessment (EA). A Need and Justification Review was completed in 2014 as part of this EA and concluded that the extension to Robert Ferrie Drive as well as the extension of Biehn drive were both necessary collector roads to accommodate the transportation needs of the Brigadoon/Doon South communities.

This recommendation was included in the Official Plan Amendment No. 103 in March 21, 2019.

## 2.0 METHODOLOGY

The Community Café process follows the principles of the "World Café" philosophy; namely, that people want to talk together about issues that matter, and that as we talk together we are able to collectively achieve greater wisdom. People have the capacity to work together and can collectively be creative and insightful when actively engaged in meaningful conversations. The Community Café is a simple yet effective conversational method for fostering dialogue, accessing collective intelligence and creating innovative possibilities for action. The seven Café principles are:

1. Set the context
2. Create hospitable space
3. Explore questions that matter
4. Encourage everyone's contributions
5. Connect diverse perspectives
6. Listen together for insights
7. Share collective discoveries

The Community Café was an informal event that facilitated conversation by providing participants with a comfortable and welcoming environment. Informational exhibits were prepared in advance of the Café and were available on the City's website. Copies of the exhibits are provided in **Appendix B**.

The event was organized to create a dialogue about issues that matter to the stakeholders and community. Each conversation was chosen to consider the most important parameters of the project and the desired goals of the participants. Four discussion topics were provided to reflect the concerns of the community. As participants discussed each topic, key ideas and perspectives were exchanged, providing new insights to the project.

A facilitator encouraged all participants to contribute to the conversation and to remain focused on the topic being discussed.

The four topics chosen to be discussed during the event were:

1. Traffic Operations
2. Pedestrians/Cyclists
3. Intersection Design
4. Neighbourhood Concerns

### 2.1 Opening Presentation

The Community Café event began with an introductory presentation from Mr. Steve Taylor, Consultant Project Manager, (see the Café Presentation in **Appendix C**). Mr. Taylor introduced the project and provided background information including the project issues, approach and process.

Following the project introduction, Mr. Taylor explained the process and objectives of the Community Café event. The participants were then moved to small breakout rooms to begin discussion on the applicable topics.

## 3.0 TOPIC DISCUSSIONS

In each breakout room, a topic of conversation was provided for discussion. Each topic had several questions associated with the topic; however, the conversation often diverged from the given questions. This allowed for conversation to flow freely and created an encouraging environment for all participants to contribute ideas and perspectives. It also provided the participants an opportunity to direct the conversation to issues that are relevant to their actual concerns.

The following sections summarize the ideas and comments expressed during the event. The comments are listed based on the discussion topic of the table.

### 3.1 Topic 1: Traffic Operations

**Question 1: What intersection/roadway improvements would you like to see with the extension of Biehn Drive?**

- General opposition to the extension of Biehn Drive from residents living on Biehn Drive.
    - The proposed extension of Biehn Drive should not be considered as a “done deal”.
    - Extension of Biehn Drive will have massive impacts on residents. This has already happened to Caryndale Drive with the extension of Robert Ferrie Drive.
    - The EA should not be initiated until Robert Ferrie Drive extension is constructed. This would allow the City to collect traffic information instead of relying on projections.
    - Consideration should be given to changes in travel patterns with more workers working from home.
    - Road users are already set in their traffic patterns. The extension is not required. Two collector roads in such close proximity are redundant.
- The extension is not considered to be required because the neighbourhood is already connected to Robert Ferrie Drive at Caryndale Drive.
- Participants noted they were aware of the project and want to ensure that the road extension will protect the natural, social and cultural environments.
    - The project has been documented in various City planning documents for approximately 20 years.
    - The proposed extension of Biehn Drive has always been part of planned area development and the plan was in place when many of the area residents purchased their homes.
    - The understanding is that the Biehn Drive and Robert Ferrie Drive Extensions are interconnected projects that would be delivered together, benefiting area traffic.
- The potential for increased traffic volume on Biehn Drive was also a concern; there were conflicting opinions that the traffic volumes on Biehn Drive would increase while

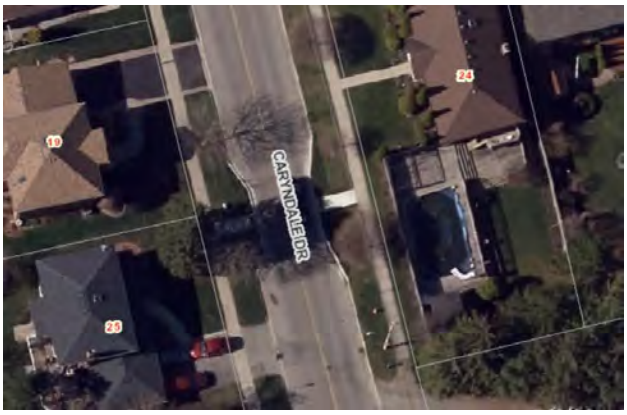
others acknowledged that the traffic volumes on sections of Biehn Drive can be expected to decrease.
    - The planned extensions of Biehn Drive and Robert Ferrie Drive would combine to redirect traffic away from Caryndale Drive and existing Biehn Drive.
- Conflicting opinions were expressed regarding access to the arterial road network:
    - That there is no problem driving north to Huron Road from within the neighbourhood; versus
    - The shorter distance to the Strasburg Road Extension would be a convenient alternative that they would use.
- Preference for Alternative 1; however, participants did not support the road or services extension.
- Consideration should be given to creating a cul-de-sac on the south side of the Provincially Significant Wetland to service the development instead of extending Biehn Drive.
- Consideration should be given to extending Biehn Drive for active transportation uses only. This would limit impacts to the natural environment and improve connectivity of the trail network.
- The opportunity for transit service through the neighbourhood, with the planned extension, would benefit existing area traffic.

**Question 2: Do you have any safety concerns related to the future extension of Biehn Drive (i.e. speed, volumes, cut-through traffic)?**

- There are existing safety concerns on Caryndale Road and Biehn Drive because of high speeds and traffic volumes.
    - Support for reducing the posted speed on Biehn Drive.
    - Support for making the area a Community Safety Zone or School Safety Zone.
- There are safety concerns at the corner of Biehn Drive and Caryndale Road because approximately 25% of cars at the intersection don’t stop. This a safety issue for the school.
- There is already a high collision rate at Robertson Crescent and Biehn Drive.
- Need to maintain a safe area for vulnerable road users.
    - There are several schools located in close proximity to the Study Area.
    - Neighbourhood children frequently use the current Biehn Drive cul-de-sac for activities. The dead-end creates a safe space for children.
- Concern for increased traffic volumes as a result of the proposed development north of Robert Ferrie Drive on the existing farmland.
    - Would the road alignment alternatives support different development scenarios (i.e. housing, commercial, large apartment buildings, traffic generators)?
- There is a lot of truck traffic on the existing Biehn Drive. Truck traffic should not be allowed on the extension.

**Question 3: Should traffic calming features be included (i.e. medians, speed humps)?**

- High speeds are an issue on Biehn Drive. Controlling traffic speed on Biehn Drive was noted to be a major concern for many individuals.
- Mitigation with narrowing roads and signs bolted to street create more of a road hazard than slowing people down. More traffic in the neighbourhood increases the chances of an injury/accident. Kids walking to school and people walking in the neighbourhood are at risk already.
- The traffic calming measures constructed on Caryndale Drive are ineffective and create more confusion for drivers (see photos below).
    - Drivers don't know how to navigate the mini roundabout constructed.
    - Drivers don't know if they are required to stop at the crosswalk. Crosswalks should be signed and have flashing lights to alert drivers.




- Centre medians are more cosmetically appealing and reflect the neighbourhood character, additional green space/grassed area.
- Narrowing roads/chicanes/medians are road hazards. Narrowing lanes forces traffic together. Chicanes would be difficult for snow removal and aren't aesthetically appealing.
- Speed humps work to slow down traffic, but drivers weave around them creating a safety concern.
- Any traffic calming measure implemented must ensure it will not impact emergency services operations.
- Support for a curvilinear alignment to slow down drivers.
- Potential to have a 90-degree bend at the existing Biehn Drive cul-de-sac to slow drivers down as they approach the future extension.

### 3.2 Topic 2: Pedestrians/Cyclists

**Question 1: What are the main safety concerns for pedestrians/cyclists along the extension of Biehn Drive?**

- Biehn Drive and the future extension are not safe because of traffic volumes and speed.
- Active transportation facilities need to be safe for children and people with disabilities.
    - There are three group homes in this area for people with disabilities.
    - There are multiple schools located in close proximity.
    - There is a day-care close to the Study Area, and they frequently walk to the dead-end.
- Crossings need to be provided to allow kids and vulnerable road users a way to cross the street.
    - Consider installing pedestrian cross-overs.

**Question 2: Should active transportation facilities be provided along the Biehn Drive extension, and if so which type (i.e. MUT, sidewalk)?**

- A multi-use trail from Robert Ferrie Drive to the existing end of Biehn Drive would be preferred.
    - A MUT provides a safe space for all road users.
    - There are a lot of children with bikes in the area; children's safety is a very important consideration for the project.
- Extending sidewalks along both sides of the proposed extension, as exists along existing Biehn Drive, was also suggested.

**Question 3: How should cycling be accommodated in the corridor?**

- There are no facilities for cyclists along the existing Biehn Drive.
    - If cycling facilities were built, they wouldn't be continuous.
- A separated cycling lane with dividers looks bad and doesn't create a welcoming environment for all cyclists.
- Pedestrians and cyclists to be separated from vehicular traffic.
- There should be a boulevard/separation between vehicular lanes and active transportation facilities.
- Preference to reduce the width of the boulevard through the wetland to protect the natural environment.

**Question 4: How should linkages be made to the existing trail system?**

- It was noted that there has already been an increase in the number of pedestrians using area trails.
- It is important to maintain the existing trail system and linkages to parks/schools, natural features etc.
    - Access needs to be maintained between residential areas and public spaces.
- There is an informal trail that exits the Parkwood Estates development. It should be continued. The trail would need to cross Biehn Drive to get to the other side.

### 3.3 Intersection Design

**Question 1: Are there concerns about implementing a roundabout at the new intersection with the future extension of Robert Ferrie Drive?**

- Support for a full-size roundabout at the Biehn Drive/Robert Ferrie Drive extension.
    - Allows for continuous traffic flow.
    - A roundabout would reduce traffic speeds.
- Concern for the proximity of the roundabouts on Robert Ferrie Drive at Biehn Drive and Strasburg Road.
- Concern for pedestrian safety at roundabouts

### 3.4 Neighbourhood Concerns

**Question 1: What are the community concerns with respect to the existing neighbourhood (i.e. noise, visual intrusion etc.)?**

- Concern for the cost of the project to City taxpayers.
- The majority of impacts will be on residents located west of Caryndale Road. These residents will experience increased traffic volumes, noise and pollution in front of their homes.
- The out-of-way travel to Robert Ferrie Drive is short enough that the extension is not needed.
- Concern for construction traffic in the neighbourhood
- Investigation of the natural environment, cultural heritage significance and archaeological potential of the area is required.
- Parking on the existing Biehn Drive should be maintained.
- Benefits of the proposed extension would include improved Emergency Vehicle Access to the existing neighbourhood.

**Question 2: Do you have any environmental concerns for the natural areas being crossed by the project?**

- The wetland attracts many visitors. The community doesn't want to lose this asset.
    - The wetland contributes to the mental and physical health of the residents and should be maintained.
    - People move to the area because of the wetland. It is the most important feature of the community.
    - The park area serves the community and should be protected.
    - The increased number of pedestrians already using area trails is already an impact on the environment.
- Concern for impacts to the natural environment and the PSW.

    - How will a road be maintained through a wetland without being washed out/compromised continuously?
    - There are branches of Strasburg Creek that are located beneath the proposed Biehn Drive extension.
        - Construction of a new road and sanitary sewer will impact the flow of water.
        - The water table is already very high and some residents have sump pumps running year round. The water table has been stable (no huge flood events) but does cutting into the environmental area impact the water table? If the water table rises, flooding basements would be inevitable.
        - Concern for sediment contamination in watercourses during construction.
- Developers have historically not protected the environment. They need to follow regulations and protect the natural habitat during construction.
    - Developers should not be allowed to build houses in the wetland.
    - A buffer should be maintained between the development and the wetland.
- The road will interrupt existing wildlife corridors.
    - Deer, foxes, ducks etc. are frequently seen in the wetland. The past winter was the best winter for deer – they follow behind the existing houses and through the environmental areas towards the Grand River.
    - Species at Risk (SAR) need to be identified and protected.
    - A rare salamander was found in the woodlot.
- There is a need to protect existing trees/vegetation.
    - It is Kitchener's policy to not cut trees and encourage tree growth - how is this road extension lining up with that?
        - It was suggested that the proposed extension violates the City of Kitchener's Strategic Plan for the Environment.
    - Any tree removed for this project should be replaced at two or three times the number.
    - Replacement trees should be native species. Avoid Norway maples.
- Concern for the impact to existing wells.
    - The health of the City's water supply should be considered.
- Concern for the increased impermeable area because of increased asphalt.
    - This will result in more salt entering the wetland.
- Support for a wildlife crossing (tunnel under Biehn Drive).

## 4.0 COMMENT SHEETS

Six comment sheets were received in advance of the Community Café and during the subsequent two-week comment period. These comments are summarized in **Table 1** and, with the exception of personal information, are provided in **Appendix D**.

**Table 1: Summary of Written Comments**

| Comment | Number of Respondents | Comment Sheet No. |
|---|---|---|
| Opposition to the extension of Biehn Drive. | 3 | 1, 2, 3 |
| Current cul-de-sac is a quiet, safe spot without heavy traffic | 1 | 1 |
| The natural environment and trails in the Study Area are important features of the area. | 3 | 1, 3, 4 |
| Concern for the impacts to the natural environment as a result of the extension. | 5 | 1, 2, 3, 4, 5 |
| Concern for impacts to the water table. | 3 | 2, 3, 5 |
| Is there a need for the extension once traffic is diverted to Robert Ferrie Drive and Strasburg Road? | 2 | 1, 2 |
| Consider providing only municipal services (i.e. water, storm and sanitary sewer) through the extension (no road). | 2 | 1, 3 |
| Some residents in the area were not aware that the extension was planned. | 1 | 2 |
| Future consultation with residents should clarify that the extension will be built so there isn't confusion over other alternatives being considered. | 1 | 2 |
| Additional traffic studies should be completed or made available for the Study Area. | 1 | 2 |
| It is discouraging that the City is more focused on serving developers instead or preserving green space/quiet neighbourhoods. | 1 | 2 |
| The City is violating its own strategic plan to protect the natural environment if Biehn Drive is extended. | 1 | 3 |
| More transparency is required regarding the evaluation of alternatives (i.e. environmental impacts). Mitigation measures must also be described in the EA. | 1 | 3 |
| Concern for the cost of the extension. | 1 | 3 |
| Consider providing a road through the development that does not connect to Biehn Drive (cul-de-sac before the wetland). | 4 | 2, 4, 5, 6 |
| Traffic speeds/volumes are already an issue on Biehn Drive. The extension will make this worse. | 1 | 5 |

## 5.0 SUMMARY AND NEXT STEPS

The discussion presented in this report represents the opinions and input of the meeting participants. This input reflects perspectives of local residents along Biehn Drive who may not have been unaware or do not support the community planning that was predicated on providing a westerly connection of Biehn Drive to Strasburg Road as part of the transportation and land use plan since the 1980's. The key messages from attendees that were summarized at the end of the meeting include:

- Can earlier decisions be reviewed including not extending Biehn Drive (change the traffic planning to divert this traffic to other communities/streets)?
- Can the link be solely for active transportation?
- Can the need for the street extension be communicated to those living near the extension?
- Create a context sensitive project that recognizes the environmental significance of the Provincially Significant Wetland.
- Traffic calming of any project should achieve a slow and safe road for those living along Biehn Drive.

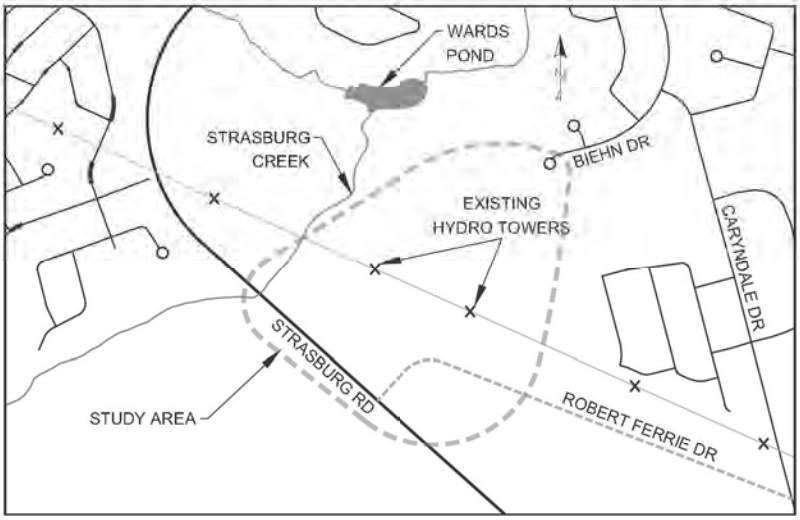
This discussion will be used as input by the Project Team for subsequent steps in the Study. At this stage of the study no decisions have been made.

Readers of the report are cautioned that the recorded ideas and discussions are unsubstantiated, may or may not be feasible, and require development. They do, however, represent an effort for the early identification of the issues and alternatives for the project that are consistent with the values and opinions of the meeting participants.

# Appendix A

Notice of Study Commencement and Community Café

# Notice of Study Commencement and Community Café
# City of Kitchener
# Biehn Drive Extension Environmental Assessment




**INTRODUCTION**

The City of Kitchener has retained BT Engineering Inc. to undertake an Environmental Assessment (EA) Study for the extension of Biehn Drive from the existing terminus 300 m west of Caryndale Drive to the future Robert Ferrie Drive extension. The Study will evaluate alternatives for alignment, cross sections, intersections and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the recommendations in the City of Kitchener Transportation Master Plan.

**STUDY PROCESS**

The Biehn Drive Extension EA Study is being conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015). The Transportation Master Plan (TMP) has previously completed Phases 1 and 2 of the Class EA; this Study will review the previously completed phases and complete Phases 3 and 4. The Study will consider all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and proactively involve the public, stakeholders and Indigenous Peoples.

**PUBLIC CONSULTATION**

**Study Design Report:** A draft Study Design Report has been prepared that describes the study background, approach, process, alternatives and consultation program. The draft Study Design Report is available on the City's website at: https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx

**Community Café:** An online Community Café event will be held to help define the study scope and issues. The goal of the Community Café event is to engage the public/stakeholders on their perspectives and interests in the Study. **To register for the Community Café, please contact Steve Taylor or Eric Riek.**

The online Community Café will be held as follows:

**Date:** April 20, 2021
**Time:** 6:30 to 8:00 pm
**Location:** Register by email to be sent the Virtual Meeting Room (Zoom) Link

**Comments:** There is an opportunity at any time during the Class EA process for interested persons to provide comments. Early identification of individual and group concerns greatly aids in addressing these concerns. All information will be collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* (2009). With the exception of personal information, all comments will become part of the public record. Persons will be advised of future communication opportunities by electronic notice in addition to newspaper public notices.

For more information, to register for the Community Café, or if you wish to be placed on the study's mailing or emailing list, contact either:

**Steve Taylor, P.Eng.**
**EA Project Manager**
**BT Engineering Inc.**
509 Talbot Street
London, ON N6A 2S5
Tel: 519-672-2222
Email: stevenj.taylor@bteng.ca

**Eric Riek, C.E.T.**
**City Project Manager**
**City of Kitchener**
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
Email: eric.riek@kitchener.ca

This notice issued on March 26, 2021.

# Appendix B

Community Café Exhibits

BT ENGINEERING
BTE

# Welcome!
# City of Kitchener
## Biehn Drive Extension
## Class Environmental Assessment

Thank you for participating in the Online Public Information Centre (PIC) for the City of Kitchener's Class Environmental Assessment (EA) for the extension of Biehn Drive and the sanitary trunk sewer.

At the present time, the Province of Ontario has implemented restrictions on public gatherings to deal with the COVID-19 pandemic. As a result, this Public Information Centre is relying on web-based communications. Should you have any questions regarding the study, please contact the City or Consultant Project Managers.

There is an opportunity at any time during the Class EA process for interested persons to provide written input. Any comments received will be collected under the *Environmental Assessment Act* and, with the exception of personal information, will become part of the public record.

Comments can be submitted by emailing stevenj.taylor@bteng.ca and/or eric.riek@kitchener.ca by **May 4, 2021**.

KITCHENER

# Introduction

The City of Kitchener has initiated a Class Environmental Assessment (EA) Study for the extension of Biehn Drive and the sanitary trunk sewer from the current terminus of Biehn Drive (approximately 60 m west of Spencer Court) southerly to the future Robert Ferrie Drive Extension.

This Study will complete the planning and preliminary design steps of the Municipal Class EA by conducting a transportation needs assessment, generating and evaluating planning alternatives, and proactively involving the public in defining a recommended plan for improvements.

This Study is being completed as a Municipal Schedule C Class EA undertaking based on the range of anticipated effects. A Draft Study Design Report describing the study process has been made available for agency and public comments and is available on the City's website.

# Class Environmental Assessment (Class EA) Process

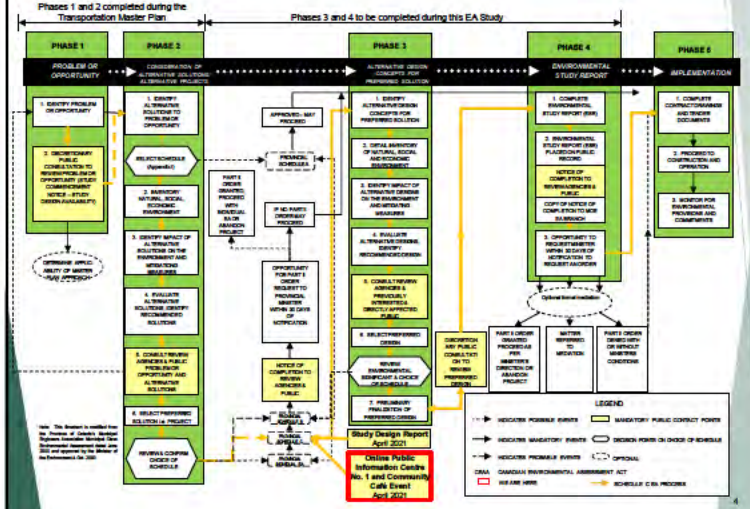
**This study is being initiated as a Municipal Schedule C project** as defined by the Municipal Class Environmental Assessment (MCEA). Consultation is a key component of the Class EA process. The goal of consultation is to provide stakeholders and affected individuals opportunities to make their interests and concerns known to the project team throughout the EA process. The early identification of issues and concerns allows the project team to investigate with the goal of, if possible, resolving the concern.

At the completion of the EA process, an Environmental Study Report (ESR) will be produced. The Report will document key components of the study: need and justification; the range and types of consultation; natural and socio-economic environmental inventories; evaluation of alternatives; selection of the recommended alternative; and supporting reports produced for the project. Upon the completion of the ESR, the public and interested stakeholders will be made aware of 30-day public review of the Report.

If, after viewing the future ESR and having made your concerns known to the project team, you still have concerns during the 30-day review period, you have rights under the *Environmental Assessment Act*. These rights will be outlined in the public notice advising of the 30-day public review period.

The Municipal Class EA process is illustrated on the following exhibit.

# Municipal Class EA Process



# Background

Since the mid-2000's, the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener have been planned to accommodate area development and evolving transportation needs. Several planning documents including the City's Official Plan and Transportation Master Plan (TMP) have identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan. This link would accommodate vehicles to and from the Brigadoon community, and would help mitigate cut-through traffic on local streets within the community. A collector road collects traffic from local roads within the community and provides connectivity to arterial roads including Strasburg Road.

Biehn Drive Extension as identified in the Official Plan (Integrated Transportation System)

# Problem and Opportunity Statement

Future development within the Doon South and Brigadoon communities requires a defined alignment for the extension of Biehn Drive to Robert Ferrie Drive as part of the area road network. In order to determine the road alignment, this Study will consider the natural, social environments and the future land use in the Study Area. The extension of Biehn Drive is required to accommodate municipal servicing, and safely and reliably accommodate all modes of transportation including vehicular, pedestrians, cyclists and trucks. By defining the future road and municipal servicing plans, the subsequent land use plans can be completed by developers.

The Study will provide the opportunity to: improve accessibility to the local community by providing additional network links; define a multi-modal transportation plan to support travel within the local neighbourhoods; and allow development to proceed on lands that currently require the roadway to be defined prior to developing the land use plan.



# Study Considerations

- **Existing Community**
  - Changes in sound levels
  - Changes in traffic volumes on Biehn Drive
  - Potential mitigation may include traffic calming measures, pedestrians/cyclist facilities, and mitigation of noise impacts.
- **Natural Environment**
  - Potential for Species at Risk (SAR) in woodlots and the Strasburg Creek Provincially Significant Wetland (PSW)
  - Two cold-water systems: Strasburg Creek (immediately north of the Study Area) and Blair Creek (900 m south of the Study Area).
  - Minimize footprint within, and impacts to, the Strasburg Creek system.
- **Transportation**
  - Improvements are required to address long-term traffic operations.
- **Active Transportation:**
  - Active modes of transportation will require separated facilities to service all ages and abilities as identified in the Cycling and Trails Master Plan.
  - This could include multi-use pathways, sidewalks, buffered bicycle lanes and/or raised cycle tracks.



# Assessment of Alternative Planning Solutions

Alternative Planning Solutions (Alternatives to the Undertaking) represent alternative ways or methods of addressing the problem to be solved by the project. In determining the preferred undertaking for the City, the following Planning Solutions were evaluated:

✗ Do Nothing: This alternative would maintain the existing road network and would not extend Biehn Drive.

✓ Transportation Demand Management (TDM): Reduces vehicular traffic demand (encourages alternative work hours, work at home and active modes of transportation).

✗ Greater Use of Local Roads: Encourage the use of local roads to reduce the need to extend Biehn Drive. Local roads are generally not designed or maintained to accommodate high traffic volumes.

✗ Limit Land Use Development: Limit any new residential, commercial or industrial development and therefore reduce the generation of new trips.

✓ Extend Biehn Drive: Provides a long-term solution for improved traffic capacity, operations and safety.

Based on the preliminary review of Alternative Planning Solutions, **"Transportation Demand Management"** and **"Extend Biehn Drive"** are recommended. This Planning Solution addresses the problem statement by improving transportation service and safety.

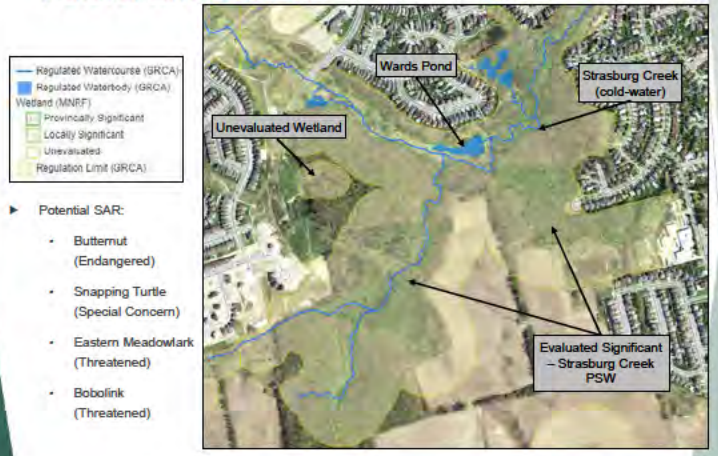
The evaluation is documented on the following exhibit for public review and comment. All comments received will be reviewed and considered before proceeding with the Study and the evaluation of TDM (Active Transportation Improvements) and New Infrastructure alternatives.

# Assessment of Alternative Planning Solutions

| Screening Criteria | Alternative 1: Do Nothing | Alternative 2: TDM | Alternative 3: Local Roads | Alternative 4: Limit Development | Alternative 5: Extend Biehn Drive |
|---|---|---|---|---|---|
| Transportation | Does not address forecast traffic demand. Results in increased volumes on local roads. | May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure. | Local roads not designed to accommodate increased volumes. | May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth. | Accommodates all modes of transportation. |
| Environmental | No impacts. | No or low impacts. Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes). | Low impacts. Creates disruption to properties on local roads that would experience an increase in traffic. | No impacts. | Low to medium environmental effect possible with new corridor. Magnitude of effects is subject to environmental mitigation. |
| City Planning Objectives | Does not meet objectives/ recommendations in City Planning documents. | Supports objective to encourage active transportation and alternate modes. | Does not meet objectives/ recommendations in City Planning documents. | Does not meet objectives/ recommendations in City Planning documents. | Supports the recommendations for the extension of Biehn Drive in OP and TMP. |
| Recommendations | Not recommended. ✗ | Recommended as a complementary solution. ✓ | Not recommended. ✗ | Not recommended. ✗ | Recommended to be carried forward. ✓ |



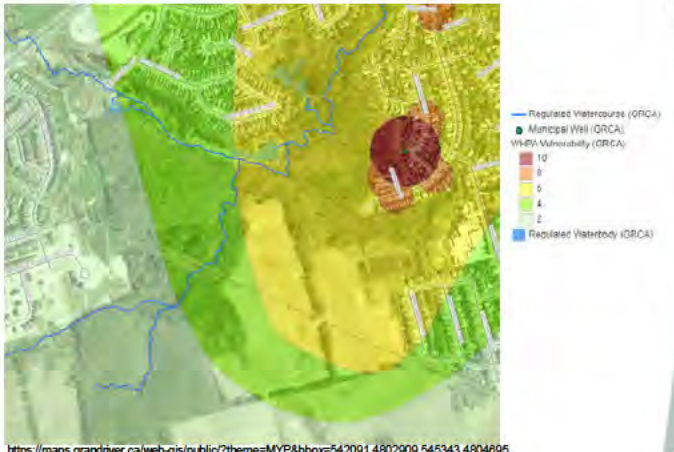
# Existing Conditions
## Natural Environment




- Potential SAR:
  - Butternut (Endangered)
  - Snapping Turtle (Special Concern)
  - Eastern Meadowlark (Threatened)
  - Bobolink (Threatened)



# Existing Conditions
## Well Head Protection Area




https://maps.grandriver.ca/web-gis/public/?theme=MYP&bbox=542091,4802909,545343,4804695



# Preliminary Design Alternatives

Preliminary design alternatives for the extension of Biehn Drive were categorized into 5 groups:

| Alignment Alternatives | Intersection Alternatives | Sanitary Sewer Alignments | Cross Section Alternatives | Traffic Calming Alternatives |
|---|---|---|---|---|
| Connect to Robert Ferrie Drive east of Hydro Tower | Signalized | On Road Alignment | Urban Cross Section with sidewalk/ Separated Bike Facilities | Chicanes |
| Connect to Robert Ferrie Drive west of Hydro Tower | Unsignalized | New Alignment | Semi-Urban Cross Section with Separated Bike Facilities | Median |
| Connect to Strasburg Road | Roundabout | | | Narrower Driving Lanes |
| | | | | Median Bulb-Out |

These groups of alternatives are presented on the following exhibits.

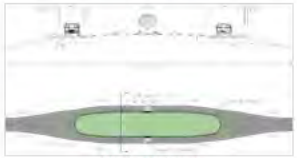
# Traffic Calming Alternatives

Traffic calming measures, to control speed and discourage through traffic, will be considered along the extension of Biehn Drive, and will further support future recommendations for the Biehn Drive Traffic Calming Study being completed to the north of the Biehn Drive extension. These may include:

Speed Humps/Cushions or Raised Crosswalks

Centre Median

Chicanes



Median Bulb-outs



# Cycling and Trails Master Plan

- Identified Cycling Facilities on Biehn Drive to be for all Ages and Abilities.
- Proposed Separated Bicycle Lanes on Biehn Drive with Multi-Use Trails along Strasburg Road and the Hydro Corridor.



# Types of Separated Bicycle Facilities

Accommodating all ages and abilities of cyclists along the proposed extension of Biehn Drive could consider a variety of alternatives. These may include:

Boulevard Multi-Use Trails

Buffered Bike Lanes

Raised Cycle Tracks

Although Separated Bike lanes/Cycle Tracks were identified in the CTMP, consideration of Boulevard MUTs would be an extension of the facilities on Strasburg Road and along the Hydro Corridor and could transition to another type of future facility along existing Biehn Drive if necessary.



# Alignment Alternatives

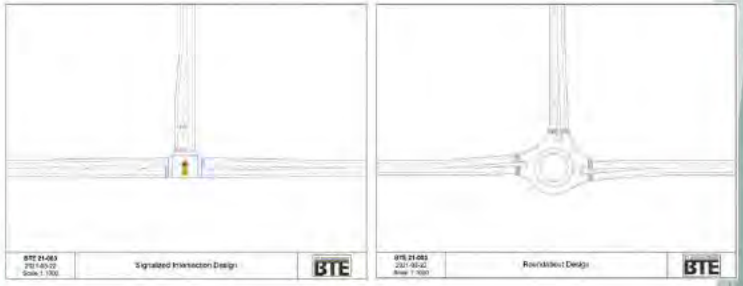
# Alignment Alternatives

## Coarse Screening

| Screening Criteria | Alternative 1: Connect to Robert Ferrie Drive east of Hydro Tower | Alternative 2: Connect to Robert Ferrie Drive west of Hydro Tower | Alternative 3: Strasburg Road Connection |
|---|---|---|---|
| Does this alternative satisfy forecast traffic demand, improve safety, and address all modes of transportation? | Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive. | Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive. | Provides a north-south connection to Strasburg Road. Accommodates all modes. |
| Does the approach result in significant impacts to the natural environment? | Minor impacts to the woodlot/PSW (~0.3 ha). | Minor impacts to the woodlot/PSW (~0.3 ha). | Significant impacts to the woodlot/wetland (~1.3 ha). |
| Is the approach affordable for the City to implement? | No significant difference. | No significant difference. | Higher cost - requires an intersection onto Strasburg Road (arterial). |
| Does this alternative comply with the recommendations of the City's planning documents (i.e., TMP, OP, KGMP) | This alternative complies with the recommendations of the City's planning documents. | This alternative complies with the recommendations of the City's planning documents. | Does not comply with the recommendations of the Official Plan or Growth Management Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible. |
| Recommendation: | Carry forward for further evaluation ✓ | Carry forward for further evaluation ✓ | Do not carry forward ✗ |



# Intersection Alternatives






# Sanitary Trunk Sewer Extension Alternatives

The trunk sanitary sewer will extend from the existing Biehn Drive cul-de-sac to the future Robert Ferrie Drive Extension. The trunk sewer will serve the area shown.

# Sanitary Trunk Sewer Extension Alternatives

Three alternative alignments will be considered. They are shown schematically in the figure.

# Potential Cross Section Alternatives

Could include but not be limited to:

Urban with multi-use path and sidewalk

Urban with sidewalk and buffered bike lanes

Semi-urban with multi-use path and paved shoulder

The planned extension of Biehn Drive is proposed to:

- Not provide direct driveway access. This will improve safety for cyclists and pedestrians,
- Not permit on-street parking.

Access to residential lots and on-street parking would be provided along local roads within the adjacent community.

The preferred cross section will consider LID measures for stormwater management within the ROW.



# Analysis and Evaluation

Alternatives will be evaluated following this Public Information Centre. The following long list of evaluation criteria (factor groups and subfactors) is being considered for the assessment of the alternatives:

**Natural Environment**
- Air quality
- Species at Risk (SAR)
- Cold / cool / and warmwater fish habitat impacted
- Water quality – stormwater runoff
- Migratory bird nesting impact/loss of existing vegetated areas
- Provincially significant natural areas and habitat (i.e. Provincially Significant Wetlands)
- Regionally significant natural areas and wildlife habitat (i.e. woodlots, non provincially significant wetlands, fauna and flora)
- Natural habitat impacted (e.g. specimen trees removed)
- Groundwater
- Climate change

**Land Use and Property**
- Property required (Residential)
- Property required (Agricultural)
- Property required (Commercial)

**Cost**
- Capital cost
- Future life cycle cost
- Utility relocation

**Social and Cultural Environment**
- Historic archaeological potential
- Prehistoric archaeological potential areas impacted
- Built heritage sites impacts
- Cultural landscape features
- Noise impacts
- Vibration impacts
- Excess materials management
- Water wells impacted
- Lighting and visual impacts
- Economic environment

**Transportation**
- Traffic operations - delays
- Safety - collision potential
- Safety – design consistency
- Movement of goods
- Pedestrian access
- Ability to accommodate cyclists
- Emergency vehicle access



# Next Steps

**Following this meeting we will:**
- Review all comments
- Carry out environmental inventories and technical investigations
- Complete the analysis and evaluation of alternatives
- Hold Public Information Centre No. 2

## We want to hear from you!

- Please provide comments by filling out the comment form or by contacting the City's representative or the consultant below:


**Steve Taylor, P.Eng.**
EA Project Manager
BT Engineering Inc.
509 Talbot Street
London, Ontario N6A 2S5
Tel: 519-672-2222
**Email:** steven.taylor@bteng.ca

**Eric Riek, C.E.T.**
City Project Manager
City of Kitchener
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
**Email:** eric.riek@kitchener.ca


Please provide your comments on or before **May 4, 2021.**

**Thank you for your participation in the study.**
- To receive updates on the project, request that your name/e-mail be added to the mailing list.
- Your input into this study is valuable and appreciated.

All information is collected in accordance with the *Freedom of Information and Privacy Act*.

# Appendix C

Community Café Presentation

# Biehn Drive Extension and Sanitary Trunk Sewer Extension

ONLINE COMMUNITY CAFÉ

APRIL 2021

1

## Meeting Overview

- Project Introduction
- Community Café Overview
- Café Roundtable Discussions
- Final Wrap-up

2

# Project Introduction

3

## Project Introduction

- This Study will be undertaken as a Schedule C Municipal Class Environmental Assessment for the extension of Biehn Drive from its current terminus to the future Robert Ferrie Drive Extension
- The Study will also include the extension of the trunk sanitary sewer, watermain and storm sewers (Schedule B)

4

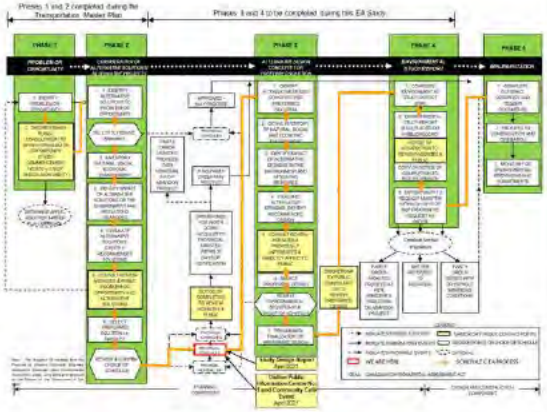
# Class EA Process

Biehn Drive Extension

*"Construction of new roads or other linear paved facilities (e.g. HOV lanes)" > 2.4 m – Schedule C*

Sanitary Sewer Extension:

*"Establish, extend or enlarge a sewage collection system and all works necessary to connect the system to an existing sewage outlet where such facilities are not in an existing road allowance or an existing utility corridor." – Schedule B*



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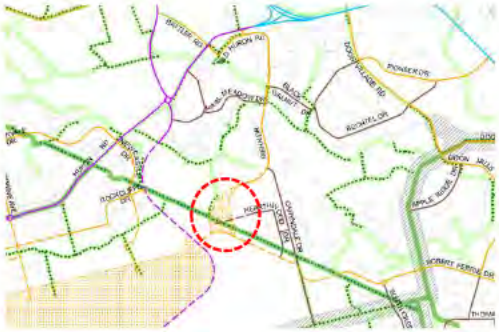
# Background Information

- Community Plans for the Doon South and Brigadoon areas have established the need for the extension of Biehn Drive
- This has been documented in the Official Plan and Transportation Master Plan
- The new road link will accommodate all modes of transportation (vehicles, trucks, pedestrians and cyclists)

6

# Official Plan – Integrated Transportation System



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# Key Issues

- **Impacts on the Existing Community**: The existing Brigadoon community is an established residential area with low ambient sound levels and low traffic volumes on Biehn Drive
  - Walking, cycling and parking are prevalent along Biehn Drive

8

## Key Issues

- **Natural Environment** : The EA will investigate the protection of surrounding terrestrial habitat and will establish mitigation for any potential impacts to the natural environment
  - There is potential for SAR in the woodlots

9

## Key Issues

- **Social and Cultural Environment:**
  - Maintain access to adjacent properties
  - Mitigate impacts to property owners and road users during and post construction (i.e. noise, air quality, safety)
  - Consideration of vulnerable road users (i.e. pedestrians, cyclists and transit)
  - Potential property impacts to residential and agricultural lands
  - Archaeological and cultural heritage resources (the Study Area is located within the Haldimand Tract)

10

## Key Issues

- Other issues include:
  - Proximity to adjacent intersections on Robert Ferrie Drive and the need to accommodate trucks through the roundabout
  - Consideration of any proposed plans of subdivision/utilization of development land and the potential network of future local streets
  - Potential utility conflicts including the east-west hydro corridor and the vertical clearance to existing aerial lines
  - Consideration and assessment of potential traffic calming measures to assist in controlling traffic speeds

11

## Preliminary Design Alternatives

- Several groups of preliminary design alternatives will be developed and evaluated:

| Alignment Alternatives | Intersection Alternatives | Sanitary Sewer Alignments | Cross Section Alternatives | Traffic Calming Alternatives |
|---|---|---|---|---|
| Connect to Robert Ferrie Drive east of Hydro Tower | Signalized | On Road Alignment | Urban Cross Section with sidewalk/ Separated Bike Facilities | Chicanes |
| Connect to Robert Ferrie Drive west of Hydro Tower | Unsignalized | New Alignment | Semi-Urban Cross Section with Separated Bike Facilities | Median |
| Connect to Strasburg Road | Roundabout | | | Narrower Driving Lanes |
| | | | | Median Bulb-Out |

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## Preliminary Design Alternatives

**Alignment Alternatives**

13

## Preliminary Design Alternatives

**Separated Bicycle Facility Alternatives**

Boulevard Multi-Use Trails

Buffered Bike Lanes

Raised Cycle Tracks

14

## Preliminary Design Alternatives

**Sanitary Sewer Alignment Alternatives**

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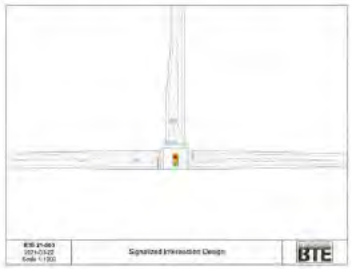
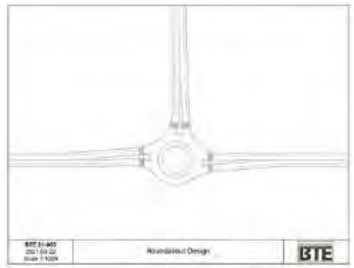
## Preliminary Design Alternatives

**Intersection Alternatives**

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## Preliminary Design Alternatives
### Cross Section Alternatives

Urban with multi-use path and sidewalk

Urban with sidewalk and buffered bike lanes

Semi-urban with multi-use path and paved shoulder

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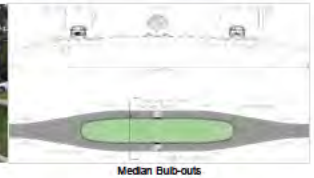
## Preliminary Design Alternatives

Traffic Calming Alternatives

Speed Humps/Cushions or Raised Crosswalks

Centre Median

Chicanes



Median Bulb-outs

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# Community Café

19

## Community Café Process

- Participants will be divided into small groups to allow conversations and dialogue
- At the conclusion of a discussion period, participants will be asked to change tables and mix between topics
- Participants are free to sit out a session
- A recorder person will make notes of the discussion of problems and potential solutions, and pose questions to generate discussion

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## Café Approach

- Focus on dialogue between neighbours
- We are here to listen to your values and priorities
- Informal discussion of topics
- Encouraged to doodle sketches
- Build consensus of perspectives
- Records will be kept of discussions

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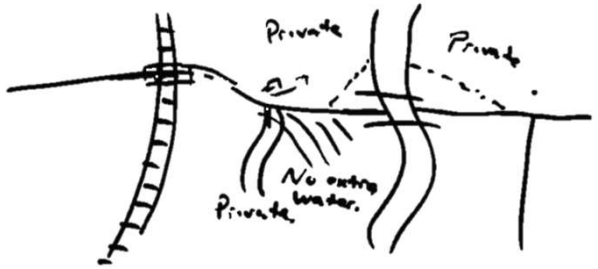
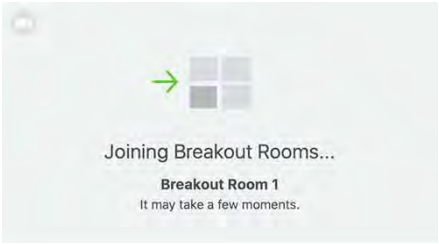
## Sample Doodle




22

## Small Group Discussions

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## Tonight's Café Discussion Topics

- Traffic Operations
- Pedestrians/Cyclists
- Intersection Design
- Impacts to Neighbourhood

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# Schedule and Next Steps

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## Next Steps

1. Needs analysis and presentation of Draft Study Design Report (SDR)
2. Environmental inventories and technical investigations to be used as input for the evaluation
3. Analysis and evaluation of alternatives
4. Selection of Recommended Plan – preferred alignment and consideration of refinements and mitigation for the Recommended Plan
5. Present Preliminary Design of Recommended Plan at PIC No. 2

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## Study Schedule

| Task | Date |
|---|---|
| Project Start-Up Meeting | January 2021 |
| Study Commencement Notice | Winter 2021 |
| Information Gathering | Winter 2021 |
| Environmental Review | Winter/Spring 2021 |
| Study Design | February 2021 |
| Public Information Centre No. 1/ Community Café | Spring 2021 |
| Analysis and Evaluation of Alternatives | May/June 2021 |
| Preparation of ESR | Summer/Fall 2021 |
| Public Information Centre No. 2 | Summer/Fall 2021 |
| City Review of ESR | September/November 2021 |
| 30-day Public Review Period | October/November 2021 |

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## Community Café Wrap-up

- Additional information can be found at:

https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx

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# Appendix D

Community Café Comment Sheets

BT ENGINEERING
BTE

**From:** [redacted]
**Sent:** Wednesday, March 31, 2021 7:40 PM
**To:** Eric Riek <Eric.Riek@kitchener.ca>; stevenj.taylor@bteng.ca
**Subject:** [EXTERNAL] Biehn Dr extension

Hi Eric and Steve,

Can I please get the link for the virtual discussion regarding this extension?

I know there'll probably be the chance to share opinions but the current cul de sac is a wonderful quiet spot to take kids for a walk and let them run around without the heavy traffic that is near our place on Biehn. Not to mention there is a scattering of great trails through that area that allows us to enjoy the woods.

As is, it will already be a big change when subdivisions inevitably get built in the farm fields to the south west of the end of Biehn, but it would be wonderful if there wasn't also a road directing traffic through this area too.

I'd be interested to first see the numbers on how much traffic will get diverted to the Robert ferrie extension when it meets up with the Strasburg extension, as my gut would be that it would help take some of the traffic away from the north end of biehn. I can't see the cars from the area south of caryndale on Biehn adding that much to the traffic on Biehn, I would assume the majority is the other more dense subdivisions to the north of caryndale and would only get added to with the new houses on Robert ferrie.

So to me the Robert ferrie to Strasburg extension makes sense as it will disturb no more forest than it already has (the section that Strasburg has cut through with the bridge). But I don't see the benefit of extending Biehn Drive as well.

If there is the need to divert or run water and or sewer lines from the end of Biehn to connect to Robert ferrie, perhaps there is a option of just running the lines through without the additional cut needed for a full road plus sidewalks.

[redacted]

# Re: Biehn Dr extension

[redacted]

Wed 4/21/2021 11:46 AM

**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; Katherine Scott <katherine.scott@bteng.ca>

Hi all,

Not sure how these community cafes typically go, and how they compare in the Zoom format vs in person, but I think the main takeaway for me was how much of the study group was opposed to the Biehn road extension. I think it's a hard stance to take that the extension will benefit more residents than those that it will hinder/negatively impact.

The concern about affecting the water table is a valid one especially for those that back onto that wetland, and I think the biggest issue for me is how small an area of farmland would actually be accessed by this extension. I don't see the benefit of the access off of Biehn vs directing it all towards Robert Ferrie and Strasburg.

That being said, it sounds like decisions have already been made in the past, though it's definitely interesting to hear how many people on the cafe said they've lived 20+ years in the area and how many were surprised that the extension had already been approved.

I think the descriptions of the paper pamphlet as well as the language used last night by the moderators gave the impression that there was still room for input regarding whether the extension would happen or not. Might have been a bit smoother to say right off the bat, the extension has been approved and is going ahead. This discussion is to get feedback on what that extension would look like.

However, I know from my end being a relatively new resident (5+ years), it is frustrating not having any say in whether the extension happens or not since this discussion has been in the works for so long. And for a project that's been so long in the works, I'm surprised there isn't more data on the existing traffic volumes and the expected volumes when new housing is built and if the extension is built to show what is being used to determine that the extension will in fact cause less traffic on Biehn instead of more.

I find communities like this one where a residential area is almost circled by green space are few and far between and it's pretty discouraging that the city/planners seem more focused on serving new developments vs preserving green space and quiet neighborhoods. I don't think anyone can argue that even the best designed subdivision these days provides a nicer atmosphere than the section of neighborhood at the end of Biehn Dr.

Like I said in the breakout group, I'm not opposed to the development of the farmload beyond the wetland, that is something that we all assume will happen at some point. But there was already a swath of green space that was cut through for the Strasburg extension, and all the new development will already crowd around the greenspace that is left. So I find it hard to justify the Biehn extension for the amount of farmland available for development to the south of the current end of Biehn.

[redacted]

Biehn Drive Extension Class Environmental Assessment and April 20, 2021 Community Café Comments

Land use planning matters.

The Grand River Conservation Authority (GRCA). has confirmed that the area behind our house and the existing Cull de Sac is part of the Provincially Significant Strasburg Creek Wetland Complex. According to the City of Kitchener (C of K) Notice of Study and Community Café, “The study will consider all reasonable alternatives with acceptable effects on the natural, social and cultural environments”. The C of K Strategic Plan for the Environment states “our strategic plan for the environment shows how we will put the environment first, reduce our carbon emissions and preserve our planet. We work to develop and maintain an ecologically diverse open space network that incorporates typical naturally occurring landscapes, significant natural features and the urban forest, all of which embody our natural heritage. We protect our water supply by working with the Region of Waterloo and the Grand River Conservation Authority to replenish and protect our water and wetlands”. If Biehn Drive is extended the C of K is violating its own Strategic Plan for the Environment. It is time for C of K staff and elected officials to lead, not continue as in the past.

Area residents have lived in a wet area for 30 years How is the C of K going to ensure we do not get more water on our properties and in our basements if the wetlands are tampered with? What is the Contingency Plan if this occurs? Documentation of the contingency plan is only fair to existing residents.

Page 9 of the Environmental Assessment (EA)

Alternative 5: Extend Biehn Drive Environmental “Low to medium environmental effect possible with new corridor. Management of effects is subject to environmental mitigation”.

Background data and methodology on how this rating was achieved must be included as part of the EA. As it reads now, the rating is only an opinion of the author(s).

“Magnitude of effects is subject to environmental mitigation.” What does this mean? Environmental mitigation steps must also be documented in the EA.

Page 13 of the EA: Biehn Drive Traffic Calming Study

Please provide the modelling data and any other information for this study as it becomes available.

During the Community Café it was pointed out many times that the proposed extension of Biehn Drive does nothing for the existing residents. We do not want the road extended. Extending Biehn Drive is an unnecessary expense.

It was also pointed out on numerous occasions in the Café that if water and sewer connections are required to the existing infrastructure on Biehn Drive a road is not required to do this. The connections could be done with an easement.

In conclusion the entire EA and Community Café is slanted towards the extension of Biehn Drive. The environment and wishes of existing area residents must be considered. Does the C of K lead and follow its Strategic Plan for the Environment or do mistakes from the past continue?

Biehn Drive City Café and Environmental Assessment Comments

The City of Kitchener invited interested residents to a Community Café Zoom meeting April 20 to discuss the extension of Biehn Drive. Many people talked at the meeting. We ask that you come to a decision with an open mind. Please take into account the comments the people have made.

Kitchener has a decision to make. On one hand the extension of Biehn, which involves plowing through the Provincially Significant Strasburg Creek Wetland Complex. On the other hand, planning a new route through the new subdivision, leaving the wetland alone.

The wetland at the end of Biehn Drive is loved by our family. It is part of our neighbourhood. We have lived here for 31 years and have seen the trees from all our windows. We have seen the forest change through the seasons, seen the mature trees moving in the wind, seen the sunset through their branches. The land behind our house and around the circle is extremely wet. It is a true wetland with its unique and complex biodiversity.

Kitchener can be archaic or Kitchener can be progressive. Archaic-disregard nature. Stick to a plan that was devised 30 years ago. Progressive- see the value of this wetland and change with the times.

Unfortunately, the forest that joins our wetland has already been altered by the removal of trees and the paving of Strasburg Road right through it. The forest was sliced in half.

How many wetlands in the City of Kitchener and Waterloo Region have been lost during all these years of development?

We hope you will save this one. Please do so before it is too late, and all that is left are regrets.

Sincerely,

[redacted]

**From:** [redacted]
**Sent:** April 23, 2021 4:28 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>
**Subject:** Re: Biehn drive extension assessment zoom meeting

Hi Steve
I did not receive a Zoom link for the Community Cafe on April 20.
Even though I was not able to take part in the discussions I am still interested in the plans for the Biehn Extension.
I wonder how much influence local residents actually will have on developing a design.

I have read the draft report on the website and have some thoughts.
-It refers to Biehn as becoming a major collector road - It already is. The speed of the traffic on Biehn has already become dangerous. If the extension is built the problem will increase. It will create the need for added "calming" devices installed to slow drivers down. At the moment cars have to stop to turn onto Caryndale. That slows the raceway down a bit.
- Mention is made of "cut through" traffic. What streets are those? Biehn is the main road through.
- what is going to happen to the wildlife corridor behind Biehn? If it gets disturbed for a road, the wildlife will be cut off from their pond access and roaming areas. Their habitat has already been disturbed by the Strasburg Extension construction.
- How will the swamp recharge area be handled? This is a sensitive area.
- Could the developers not access servicing off Hearthwood or Robert Ferrie?

Please add me to the study's mailing list.
[redacted]

## Katherine Scott

**From:** [redacted]
**Sent:** April 22, 2021 1:04 PM
**To:** Katherine Scott
**Subject:** RE: Biehn Drive | Online Community Cafe (April 20, 2021)

I have one add on suggestion please

Would it be possible to build the road towards Biehn dr. and just stopping short of wetlands? You could build a cul de sac? This would allow development for most of area

Thanks

[redacted]

Sent from Mail for Windows 10

---

**From:** Katherine Scott
**Sent:** April 12, 2021 11:24 AM
**Cc:** Steve Taylor (London); Eric Riek
**Subject:** Biehn Drive | Online Community Cafe (April 20, 2021)

Good morning,

Thank you for registering for the Biehn Drive Extension Class Environmental Assessment (EA) Community Cafe Event. The online Community Cafe is scheduled for April 20, 2021 from 6:30 to 8:00 pm. The meeting will be held on Zoom and can be accessed via the following link: https://us02web.zoom.us/j/88151905825

I will also forward a meeting invite to update your calendar.

Please let me know if you have any comments or concerns in advance of the call.

Thanks,

Katherine Scott

BT ENGINEER

509 Talbot Street

London, Ontario N6A 2S5

katherine.scott@bteng.ca

(519) 672-2222

# Newsletter

**Biehn Drive Extension**

## 1. BIEHN DRIVE EXTENSION CLASS ENVIRONMENTAL ASSESSMENT

The City of Kitchener (City) is conducting a Class Environmental Assessment (EA) Study for the extension of Biehn Drive southerly to the Robert Ferrie Drive. The Biehn Drive extension will include a trunk sanitary sewer, storm sewer/ditches and watermain. The Study is evaluating alternatives for the alignment of the Biehn Drive extension, intersection locations and designs, and municipal services, while minimizing natural, social, cultural and land use impacts. The Study Area is illustrated on the **Figure 1, Study Area**.

**Figure 1: Study Area**

## 2. NEED AND JUSTIFICATION

The extension of Biehn Drive has been part of the integrated land use and transportation plan for the larger community. The City of Kitchener Official Plan (November 2014) identifies Biehn Drive as a Major Community Collector Street, shown in yellow. Refer to **Figure 2, Future Road Network**. Collector streets function to collect traffic from several local streets and provide access to arterial streets, shown in purple.

The previous studies that have led to this plan have included:

1) Brigadoon Community Plan (1989);
2) Official Plan Amendment No. 98 (1991);
3) Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994);
4) Kitchener Planning and Development Staff Report PD95/51 (1994);
5) Updated Brigadoon Community Plan (2005);
6) Kitchener Integrated Transportation Master Plan (2013);
7) Robert Ferrie Drive Extension Environmental Assessment (2014); and
8) Official Plan Amendment No. 103 in March 21, 2019.

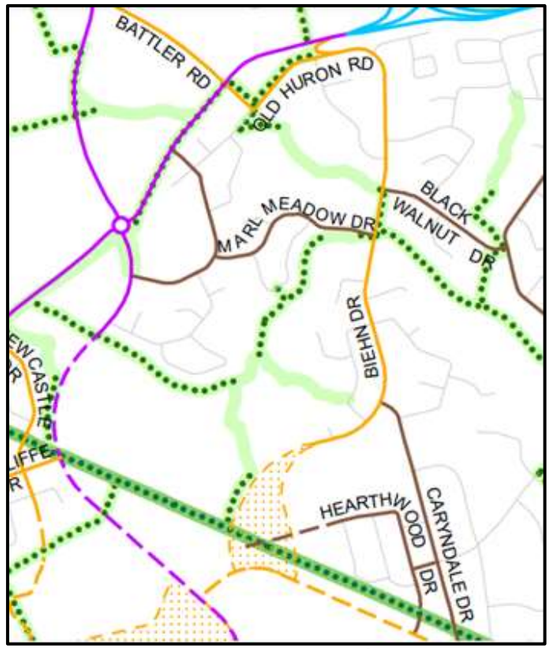



**Figure 2: Future Road Network (OP Map 11 - Integrated Transportation System)**

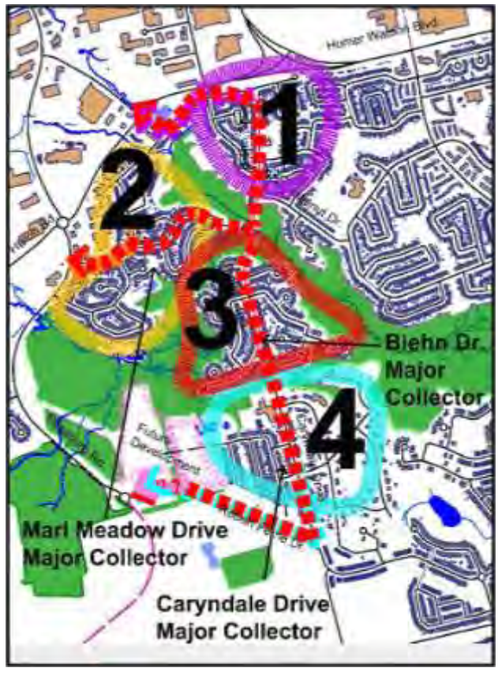



**Figure 3: Community Neighbourhoods**

## 3. WHAT IS THE TRAFFIC RATIONALE FOR THE BIEHN DRIVE EXTENSION?

During the recently held Community Café event, residents on Biehn Drive questioned the transportation justification for the street extension. Many previous transportation studies have described the need for an adequate collector road network for access to the community.

The individual neighbourhoods are shown in **Figure 3**. These neighbourhoods are bounded by Strasburg Road and Huron Road, each an arterial road. Close convenient access to the arterial road network will minimize traffic on any one collector road and provide greater safety. To demonstrate the rationale for the current plan (Biehn Drive extension), the four neighbourhoods and the average travel distance of each to the arterial road system are as follows:

**Neighbourhood 1** (purple): average distance to Huron Road is approximately 800 metres.

**Neighbourhood 2** (yellow): average distance to Strasburg Road is approximately 450 metres.

**Neighbourhood 3** (red): average current distance to Strasburg Road is approximately 1200 metres, and 1300 metres to Huron Road.

**Neighbourhood 4** (blue): average distance to Strasburg Road is approximately 600 metres.

If the new Biehn Drive link is not constructed, traffic from Neighbourhood 3 will continue to go through an adjacent neighbourhood.

## 4. PREVIOUS NEED AND JUSTIFICATION REVIEW (2014)

The Biehn Drive Extension Need and Justification Report was completed by Paradigm Transportation Solutions in June 2014. This report identified that eliminating the Biehn Drive extension would result in:

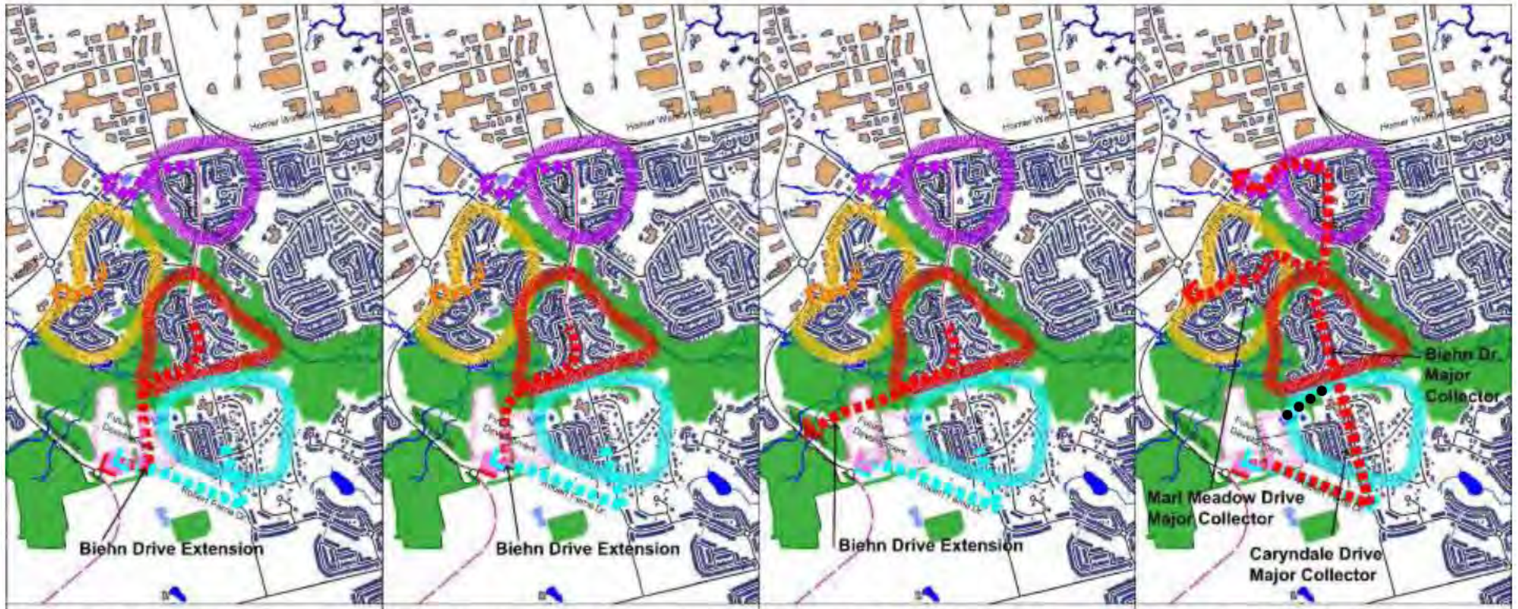
- Inefficiencies in the road network and backtracking/out-of-way travel for residents in the Doon South/Brigadoon communities;
- Insufficient capacity to accommodate the forecast traffic demands at the 2031 planning horizon; and
- Increased traffic on adjacent streets (i.e. Caryndale Drive, Templewood Drive, and Biehn Drive, northeast of the Study Area). These roads would be operating at traffic levels above their road classifications.

The Report concluded that eliminating Biehn Drive would be a fundamental design change to the Doon South/Brigadoon communities and would result in significant impacts to adjacent roads and other neighbourhoods, and that the Biehn Drive extension is therefore required

## 5. ALTERNATIVES

Three alternatives were presented at Public Information Centre (PIC) No. 1 and to residents at the Community Café event. Based on comments received by attendees at the Community Café, a fourth alternative has been added for the subsequent evaluation. The preliminary transportation alternatives for the study are shown on **Figure 4** below:

**New:** Alternative 4 will use existing collector roads to move vehicular traffic within the Doon South and Brigadoon communities, as shown in the figure below. With Alternative 4, these collector roads will serve traffic from their local neighbourhoods as well as Neighbourhood 3 (red). The project will include an extension of Biehn Drive for a maintenance road for the new sanitary sewer extension and an active transportation link as per the Official Plan.




| Alternative 1 - Carried Forward ✓ | Alternative 2 - Carried Forward ✓ | Alternative 3 - Not Carried Forward ✗ | Alternative 4 - Carried Forward ✓ |
|---|---|---|---|
| Extension of Biehn Drive to Strasburg Road east of Hydro One transmission tower | Extension of Biehn Drive to Strasburg Road west of Hydro One transmission tower | Extension of Biehn Drive to Strasburg Road directly westerly to Strasburg Road (**not carried forward** based on higher relative environmental impacts) | Use existing collector roads in adjacent neighbourhoods to access the arterial roads<br>●●●● Sanitary sewer and active transportation link |

**Figure 4: Alternatives**

## 6. FREQUENT QUESTIONS AND ANSWERS

Answers to questions we received at the initial community engagement are provided on the City's website at https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx#Frequently-asked-questions

**NEXT STEPS**

Next steps in the Class Environmental Assessment (EA) process are:

- Carry out environmental inventories and technical investigations;
- Complete the analysis and evaluation of alternatives;
- Hold Public Information Centre No. 2;
- Document the recommendations in the Environmental Study Report; and
- 30-day public review period of the Environmental Study Report.

There is an opportunity for public input at any point during the EA process. Comments and questions can be sent to the City and Consultant representatives below. All information is being collected in accordance with the *Freedom of Information and Privacy Act*.


| **Steve Taylor, P.Eng.** | **Eric Riek, C.E.T.** |
|---|---|
| EA Project Manager | City Project Manager |
| BT Engineering Inc. | City of Kitchener |
| 509 Talbot Street | 200 King Street West |
| London, Ontario N6A 2S5 | Kitchener, ON N2G 4G7 |
| Tel: 519-672-2222 | Tel: 519-741-2200 ext. 7330 |
| Email: stevenj.taylor@bteng.ca | Email: eric.riek@kitchener.ca |

# Public Information Centre No. 2 Summary Report

## Biehn Drive Municipal Class Environmental Assessment

December 2021

**Submitted by:**
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
519-672-2222

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Appendix B PIC Exhibits
Appendix C Comment Sheets

# 1.0 INTRODUCTION

The City of Kitchener (City) has initiated a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive Extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain.

The Class EA Study will complete all required phases of the Municipal Class Environmental Assessment. The study will: establish the need and justification for the improvements; complete environmental inventories; establish a baseline to compare alternatives; consider all reasonable alternatives; and proactively involve the public in defining a recommended plan for improvements.

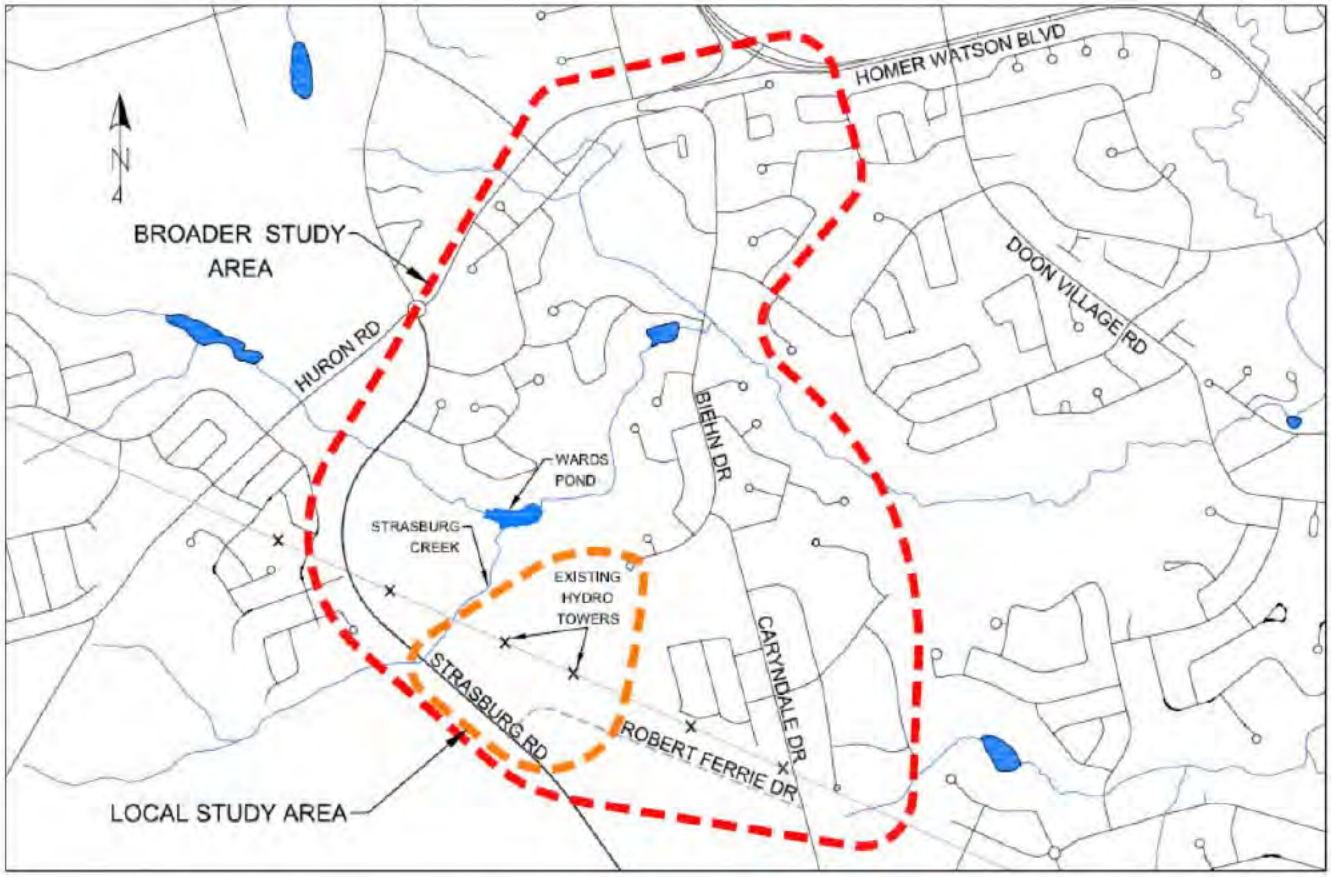
Based on the range of anticipated effects and capital cost of the project, the study is being conducted as a Municipal Schedule C Class EA. At the completion of the project, an Environmental Study Report will be prepared for a 30-day public review period.

Public Information Centre (PIC) No. 2 for this Study was held online from November 15 to November 29, 2021. A “live” virtual meeting was held on November 17, 2021 from 6:30 to 8:00 pm and included a presentation and a question and answers session. The Public Information Centre presented information on background information, the analysis and evaluation of alternatives, and the technically preferred alternative.

All members of the public and interest groups were invited to view the Online Public Information Centre material and were encouraged to provide a written response to any issues or concerns.

## 1.1 Study Area

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension. Based on comments from the public at the Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods.




**Legend**

Local Study Area

Broader Study Area

Based on comments from PIC No. 1

**Figure 1: Project Location**

## 2.0 PUBLIC AND AGENCY CONSULTATION

One of the key aspects of the study is to provide the public, interested parties, affected agencies and municipalities with the opportunity for input. In order to ensure this objective is met, a public and agency notification program was undertaken. The program includes a number of communication mechanisms, discussed in the following sections.

### 2.1 Individual Property Owner Contacts

Notices were mailed to property owners within the study area, inviting them to attend the online Public Information Centre. The notice was also distributed electronically to members of the public/ stakeholders that had identified an interest in the study or requested to be on the mailing list.

### 2.2 Indigenous Peoples Contacts

Notices were sent to the Indigenous Peoples in the vicinity of the Study Area, inviting them to attend the online PIC. Notices were sent to the following:

- Huron Wendat Nation
- Haudenosaunee Confederacy Chiefs Council
- Metis Nation of Ontario
- Six Nations of the Grand River
- Mississaugas of the Credit First Nation

### 2.3 Newspaper Notice

Notices of the Public Information Centre were published in The Record on October 29, 2021.

The newspaper notice is in **Appendix A**.

### 2.4 Agency and Stakeholder Contacts

The following ministries, agencies and stakeholders were invited to attend the online PIC:

- Ministry of the Environment, Conservation and Parks
- Ministry of Natural Resources and Forestry
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Environment Canada, Ontario Region
- Infrastructure Ontario
- Ministry of Agriculture, Food and Rural Affairs
- Ministry of Indigenous Affairs
- Grand River Conservation Authority
- Emergency Services
- Utilities
- Regional Municipality of Waterloo

## 3.0 PIC COMMENTS

PIC Exhibits were provided online for public/agencies to view at their convenience. A copy of the PIC exhibits is provided in **Appendix B**.

Nine (9) comment sheets and emails were received during and after the comment period. Copies of the comments, excluding personal information, are provided in **Appendix C**.

### 3.1 Summary of Comments

The comments received and discussions held during the Public Information Centre are summarized below in **Table 1**.

**Table 1: Summary of Written Comments**

| Comment | Number of Respondents | Comment Sheet No. |
|---|---|---|
| Support for extension of Biehn Drive to Robert Ferrie Drive. | 2 | 1, 5 |
| Concern for prioritizing road improvements and development over the environment and not preserving green areas. | 4 | 2, 4, 6, 7 |
| Opposition to constructing a parking lane and multi use path on the Biehn Drive extension to minimize disruption to the wetland and preserve the environment. | 1 | 3 |
| Concern for community disruption and increased traffic volumes, and identifying the need for traffic calming measures. | 4 | 4, 6, 7, 9 |
| Concern for sightlines of vehicles entering/exiting driveways along the existing Biehn Drive. | 2 | 7, 8 |
| Concern that the publics' input was not included in the decision making process and selection of the preferred alternative. | 3 | 6, 7, 8 |
| Opposition to the extension of Biehn Drive extension and concern that the roadwork does not align with the City of Kitchener's strategic plan for environmental protection. | 1 | 8 |
| Concern that private properties will flood due to permanent disruptions to the wetland. | 2 | 4, 8 |
| Emergency access/response should rely on response time instead of access. | 1 | 4 |
| People shortcut through Marl Meadow Drive and Templewood Drive to Strasburg Road or Huron Road. This should be taken into consideration in the evaluation for efficiency of travel and community disruption to Biehn Drive north. | 1 | 4 |
| Concern regarding the negative impacts on Strasburg Creek which connects to the wetland. | 1 | 4 |

| | | |
|---|---|---|
| Request to redo the evaluation of alternatives after removing traffic from Caryndale South and Doon South since it will be accommodated by the Robert Ferrie Drive extension. | 1 | 4 |
| Concern that Alternative 4 was not fairly evaluated and evaluation criteria were prejudiced against this criterion. Concerns include:<br>• Introducing a second access road to Street A on the north side of the hydro tower for this alternative.<br>• Need to consider proper development of the lands south of the PSW.<br>• Traffic will be support by the extension of Robert Ferrie Drive. | 1 | 4 |

# 4.0 CONCLUSIONS AND RECOMMENDATIONS

## Conclusions

The main comments or concerns, both verbal (i.e. phone calls, virtual meetings) and written, from the public information centre include:

- Disruption to the environment/wetland and prioritizing transportation needs over the environment
- Support for the project and the need for the Biehn Drive extension
- Negative impacts on Strasburg Creek which connects to the wetland
- Impacts to drainage and groundwater levels due to possible wetland and environment disruption
- Consider greater use of Caryndale Drive to carry additional traffic and have more community traffic reach Strasburg Road using Robert Ferrie Drive as opposed to Biehn Drive

## Recommendations for Future Actions

Actions for future review and consideration in the design include:

- Consideration of sightlines of vehicles entering/exiting driveways along the existing Biehn Drive
- Consideration for modifications to the cross section to minimize wetland disruption (i.e. removing the multi-use pathway, narrower boulevards and parking lanes)

# Appendix A

Newspaper Notice

BT ENGINEERING

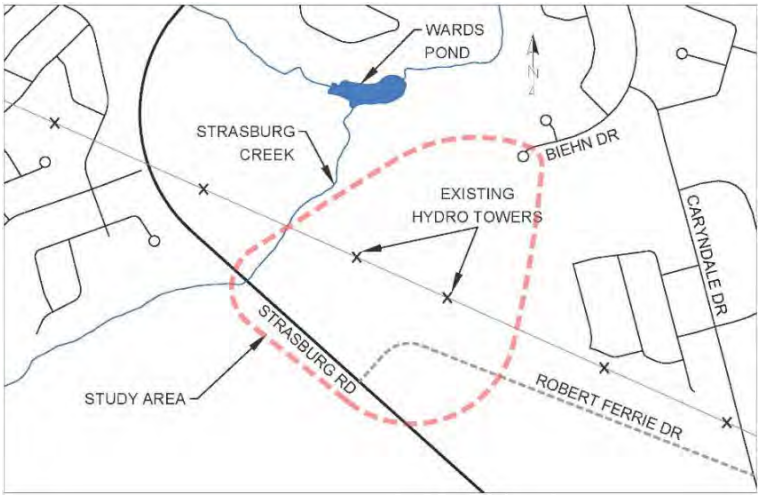
# Notice of Online Public Information Centre (PIC)

# City of Kitchener

# Biehn Drive Extension Environmental Assessment Study

## INTRODUCTION

The City of Kitchener is conducting an Environmental Assessment (EA) Study for the extension of Biehn Drive from the existing terminus 300 m west of Caryndale Drive to the future Robert Ferrie Drive extension. The Study will evaluate alternatives for alignment, cross sections, intersections, and active transportation to develop a preferred plan to address the needs of the Study Area and reflect the recommendations in the City of Kitchener Transportation Master Plan.




## STUDY PROCESS

The Biehn Drive Extension EA is being conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015). The Transportation Master Plan (TMP) has previously completed Phases 1 and 2 of the Class EA; this Study will review the previously completed phases and complete Phases 3 and 4. The Study will consider all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and proactively involve the public, stakeholders and Indigenous Peoples.

## PUBLIC CONSULTATION

The City wishes to ensure that anyone interested in this study has the opportunity to be involved and provide input. The City has scheduled a second online Public Information Centre (PIC) meeting for this project that will include a series of exhibits that present background information, the evaluation of alternatives and the Technically Preferred Alternative. At the present time, this PIC is relying on web-based communications due to restrictions on public gatherings. Comments on the information presented can be provided by contacting the City or consultant project managers' email addresses listed below.

The PIC will be held for a two-week period, with a "live" virtual Zoom meeting on November 17, 2021. **To register for the Zoom meeting, please contact Steve Taylor or Eric Riek.** The Online Public Information Centre is scheduled for:

**PIC Date:** November 15 to 29, 2021

**Virtual Zoom Meeting Date:** November 17, 2021 from 6:30 to 8:00 PM

**Website:** https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx

There is an opportunity at any time during the Class EA process for interested persons to provide comments. Early identification of individual and group concerns greatly aids in addressing these

concerns. All information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act* (2009). With the exception of personal information, all comments will become part of the public record. Persons will be advised of future communication opportunities by newspaper public notice, email notice and posting on the City website.

For more information or if you wish to be placed on the study's email mailing list, contact either:

**Steve Taylor, P.Eng.**
**EA Project Manager**
**BT Engineering Inc.**
509 Talbot Street
London, ON N6A 2S5
Tel: 519-672-2222
Email: stevenj.taylor@bteng.ca

**Eric Riek, C.E.T.**
**City Project Manager**
**City of Kitchener**
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
Email: eric.riek@kitchener.ca

# Appendix B

PIC Exhibits

BT ENGINEERING

# Welcome!
# City of Kitchener
## Biehn Drive Extension
## Class Environmental Assessment

Thank you for participating in the Online Public Information Centre (PIC) for the City of Kitchener's Class Environmental Assessment (EA) for the extension of Biehn Drive and the sanitary trunk sewer.

At the present time, the Province of Ontario has implemented restrictions on public gatherings to deal with the COVID-19 pandemic. As a result, this Public Information Centre is relying on web-based communications. Should you have any questions regarding the study, please contact the City or Consultant Project Managers.

There is an opportunity at any time during the Class EA process for interested persons to provide written input. Any comments received will be collected under the *Environmental Assessment Act* and, with the exception of personal information, will become part of the public record.

Comments can be submitted by emailing stevenj.taylor@bteng.ca and/or eric.riek@kitchenar.ca by **November 29, 2021**.

KITCHENER

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# Purpose of Public Information Centre

The purpose of this meeting is to:

- Present the evaluation of alternatives.
- Obtain comments on the Technically Preferred Alternative.
- Obtain comments on the proposed mitigation plan.
- Identify any remaining areas of concern.

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# Introduction

The City of Kitchener has retained BT Engineering Inc. to undertake an Environmental Assessment (EA) Study for the extension of Biehn Drive from its current terminus to the future Robert Ferrie Drive Extension. The Study includes the extension of the trunk sanitary sewer, watermain and storm sewers to Robert Ferrie Drive, to serve areas to the south.

The City has completed Phases 1 and 2 of the Municipal Class EA through the Transportation Master Plan, which has been reviewed and summarized in this study. Phases 3 and 4 of the Municipal Class EA are being completed by developing and evaluating alternative designs and completing the Environmental Study Report, while proactively involving the public and stakeholders in defining a recommended plan for improvements.

This Study is being completed as a Schedule C undertaking, based on the range of anticipated effects, and the proposed infrastructure extension will be completed as a Schedule B. The Study Design Report describing the study process has been made available for agency and public comments and on the website.

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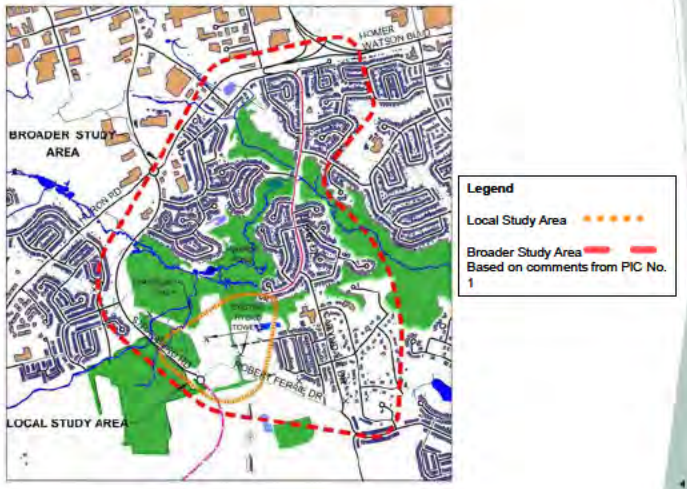
# EA Study Area

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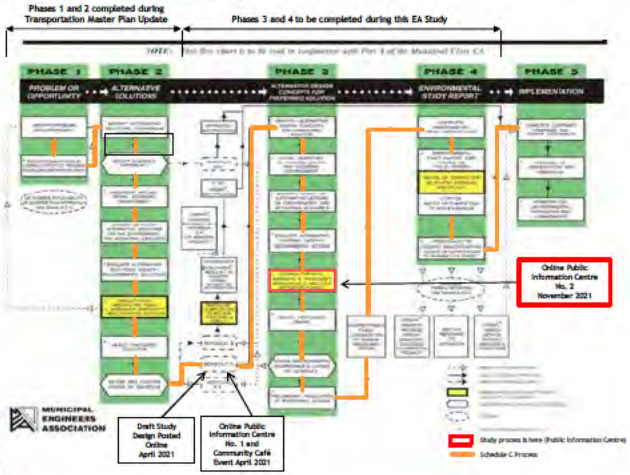
# Municipal Class Environmental Assessment

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# Background Studies

The following studies have been completed that are relevant to this study:

1. Brigadoon Community Plan (1989);
2. Official Plan Amendment No. 98 (1991);
3. Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994);
4. Kitchener Planning and Development Staff Report PD95/51 (1994);
5. Updated Brigadoon Community Plan (2005);
6. Kitchener Integrated Transportation Master Plan (2013);
7. Robert Ferrie Drive Extension Environmental Assessment (2014); and
8. Official Plan Amendment No. 103 in March 21, 2019.

These reports are available online for review upon request. Please contact the identified Project Managers to arrange for review.

6

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# Background Information

- Community Plans for the Doon South and Brigadoon areas have established the need for the extension of Biehn Drive
- This has been documented in the Official Plan and Transportation Master Plan
- The new road link will accommodate all modes of transportation (vehicles, trucks, pedestrians and cyclists)

**Why is the project needed?**

- Needed to evenly distribute traffic to the arterial road network.
- Multiple connections to arterial roads reduce the traffic volumes in any one neighbourhood and the travel time, and improve access for emergency services.
- Currently, existing traffic from Biehn Drive must travel through adjacent neighbourhoods.
- To provide a sanitary and water service corridor.

**Why is it being implemented now?**

- Strasburg Road has been constructed and will provide a western arterial street to service the community.
- With implementation of the proposed Biehn Drive extension, traffic will not have to take a circuitous route through neighbourhoods to reach the arterial road network.
- Required to accommodate future development.

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# Existing Conditions

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## Official Plan – Integrated Transportation System

Source: City of Kitchener Official Map 11 Integrated Transportation System, 2014

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## Natural Environment

Overview:

- Strasburg Creek Provincially Significant Wetland
- Intermittent overland flow through the wetland
- Strasburg Creek
- Wildlife habitat
- Specimen trees

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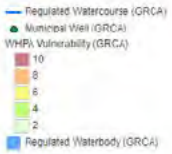
## Well Head Protection Area




https://maps.grandriver.ca/web-gis/public/?theme=MYP&bbox=542091,4802909,545343,4804695

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## Preliminary Design Alternatives

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# Preliminary Alignment Alternatives

## Alternative 4 added following PIC No. 1

13

# Coarse Screening of Alignment Alternatives

| Coarse Screening of Alignment Alternatives | | | | |
|---|---|---|---|---|
| **Screening Criteria** | **Alternative 1: Connect to Robert Ferrie Drive east of Hydro Tower** | **Alternative 2: Connect to Robert Ferrie Drive west of Hydro Tower** | **Alternative 3: Strasburg Road Connection** | **Alternative 4: Connect Biehn Drive to Robert Ferrie Drive – Via Caryndale Drive** |
| Does this alternative satisfy forecast traffic demand, improve safety and address all modes of transportation? | Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive. | Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive. | Provides a north-south connection to Strasburg Road. Accommodates all modes. | Provides a north-south connection to Strasburg Road. Accommodates all modes. However, there are increased levels of traffic on local roads. |
| Does the approach result in significant impacts to the natural environment? | Minor impacts to the woodlot/PSW (~0.3 ha). | Minor impacts to the woodlot/PSW (~0.3 ha). | Significant impacts to the woodlot/wetland (~1.3 ha). | No impacts. |
| Is the approach affordable for the City to implement? | No significant difference. | No significant difference. | Higher cost - requires an intersection onto Strasburg Road (arterial). | Affordable alternative. |
| Does this alternative comply with the recommendations of the City's planning documents (i.e., TMP, OP, KGMP) | This alternative complies with the recommendations of the City's planning documents. | This alternative complies with the recommendations of the City's planning documents. | Does not comply with the recommendations of the Official Plan or Growth Management Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible. | This alternative does not comply with the recommendations of the City's planning documents. |
| Recommendation: | ✓ Carry forward for further evaluation | ✓ Carry forward for further evaluation | × Do not carry forward | ✓ Carry forward for further evaluation |

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# Alignment Alternative 1

Connect Biehn Drive to Robert Ferrie Drive – East Alignment

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# Alignment Alternative 2

Connect Biehn Drive to Robert Ferrie Drive – Central Alignment

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## Alignment Alternative 4

Connect Biehn Drive to Robert Ferrie Drive – Via Caryndale Drive

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## Analysis and Evaluation Alignment Alternatives

The analysis and evaluation of the alternatives has been undertaken using a quantitative evaluation methodology. Seven global evaluation factor were considered:

- Transportation
- Natural Environment
- Cultural Environment
- Socio-Economic Environment
- Land Use and Property
- Cost
- Engineering

- The factor groups are made up of measurable criteria (sub-factors) used to identify relevant benefits and impacts.
- They define a unit of measure and the relative differences between alternatives.
- Evaluation data was collected from literature reviews of background documentation and environmental inventories completed for this project.
- The results are presented on the following exhibits and documented in the Analysis and Evaluation Report, available upon request.

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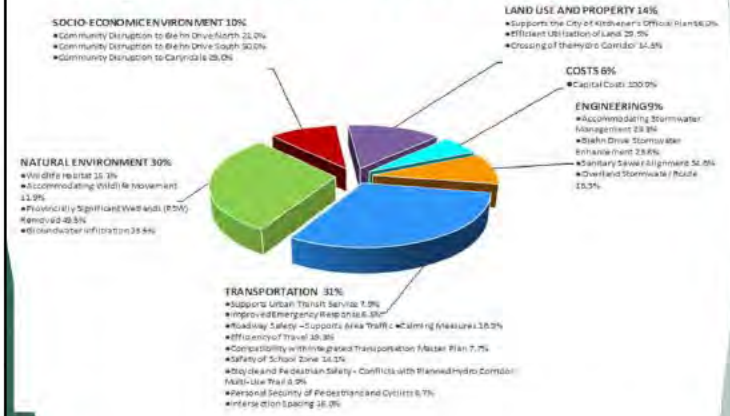
## Evaluation - Global Factor Weights and Sub-factor Weights

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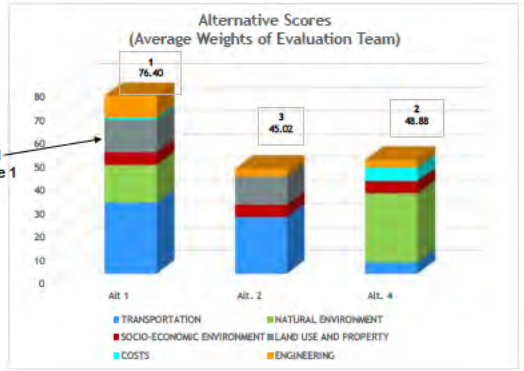
## Alignment Alternatives - Scores

Technically Preferred Alternative Alternative 1

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## Sensitivity Testing

| Alternatives | | | Alt 1 | Alt. 2 | Alt. 4 |
|---|---|---|---|---|---|
| FACTORS | WEIGHT | Score: | 76.40 | 45.02 | 48.88 |
| Ranking | | | 1 | 3 | 2 |
| | | | | | |
| TRANSPORTATION | High | 45.00% | 1 | 2 | 3 |
| | Low | 20.00% | 1 | 3 | 2 |
| NATURAL ENVIRONMENT | High | 40.00% | 1 | 3 | 2 |
| | Low | 20.00% | 1 | 2 | 3 |
| SOCIO-ECONOMIC ENVIRONMENT | High | 15.00% | 1 | 3 | 2 |
| | Low | 10.00% | 1 | 3 | 2 |
| LAND USE AND PROPERTY | High | 20.00% | 1 | 2 | 3 |
| | Low | 10.00% | 1 | 3 | 2 |
| COST | High | 10.00% | 1 | 3 | 2 |
| | Low | 2.00% | 1 | 2 | 3 |
| ENGINEERING | High | 15.00% | 1 | 3 | 2 |
| | Low | 5.00% | 1 | 3 | 2 |

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## Cross Section Alternative Evaluation

Alternatives were developed to reflect the City of Kitchener's Complete Streets guidelines.

| Evaluation Criteria | Alternative 1 – 26 m ROW with Multi-use Trail ✓ | Alternative 2 – 26 m ROW with Bike Lanes |
|---|---|---|
| Active Transportation | MUTs are preferred by the greatest proportion of cyclists (interested but concerned).<br>Greater network continuity for cyclists with the future MUT along the Hydro corridor and potential to connect to the MUTs along Strasburg Road | Better accommodates pedestrians by separating pedestrians and cyclists<br>Increased conflict between cyclists and access to/from parked vehicles |
| Traffic Calming | The reduced pavement width would better promote lower travel speeds | Wider asphalt surface would be less effective in reducing travel speeds |
| Impacts to Natural Environment / Storm Water Quality | All alternatives considered equal. | All alternatives considered equal. |
| Impacts to Developable Lands | All alternatives considered equal. | All alternatives considered equal. |
| Cost | MUTs are more cost effective to construct with reduced pavement thickness and granulars | Wider roadway pavement structure increases construction cost |

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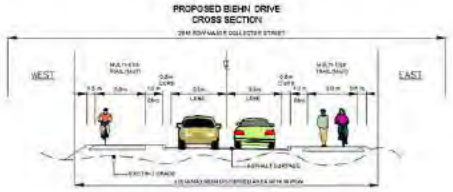
## Preferred Cross Section

CROSS SECTION
ALTERNATIVE 1




TYPICAL PSW SECTION

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## Preliminary Design Alternatives

- Two (2) Sanitary Sewer Alignment Alternatives were considered.
- The Preferred Sanitary Sewer alignment matches the Preferred Road Alignment Alternative 1.

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## Preliminary Design Alternatives

- Sanitary Sewer service area

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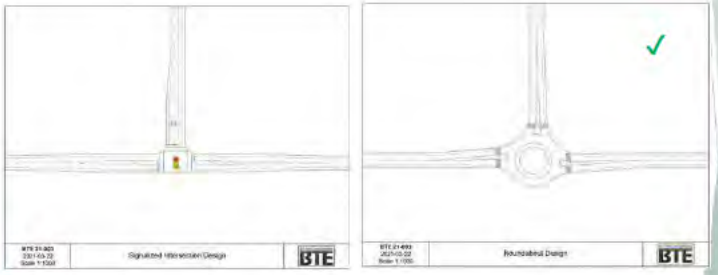
## Preliminary Design Alternatives
## Intersection Alternatives
### Biehn Drive and Robert Ferrie Drive

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## Traffic Projections

**The proposed extension of Biehn Drive is projected to:**

- Carry an average of 2500–3000 vehicles/day, well within its capacity as a major collector road,
- Result in a more balanced redistribution of area traffic volumes, providing relief (reducing the traffic volumes) on other area roads including Caryndale Drive and the north segment of Biehn Drive, which are both currently overutilized.

**A roundabout is proposed at the intersection of Biehn Drive and Robert Ferrie Drive:**

- Consistent with the approved plan identified in the Robert Ferrie Drive Class Environmental Assessment
- Due to the proximity to Strasburg Road (to limit queuing) and to accommodate pedestrian crossings
- To accommodate access to future development south of Robert Ferrie Drive.

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## Technically Preferred Alternative

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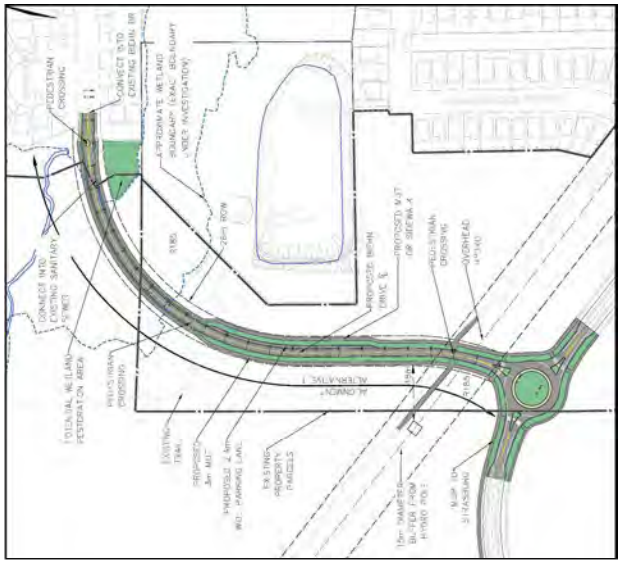
## Preferred Alignment Alternative



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## Mitigation Table

| Issue/Concern Potential Effects | Concerned Agency | Proposed Mitigation (prevent, lessen or remedy potential detrimental environmental effects) |
|---|---|---|
| Loss of Provincially Significant Wetland (PSW) | GRCA | • Wetland Restoration in vacant lot on Biehn Drive.<br>• Narrowing of roadway through PSW.<br>• Utilize Best Management Practices and limit disturbance to wetlands and vegetation.<br>• Limit vegetation removal, where feasible.<br>• Protect vegetation to remain using tree protection. |
| Wildlife Crossing | GRCA | Provide equalization culverts and permanent, directional wildlife fencing to permit wildlife passage across roadway. |
| Groundwater | MECP | Avoid draw-down of water table by ensuring the bottom of granulars are above original ground. |
| Fish Habitat: downstream impacts to Strasburg Creek cold water fish habitat | GRCA, NDMNRF | • Provide erosion and sediment controls.<br>• Minimize the delivery of sediments and associated pollutants to receiving watercourses.<br>• Minimize the impact of road salt on the local vegetation and receiving watercourses.<br>• Minimize the impact of increased flows on receiving watercourses.<br>• Minimize potential erosion within the drainage system, and within the local receiving watercourses. |

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## Mitigation Table

| Issue/Concern Potential Effects | Concerned Agency | Proposed Mitigation (prevent, lessen or remedy potential detrimental environmental effects) |
|---|---|---|
| SAR | MECP | • Undertake targeted, specialized SAR surveys during Detail Design as required depending on species conservation status designations as they exist at that time. At this time, no SAR have been identified in the Study Area.<br>• Ensure the design and construction complies with the *Endangered Species Act* (ESA, 2007) |
| Migratory Birds | NDMNRF | Any clearing and grubbing should be completed outside of the active breeding bird season of April 1 to August 31. |
| Turtles and Turtle Habitat | NDMNRF | • Install silt fencing before turtle nesting season (May 15 to Sept. 30).<br>• Protect and buffer active nests.<br>• Avoid groundwater alteration in nearby wetlands between October 1 and April 1 during turtle hibernation. |
| Water Quality and Stormwater | MECP | Provide a Stormwater Management Plan. |
| Significant Woodlots | NDMNRF | Avoid specimen trees and limit tree clearing. |

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## Mitigation Table

| Issue/Concern Potential Effects | Concerned Agency | Proposed Mitigation (prevent, lessen or remedy potential detrimental environmental effects) |
|---|---|---|
| Noise | City | Municipal Noise By-laws are to be followed during construction adjacent to residential areas. |
| Management of Surplus Materials | MECP | OPSS 180 apply MECP "Management of Excess Materials in Road Construction and Maintenance Guidelines".<br>Management and Disposal of Wet Soils. |
| Traffic calming | City | • Narrowing of cross section<br>• Reduced lane widths<br>• Provision of a roundabout to assist in controlling speeds |
| Lighting | GRCA | Provide cut-off lighting through PSW. |
| Utilities | | Liaison during detail design. |
| Changes to Emergency Services | | Liaison during detail design. |

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# Next Steps

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## Next Steps

**Following this Public Information Centre we will:**

- Review all online Public Information Centre comments and prepare a Summary Report
- Develop refinements to the Technically Preferred Alternatives (if required) based on public comments
- Prepare the Environmental Study Report (ESR)
- Initiate 30-day public review period of the ESR

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## Your Involvement

**How can you remain involved in the Study?**

- Request that your name/e-mail be added to the Study Mailing List
- Provide an online comment
- Contact the Municipality's representative or the consultant at any time. Contact information is available below.

**Thank you for your participation in this online Public Information Centre.**

Your input into this study is valuable and appreciated.

All information is collected in accordance with the *Freedom of Information and Protection of Privacy Act*.

## For More Information Please Contact:

Steve Taylor, P.Eng.
BT Engineering Inc., Project Manager
Email: stevenj.taylor@bteng.ca
Phone: 519-672-2222

Eric Riek, C.E.T.
City of Kitchener, Project Manager
Development Engineering
Email: eric.riek@kitchener.ca
Phone: 591-741-2200 ext. 7330

Please submit any questions or comments to the contacts listed above by **November 29, 2021**.

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# Appendix C

Comment Sheets

BT ENGINEERING

1

[redacted]
**Sent:** Wednesday, May 19, 2021 5:49 PM
**To:** Christine Michaud <Christine.Michaud@kitchener.ca>
**Cc:** Eric Riek <Eric.Riek@kitchener.ca>
**Subject:** [EXTERNAL] Biehn Road Extension Project

Hi Christine

We received your letter today regarding the proposed Biehn Drive extension project. As you mentioned in your letter, this project has been on the books for a long time. We have lived in the area for 30 years and were made aware of this plan in the early 1990's.

From the tone of your letter it appears that the vocal group of people opposed to this project have caught your attention more so than the group of us who want the extension to go ahead as planned. This is a classic case of "NIMBYism" where the home owners didn't complete their due diligence when they moved into their residences. Looking at the Biehn Drive dead end it is obvious that there was always a plan to continue the road.

The people opposed to these changes [redacted] must realize that their own homes were also once part of the rural area that made way for progress when the Brigadoon area was built. There have been many changes to this part of Kitchener since we have lived here. The fields and forests we used to hike in around here have been developed and new areas have been opened up for people to live in this part of the city. It is unfortunate that people can't see beyond their own yards to understand the city needs to grow and it can't always be in someone else's neighbourhood. As you know most of the undeveloped land left in Kitchener is in the south west and perhaps if people don't want to see development, they should move to more established areas.

We hope you will support the planning department in their efforts to proceed with the plans to finally bring this project to fruition. I know as a local politician it can be difficult to support a well planned project when a very vocal group of potential voters are opposed to it, but giving in to a NIMBY mentality is not the way a city progresses.

Thank you for keeping us in the loop about the status of the Biehn Road extension project.

[redacted]

2

[redacted]
**Sent:** November 17, 2021 4:18 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; eric.riek@kitchener.ca <eric.riek@kitchener.ca>
**Cc:** [redacted]
**Subject:** Biehn Drive Extension for Discussion Nov 17 2021

Eric,
As per the Freedom of Information Act, provide the GRCA assessments from the past 3 decades. You have completely left them out, and therefore your EA is incomplete. These need to be aligned with the content of the latest options you have provided in the PowerPoint presentation online.

Also, I find this EA a complete failure in light of the COP 26 which was also a failure.

You may consider yourselves part of the problem here where we continue to clear forests which are in short supply on earth now while you line your pockets. Maybe you take clean air for granted these days. Did you know CO2 levels have risen 400% over the past century because of forest removal?

Shame on you for doing this.

Perhaps you should take half an hour and come out to the walking trail in this area around Wards Pond and see the beauty of the area which many families enjoy. Instead of having the vision to promote the Doon area as a green oasis within the City of Kitchener, you only seek to honour promises from Mayor Cardillo signed over to the contractors to over-develop Kitchener as they see fit. But that is ancient history I guess. Again, shame on you. This is a scandal which you are all part of.

It's such a shame.

[redacted]

3

[redacted]
**Sent:** November 18, 2021 10:06 AM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** Eric Riek <eric.riek@kitchener.ca>
**Subject:** Biehn Drive extension

[redacted] and am opposed to the extension through this Algonquin like wetland.

Re: proposed Preferred Cross section on page 23 of the plan;

If the plan is to minimize disruption to the wetland, why is a parking lane shown in the schematic as well as multi use paths on either side of the road? Would this not add an increase of traffic and invasion of the wetland?
There are already natural trails through the wetland and wooded areas.
For the preservation of this environment, it needs to be left natural.
IF a road is approved by council, that's all it should be, a ROAD.

Sent from my iPhone

4

[redacted]
**Sent:** Monday, November 29, 2021 9:07:06 PM
**To:** Eric Riek <Eric.Riek@kitchener.ca>; Christine Michaud <Christine.Michaud@kitchener.ca>
**Subject:** [EXTERNAL] Comments, Questions and Concerns about Biehn Drive Extension Environmental Assessment

Good evening Eric and Christine,

Following the Virtual Zoom Meeting on Nov 17th, we were invited to provide feedback and comments. Please find below my comments, questions and concerns about the Biehn Drive Extension Environmental Assessment (EA).

The EA's evaluation weights set the Transportation weight at 31% and the Natural Environment at 30%. On June 24, 2019 the City of Kitchener's city council unanimously voted to declare a climate emergency. Since then, Canada has also made several statements, including at COP26, about reducing our impact on climate which is to be achieved through the preservation of the natural environment. On the transportation side, the City of Kitchener had made no such emergency declaration. As a result, how can a weight for the Natural Environment being less than Transportation make any sense when the emergency declaration and the statements from the Federal Government are taken into consideration? The Natural Environment weight should be much greater than the Transportation weight if we hope to have some kind of decent environment to live in for the decades to come.

The EA mentions the need to distribute the traffic evenly in the arterial road network. Where is the analysis of the current situation? One can observe in the morning the vast majority of the traffic coming down Caryndale towards Biehn Drive and then go north on Biehn. There is some traffic going from Biehn Drive and up Caryndale but did BTE check to make sure they are not simply going to the school? If going to the school, extending Biehn drive will not change this. For the traffic coming down Caryndale and going north on Biehn, it seems to be sourced from the south end of Caryndale and Doon South neighborhoods. Why should the residents of Biehn Drive be forced to have the residents of other neighborhoods go through ours? Is it possible that the traffic other neighborhood (north of Brigadoon) think is coming from Biehn is simply flowing through Biehn and coming from communities south of Biehn? This is where the opening of Robert Ferrie Drive to Strasburg will fix this situation and improve school zone safety on Caryndale. All the extension of Biehn Drive would do with the traffic situation is substantially and permanently damage to Provincial Significant Wetlands (PSW) at the end of Biehn Drive.

The EA project manager (Steven Taylor) mentioned during the Nov 17th meeting an increase of about 2,500 vehicles per day, where did this come from? He also mentioned the north side of Biehn Drive was being overused. The Biehn Drive Extension Need and Justification Review conducted by Paradigm Transportation Solutions (page 4) in 2014 mentions that by 2031, Biehn drive would be handling 8,100 vehicles per day (in excess of capacity as mentioned in that review) which factored in the development of Robert Ferrie Drive. This is a **substantial** increase

compared to what BTE is mentioning. Also, at the Biehn Drive traffic calming meeting of Nov 23, Steve Ryder made a comment about the traffic on Biehn Drive being appropriate/acceptable since the road is a collector road. So, which one is it? Is it overused, fine or are the residents of Biehn Drive about to have a massive increase that will destroy the safety of the Biehn south neighborhood and the PSW?!

For alternative 4, why is the south side of the PSW not showing any development? A court could be developed on that side while ensuring the PSW does not have a street going through it to minimize the environmental impact. Proper drainage could be implemented to ensure stormwater is properly directed to the Storm Water Management pond that is currently beside the wet lands. This would help to provide a more fair comparison to alternative 1 and would increase the scoring for both the Land Use and the Engineering global factors.

**This section of comments, questions and concerns factors in the Analysis and Evaluation Report for the Biehn Drive Extension EA**

For the Improved Emergency Response (pg 70), why is the evaluation done on an access basis when normally response to something is calculated based on time? All emergency services determine their performance on time to the location where the emergency is happening. What is the current response time to the various neighborhoods and what would be the impact of each option?

For the Roadway Safety – Supports Area Traffic Calming Measures (pg 71), has the impact of Robert Ferrie being built been factored in the evaluation? Since the majority of traffic on Biehn is coming from the south end of Caryndale and Doon South, the minute Robert Ferrie would be open, a lot of this traffic flow should go away. Extending Biehn Drive will have a marginal impact (if any) on the traffic from south Caryndale and Doon South (which is a major issue) compared to Robert Ferrie opening.

For the Efficiency of Travel (pg 72), was the shortcut a lot of people take from Biehl Drive through Marl Meadow Drive and Templewood Drive to Strasburg Road or Biehn Drive through Marl Meadow Drive and Templewood Drive to Huron Road taken into account? If not, how would this impact the ratings for the various alternatives?

For the Safety of School Zone (pg 74), was the impact of opening Robert Ferrie drive and the reduction of the traffic coming down from South Caryndale and Doon South been factored in? This has a direct impact on how many vehicles go through the school zone especially in the morning. If factored in, how would it impact the rating of the various alternatives?

For the Bicycle and Pedestrian Safety - Conflicts with Planned Hydro Corridor Multi-Use Trail (pg 75), Caryndale is already crossing the hydro corridor. Alternative 4 is being unfairly impacted by including this already existing crossing. Also, Alternative 4 is further being unfairly designed (bordering on flagrant) for this part of the assessment by introducing a second access road to Street A (pg 77) on the north side of the hydro tower. This second access road from Robert

Ferrie Drive would be about 50 meters from where Biehn Drive (south portion that would not cross PSW) would connect. There is no need for this second access road since it was not included in the other alternatives. As a result, all alternatives are going to introduce the same number of new crossings. What would be the impact to the overall rating of eliminating this item since it is the same for all alternatives?

For the Personal Security of Pedestrians and Cyclists (pg 78), Alternative 4 is not being treated fairly since it does not need Multi-Use Pathway (MUP) connections because there is no continuous road being put through!! It has something even better, a dedicated walkway for pedestrians and cyclists, as shown on page 58, which doubles as access for the utilities!!! As a result, the way this criterion is set up is prejudicial to Alternative 4. Therefore, what would be the impact on the overall rating of eliminating this item?

The ratings for Wildlife Habitat (pg 80), Accommodating Wildlife Movement (pg 82), Provincially Significant Wetlands Removed (pg 85) and Groundwater Infiltration (pg 87) clearly demonstrate that Alternative 1 and 2 would have negative impacts on the environment. How is the over $2 million investment by the City of Kitchener (as mentioned in The Record on April 11, 2020) in Strasburg Creek and saving the brook trout being protected? The PSW at the end of Biehn Drive links right into this creek and having a through road will impact not only the PSW but by extension Strasburg Creek. How many more millions will it be to reverse the negative impacts of this through road?

For the Community Disruption to Biehn Drive North (pg 88), was the fact that a substantial part of the traffic on Biehn Drive North is the result of traffic coming from Caryndale South and Doon South? How would it impact the rating if this traffic was removed from the analysis since it will be handled by Robert Ferrie Drive? Also, are the shortcuts a lot of people take from Biehl Drive through Marl Meadow Drive and Templewood Drive to Strasburg Road or Biehn Drive through Marl Meadow Drive and Templewood Drive to Huron Road taken into account? If not, how would this impact the ratings for the various alternatives?

For the Efficient Utilization of Future Development Land (pg 96), was the proper development of the lands for Alternative 4(removal of the through road going through the PSW from Alternative 1) factored into the rating? If so, please demonstrate. If not, what would be the impact to the rating of Alternative 4?

For the Crossing of the Hydro Corridor (pg 97), Alternative 4 is being unfairly designed (bordering on flagrant) for this part of the assessment. The crescent should give on the portion of Biehn Drive South (between PSW and Rebert Ferrie Drive since it would not go through the PSW) just like for Alternative 1. The only difference between Alternative 1 and Alternative 4 for these evaluation criteria should be the removal of the through road going through the PSW. There is no need for this second access road as demonstrated by its exclusion from the other alternatives. As a result, all alternatives are going to introduce the same number of new crossings. What would be the impact to the overall rating of eliminating this item since it is the same for all alternatives?

For the Accommodating Stormwater Management (pg 99), has the proper development of the lands south of the PSW been factored in for Alternative 4 (removal of the through road going through the PSW from Alternative 1)? What is the impact on the rating of Alternative 4 if this is factored in?

For the Biehn Drive Stormwater Enhancement (pg 100), has the impact of the natural absorption of the stormwater been factored in? That is nature doing what it does well when there is little human interruption. What is the impact on the rating of Alternative 4 if this is factored in?

For the Overland Stormwater Management Route (pg 103), has the proper development of the lands south of the PSW been factored in for Alternative 4 (removal of the through road going through the PSW from Alternative 1)? What is the impact on the rating of Alternative 4 if this is factored in?

Thank you for the opportunity to make comments and ask questions that will become part of the public record on this important issue.

5

[redacted]
**Sent:** Wednesday, November 17, 2021 8:09:20 PM
**To:** Eric Riek <Eric.Riek@kitchener.ca>
**Subject:** Biehn

The EA for Biehn fixes the location of the RF roundabout. That is why the EA for Biehn has to be completed now.

Sent from my iPhone

6

[redacted]

**Sent:** November 21, 2021 9:37 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; Eric Riek <eric.riek@kitchener.ca>; Christine Michaud <christine.michaud@kitchener.ca>
**Subject:** Re: Biehn Dr extension

Christine, Steve, Eric,

Please forward my message on to whoever else you need.

First of all, I'm not used to these kind of processes, but my gut reaction to Wednesday's meeting was I don't see the point of involving the public when you're just talking for the first 45 min about what your choice is and not actually going to change it or reconfigure or do anything about it based on all of our concerns. At that point, it seems like a massive waste of time and money, which as always brings a lot of doubt about our tax dollars being used effectively and to our benefit.

Have you had that many residents reaching out to say that they are excited and hopeful for the Biehn Dr extension? I find it hard to believe that a majority of residents feel that way. Especially when we presented specific concerns and recommendations that were either not answered or not met, how does it not come across that you have a jaded/biased perspective on transportation vs the environment.

So, I'm in the structural eng field, and when someone doesn't trust my design they can ask for my calcs. I'd like to see how your report numbers were assigned, because on the one hand I understand you are saying you are an impartial consulting company hired by the city to do an assessment, but on the other hand, your report and designs determine how the city and council will be swayed. And there is someone human who is assigning factors to things. Saying transportation is rated higher than the environment sounds an awful lot like that person is more focused on moving cars around the region than preserving the little green space we have left. Which is directly contradicting what the region and most reputable scientists would recommend as they declare a state of emergency when it comes to global warming.

It also seems like the focus is making the cars per day numbers etc work out in your theoretical models vs listening to the residents that experience the traffic day to day. The current traffic level on Biehn is tolerable and would be better with speed control. I understand you're using future numbers to run these models, but how will future numbers be larger than what they are now, there's no area to add housing in these neighborhoods. Our decisions affect people in the future, and who in the future is going to be happy about having Biehn not be a cul de sac. People living on Caryndale as well as Biehn know what the existing traffic level is when they buy and speed calming has and will been done to make it better.

Back to the graphs and tables in the presentation, I find it extremely convenient that the alternative 1 got a score of 1 for every item. Even someone making up numbers would vary the scores so it doesn't look suspicious.

Also the housing land use brown factor is 0 for alt 4? You can still make road access from the south from Robert Ferrie. To me assigning an actual realistic value for the land use factor to alternative 4 would bring alternative 1 and 4 closer in score.

End of the day, it's not just the trails that exist in this protected area, it's the way Biehn ends in a woodlot that creates a beautiful bubble at the end for the neighborhood to enjoy. And as many times as you want to say how you're the experts and the numbers check out and this is the best technical recommendation for the project, just means that you're more and more ignoring the effect on the people that actually live in the area and benefit from what you're recommending be destroyed.

7

[redacted]
**Sent:** Thursday, November 25, 2021 4:23 PM
**To:** Eric Riek <Eric.Riek@kitchener.ca>
**Cc:** Christine Michaud <Christine.Michaud@kitchener.ca>
**Subject:** [EXTERNAL] Biehn Drive Extension Class Environmental Assessment Comments

Good afternoon Eric,

My comments are attached.

[redacted]

**ATTACHMENT:**

I want to say how disappointed I am in the City of Kitchener. You have shown us you want to choose development over environment. And you have chosen to disrupt a quiet community for a highway going past our homes. And make no mistake, when Biehn is finished, there will be hundreds, if not thousands of commuters coming up from the 401, using Biehn Drive as a shortcut from Strasburg to Homer Watson. You will have a huge problem on your hands, but then, the damage will be done, and there will be no solution. (Or maybe, you just won't care.)

There is another situation that I am upset about. Again, it shows a lack of consideration for the residents of this area. You gave us options for the route of the road, and then chose the one you, or the developer, preferred. Do we not get a say in anything? Why show us the alternatives if you don't give us the opportunity to have at least have a say in the decision- making process?

Everything here seems slanted, dictatorial. When did City of Kitchener become so narrow minded?

[redacted] Our unsettling concern is that either option does not give us a good sightline of the road. Coming out of our driveway will be very hazardous. The bend of the road coming out from the forest seems much too abrupt.

Let's finish Robert Ferrie first and then see if the extension is necessary.

[redacted]

8

[redacted]
**Sent:** Saturday, November 27, 2021 9:22:16 AM
**To:** Eric Riek <Eric.Riek@kitchener.ca>
**Cc:** Christine Michaud <Christine.Michaud@kitchener.ca>
**Subject:** [EXTERNAL] November 17, 2021 Public Information Centre Comments

Good morning Eric,

My comments are attached.

Have a great weekend.

Regards,

[redacted].

**ATTACHMENT:**

Biehn Drive Extension
Class Environmental Assessment
November 17, 2021 Public Information (PIC) Centre Comments

The Grand River Conservation Authority (GRCA). has confirmed that the area behind our house and the existing Cull de Sac is part of the Provincially Significant Strasburg Creek Wetland Complex. According to the City of Kitchener (C of K) Notice of Study and Community Café, "The study will consider all reasonable alternatives with acceptable effects on the natural, social and cultural environments". The C of K Strategic Plan for the Environment states "our strategic plan for the environment shows how we will put the environment first, reduce our carbon emissions and preserve our planet. We work to develop and maintain an ecologically diverse open space network that incorporates typical naturally occurring landscapes, significant natural features and the urban forest, all of which embody our natural heritage. We protect our water supply by working with the Region of Waterloo and the Grand River Conservation Authority to replenish and protect our water and wetlands". If Biehn Drive is extended the C of K is violating its own Strategic Plan for the Environment. It is time for C of K staff and elected officials to lead, not continue as in the past.

Area residents have lived in a wet area for 30 years How is the C of K going to ensure we do not get more water on our properties and in our basements if the wetlands are tampered with? What is the Contingency Plan if this occurs? Documentation of the contingency plan is only fair to existing residents.

The Environmental Assessment (EA) is inherently flawed towards transportation and **must be redone.** On Page 19 of the EA Evaluation – Global Factor Weights and Sub-factor weights show Transportation 31% and Natural Environment 30%. This is wrong! The Natural Environment must be rated much higher and the scores recalculated. Current examples of what climate change is doing to Canada in British Columbia and Nova Scotia are front page news.

Robert Ferrrie Drive was not even planned when the initial extension of Biehn Drive was approved. Why not wait until Robert Ferrie Drive is extended to Strasburg Road and after a sufficient time period for residents to use this new alternative, then evaluate the need to extend Biehn Drive? As discussed on numerous occasions a road is not required for watermain and sewer installation. This can be done with an easement.

If the extension of Biehn Drive is approved by Council, area residents must have a voice on which alternative is chosen. This is only fair to the existing residents, many of whom are long term residents.

As discussed in Tuesday's (November 23) Traffic Calming Review – Biehn Drive, our section of Biehn was not included in the review and traffic calming measures the same as the rest of Biehn would be done after construction. This is wrong and not fair to the existing residents of our section of Biehn.

[redacted] If Biehn Drive is extended with the preferred alternative (Alternative1) and corresponding sharp curve, will there be appropriate sight lines for us and close neighbours to get out of and into our driveways safely?

9

[redacted]
**Sent:** November 24, 2021 7:58 PM
**To:** Eric Riek <Eric.Riek@kitchener.ca>
**Cc:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; Christine Michaud <Christine.Michaud@kitchener.ca>
**Subject:** Re: Re: Biehn Dr extension

Eric,

In the biehn Dr traffic calming presentation last night, they mentioned that major collectors in the area are designed for around 5000 to 8000 a day
They also mentioned that Biehn Dr traffic numbers are in line or bit less than the standard major collector numbers.

This seems to conflict with the concept that is one of the main proponents for proposing the biehn Dr extension, as the extension presentation seemed to say Biehn Dr numbers are far above what they should be. And that it will just get worse even when robert ferrie extension is made.

Do you have more exact numbers regarding Biehn Dr traffic and what it should be? I wasn't able to find it in this report you sent

# Public Information Centre No. 3 Summary Report

## Biehn Drive Municipal Class Environmental Assessment

August 2024, Revision 1

**Submitted by:**
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
519-672-2222

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# 1.0 INTRODUCTION

The City of Kitchener (City) initiated a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive southerly to the Robert Ferrie Drive Extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain.

The Class EA Study will include all required phases of the Municipal Class Environmental Assessment. The study will: establish the need and justification for the improvements; complete environmental inventories; establish a baseline to compare alternatives; consider all reasonable alternatives; and proactively involve the public in defining a recommended plan for improvements.

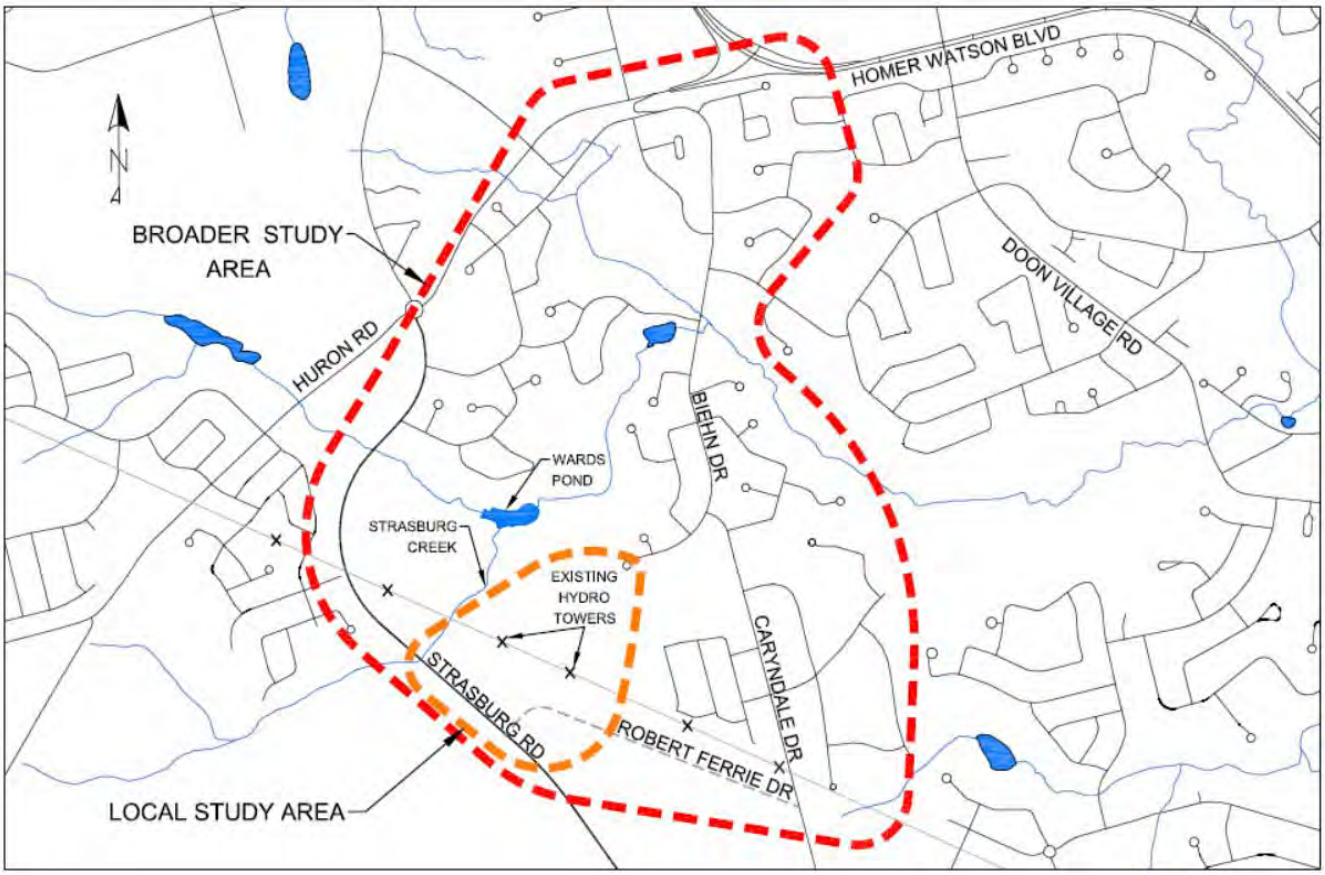
Based on the range of anticipated effects and capital cost of the project, the study is being conducted as a Municipal Schedule C Class EA. At the completion of the project, an Environmental Study Report will be prepared for a 30-day public review period.

Public Information Centre (PIC) No. 3 for this Study was held in-person on June 20, 2024 from 7:00 to 9:00 pm and included exhibits and an opportunity to speak to the consultant and City of Kitchener staff. The Public Information Centre presented information on the findings of the environmental, transportation and municipal servicing review, the Recommended Plan and Mitigation Measures.

All members of the public and interest groups were encouraged to provide a written response to any issues or concerns.

## 1.1 Study Area

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**. The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension. Based on comments from the public at the initial Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods.




**Legend**

Local Study Area

Broader Study Area Based on comments from PIC No. 1

**Figure 1: Project Location**

## 2.0 PUBLIC AND AGENCY CONSULTATION

One of the key aspects of the study is to provide the public, interested parties, and affected agencies with the opportunity for input. In order to ensure this objective is met, a public and agency notification program was undertaken. The program includes a number of communication mechanisms, discussed in the following sections.

### 2.1 Individual Property Owner Contacts

Notices were mailed to property owners within the study area, inviting them to attend the in-person Public Information Centre. The notice was also distributed electronically to members of the public/ stakeholders that had identified an interest in the study or requested to be on the mailing list. A map of the hard copy notice distribution area are shown below, **Figure 2** and **Figure 3**.

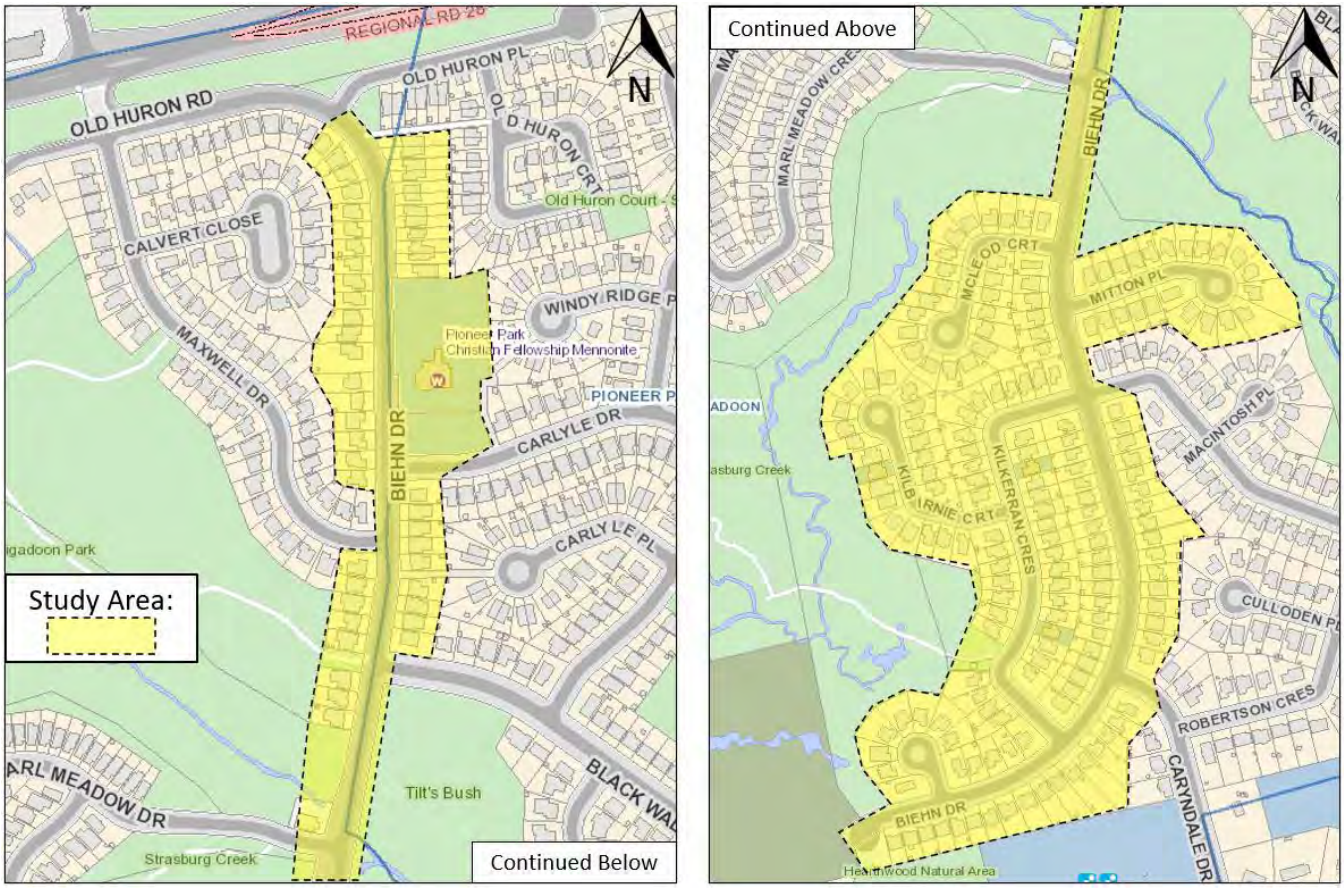



**Figure 2: Hard Copy Notice Distribution Area**

**Figure 3: Hard Copy Notice Distribution Area 2**

### 2.2 Indigenous Peoples Contacts

Notices were sent to the Indigenous Peoples identified by the Province (MECP), inviting them to attend the PIC. Notices were sent to the following:

- Huron Wendat Nation
- Haudenosaunee Development Institute
- Metis Nation of Ontario
- Six Nations of the Grand River
- Mississaugas of the Credit First Nation

At the request of the Six Nations a follow-up meeting was held to present the PIC information and receive comments.

### 2.3 Notice Distribution

The Notice of the Public Information Centre was distributed as follows:

- Email notice to electronic distribution list and stakeholders.
- Mailed hard-copy notices to homes in the study area.
- Posted notice to City of Kitchener website.
- Posted ad in The Record newspaper on Friday June 14th, 2024.

The notice is provided in **Appendix A**.

### 2.4 Agency and Stakeholder Contacts

The following ministries, agencies and stakeholders were invited to attend the in-person PIC:

- Ministry of the Environment, Conservation and Parks
- Ministry of Natural Resources and Forestry
- Ministry of Heritage, Sport, Tourism and Culture Industries
- Environment Canada, Ontario Region
- Infrastructure Ontario
- Ministry of Agriculture, Food and Rural Affairs
- Grand River Conservation Authority
- Emergency Services
- Utilities
- Regional Municipality of Waterloo

## 3.0 PIC COMMENTS

PIC Exhibits were provided online for public/agencies to view at their convenience. A copy of the PIC exhibits is provided in **Appendix B**.

A total of 50 individuals attended the PIC. Forty-one (41) comment sheets and/or emails were received during and after the comment period. Copies of the comments, excluding personal information, are provided in **Appendix C**.

### 3.1 Summary of Comments

The comments received and discussions held during the Public Information Centre are summarized below in **Table 1**.

**Table 1: Summary of Written Comments**

| Comment | Number of Respondents | Comment Sheet No. |
|---|---|---|
| Extend Robert Ferrie to Strasberg Drive Road before considering extending Biehn Drive). | 31 | 1, 2, 7, 8, 9, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 41 |
| Environmental impacts are negative for community resilience (building on Provincially Significant Wetlands (PSW), flood risks, higher insurance, contaminated drinking water, black ash protection approach, ecological integrity, higher expense for long-term damage than any benefits). | 30 | 5, 7, 8, 11, 12, 13, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 26, 27, 28, 29, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41 |
| Road salt issue with Strasburg Creek & Brown trout impact. | 13 | 6, 8, 13, 17, 24, 25, 26, 30, 32, 34, 35, 39, 40 |
| Support for horizontal drilling to accommodate future growth by installing utilities, but not Biehn Drive extension. | 13 | 13, 15, 16, 19, 20, 23, 24, 27, 29, 34, 35, 36, 37 |
| Alternative 4 is preferred. | 7 | 1, 12, 13, 24, 27, 34, 39 |
| Speed safety issues with extending Biehn. | 8 | 6, 10, 13, 15, 24, 27, 28, 32 |
| Rising water table is a concern that affects lower sitting properties in the area. | 6 | 16, 24, 26, 27, 32, 39 |
| Trail in place of a road (promotes active living, reduce traffic, protects environment). | 3 | 22, 27, 33 |
| PIC No. 3 should have updated maps of the greater Biehn Drive area, including Robert Ferie Drive and Strausburg Road (to see how it impacts the whole area). | 4 | 4, 6, 16, 28 |

| Table 1: Summary of Written Comments | | |
|---|---|---|
| **Comment** | **Number of Respondents** | **Comment Sheet No.** |
| PIC No. 3 was confusing and lacked consistency for answers on construction/project plans, environmental issues and protection, traffic studies and historical knowledge. | 2 | 32, 34 |
| Raised similar concern for separate flooding incidents, on-going costs, basement repairs, foundation crack repairs, regrading rear yard to divert water flow from the house, and sump pump replacements. | 1 | 2 |
| Once Robert Ferrie is extended, preference for alternative 2. | 1 | 3 |
| Biehn Drive extension will be a positive change for the neighbourhood helping with flow of traffic through the area. | 1 | 3 |
| Efficiency benefit with emergency vehicles responding to crisis. | 1 | 4 |
| Balance the specific environmental impacts of Alternative 2: Extend Biehn Drive to Robert Ferrie. | 1 | 10 |
| If not building Biehn Drive means more traffic on Caryndale then it should be built. | 1 | 14 |
| Focus development near Huron and Fischer Hallman, before impacting PSW 30. | 1 | 20 |
| Closing Staufer places farm traffic and equipment onto Robert Ferrie, posing a problem as cars are parked on the street. | 1 | 26 |
| No community plazas for shopping planned or shown. | 1 | 26 |
| The proposed design of 12 homes in a crescent off the road ignores efficient urban planning principles and poses challenges for future public transportation access. | 1 | 20 |
| No room for catchment pond. | 1 | 26 |
| No window for construction if abiding by Turtle protection plans (May 15 - Sept 30) and (Oct 1 - April 1). You will be monitored. | 1 | 26 |
| Puslinch lake issue regarding material to be vacuumed from the lake and deposited on farmland, deemed unacceptable by MNR. Do you mitigate the decomposition of this material? | 1 | 26 |
| Excavated material cannot be dumped on surrounding wetlands or stored nearby. | 1 | 26 |
| What is the plan for New Dundee 2 lane road with new subdivision traffic trying to use it to get to Homer Watson. | 1 | 26 |
| Trade offs are for those that won't make the correct choice. | 1 | 32 |

| Table 1: Summary of Written Comments | | |
|---|---|---|
| **Comment** | **Number of Respondents** | **Comment Sheet No.** |
| Concern for who takes consequence (desalinating drinking water), public or private cost. | 1 | 32 |
| Traffic study does not show volume to be classified as a major feeding road. | 1 | 32 |
| Strasburg road will need to be completed, and join New Dundee Road, New Dundee Road will need to be expanded to 4 lanes of traffic, with turning lanes and a way to link to the 401 or Homer Watson Boulevard will have additional problems and back ups. | 1 | 32 |
| City spent $2M to create a new creek bed/channel so Brook trout habitat could improve, this extension puts all of this at risk. | 1 | 34 |
| Recall in 1989, City Council directed that the Biehn Drive EA weigh environmental factors more heavily than other factors in its evaluation of alternatives. | 1 | 39 |

## 4.0 CONCLUSIONS

The main comments or concerns, both verbal (i.e. phone calls) and written, from the PIC include:

- Prioritize the extension of Robert Ferrie Drive to Strasburg Road, instead of extending Biehn Drive.
- Concern for the negative environmental impacts from the loss of PSW.
- Other environmental concerns (flood risks, higher insurance, contaminated drinking water, black ash protection approach, salt runoff into Strausburg Creek affecting trout population).
- Support for horizontal drilling to accommodate municipal services installation and active transportation link on Biehn Drive extension.

A comment and response log is provided in **Appendix D**.

## 5.0 RECOMMENDATIONS

The following recommendations address comments from the public meeting:

1) Proceed with identifying the preferred municipal corridor for a Biehn Drive extension to accommodate municipal services and active transportation linkages. Land development can proceed while protecting for the future street right-of-way.
2) Construct improvements to include the municipal services and an active transportation pathway/street as the first priority and the extension of Robert Ferrie as the second priority.
3) Following the comments received that the most significant concern from the public and Six Nations was the loss of PSW and the ecological effect of this impact the study should consider the ability to achieve no net loss of PSW from the road project. Creation of new PSW restoration areas as part of the project to be investigated.
4) Monitor the health of the Ash trees in the influence of the future road project.

# Appendix A

Newspaper Notice

BT ENGINEERING

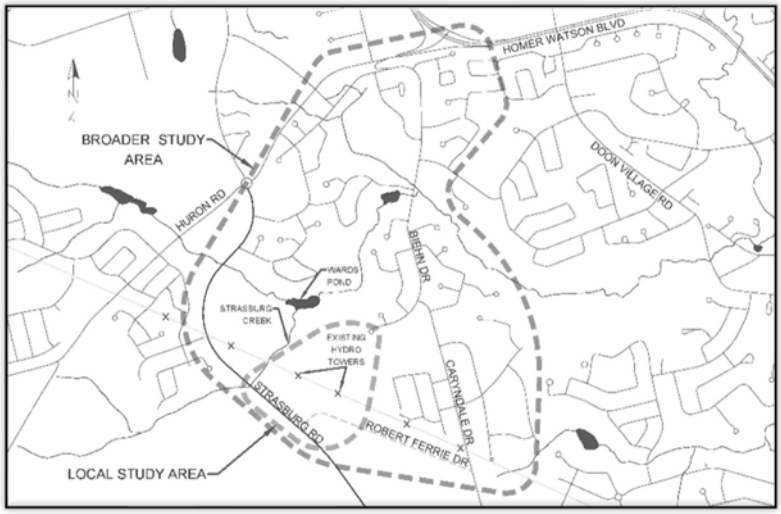
# Notice of Public Information Centre (PIC)
# City of Kitchener
# Biehn Drive Extension Environmental Assessment Study

**INTRODUCTION**

The City of Kitchener is conducting an Environmental Assessment (EA) Study for the extension of Biehn Drive from the existing terminus 300 m west of Caryndale Drive to the future Robert Ferrie Drive extension.

In 2023, Council directed staff to complete further studies to review both the need for extensions of Biehn Drive and the trunk sanitary sewer as a Class Environmental Assessment Study. At this stage additional studies have been completed including the natural habitat review of Species at Risk following new Provincial legislation designating the Black Ash as a protected species in January 2024.

This PIC will present the findings of the environmental, transportation and municipal servicing review.




**STUDY PROCESS**

The Biehn Drive Extension EA is being conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015). The Study has recently completed additional work on the environment, geotechnical and hydrogeological investigations, as well as a Doon South area Transportation Study Update. The Study process has proactively involved the public, stakeholders and Indigenous Peoples.

**PUBLIC CONSULTATION**

The City wishes to ensure that anyone interested in this study has the opportunity to be involved and provide input. The City has scheduled a third in-person Public Information Centre (PIC) meeting for this project that will include a series of exhibits that present additional findings, the Recommended Plan and Mitigation Measures. Comments on the information presented can be provided by filling out a comment sheet or contacting the City or consultant project managers' email addresses listed below.

**Date:** June 20, 2024
**Time:** 7:00 pm to 9:00 pm
**Location:** Brigadoon Public School Gymnasium, 415 Caryndale Drive, Kitchener, ON, N2R 1J7

The PIC exhibits will also be available at City's Website after June 20, 2024 at:

https://www.kitchener.ca/en/development-and-construction/infrastructure-projects.aspx

There is an opportunity at any time during the Class EA process for interested persons to provide comments. All information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act* (2009). With the exception of personal information, all comments will become part of the public record. Persons will be advised of future communication opportunities by newspaper public notice, email notice and posting on the City website. Comments can be submitted by July 4, 2024.

For more information or if you wish to be placed on the study's email mailing list, contact either:


**Steve Taylor, P.Eng., M.Eng.**
**EA Project Manager**
**BT Engineering Inc.**
509 Talbot Street
London, ON N6A 2S5
Tel: 519-672-2222
Email: stevenj.taylor@bteng.ca

**Eric Riek, C.E.T.**
**Project Manager**
**City of Kitchener**
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
Email: eric.riek@kitchener.ca

# Appendix B

PIC Exhibits

BT ENGINEERING

# Welcome!
# City of Kitchener
## Biehn Drive Extension
## Class Environmental Assessment

Thank you for participating in the Public Information Centre (PIC) for the City of Kitchener's Class Environmental Assessment (EA) for the extension of Biehn Drive and the sanitary trunk sewer.

There is an opportunity at any time during the Class EA process for interested persons to provide written input. Any comments received will be collected under the *Environmental Assessment Act* and, with the exception of personal information, will become part of the public record.

Comments can be submitted by emailing stevenj.taylor@bteng.ca and/or eric.riek@kitchener.ca by July 4, 2024.

KITCHENER

# Purpose of Public Information Centre (PIC)

The purpose of this meeting is to:

- Present the findings of additional investigations, completed since PIC 2:
  - Black Ash tree inventory
  - Geotechnical
  - Transportation
- Obtain comments on the Recommended Plan.
- Obtain comments on the proposed mitigation plan.
- Identify any remaining areas of concern.

# Introduction

The City of Kitchener retained BT Engineering Inc. to undertake an Environmental Assessment (EA) Study for the extension of Biehn Drive from its current terminus to the future Robert Ferrie Drive Extension. The Study includes the extension of the trunk sanitary sewer and watermain to Robert Ferrie Drive, to serve areas to the south.

The City of Kitchener as part of this EA completed Phases 1 and 2 of the Municipal Class EA through the Transportation Master Plan. The study is now in Phases 3 and 4 of the Municipal Class EA which involves developing and evaluating alternative designs and completing the Environmental Study Report, while proactively involving the public and stakeholders in defining a recommended plan for improvements.

The focus of this PIC is additional environment, geotechnical and hydrogeological investigations and the Doon South Area Transportation Study Update. This PIC will also present the Construction Staging Approach and the Recommended Plan for the municipal services and transportation projects, as well as mitigation measures.



# Problem and Opportunity Statement

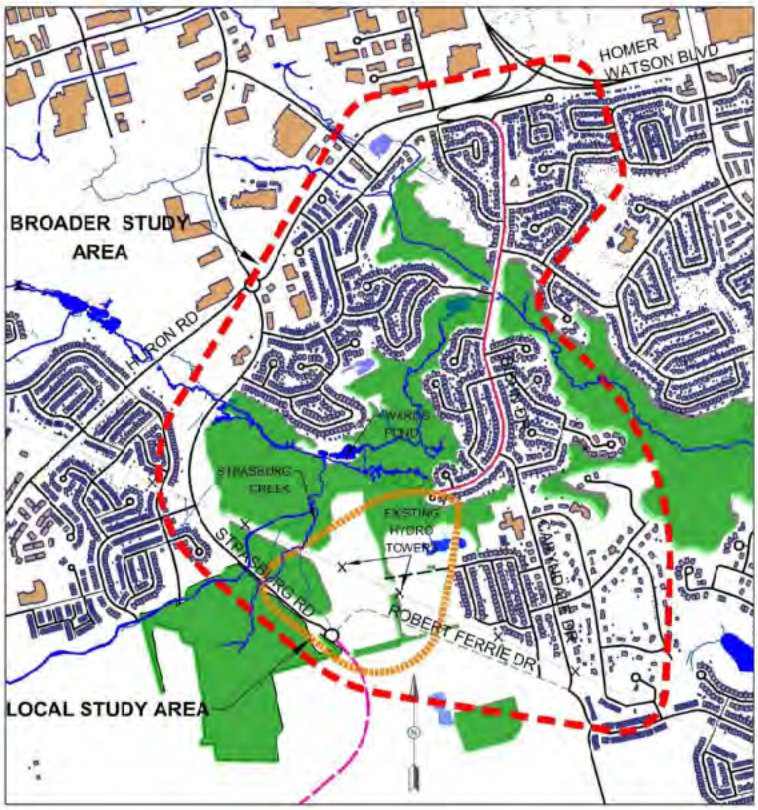
The planned extensions of Strasburg Road and Robert Ferrie Drive combined with new development will result in changes to the traffic demands and patterns within the Doon South and Brigadoon communities. To address those changes, the City of Kitchener Transportation Master Plan and Official Plan have identified an extension of Biehn Drive from its current terminus to Robert Ferrie Drive. The Study has revisited the need for an extension of Biehn Drive and evaluated potential alignment alternatives if an extension of Biehn Drive is still recommended. The Study has considered the natural, social environments and the future land use in the Study Area. The study is assessing the road network to provide safe, reliable transportation access to communities within Doon South and Brigadoon considering vehicular, pedestrian, cycling and truck routes. The road project is being completed as a Schedule C undertaking.

The Project provides the opportunity to:

- Improve accessibility to the local community by providing additional network links;
- Define a multi-modal transportation plan to support travel within the local neighbourhoods; and
- Allow development to proceed on lands that currently require the infrastructure requirements to be defined prior to developing the land use plan.

In parallel, the City is planning for new municipal services that are required to serve future development to the south. The future watermain and sanitary trunk sewer crossing of the Provincially Significant Wetland (PSW) from the existing services at the end of Biehn Drive are being completed as a Schedule B project.

# EA Study Area




**Legend**

Local Study Area

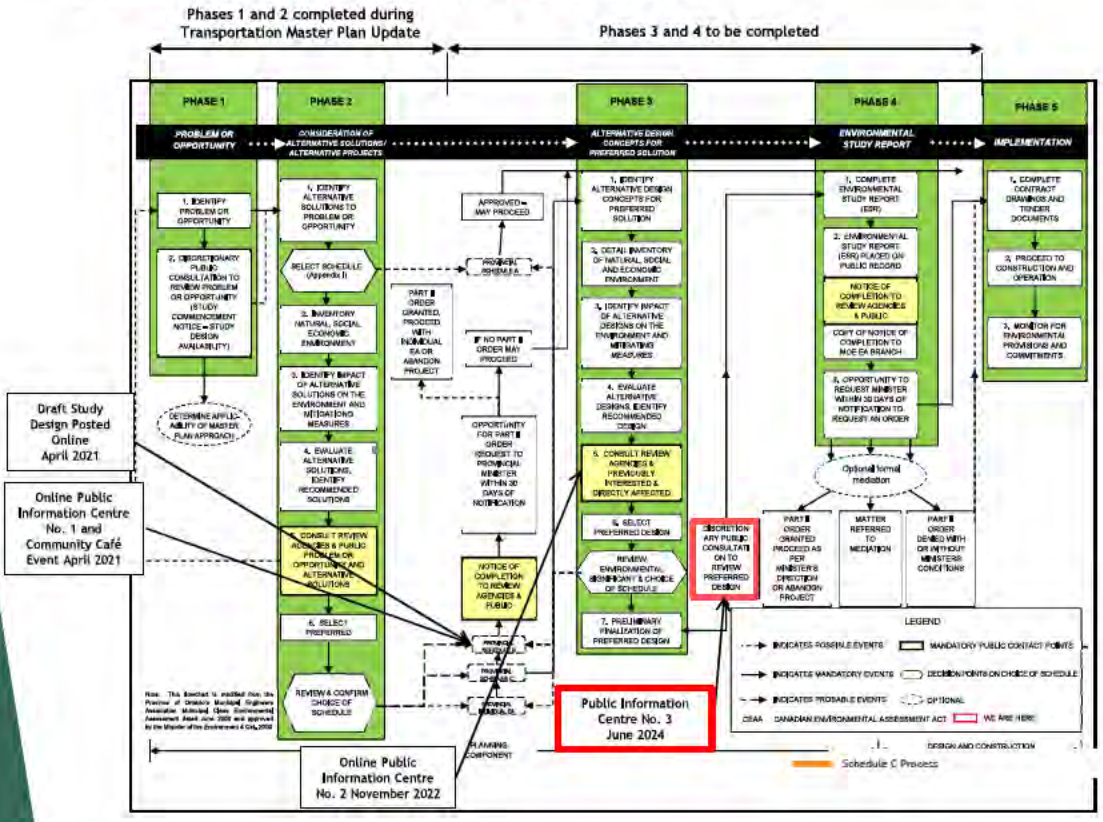
Broader Study Area
Based on comments from PIC No. 1



# Municipal Class EA

- Road improvements are being completed as a Schedule C undertaking, based on the range of anticipated effects.
- Proposed municipal services extension is being completed as a Schedule B activity.
- The Class EA process is shown on the next exhibit.
- This study was initiated following the Municipal Class EA, 2015.

# Municipal Class Environmental Assessment Process






# Alternative Planning Solutions

| Screening Criteria | Do Nothing | TSM | Use of Existing Local Roads | Limit Development | Extend Biehn Drive (Road and servicing corridor) |
|---|---|---|---|---|---|
| **Transportation** | Does not address forecast traffic demand. Results in increased volumes on local roads. | May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure. | Local roads not designed to accommodate increased volumes. Caryndale Drive is not designated as a major collector and as such should not be expected to carry additional traffic. | May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth. | Accommodates all modes of transportation. |
| **Municipal Services (Water and Trunk Sanitary Sewer for future development)** | Does not accommodate future development. | Does not accommodate future development. | Does not accommodate future development. | Does not accommodate future development. | Accommodates future development. |
| **Environmental** | No impacts. | No or low impacts.<br>Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes). | Low impacts.<br>Creates disruption to properties on local roads that would experience an increase in traffic. | No impacts. | Low to High<br>Servicing: Low<br>Roadway: High environmental effect possible with new corridor. Magnitude of effects will depend impact on Provincially Significant Wetland (PSW) and Species at Risk (SAR) tree species. |
| **City Planning Objectives** | Does not meet objectives/ recommendations in City Planning document or support the Provincial Places to Grow Act requirement to create additional development areas (including municipal services). | Supports objective to encourage active transportation and alternate modes.<br>Does not support the Provincial Places to Grow Act requirement to create additional development areas (including municipal services). | Does not meet objectives/ recommendations in City Planning documents.<br>Does not support the Provincial Places to Grow Act requirement to create additional development areas (including municipal services). | Does not meet objectives/ recommendations in City Planning documents.<br>Does not support the Provincial Places to Grow Act requirement to create additional development areas (including municipal services). | Supports the recommendations for the extension of Biehn Drive in OP and TMP.<br>Supports the Provincial Places to Grow Act requirement to create additional development areas (including municipal services). |
| **Recommendations** | ✗<br>Not recommended but carried forward as a baseline to compare other alternatives. | ✓<br>Recommended as a complementary solution. This is not a standalone solution. | Following PIC No. 1 there was public support to carry forward this alternative. This is not a standalone solution. See Extend Biehn Drive which is a combination of Use of Local Roads and a New Municipal Servicing Corridor.<br>✓ | ✗<br>Not recommended. | ✓<br>Recommended to be carried forward for further study, for both municipal services and a transportation connection. |

# Supplemental Investigations

## 2024 Doon South Community Area Transportation Study Findings

The City of Kitchener undertook an independent transportation review of the previous Doon South – Brigadoon Transportation Network and Corridor Study (McCormick Rankin, 1994), recommendations and the transportation conclusions presented as part of the EA. The transportation review, undertaken by Paradigm Transportation Solutions Limited, provided the following conclusions and recommendations:

- Caryndale Drive is functioning as a major neighbourhood community collector but is classified as a minor neighbourhood collector street. It provides the only westerly connection between Biehn Drive and Robert Ferrie Drive.
- Caryndale Drive in combination with Biehn Drive and Robert Ferrie Drive provides the only continuous route through the western area of the Doon South neighbourhood between New Dundee Road and Huron Road.
- The future extension of Robert Ferrie Drive west to Strasburg Road, and the extension of Strasburg Road south to New Dundee Road is likely to redistribute traffic volumes on Caryndale Drive
- The extension of Biehn Drive to Robert Ferrie Drive is justified to ensure Caryndale Drive correctly serves its function as a minor neighbourhood collector street, as described in the City of Kitchener Official Plan and provides an alternate route around the Caryndale Drive corridor.

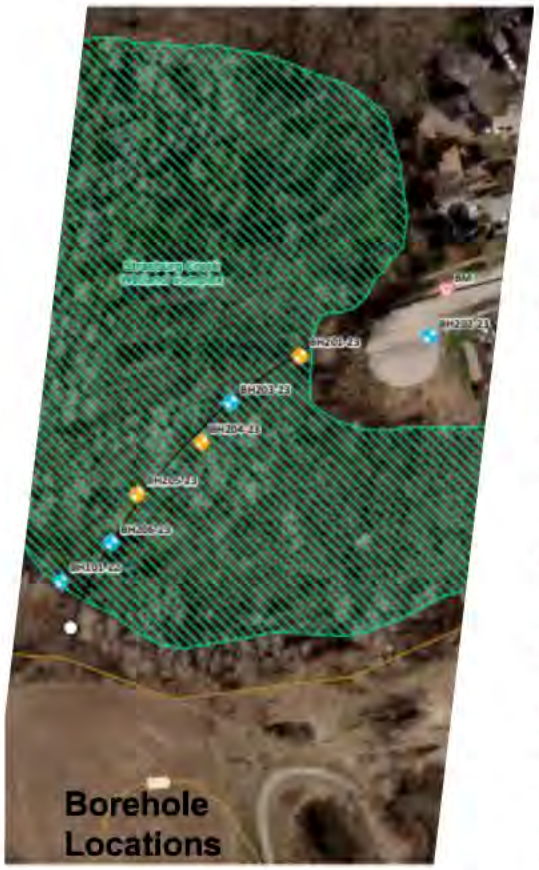
The extensions of Robert Ferrie Drive to Strasburg Road and Strasburg Road to New Dundee Road will provide an alternative north-south route with access to Highway 401. Without the planned extension of Biehn Drive an increase in traffic on Caryndale Drive from within the Brigadoon Neighbourhood should be anticipated.

# Black Ash

- Black Ash (approximately 21 trees found within the right-of-way)
  - Identified as Endangered under the *Endangered Species Act, 2007* (ESA) due to the threat of the Emerald Ash Borer (EAB).
  - Ontario regulation 6/24 and 7/24 were filed on January 24, 2024, and they came into force on January 26, 2024 to protect the Black Ash in areas where notable Emerald Ash Borer (EAB) caused mortality is occurring which includes the City of Kitchener within the Region of Waterloo.
  - In addition, habitat protection will apply for a radial distance of 30 metres around each healthy tree identified above.

The Black Ash Inventory is available on the resource table.

EAB larvae and exposed larval galleries under the bark of an ash tree



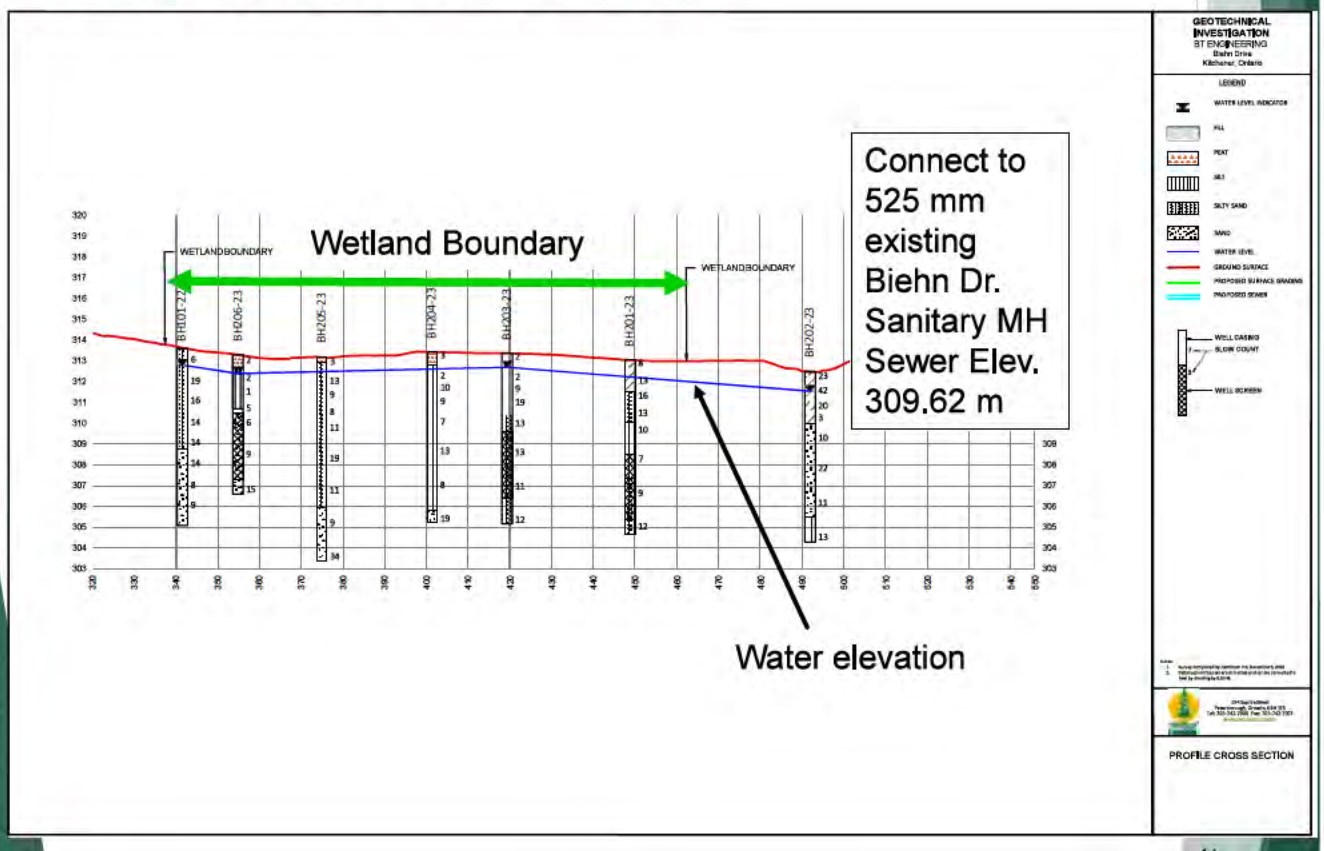

# Geotechnical Investigation (2024)

- Subsurface conditions consist of a peat or fill underlain by a sand to silty sand soil with silt and sand deposits.
- Wetland area consisted of a black peat material containing high amounts of organic material, with an average thickness of 0.8 metres.
- A Permit to Take Water (PTTW) or registration in the Environmental Activity and Sector Registry (EASR) will likely be required;
- Trunk sewer pipe construction to be performed in drier seasons; and
- Microtunnelling is the preferred method within the wetland area;
- Roadway to have geotextile to stabilize the poor subgrade; and
- Elevate roadway through wetland area to reduce groundwater impact.

The report is available on the resource table.



# Geotechnical Soil Profile



# Geotechnical Recommendations

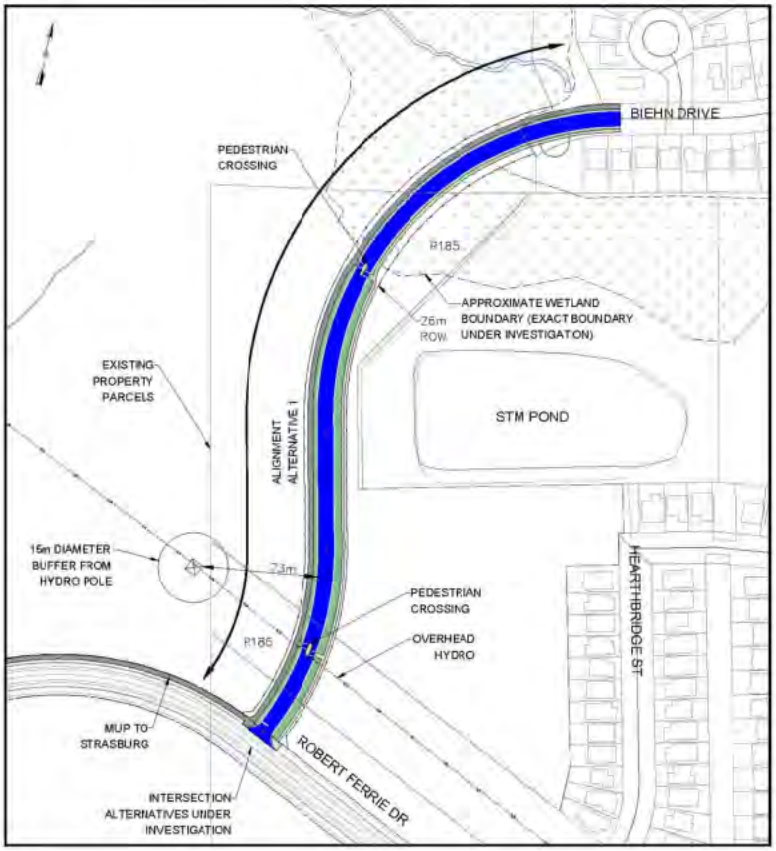
The recommendations for the dewatering assessment included the following item:

- The proposed trenchless installation methods (Micro-tunnelling/Directional drilling) is suitable and preferred for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland complex, based on hydrogeologic conditions assessed across the area.



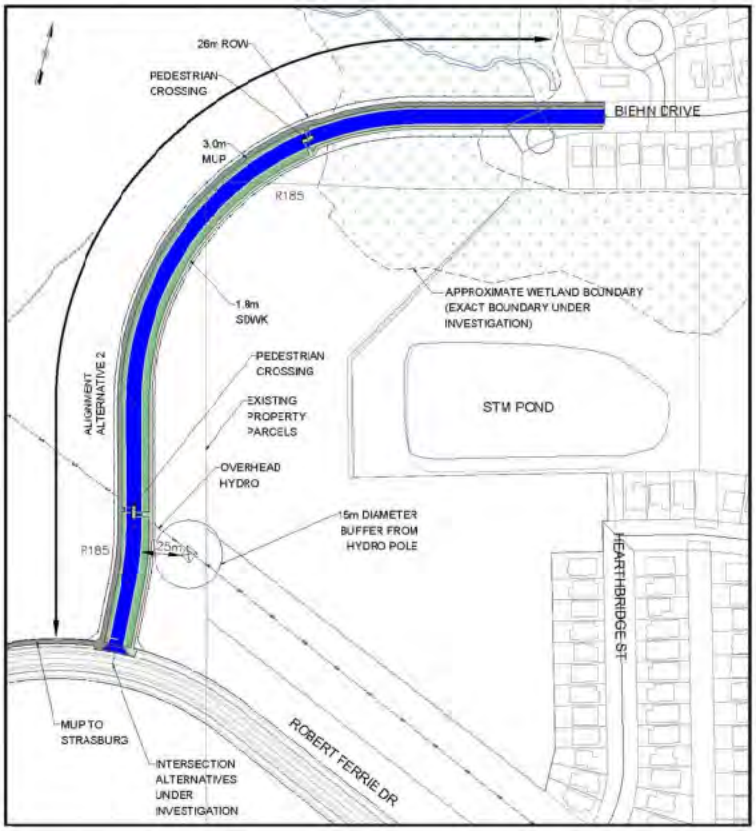
# Alignment Alternative 1

## Connect Biehn Drive to Robert Ferrie Drive – East Alignment



# Alignment Alternative 2

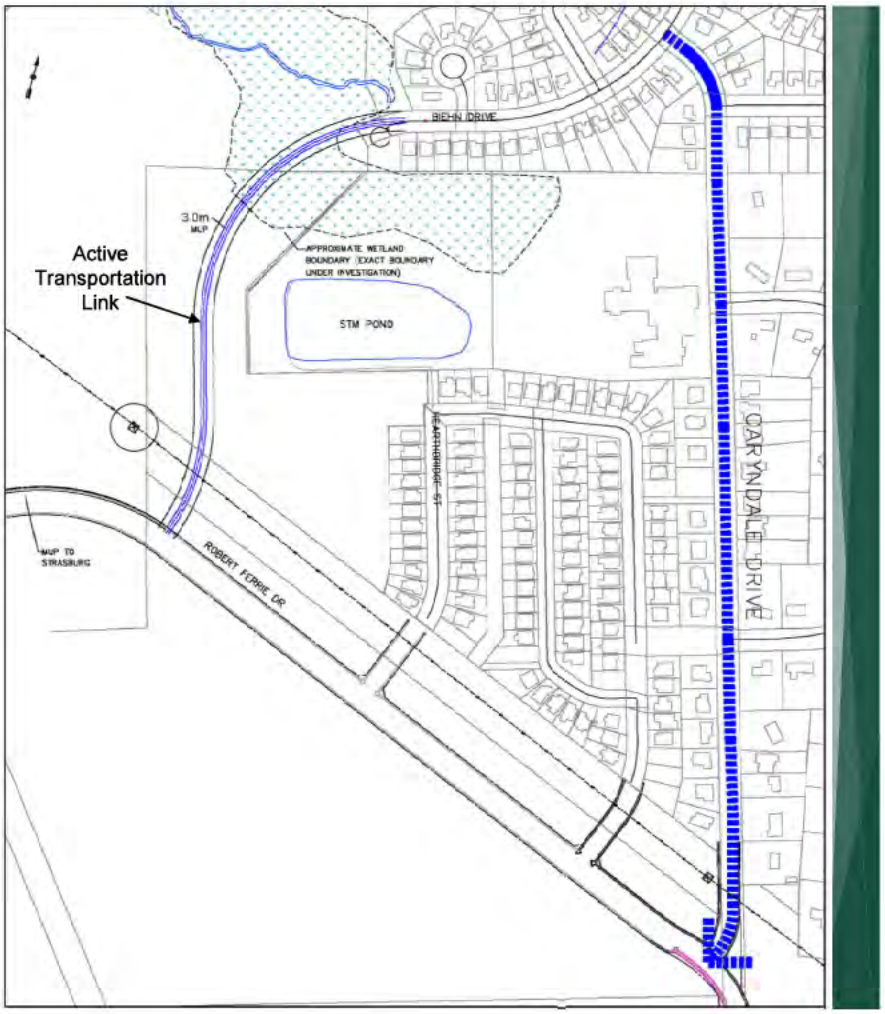
## Connect Biehn Drive to Robert Ferrie Drive – Central Alignment



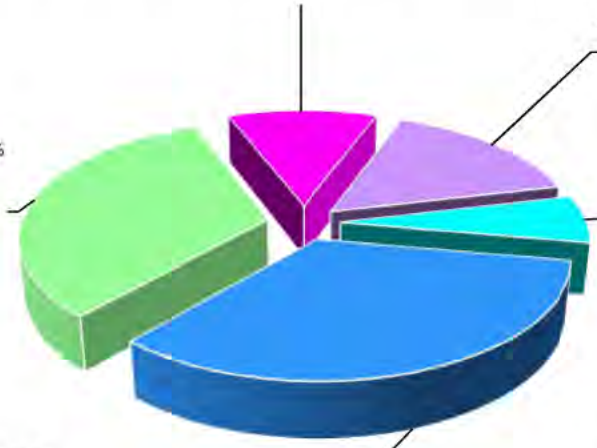



# Alignment Alternative 4

## Connect Biehn Drive to Robert Ferrie Drive – Via Caryndale Drive



# Global Factor and Sub-factor Weights



**Socio - Economic Environment 10.3%**
- Community Disruption to Biehn Drive North 21.0%
- Community Disruption to Biehn Drive South 50.0%
- Community Disruption to Caryndale 29.0%

**Land Use and Property 14.2%**
- Supports the City of Kitchener's Official Plan 56.0%
- Efficient Utilization of Land 29.5%
- Crossing of the Hydro Corridor 14.5%

**Natural Environment 29.7%**
- Wildlife Habitat 15.1%
- Accommodating Wildlife Movement 11.9%
- Provincially Significant Wetlands (PSW) Removed 24.8%
- Potential Black Ash Impacted 24.8%
- Groundwater Infiltration 23.5%

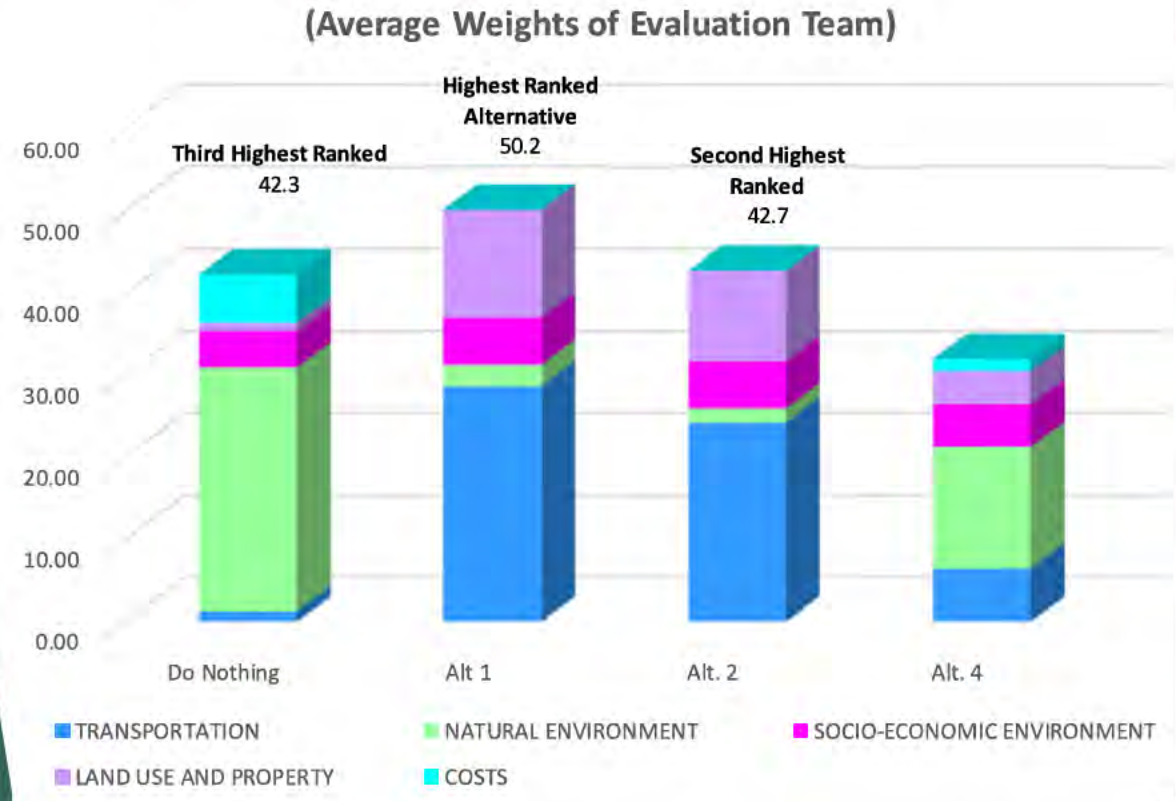
**Cost 5.9%**
- Capital Costs 100.0%

**Transportation 30.5%**
- Supports Urban Transit Service 8.5%
- Improved Emergency Response 7.1%
- Roadway Safety – Supports Area Traffic Calming Measures 17.5%
- Efficiency of Travel 19.9%
- Compatibility with Integrated Transportation Master Plan 8.3%
- Safety of School Zone 14.7%
- Personal Security of Pedestrians and Cyclists 7.3%
- Intersection Spacing/Safety 16.6%

Note:
Weights have been adjusted to account for updates to sub-factors.



# Alternative Totals



# Evaluation

| Do Nothing | Alternative 1: Extend Biehn Drive to Robert Ferrie Drive east of Hydro Tower | Alternative 2: Extend Biehn Drive to Robert Ferrie Drive west of Hydro Tower | Alternative 4: Existing Caryndale Drive and a Multi-Use Path crossing the PSW |
|---|---|---|---|
| Not recommended.<br>The Do Nothing alternative fails to address the traffic volume and safety concerns along Caryndale Drive which should be expected to increase when the extension of Strasburg Road to New Dundee Road provides an alternative access to Highway 401. Caryndale Drive will continue to accommodate a higher volume of traffic and forced to function as a major collector street.<br>The limited number of Black Ash trees in the PSW will continue to decline due to the Emerald Ash Borer. | Recommended as the **Preferred Design**<br>Alternative 1 is the best-balanced alternative. It provides the best transportation performance while minimizing natural and social environmental impacts. A limited number of Black Ash trees have been identified along the corridor however the city's best efforts to combat the Emerald Ash Borer has had limited success. The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors. | Not recommended.<br>Although this alternative provides comparable transportation performance to Alternative 1 the environmental impacts are much greater. | Not recommended.<br>Caryndale Drive, classified as a minor neighbourhood collector street, will be forced to function as a major collector street. The neighbourhood was not designed for Caryndale Drive to continue to carry increasing volumes of vehicle traffic. |



# Conclusions and Recommendations

- The following are updated 2024 preliminary recommendations from the EA based on new data sources that included, the geotechnical investigation, the 2023 field inventory of ash trees, the history of the EAB through North America and the Doon South Community Area Transportation Study:
  - Based on the 2023 geotechnical investigations it is feasible for the sanitary sewer and watermain without surficial construction to cross the PSW. The use of open cut or trenchless construction for the sanitary sewer and the watermain to be determined during detail design.
  - The 2024 Doon South Community Area Transportation Study confirmed the recommendations of the current Transportation Master Plan, 2013 reflected in the Official Plan, 2019, for the long-term use of Biehn Drive and its extension as a major collector in the City.
  - The 2024 provincial designation of the Black Ash trees as a Species at Risk (SAR) is now reflected in the recommendations.

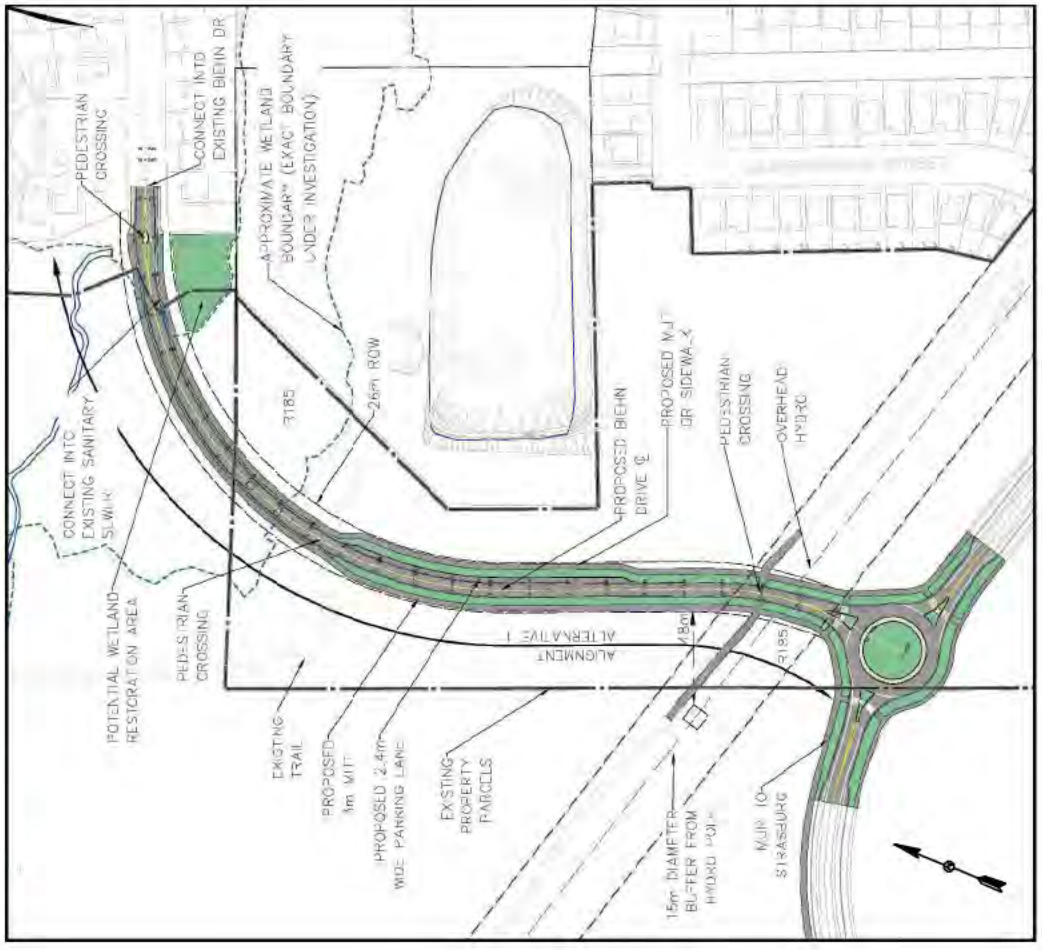
# Conclusions and Recommendations

- The following is the preferred approach for the planned improvements:
  - The health of the Black Ash trees are to be monitored.
  - Development south of the PSW be permitted to proceed.
  - That a right-of-way continue to be protected at the intersection of Biehn Drive and Robert Ferrie Drive for a future roundabout.
  - The land acquisition should include the Right-of-Way required for municipal services and a road corridor.
  - The alignment of the servicing corridor for the trunk sanitary sewer and watermain to follow the alignment for the road corridor.
  - If Black Ash trees are impacted due to construction, the City will compensate for the loss. Compensation to be determined by Ministry of Environment Conservation and Parks.



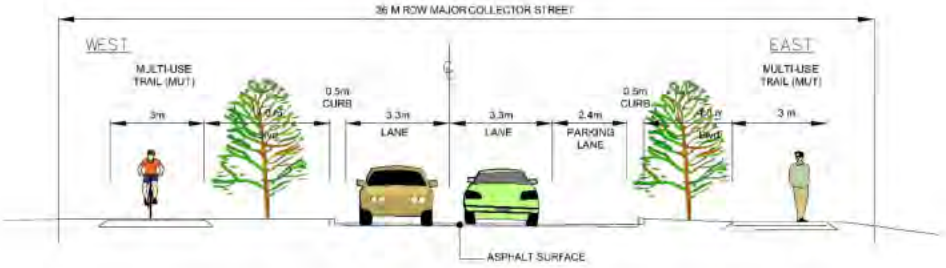


## Preferred Design

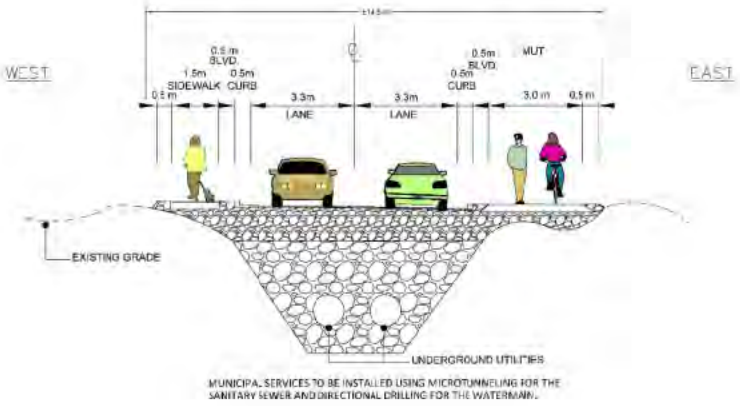


# Recommended Cross Sections

**PROPOSED BIEHN DRIVE**
**CROSS SECTION**




**PROPOSED BIEHN DRIVE CROSS SECTION**
**THROUGH WETLAND**






# Mitigation Table

| Issue/Concern<br>Potential Effects | Concerned Agency | Proposed Mitigation<br>(prevent, lessen or remedy potential detrimental environmental effects) |
|---|---|---|
| Loss of Provincially Significant Wetland (PSW) | GRCA | • Wetland Restoration in vacant lot on Biehn Drive.<br>• Narrowing of roadway through PSW.<br>• Utilize Best Management Practices and limit disturbance to wetlands and vegetation.<br>• Limit vegetation removal, where feasible.<br>• Protect vegetation to remain using tree protection. |
| Wildlife Crossing | GRCA | Provide equalization culverts and permanent, directional wildlife fencing to permit wildlife passage across roadway. |
| Groundwater | MECP | Avoid draw-down of water table by ensuring the bottom of granulars are above original ground to the greatest extent possible. |
| Fish Habitat: downstream impacts to Strasburg Creek cold water fish habitat | GRCA, NDMNRF | • Provide erosion and sediment controls.<br>• Minimize the delivery of sediments and associated pollutants to receiving watercourses.<br>• Minimize the impact of road salt on the local vegetation and receiving watercourses.<br>• Minimize the impact of increased flows on receiving watercourses.<br>• Minimize potential erosion within the drainage system, and within the local receiving watercourses. |

# Mitigation Table

| Issue/Concern<br>Potential Effects | Concerned Agency | Proposed Mitigation<br>(prevent, lessen or remedy potential detrimental environmental effects) |
|---|---|---|
| SAR | MECP | • Undertake targeted, specialized SAR surveys during Detail Design as required depending on species conservation status designations as they exist at that time.<br>• Ensure the design and construction complies with the *Endangered Species Act* (ESA, 2007) |
| Migratory Birds | NDMNRF | Any clearing and grubbing should be completed outside of the active breeding bird season of April 1 to August 31. |
| Turtles and Turtle Habitat | NDMNRF | • Install silt fencing before turtle nesting season (May 15 to Sept. 30).<br>• Protect and buffer active nests.<br>• Avoid groundwater alteration in nearby wetlands between October 1 and April 1 during turtle hibernation. |
| Water Quality and Stormwater | MECP | Provide a Stormwater Management Plan. |
| Significant Woodlots | MNRF | Avoid specimen trees and limit tree clearing. |



# Mitigation Table

| Issue/Concern<br>Potential Effects | Concerned Agency | Proposed Mitigation<br>(prevent, lessen or remedy potential detrimental environmental effects) |
|---|---|---|
| Noise | City | Municipal Noise By-laws are to be followed during construction adjacent to residential areas. |
| Management of Surplus Materials | MECP | OPSS 180 apply MECP "Management of Excess Materials in Road Construction and Maintenance Guidelines".<br>Management and Disposal of Wet Soils. |
| Traffic calming | City | • Narrowing of cross section.<br>• Reduced lane widths.<br>• Provision of a roundabout to assist in controlling speeds. |
| Lighting | GRCA | Provide cut-off lighting through PSW. |
| Utilities | | Liaison during detail design. |
| Changes to Emergency Services | | Liaison during detail design. |

# Municipal Services Recommendations

- Based on geotechnical investigations in 2023, the feasibility of subsurface construction of municipal services has been verified.
- Measures to avoid impacts to the PSW include:
  - Microtunnelling of the sanitary sewer under the PSW.
  - Directional drilling of the watermain under the PSW.
- This construction avoids environmental impacts and any potential draw down of the water table.

Microtunnelling launch shaft



# Next Steps

**Following this Public Information Centre we will:**

- Review all Public Information Centre comments and prepare a Summary Report.
- Develop refinements to the Recommended Plan (if required) based on public comments.
- Presentation to Council on September 16, 2024 prior to 30-day public review period.
- Finalize the Environmental Study Report (ESR).
- Initiate 30-day public review period of the ESR.

# Your Involvement

**How can you remain involved in the Study?**

- Request that your name/e-mail be added to the Study Mailing List
- Provide an online comment
- Contact the Municipality's representative or the consultant at any time. Contact information is available below.

**Thank you for your participation in this online Public Information Centre.**

Your input into this study is valuable and appreciated.

All information is collected in accordance with the *Freedom of Information and Protection of Privacy Act*.

# For More Information Please Contact:


Steve Taylor, P.Eng.
BT Engineering Inc., Project Manager
Email: stevenj.taylor@bteng.ca
Phone: 519-672-2222

Eric Riek, C.E.T.
City of Kitchener, Project Manager
Development Engineering
Email: eric.riek@kitchener.ca
Phone: 591-741-2200 ext. 7330


Please submit any questions or comments to the contacts listed above by **July 4, 2024.**

# Appendix C

Comment Sheets

BT ENGINEERING

**From:** [redacted]
**Sent:** June 21, 2024 7:05 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; eric.riek@kitchener.ca <eric.riek@kitchener.ca>
**Subject:** Biehn Drive Exten on

Hi Steven and Eric,
After reading the exhibits from the PIC 3, I was wondering about the increased traffic on Caryndale Drive that was the deterrent for recommending the multi-use path (alternative #4). I think once Robert Ferrie and Strausburg are connected that traffic on Caryndale would be reduced without the need for a road from Biehn Dr. to Robert Ferrie because traffic from the Doon South area would be diverted. Was that possibility considered?
My family and I would love to see a trail in place of a road to encourage active living, reduce traffic, and protect the environment. My son is especially keen to see a trail in place of a road for environmental reasons. He's in grade 3 and made the initial recommendation that a trail be considered. I think the next generations' concern for water, plants, and animals should be valued above how city planners labelled a type of road (namely Caryndale Dr. as a minor vs. major collector street.
Thanks for reading.

[redacted]

KITCHENER

**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

When the Robert Ferrie extension to Caryndale Drive was happening, City Planners promised residents that the extension from Robert Ferrie Drive to Strasburg Road would happen very quickly after the Robert Ferrie Drive extension to Caryndale Drive was passed. Well we all know that didn't happen! Of course, as the residents pointed out during that planning phase, it would be a disaster for the traffic on Caryndale and also on Biehn. Caryndale Drive which is supposed to be a minor arterial road is very close to a major highway. If this present Council votes to extend Biehn Drive without first extending Robert Ferrie to Strasburg Drive Road you will simply be compounding the problem. Residents deserve better.

City staff has stated to me the developers are in control on whether the Robert Ferrie extension proceeds. If that is true, then why were residents promised Robert Ferrie would be extended soon after that road was extended to Caryndale Drive? What changed? Did the City somehow lose control of that decision or were the citizens lied to and the City never had control? In any event, Council can certainly withhold approval for Biehn Drive extension until the Robert Ferrie extension is done. As we all know, the developers are only concerned with making money. They don't care what they do to neighborhoods. That responsibility belongs to the City. In addition, the developers will use any excuse they can think of, included promises they won't keep, to further their agenda. The City needs to finally stand up and be counted on this one. Furthermore, the excuse of stating costs will be cheaper if the Biehn extension proceeds now without Robert Ferrie extension first is simply a cop out and it certainly would raise questions.

With respect to the proposed alternatives for the Biehn extension (once Robert Ferrie is extended), I would have preferred alternative #2 over alternative #1. I understand there could be more of an environmental impact, but, you are building a road which will be populated by houses. **The environmental impact will be done.** Does it really matter at that point on whether there may be a little more impact choosing #2 over #1?

**(Please turn over if additional space is required.)**

Please complete your comment sheet this evening and place in the comment box provided OR send your completed comment sheet by **July 4, 2024** to:

**Steve Taylor, P.Eng., M.Eng.**
**Consultant Project Manager**
**BT Engineering Inc.**
509 Talbot Street
London, ON N6A 2S5
Email: stevenj.taylor@bteng.ca
Phone: 519-672-2222

**Eric Riek, C.E.T.**
**Project Manager**
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**Comment Sheet 3**

**From:** [redacted]
**Sent:** June 20, 2024 8:48 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; 'Eric Riek' <eric.riek@kitchener.ca>
**Subject:** Biehn Road extension - Comments re PIC No.3

June 20, 2024

Hello Steve & Eric

I attended the PIC No. 3 today and found it informative. I have been going to various meetings about the development of this road extension since 1993 when I received an information letter about if from Alderman Tom Galloway. This project has been scheduled for so long, I'm not sure it will ever get completed.

At all these meetings there is always strong opposition to this project from several home owners for various reasons. At one virtual meeting during the Covid pandemic a home owner said she had been living in the area for two years and her real estate agent had never told her about the proposed Biehn Road extension. For me, this typifies some of the home owners who oppose this project. They either haven't researched the plans for the area when buying their house or they think that they can ignore or oppose them because the project should not happen due to the fact that they have lived here for several years. It is often a NIMBY reaction to the project, yet they fail to recognize that their own home was also built in the same prime forest and wetland. The road extension is only going through a small corner of the forest whereas their own streets were cut through forest and wetlands many times larger. Having lived in the area for 33 years, I have seen many changes and major new developments and changed traffic patterns as a result of new roads, homes and schools. I believe this is called progress.

I feel the Biehn Road extension will be a positive change for our neighbourhood and will help with the flow of traffic through the area. Some of the current roads were never designed to handle as much traffic as they now see on a daily basis. Getting the proper roads will help route the traffic in safer way and will also allow access for emergency vehicles so the can respond to any crisis in a more efficient manner.

We keep hearing about the lack of housing and it seems that in order to continue developing the area. the proper infrastructure and roads need to be built. Hopefully, council will see the need to move forward with the Biehn Road extension and this project will finally get green lighted and shovels will get in the ground sooner than later.

Regards

[redacted]

Comment Sheet 4

KITCHENER

**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

There should have been maps of the greater Biehn Drive area, including Robert Ferrie Dr and Strasburg Road, to see how it affects the whole area.
Maps in report on table in gym, are old. not current.
Also map in newspaper announcement is very old.

**(Please turn over if additional space is required.)**

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**Steve Taylor, P.Eng., M.Eng.**
**Consultant Project Manager**
**BT Engineering Inc.**
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**Eric Riek, C.E.T.**
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**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

Every solution is negative for the environment and the community.

Your "matrix" is not bias and as such ignores the needs and wants of the community.

- More traffic
- Higher water table.
- Destruction of protected trees
- Destruction of protected wildlife
- Faster traffic & more traffic on Biehn.

JUST directional drill for services. DO NOTHING ELSE!

Save tax money
Help our community - This is our home!

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Comment Sheet 6

KITCHENER

**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

The question I asked and was ignored was around ethics! When you look at the list of concerns, the only alternative that is even remotely ethical is alternative 4. The people who are making these decisions are not personally impacted, nor do they have an appropriate environmental lens.
There are also speed safety issues with extending Biehn.
It is disheartening to see alternative 4 as being considered, but not really, as it appears to have been dismissed as not recommended.
Please follow a moral compass. It seems clear that money and developers are behind the preferred city alternative. Not acceptable.
By the way, you forgot about the bonus tower - again!

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**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

No to Biehn Drive – Yes to Robert Ferrie.

Building on wetlands risks flooding, higher insurance, and contaminated drinking water. Who is going to pay for this?

Don't do this to our community!

OVER

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**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No.3**
Thursday, June 20, 2024

You're destroying our quaint area

you're putting our children at risk

You're destroying wetlands, once you do you can't fix it.

Finish what you started on Strasburg then do another traffic study. The amount of traffic on Caryndale is less than you orginally indicated.

KITCHENER

**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

You've done a lot of work but it's all the same. It's the same as it was years ago.

This is the crux of the matter it is not this small road joining Biehn to Strasburg, it is not the traffic flow, it is the wetlands.

For crying out loud can you not make it your highest priority? What has happened to Kitchener? This land should not be touched Forget your "mitigation Table".

Alternative four is my decision

And it is so simple. Plan around it. You have Carandale + Robert Ferrie and Strasburg. Use them first. Or at least join Robert Ferrie to Strasburg and see if you really really really →

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**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No.3**
Thursday, June 20, 2024

need to destroy the wetlands.

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City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Public Information Centre (PIC) No.3
Thursday, June 20, 2024

Why can't Robert Ferrie be built first, then assess the traffic needs? The houses on Biehn and off Biehn are limited + even if the population increases to the south, Strasburg + Robert Ferrie remain solid choices for exiting the neighbourhood instead of Coryndale + Biehn.

As citizens, we feel we are speaking into the wind and that the staff is doing their own agenda, instead of seriously considering our concerns and solutions. No number of PIC's will fix the fact that we are maybe being listened to but ultimately, ignored.

KITCHENER

**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

What about the trout (fish)
please give info and plan of care for the fish

In the evaluation please balance the specific environmental impacts of Alternative 2:

Extend Biehn Dr to Robert Ferrie.

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Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

There is the mention in the Area Transportation Study (Pg 43) that all the ~10 listed roads would use Carysdale as a way out of ~~the~~ subdivision if Biehn Dr is not extended. People are creatures of habit and take of least resistance when driving. As a result, they will take the shortest point from A to B. Most people will either go into town (use Biehn) or going into Doon South for school (middle school). Why would they take Biehn Dr all the way to Robert Ferrie Drive turn left and the drive past Carysdale? They won't, they will still cut through Carysdale!. So, the wetlands are ruined for no reason!

As well where is the environmental assessment for the ~~Bench~~ and during construction? Removing that much water to allow for construction has to be an issue!

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**Public Information Centre (PIC) No. 3**
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Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

I get the distinct feeling the extension of Biehn drive is a done deal, which I find very discouraging. It was planned for years ago, so they are going to do it. How we not learned from our environmental mistakes. The area is environmentally sensitive, it filters the ground water which we all use. If a road is installed, the water table will be effected. There are homes on Biehn near the proposed extension that have sump pumps run year round. Is it can't have a - has 2 industrial grade sump pumps. One is a back up. Decades their basement has flooded several times. When our basements get flooded are you "The City of Kitchener" going to compensate us?

I understand and welcome the need to extend Strasburg Road to Robert Ferrie drive. My call is that it be extended first, and then revisit the need to extend Biehn as I think very few would use it. Can you please advise who owns / "Which Developer" owns the property adjacent

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City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Public Information Centre (PIC) No.3
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to the proposed Biehn extension. Are they proposing large # lots / homes and that is really why the push is on to extend?

You have already indicate that the sewer and water services will be put underground, so why don't you not put in a road but rather a nature trail that can be used by walkers & bikers. So the forest area can remain pristine and creature to provide value to the community

Once it's paved over, there is No going back

There is no need to rush this road through. Let extend Strasburg and then in a year or two there will be actual accurate traffic analysis that can take place - not projected or best guess.

I am very much against you destroying our environment, when we don't have the proof the road is actually needed.

A road brings destroyed wet land, and the surrounding trees. Salt will be added in the winter further affecting the water source. Man-kind is not able to replace what mother nature is currently doing.

Regards,

[redacted]

KITCHENER

**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

Don't do the road. The future throughput isn't worth the impact on the current residents or the environment. I'm fine with the horizontal drilling for accomodating the need for future growth by installing utilities but turning Biehn into a highway (basically) is going to effect the ability of kids to safely play outside. At the moment kids play street hockey, basketball and soccer in their yards. Balls go into the street occasionally. Hockey is (was) a part of the fabric on Canadian society. Kids chasing balls into highways is dangerous. I used to live in Barrie. We already had a fatality. This community wants to remain quiet. We don't mind the inconvenience of taking a longer route and we don't want to be a main artery. Secondly, we don't want to see the environment effected and a road will effect the wetland. We need to preserve our watershed and the animals. A road with a "funnel" for the animals is not acceptable. A walking path like alternative 4 is a good alternative. Please don't force this through. It will destroy our neighborhood and community.

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Third, if a road needs to be put in, just do Robert Ferrie Dr to Strasburg. Don't connect Biehn.
Lastly, the salt is going to kill off the Brook Trout. My kids fish there and if they are robbed of their childhood passion, and put at risk due to increased traffic, [redacted] it will be a damn shame. Please no road. Meet us halfway, put the utilities in and a pathway (if necessary) But PLEASE NO ROAD! Thank you for your consideration and hearing me out.

[redacted]

KITCHENER

**City of Kitchener**
**Biehn Drive Extension Environmental Assessment Study**
**Public Information Centre (PIC) No. 3**
Thursday, June 20, 2024

Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

AS A RESIDENT OF CARYNDALE DR I AM AGAINST ANYTHING ADDING MORE TRAFFIC TO OUR STREET, CARYNDALE IS A MINOR COLLECTOR AND FUNCTIONED AS ONE UNTIL THE CITY OPENED IT UP TO ALL TRAFFIC FROM DOON SOUTH. WE ARE SUBJECTED TO TRAFFIC EXCEEDING LIMITS BY A WIDE MARGIN PAST BRIGADOON SCHOOL. IF NOT BUILDING BIEHN DR MEANS MORE TRAFFIC ON CARYNDALE THEN IT SHOULD BE BUILT

**(Please turn over if additional space is required.)**

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Thank you for attending tonight's public meeting. Please provide your comments on any of the material presented.

I see the city staff/PM's have made several improvements from last year's public discussion: 1) horizontal/directional drilling to reduce environmental impact as well as water table increase/house flooding, 2) reduce the area impacted, and 3) use geotextiles. However the PM's fail to take into account the democratic will of 500 residents who have made the case last year their preference of Robert Ferrie Dr. to Strasburg Dr. over the Biehn Dr. Extension.

> Out of the two proposals the Robert Ferrie Drive to Strasburg provides a major collector to the southmost residents compared to the Biehn Dr Extension which will only provide a minor collector to commuters. Furthermore commuters won't have a forced detour through Caryndale, Biehn, and Marl Meadow roads that the construction of Robert Ferrie would free up.

> Second the decision to minimize the environmental damage does not take into account the community's desire to have zero environmental damage. Moreover the current impact study misses the runoff of salt from the road which will kill off fish and small amphibians.

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Finally the last issue that the city staff raised was with school safety, however that is our concerns not the political talking point of non-residents. What the PM's fail to mention is the existence of speed-reducing measures already installed on Caryndale. They cede the point that Robert Ferrie to Strasburg will reduce this traffic and increase Brigadoon School safety.

After 30 years the city should learn to listen to its working class voting constituents. Last year we were vocal about selecting Robert Ferrie over Biehn Dr due to better choice/priority, environmental factor/unaddressed during this P.I.C, and sensible school safety. Let us Vote No on the Biehn Dr Extension and Yes to the better alternative.

**From:** [redacted]
**Sent:** June 25, 2024 2:37 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; Eric.riek@kitchener.ca <Eric.riek@kitchener.ca>
**Subject:** Biehn Drive

Gentlemen,

I want to thank you for taking the me to explain the thorough process you used in considering the Biehn Drive extension.

I want to share some of my thoughts with you.

At the basic level, the reason for this discussion is the extension of the water main and sewage. That is not a debate. The city's plan calls for that, and it sounds like the City has finally come around to accep ng the idea of direc onal drilling. Terrific. Direc onally drill sewage and waterlines and extend those requirements to the next community.

However, further talks about extending Biehn's drive to Robert Ferrie seem shortsighted and detrimental in various ways. I have numerous concerns about the destruc on of green space and protected animals. The most recent discovery of protected Ash trees in the line of this road adds further to my concerns. The runoff of toxins into the green space means that the destruc on will not merely be the road but further damage beyond that. The green space in this community is a key factor in why people moved here. We were told it was protected land. Yet, here we are discussing the destruc on of this protected space.

Secondly, the Robert Ferrie extension will 100% take the pressure off of Biehn Drive and will revert that road to the numbers it was made for. As your planning team noted, the Robert Ferrie extension will be faster for commuters. Whereas Biehn Drive now has traffic calming measures and mul ple stop signs, no one - other than those who live in this neighbourhood - will take Biehn. Expanding Robert Ferrie will be best for the flow of traffic. The extension of Biehn literally make no sense from a cost perspec ve.

Thirdly, adding an offshoot from Robert Ferrie onto Biehn is a recipe for disaster. As I sit in my house with the windows open at night, I can hear cars racing in the distance. The Biehn Drive extension would bring dangerous driving into our neighbourhood. The road would be dark and have hidden forest entrances on either side. Cars will come out of that roundabout and speed down to Caryndale. This is an accident wai ng to happen. And what of a child walking from forest to forest, cu ng across the road as a car flies from Robert Ferrie onto Biehn?

Finally, there is no clarity on the effects of this construc□on on a rising water table. I am already in talks with the City of Kitchener on the rising water level beneath my home and the lack of sewage distribu□on in the area. This led to a flood in my house last year, and the City explained that the City of Kitchener is not responsible and that a rising water level is the homeowner's responsibility. Yet, when I approached people at the informa□on session, some said this would affect the water table. One engineer said it would not, and another said it would. When I spoke to a water expert I know, he laughed and said "it will 100% affect your water table". Therefore, this will 100% affect my home, as it is one of the lowest sitting proper□es in the area.

When speaking with experts, I con□nuously hear the word "matrix" and "the matrix shows". I understand that your matrix is an attempt to be objec□ve, and although that usually is something I believe poli□cal ideas should be based on, in this case, there is an issue with an objec□ve matrix. And that issue is us. We the people of Brigadoon. We are watching this decision by the City of Kitchener and engineers from London. We see decisions based on an objec□ve reality discussed in mee□ng rooms in Downtown Kitchener. But we live here. We are the people who will live with the fallout of this decision. We are the people who will lose greenspace. We are the

people who will have to deal with traffic endangering our children. We are the people who are worried about the poten□al rising water table and subsequent damage. A matrix is fine, but some□mes, you need to look outside your matrix and at the people affected by this extension. Last week, at the mee□ng, your team couldn't do that. You couldn't look me in the eye and tell me that my life would be better because of this extension.

The only things I heard last week were, "This will get you connected to shopping" and "This will save you two or three minutes when you leave the neighbourhood." I am saddened that we live in a world where two or three minutes is a reason to destroy protected green space. I am saddened that speeding up people's commutes is worth hur□ng other people's lives.

Please, build the infrastructure. Leave the greenspace. Let Brigadoon be.

Thank you for your □me.

**From:** [redacted]>
**Sent:** June 26, 2024 2:56 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; eric.riek@kitchener.ca <eric.riek@kitchener.ca>
**Subject:** Biehn Dr Extension

Hello Mr Taylor and Mr Riek,

I am responding as a citizen in the Doon South Neighbourhood of Kitchener regarding the Biehn Dr Extension.

I believe that this project is not worth the unknown impact on the local environment. The proposed site is sensitive wetlands which are critical to the health of the local watershed, flora/fauna, and overall ecosystem. Even in the report, the area is called Provincially **Significant** Wetlands (PSW); the impact of removal is unknown and once done, cannot be undone. The other options are stated as No to Low environmental impacts whereas the Biehn Extension ranges from "Low to High", if it ends up being "High" will it have been worth it?

The extensions of Robert Ferrie to Strasburg as well as Strasburg to New Dundee Rd are safer environmental projects and will be able to alleviate increased traffic demand while allowing for community development along those routes. There is also the Alternative #4 where Biehn Dr is Connected to Robert Ferrie via Caryndale Dr; although it is cited as too small of a street to manage the expected volume of traffic, the "inconvenience" of this option must be weighted strongly against the preservation of our PSW, if we have an option that assists the goals AND preserves our important natural spaces, then surely that should be strongly considered. Frankly, the previous classification of Caryndale Dr as a minor street was shortsighted when this type of growth in the Region could have been anticipated and the precious natural environment should not have to pay for the City previously making another street too small.

Additionally, the blase wording of the loss of endangered Black Ash trees due to the project (which I am sure will be inevitable once construction begins). How can the loss of Endangered species be adequately compensated?

I strongly urge the City to reconsider the planned Biehn Extension. With the decimation of Ontario's environment due to Hwy 413, the proposed grab of prime farmland in Wilmot, and forced expansion of municipalities; Waterloo Region and the City of Kitchener has a duty to preserve this PSW and other natural spaces. The focus on green energy, public transit, and environmental protection in our area is commendable overall and a project like this flies in the face of the values of the citizens of our Region.

Thank you for your consideration,

[redacted]

**From:** [redacted]>
**Sent:** June 26, 2024 4:10 PM
**To:** Eric.riek@kitchener.ca <Eric.riek@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Biehn Drive Extension Disappointment

As a Brigadoon resident it's very disappointing that even more disruption to the wetlands and wildlife in this neighborhood is being considered.

I really hope council agrees with me and what appears to be the concensus of my neighbours and proceeds with the expansion from Robert Ferrier instead of Biehn Drive.

[redacted]

Sent from my iPhone

Hello Steven & Eric,
I hope this email finds you well. This is my official statement regarding the Biehn Drive extension.
For years, we've seen discussions about extending Biehn Drive, but the environmental implications for PSW 30 are profound. As someone who cherishes walking in these woods, I'm deeply concerned about preserving their biodiversity and ecological integrity.
The wetlands here provide essential ecosystem services, including water purification and flood mitigation, crucial for our community's sustainability. If development is unavoidable, I support directional drilling under a MUP as a less disruptive option to traditional road construction.
Let's prioritize smart development strategies that balance economic growth with environmental stewardship. Exploring alternative pathways, like those near Huron and Fischer Hallman, can meet our community's needs without compromising our natural heritage.
Thank you for considering my viewpoint. I stand with the Robert Ferrie Now group in advocating for sustainable development practices.

[redacted]

Steve Taylor P.Eng., M.Eng., CVS-LIFE, P.E.
Chief Execu ve Officer
509 Talbot Street
London, Ontario
N6A 2S5
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**Phone:** 519-672-2222
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**From:** [redacted]>
**Sent:** July 3, 2024 10:09 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; eric.riek@kitchener.ca <eric.riek@kitchener.ca>
**Subject:** Biehn Drive Extension.

Hello Steven & Eric,
I hope this email finds you well. This is my official statement regarding the Biehn Drive extension.
The Biehn Drive extension has been part of the plan since 1989, but it's crucial to assess its environmental impact on Provincially Significant Wetlands like PSW 30 in Brigadoon Woods. We need to prioritize preserving these natural areas for their role in stormwater management and reducing flood risks, which directly affect our community's resilience.
I advocate against any development that fragments our wetlands unless absolutely necessary. If we must proceed, directional drilling with a Multi-Use Path (MUP) overhead should be considered over a conventional road to minimize ecological disturbance. The proposed design of 12 homes in a crescent off the road ignores efficient urban planning principles and poses challenges for future public transportation access.
Let's explore alternative routes, such as leveraging Robert Ferrie's existing infrastructure or focusing development near Huron and Fischer Hallman, before impacting PSW 30. This approach aligns with responsible urban development and supports sustainable city planning.
Thank you for considering my perspective. I stand with the Robert Ferrie Now group in advocating for environmentally conscious alternatives.

[redacted]

**From:** [redacted]
**Sent:** July 4, 2024 12:47 PM
**To:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** There is another way - Biehn Drive Extension

Good afternoon,

Regarding the proposed plan to extend Biehn Drive through a wetland; there is another way to go about this development! Extend Robert Ferrie to Strasburg to allow for better traffic flow, directionally drill the water and sewer services for development under the wetland and otherwise leave the wetland alone. This would be a win for all parties and preserve the wetland for future generations. The cost is virtually identical, but studies show it could minimize flood risks to existing houses and preserve the current wildlife. Please do not destroy a wetland for a road that can easily and more effectively be built elsewhere.

[redacted]

**From:** [redacted]
**Sent:** July 4, 2024 11:02 AM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Biehn Drive extension

Good day Steven,

I have enjoyed living in beautiful Brigadoon for 12 years, with a lot backing onto forest. We are about 3 blocks from where Biehn ends at Brigadoon woods. It is peaceful and quiet, but very wet!
In the twelve years, we have lived here, we have had 3 separate flooding incidents, with costly basement repairs, foundation crack repairs, regrading the entire rear yard to divert water flow from the house, and three sump pump replacements! We also went 10 years without insurance coverage for water damage due to multiple claims. After a good rain, the rear part of our property is like a bog. The water takes a long time to drain away, so we have standing water for hours/days. There is a huge mosquito presence which makes it difficult to enjoy the outdoors. This is what happens when you build in wetlands to begin with!

This neighbourhood was planned and built in the 1980's. We know so much more now about engineering and environmental impacts than we did then. The original plan to extend Biehn Drive through the "protected" wetlands has become so unnecessary. Especially since Robert Ferrie Drive is going to connect to Strasburg Road anyway. This will divert so much traffic away from Biehn drive, that it makes destroying the wetlands illogical. As it stands now, we do not see the traffic projections that have been stated, and once Robert Ferrie to Starsburg is complete, we will see so much less.
I would like to implore the city to see the extension of Robert Ferrie to Strasburg BEFORE any more wetlands are cleared, and even abandon the consideration of Biehn Drive being extended at all!

Thank you for your time.

[redacted]

**From:** [redacted]
**Sent:** July 3, 2024 11:05 PM
**To:** erik.riek@kitchener.ca <erik.riek@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Biehn Drive Extension

Hello Steven & Eric,

I hope this email finds you well. This is my official statement regarding the Biehn Drive extension.
The debate over extending Biehn Drive highlights critical decisions about our community's future. As someone who values these forests for exercise and mental well-being, I oppose any development that threatens their integrity, especially through our precious wetlands.
The proposed extension could significantly impact PSW 30, which plays a vital role in our local ecosystem. If development is unavoidable, I urge the consideration of alternative routes and methods, including directional drilling with a MUP, to minimize ecological disruption.
Let's prioritize urban planning that enhances community health and environmental sustainability. Focusing on infill development elsewhere in the city can meet growth needs without compromising our natural habitats.
Thank you for considering my perspective. I stand with the Robert Ferrie Now group in advocating for responsible urban development.

Thank you very much,

[redacted]

Comment Sheet 24

**From:** [redacted]
**Sent:** July 3, 2024 4:31 PM
**To:** Eric.Riek@kitchener.ca <Eric.Riek@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** Berry Vrbanovic <berry.vrbanovic@kitchener.ca>; jason.deneault@kitchener.ca <jason.deneault@kitchener.ca>; Debbie Chapman <debbie.chapman@kitchener.ca>; ayo.owodunni@kitchener.ca <ayo.owodunni@kitchener.ca>; stephanie.stretch@kitchener.ca <stephanie.stretch@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>
**Subject:** June 20 PIC, Biehn Dr. & Sanitary Trunk Sewer Extension

Good Day;

My name is [redacted] & I a ended the PIC on June 20th , concerning the proposed Biehn Dr. & Sanitary Trunk Sewer Extension.

On February 13th , 2023 several Neighbours & myself made presenta. ons to Kitchener City Council concerning the above noted project. My presentation addressed my concerns about the Provincially Significant Wetlands 30 (PSW30) which is @ the end of the present Biehn Dr. & goes into the Brigadoon Woods, if the Biehn Dr. extension was to go forward. I presented to Council a newspaper article dated February 3rd , 2023 wri en by Reporter Terry Pender of the Waterloo Region Record, entitled 'Now is the time to Protect these Wetlands'. The article quoted Nandita Basu, Professor & University of Waterloo & Canada Research Chair in Global Water Sustainability & Ecohydrology to support my concerns.

At this time I would like to thank Kitchener Council for directing City Staff to conduct & complete further studies for this project @ the February 13th , 2023 meeting.

I would like to thank you for giving me the opportunity to make my concerns, positions & comments concerning the Biehn Dr. extension known.

I want to make it very clear that I am NOT opposed to development in the area & I support the need for the Sanitary Trunk Sewer Extension & I support Directional Drilling to address this portion of the Project, so as to do less harm to PSW30, as well as supporting the building of a Trail through the Wetlands & Brigadoon Woods for the continued enjoyment of Nature Lovers & so the City can service the Sanitary & Sewer lines & any other infrastructure that may be required for future development.

However, I DO NOT support the Biehn Dr. road extension for the following reasons;

1) It would destroy the PSW30.
2) It would destroy Strasburg Creek, Black Ash Trees, Coldwater Brook Trout & other species of birds & animals.
   Note: None of the PIC documents mentions anything about the Coldwater Brook Trout? Yet, resident Mr. Mike Funck made a presentation about his concerns with regards to the survival of Coldwater Brook Trout @ the February 13th , 2023 Kitchener Council meeting. His concerns were with regards to the Salt Runoff, other Toxins such as Oil, Tire & Tar Runoff going into Strasburg Creek & destroying the Creek & the Coldwater Brook Trout that presently inhabit the Creek, if the extension of Biehn Dr. goes forward!
3) It would contaminate & destroy the Ground water due to salt, oil, tire & tar runoff into the Wetlands & Creek if Biehn Dr. moves forward.
4) There have been many concerns from Homeowners in the area concerning the Water Table rising, causing flooded basements. They are currently experiencing water in their basements & they feel it will only get much worse if the Biehn Dr. extension goes forward.

At the PIC several Neighbours & myself heard a conflicting message from the Engineers about the evaluations of the proposed Alternatives. All the Engineers agreed that Alternative #1 received the highest evaluation, but some of the Engineers stated that Alternative #4 was a close 2nd in the evaluation process. Yet when I reviewed the PIC documents Alternative #4 ranked 4th on the evaluation chart?

Upon reviewing the PIC documents & specifically Alternative #1, I noticed that Alternative #1 included a lot of mitigation items, such as raising the road, membrane under the road to collect salt & toxin runoff to keep them from entering the Environment (membranes only have a 50 year lifespan), culvert under the road for animal species to cross, spraying of Black Ash trees & moving & expanding the Wetlands. These mitigation items will cost Millions of dollars & will cost millions of dollars in the future! This all for a 500m road extension? These millions of dollars would be be□er utilized & spent by immediately extending Robert Ferrie Dr. from Caryndale Dr. to the Strasburg Rd. extension & other Capital expenses & projects in the future.

At the PIC session I spoke with City Engineer, Mr. Chris Spere & I asked if the Engineers had ever done a traffic study on Doon Village Rd. between Pioneer Dr. & Homer Watson Blvd. during the hours of 8-9am on week days? He informed me that the Engineers had not done any such study. I informed him that a couple of days a week I walk up the hill on Doon Village Rd. from Pioneer Dr. to Homer Watson Blvd. between 8 & 9am & the vehicles from Doon South Dr. onto Doon Mills Dr. & then onto Doon Village Rd. are backed up from Pioneer Dr. up the hill to turn left onto Homer Watson Blvd. on a daily basis. These same residents from Doon South that are using this route are not using Caryndale Dr. or Biehn Dr. to access Huron Rd., Bleams Rd., Strasburg Rd. or Homer Watson Blvd., nor will they use the proposed Biehn Dr. extension or Caryndale Dr. to access these same roads! However, if you build the Robert Ferrie Dr. extension to the Strasburg Rd. extension these residents will use this route to access these same roads.
With regards to safety of our Children accessing Brigadoon Public School on Caryndale Dr. as a reason for the extension of Biehn Dr. as the Engineers have continuously stated, the current situation of the vehicles from Doon South using Doon Mills Dr. & Doon Village Rd. causes just as much safety concerns for the Children of J.W. Gerth Public School @ the 3 way Stop @ Doon Mills Rd. & Apple Ridge Dr. as well as Pioneer Park Public School @ the corner of Upper Canada Dr. & Doon Village Rd. where there is a school crossing that is sometimes block by vehicles that are backed up to turn left onto Homer Watson Blvd.

At the February 13th , 2023 Kitchener Council meeting as well as the June 20th , 2024 PIC, I heard the City Engineers bring up their concerns about Emergency vehicles not having access to the current dead end on Biehn Dr. as another reason for extending Biehn Dr..

FYI; The current dead end of Biehn Dr. can be accessed from Kilkerran Cr., further the homes @ the end of Biehn Dr. have been there for over 30 years & now the Engineers have this concern?

In closing here is my positions;

1) I support the Sanitary Trunk Sewer Extension & other required services using Directional Drilling with a Trail for Nature Lovers to use & for accessing the underground City services, so as to NOT to damage the Provincially Significant Wetlands 30 & the animal, bird species & the Coldwater Brook Trout, as well as protecting the Ground Water for our Children's future use!
2) I support the Immediate extension of Robert Ferrie Dr. to the Strasburg Rd. extension using the Millions of dollars saved by NOT extending Biehn Dr. 500m & the proposed mitigation items.
3) I support Alignment Alternative #4 (Connect Biehn Dr. to Robert Ferrie Dr.-via Caryndale Dr., no change to the current road network).

Respectfully Submi□ed,

Yours Sincerely,

[redacted]

**From:** [redacted]>
**Sent:** July 3, 2024 4:40 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Fwd: Biehn Drive Extension

I attended the presentation of options at Caryndale School on June 20th and after considering all aspects including road capacity, future development, traffic volume, environmental consequences and the wide consensus of my neighbours, and as a resident of Caryndale Drive, please note that I support Alternative 4 of the Environmental Assessment.

Thank you.

[redacted]

**From:** [redacted]>
**Sent:** July 3, 2024 6:07 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Re: Biehn drive comments

Have you received my input? Please confirm.

On Wed, Jul 3, 2024 at 6:02 PM [redacted] wrote:

1. Pushing Beihn drive through will not divert many cars as no one wants to double back from Strasburg to Robert Ferrie.
2. If you close Staufer where does the farm traffic and equipment go? Onto Robert Ferrie. There is no room for fam equip with all the cars parked on the street. Who clears the cars? The police.
3. What is your plan for New Dundee 2 lane road with all the new subdivision traffic trying to use it to get to Homer Watson.
4. There aren't any community plazas for shopping planned or shown.
5. What is the percentage of home owners who are commuters.
6. If you push the road through and disturb the wetlands do you guarantee no water intrusion in the basements of the houses on the south side of Biehn.
7. You need to plan now for a new 401 exchange not 10 years from now. I remind you of highway 7.
8. The least intrusive and best of a bad plan is alternative 4
9. How do you eliminate the chance of road salt getting in to Strasburg creek. There is no room for a catchment pond.
10. If you abide by the turtle protection plans you have no window for construction. May 15-Sept 30 and Oct 1- April 1. You will be monitored.
11. Excavated material cannot be dumped on the surrounding wetlands or stored nearby.
12. do you mitigate the decomposition of this material. I remind you of Puslinch lake issue regarding material to be vacuumed from the lake and deposited on farmland. That was deemed unacceptable by MNR.

[redacted]

**From:** [redacted]>
**Sent:** July 4, 2024 5:15 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Re: Biehn Drive comments

Sir,

I am concerned with my water supply. Kitchener is on wells and this may adversely affect my drinking water. If the water supply is disrupted or the water is contaminated because of what is planned who is responsible. I think the city may be liable for damages and may be sued. Your company may be dragged into any litigation as the engineering firm that recommended any of the 4 alternatives proposed for crossing the wetlands.

[redacted]

# No to Biehn, Yes to Robert Ferrie

Biehn Drive was first approved many years ago. Robert Ferrie was not planned in any way at that time. Since then Robert Ferrie has been constructed to Caryndale Road and will be extended to Strasburg Road. Extending Robert Ferrie to Strasburg must be completed first to reduce traffic on Caryndale.

The end of Biehn Drive is a Provincially Significant Wetland (PSW 30). This area feeds Strasburg Creek one of the few remaining cold water streams in Kitchener. Any construction in the area will impact the very sensitive Brook Trout population. Once they are gone, they are gone forever.

The City of Kitchener spent millions of dollars approximately 10 years ago rehabilitating Wards Pond and the surrounding area. Why risk this especially since the Brook Trout inhabit the surrounding streams?

Our climate is changing. Wetlands buffer storm events. Putting a road through the PSW will put our homes and surrounding area in jeopardy during storm events. Why risk this?

The majority of the Region's drinking water is from wells. There are 2 drinking water wells in the area, K34 and K36. PSW 30 contributes to the replenishment of the aquifer. Why risk our source of drinking water? If we run out of drinking water the next step is a pipeline to Lake Erie. This is a massive and complex project that would take approximately 30 years and billions of dollars. Why risk expediting the need for this?

The water table at the end of Biehn Drive is very high. Our house is the last one on Biehn Drive. Many yeas ago we installed a 3" submersible sump pump with a battery backup to mitigate flooding in our home. Any construction in the area will affect the ground water levels which may result in liabilities for the City of Kitchener.

We are not opposed to the construction of new homes in the area. The decision to go with trenchless installation of sanitary sewer and watermain through the PSW is positive.

Traffic volumes in the area are significantly below the projections. Connecting Robert Ferrie to Strasburg first and re-doing the traffic counts with real numbers after construction makes sense.

The budget for the extension of Biehn Drive is approved. However, the extension is not warranted and the environmental risk is significant. Why not use this money for trail enhancement and construction in the area and repair of our aging infrastructure?

No to Biehn, yes to Robert Ferrie.

[redacted]

[redacted]

**From:** [redacted]>
**Sent:** July 4, 2024 1:12 PM
**To:** Eric Riek <eric.riek@kitchener.ca>; Chris Spere <chris.spere@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Stop the Biehn Drive extension

Unfortunately my [redacted] and I were away and we couldn't make it to the latest meeting at Brigadoon Public School.
Wetland conservation is critical to support the ecosystem of Brook Trout, mammals, birds and plant species.
Put the infrastructure in safely, but the road is not needed to connect to new neighborhoods or ease traffic on Biehn Drive. More traffic calming that motorists don't slow down for and STOP signs that are blown through would result!
Rather, extend Robert Ferrie to Strasburg Road to support Doon residents and new subdivisions in Kitchener West.
A direct route to Huron Road!
The wetland cannot be recovered later if destroyed now. The impact on nature and existing residential properties due to changes in water tables as well as salt run off are not worth it.
Let us enjoy these beautiful woods where we can explore calming natural beauty and a place where our kids and grandchildren can be excited to play!
[redacted]

**From:** [redacted]
**Sent:** July 3, 2024 7:22 PM
**To:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; [redacted] Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Concerns regarding extension of Biehn drive

Dear Mr. Riek and Mr. Taylor,

[redacted] I write on behalf of my family [redacted]. We are really concerned abou
chool on June 20 and tried to understand how the ecological risks could be mitigated, and which is the benefit/cost analysis of the project.
We were explained that based on traffic analysis it is advisable to extend Biehn drive to Robert Ferrie.
As everybody is aware this project would have a significant impact on the wetlands, causing permanent damage to the wildlife and groundwater as well as increase the flood risk. We are very concerned if this project is carried on first, despite all the negative ecological impact, just based on potential traffic improvements (which don't seem to be sustained). It is clear to us that it would make more sense to continue with the extension of Robert Ferrie to Strasbourg and reevaluate the traffic analysis afterwards.
We strongly believe that wetland and nature protection should come first for our children and grandchildren to live a normal life. Moreover, when the destruction is not necessary, consideration should be given first to other solutions to support economic development (e.g. extension of Robert Ferrie to Strasbourg as well as directional drilling). Conservation of wetlands and natural habitats should take precedence over short-term infrastructure projects, especially when alternative solutions are available. Our local community shares environmental stewardship values and has serious concerns about the significant and potentially irreversible damage this road construction through wetlands could cause to wildlife habitats, groundwater quality, and overall ecosystem health as well as the potential for increased flood risk. In the past years we have lost a significant part of the wetland and farmland. Why don't we put all our efforts in protecting these natural areas for future generations?

[redacted]

**From:** [redacted]
**Sent:** July 2, 2024 10:38 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Biehn Dr Extension Proposal

Gentlemen
As a Kitchener resident living on Hearthwood Dr, I appreciate the public presentation prepared for us concerning the proposed Biehn Drive. However I was most concerned about the incomplete and misleading information and studies presented to us that evening.

Living in the area for over 20 years, my 'lived experience' calls into question both the traffic studies, and their conclusions. From my home, I now join the ever-increasing traffic coming from Robert Ferrie and passing in front of Brigadoon School on the way to Biehn (Not the reverse!) … and I worry for the children and their parents having to navigate this traffic.

A Robert Ferrie extension would greatly alleviate this situation, while a Biehn Dr extension would do next to nothing to reduce traffic in front of Brigadoon School.

In addition to my concerns about the amount of traffic passing in front of the School not being allieviated by extending Biehn, I'm even more concerned about the Environmental Damage which by its very nature would occur by the creation of a road through the Wetlands as part of the proposed Biehn Extension.

Road construction through the Wetlands would have obvious damaging impact on our critical fresh water supply which is supported by our Wetlands, and which is based on a delicate balance, Not Re-creatable by humanity's harsh 'solutions. Additionally the majority of proposals would be both expensive - including undetermined on-going costs in many cases - and irreparably Damaging! (Please see email to you from citizen Michael Spiar for details of inconsistencies and lack of appropriate Environmental studies, etc)

Finally a Biehn Extension would save residents in that area way under 5 minutes compared to a Robert Ferrie extension - yet would dramatically increase the traffic on the quietest part of the street to that of a major artery; Hardly a winning trade-off for residents!

It would appear that a developer of this Wetland- related area … and perhaps city staff who came up with this plan before Robert Ferrie was even an open … certainly Not Taxpayers … would benefit most if the Biehn extension is chosen over a Robert Ferrie road extension.

Instead of this damaging possibility, I Strongly Support 'Alternative 4' to be chosen among the Environmental Assessment options presented i. e. No Biehn extension - and trenchless drilling (the much less damaging choice) for utilities impacting the Wetland!

Thank you for your work to bring about the wisest action on behalf of the environment, the Brigadoon school children, and the taxpayers impacted by the decisions to be made on the matter of the proposed Biehn extension.

[redacted]

**From:** [redacted]
**Sent:** July 3, 2024 9:49 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** Eric Riek <eric.riek@kitchener.ca>; Chris.Spere@kitchener.ca <Chris.Spere@kitchener.ca>
**Subject:** Re: Biehn Dr Extension Proposal

Mr Taylor (and also Mr Riek, and Mr Spere)
Thank you Mr Taylor, for your prompt reply - and for being on-the-job in time for the deadline that we, as the public were given. It's vacation time, and I, like many, are away on holidays … but we were expected to have our replies in - despite the city representatives not even being at work. Rather disrespectful of them it would seem.

Thank you too for your comments. Unfortunately they seem to have a preconceived conclusion. Are you aware that - despite Strasburg being completed to a round-about ready to intersect with Robert Ferrie, and the extension also looking ready to begin any time when the road now ends - that this extension isn't even on the books for the next FIVE Years! Why this deceptive look of being ready to go anytime, while in fact it's not even being considered a this time? (Not what you, Mr Taylor, were asked to consider I'm sure.)

Perhaps Mr Riek, Mr Spere, or other city staff can explain how - in good conscience - this study failed to even consider real public input, and this obviously important option? I expect the answer is 'the broken … or is that 'brilliantly working' system which has been well crafted to work in the best interests those who created it.

I appreciate the factors that your firm, as an environmental company have studied. But I'm concerned that while, as you say, the design will be a 'demonstra on project for best prac ces of environmental engineering' - a good thing on it's own … that the op on which would not require all these best prac ces to even be necessary seems to have been overlooked! And we as taxpayers will be the ones paying the on-going costs associated with these so-called solu ons.

Learning how the city goes about studying issues such as this proposed extension has been quite eye-opening. I truly thank you for at least respec ng public input enough to have a standard reply ready to acknowledge our input.

**From:** [redacted]
**Sent:** July 4, 2024 2:00 PM
**To:** chris.spere@kitchener.ca <chris.spere@kitchener.ca>
**Cc:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Fwd: Biehn Drive extension

Please see the email below that was sent to Eric Riek today.

[redacted]

Begin forwarded message:

**From:** [redacted]>
**Date:** July 4, 2024 at 12:50:59 PM ADT
**To:** eric.riek@kitchener.ca
**Subject: Biehn Drive extension**

Singleminded is how we view the approach that city planners have taken in response to opposition of the Biehn Drive extension.

35 yeas ago, when this plan was first created, the development in Doon South was not even on the books. With city expansion, a new opportunity is available- extend Robert Ferrie over to Strasburg Rd. It will divert traffic from Caryndale Road and improve safety in front of Brigadoon School. Why is this viable option not preferred?

Please, please, please! Listen to the people who know this part of Kitchener the best and who highly value the natural treasure in our midst.

Sincerely,
[redacted]

**From:** [redacted]>
**Sent:** July 3, 2024 2:19 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** 'Eric Riek' <Eric.Riek@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>
**Subject:** RE: Biehn Drive Extension Environment Assessment Study (PIC) No. 3

Gentlemen,

Trade offs are for small people that won't make the right difficult and o. en unpopular decisions, and give into pressures from people with influence and money. There is no shortage of these people in this world and that is why our world is in the state it is in and get much worst. Change has to start small and progress. Every wants the other person to make the right decision and absorb the costs or inconvenience, but they do not want to make the correct choice.
Build Robert Ferrie first and then see the effects if Biehn is required, there is virtually no addi□onal development in the Brigadoon area (no addi□onal SW travel). Brigadoon has survived with the exis□ng roads for nearly 30 years. The present problems are being caused by the city failing to put the proper roads in for Doon South before building it up. The move of the proposed Strasberg road actually saved 2 million dollars by staying out of wetland. It likely cost more money only because of delays and the city being stubborn and not wan□ng to make the required adjustments.
With this road extension and the Strassberg road bridge directly dumping heavy salt laden storm water into the creek will destroy the trout popula□on in the short order.
Regional water will not be suitable for drinking and we will be desalina□ng water for drinking in the near future, the ques□on is this going to be a public or private cost?
Our environment is telling us the canary is very sick and dying, you know what happens to the miners after the canary dies.
Is this drama□c, not in the big picture. Change starts with the first baby step.
TRADE OFFS ARE NEAR SITED, AND FOR PEOPLE THAT WON"T MAKE THE CORRECT CHOICE.

[redacted]

Biehn Drive Extension Environment Assessment Study (PIC) No. 3
City of Kitchener,

In general, this road extension is not required and posses more risks than benefits and is not worth the large expenditure of money it will require.
I acknowledge that the storm and sanitary must go through this area, it should be done with the least disruption to the natural area and upon completion, restored to the natural state (Alternative 4).
This would likely be achieved installing pipes via boring (trenchless) rather than digging and trenching the pipes installations.
These are the reasons I feel the city should not proceed with this project.

1) The area is environmentally very sensitive and has been since this road's conception in the early 1970's. Despite the city being advised by the Ministry of the Environment staff in the late 1970's, that development in this area would damage or destroy the speckled trout nursey (ultimately the existence of the fish) the city has ignored this advise and moved forward with development. Many things could have been done differently with planning at this time but were not. Fifty, years later and City Staff are still ignoring the experts and moving to destroy the environment.

2) Besides the very sensitive trout population this area is home to other endangered/threatened species, both plant and animals including but not limited to Black Ash, various amphibians (including salamanders [maybe Jefferson] and turtles [Snappers and maybe Blanding]). The city staff stated that there will be wildlife corridor passes under the road for some of these animals, but no details or locations, or how the wildlife will be diverted to use this corridor can be provided. There is no way of ensuring this will be done correctly before approval for this development is given. This will add additional costs to the project. If no details can be given than costs must not be accounted for. The city stated that the with the removal of the endangered black Ash, compensation will be determined by the Ministry of Parks and Recreation (Environment), but the person I spoke with did not know what this would be yet. Alternate tree species are not a true replacement for an endangered species. Only the endangered species can be the true replacement of the endangered species, even if only young whips. Very few if any nurseries are growing these because of the Ash Borer. If these trees are not being affected by the Ash Borer, they could be very special and need to be preserved, similar to what occurred with Elm trees. They may have a built-in resistant, or their environment is creating a resistance to the Ash Borer. This will add additional costs to the project.

3) The areas water table is extremely high and water is at ground level approximately 80% of the year and is barely walkable any time of year without high boots or hip waders. The city is unsure how this development will affect the current water table, but is expected to raise the water table several inches (6"?) because it will alter the natural flow of the current wetland. Some homes in this area have experienced repeated flooding and now are having insurance companies, increase premiums, demand increase flood control (which may include multiple sump pumps with battery backup with considerable costs) or outright insurance refusal. The full extent of this is not well known because many property owners do not want to be public with these details fearing the devaluing of the house or difficult resale. The Display #14 (PIC presentation) showed the water table at 1 meter below the ground level, this is very optimistic by anyone's standard if this exists it is for 2 months in the summer most of the time the water table is near ground level. With this present water table expected to rise with this project it will likely cause more flooding concerns for nearby residents and in the new homes that will be along this road. This is opening the city to

a class action law suit for water damage done to the homes. The city is aware of the possible water table risks yet is ignoring and proceeding which will be negligence and another expense that this project will create.

4) The use of salt and other contaminates that accumulate on any road, will contaminate the marsh directly affecting the species living in the area. Ultimately the fish habitat and ground water will very likely be heavily affected. The city spent millions of dollars on the Wards Pond development project to protect the habitat of the trout, this road extension project has the possibility of negating that work. There is a main water pumping station (proximity 300 feet away) that pumps water to supply city residential areas with water. Salt contamination is a major problem in all municipalities with our drinking water that salt content is already at unhealthy levels for some people. The city engineering official said that the salt run off would be treated before releasing to the water course and marsh waterways, but the only way to treat it is to dilute it with more water, he suggested that the Hearthwood storm management are would be a good location, but the elevation is too high. He stated that the present road is draining directly to the swamp area, this would mean that in order to achieve this dilution of contaminated water the new design must include another storm water management pond increasing the costs for this project. The concentration of salt will be far more with a major collector road (city representatives' words) than a dead-end street. The ground is silt and sand which readily allows water and contaminates to enter the water table and the drinking water source nearby. Additionally, the new Strasberg bridge (not open yet) over the creek area directly dumps possible salty storm water into the creek (no treatment/dilution), directly contaminating the creek thereby causing potential problems to a sensitive ecosystem and the trout nursey down stream.

5) Biehn Drive is being represented as a major feeding road by the city and is thus required to control traffic in the area. However, the traffic studies do not show this in traffic volume to be classified as such, nor does it reflect the completion of Robert Ferrie Road and the affect that it will have on alleviating the traffic on existing roads. Biehn will connect to Brian Ferrie and no loner Strasberg Road as I believe the original intent, thus further negating the need for this extension. The traffic study fails to address where the traffic is coming from nor where it is going, the direction of traffic, nor the time of day to fully understand how future road development is going to be used. The study failed to include the previous traffic study done in 2016 to compare results. Long time residents will tell that the vast majority of recent (7 years) traffic is coming from the Doon South Development. Having said that, with reviewing the maps of the area, it can be assess that most of the additional increase traffic (3800 cars) is going North/West (towards Strasberg and Huron) and is from the South/West part of Doon South (close to New Dundee Road). With the Completion of Robert Ferrie to Strasburg Road and the lost of over 3000 to 3500 cars, it will negate the requirement of traffic from Doon South going down Caryndale (by school) to Biehn and thus the extension of Biehn that goes into Robert Ferrie. If Biehn is installed before Robert Ferrie traffic will likely increase on Caryndale, especially with future growth almost entirely in Doon South.
Remember that the city is determined that Biehn is required before Robert Ferrie yet the Biehn extension runs into Robert Ferrie and Robert Ferrie must be completed for Biehn to reach Strassburg. Future growth mentioned in the report is mostly in Doon South and will use Robert Ferrie. Growth in Brigadoon will be in the South West part and use Brian Ferrie not Biehn Drive. The Brigadoon area has survived for 35 years with out the Biehn extension with little traffic problems and will continue to do so if the city stops directing the traffic from the newer Doon South through the Brigadoon subdivision, school and the network of roads. Build the Robert

Ferrie Road extension to Strasberg Road and the Biehn extension will not be required. The city appears to be looking at a port hole and not seeing the entire picture. They are continuing to build in an area with no concrete plans or coordination with the region. Strasburg road will need to be completed, and join New Dundee Road, New Dundee Road will need to be expanded to 4 lanes of traffic, with turning lanes and a way to link to the 401 or Homer Watson Blvd will have additional problems and back ups.

6) Not building the Biehn extension road will save millions of dollars, is not required and very likely will cause problems that will cost the city more latter causing damage to the trout and endangered/threatened species habitat, contamination of drinking water and damage to existing and future residences due to flooding. Not likely in the budget is the wildlife road crossings, storm water management pond (salt water conditioning), replacement of Black Ash, possible contamination of the drinking water well near by etc.

7) No homes were shown on any of the proposed road extension, yet previous city plans showed 15 to 20 homes on two new courts similar to existing Spenser Court. and in addition, along the new road way. This swamp or near it, is no place to build flood prone homes.

8) Wetland is still being lost at an alarming rate, agriculture is draining and tiling swamplands causing increase flood problems and high nitrogen levels in the great lakes and future water source problems for many cities. City areas are the only location that some of this is starting be addressed in new development, but the natural swamps are still better and less expensive.

9) The city is failed to properly inform residents with their meeting notifications and worst yet, the very poor presentation and representatives at the June 20 Open House a Brigadoon School. The number of display boards where confusing at best for any one that was not totally up to date with the issues. More than half the boards were useless information, designed to confuse and wear down the residents. The staff present, did not know the issues, future plans or history of the project and most residents that I talked to got conflicting answers with regards to full construction/project plans, environmental issues and protection, traffic studies and future surrounding area development plans. The staff should be on the developers pay roll, because they seemed to be mere puppets. Doug Ford is looking for people like the city staff I talked to. Any study is useless and a waste of money when directed and bias what is to be the conclusion.

My conclusion; Build Robert Ferrie Road now, and it will remove nearly 3000 - 3500 cars traveling down Caryndale Dr. and the Biehn Road extension is not required. The Biehn extension posses too much environment damage and future damage costs. Do not spend tax payers' money on a useless project that will run over budget cause far more expense and damage than any benefits. Biehn was conceived when there was no plan for Robert Ferrie and Robert Ferrie will handle most of the traffic Biehn was planned for. To build the Biehn extension before installing Robert Ferrie will significantly increase traffic on Caryndale Dr. at the school. Build Robert Ferrie Now and the need for Biehn will disappear. Staff should use their education, common sense and not be pressured by aggressive staff, counsel and developers. The city has a very unique natural area that people travel from around the city to engage and even surrounding cities are finding this neighbourhood gem. Like our city golf courses, our good parks and natural areas need to be preserved for the enjoyment of future generations.

Best Regards,

[redacted]

**From:** [redacted]>
**Sent:** July 3, 2024 9:12 AM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; eric.riek@kitchener.ca <eric.riek@kitchener.ca>
**Subject:** Comments - Biehn Drive Extension

I do not agree with the City's recommended Biehn Drive extension, as this proposed road will go through the Provincially Significant Wetland which is part of our drinking water source in Brigadoon. The City's PIC presentation admitted that there could be high environmental impacts from this development, and that the extent of which are unknown.

I also feel this recommendation will only increase traffic on Biehn Drive, making the situation worse, not better. A better solution would be to complete the Robert Ferrie Drive to Strasburg Road extension, which should lessen the traffic on Caryndale and Biehn from the Doon South area. The completion of Strasburg Road to Dundee Road should also be a priority.

I was disappointed that Ward 4 Councillor Christine Michaud did not attend the June 20th PIC. Someone at the meeting told me she felt it would be a conflict of interest if she attended. How could meeting the area's residences and hearing their concerns regarding this proposed development be a possible conflict of interest?

Please add my email address to the mailing list for the EA publication.

[redacted]

[redacted]

Comments/Concerns on the Information presented

At the PIC on June 20, 2024

I would like it to be known that I continue to be against the extension of Biehn Dr. The presentations of the boards left many unanswered questions due to the format that was used. It does not inspire much confidence in the Consultant and staff who often answered questions with some inconsistencies.

I have been against this proposal for over 20 years based on the following research and information that I have gathered over the years.

1) The Provincially Significant Wetland ( PSW 30) has long been identified as an important feature in the area. Not only does it provide water for the eco system, it also provides habitat for many wildlife species. It should also be considered that it may feed Strasburg Creek as this creek is dependent on ground water as is Wards Pond. The cold water trout has been identified as a species at risk. The Department of Fisheries and Oceans/Ministry of Natural Resources and the Ministry of the Environment and Climate Change all identified this creek as a significant habitat when a silt and sediment failure occurred in the early 2000's. That failure resulted in a lawsuit against Hallman Developments and MTE . The lawsuit was settled behind closed doors.
2) The City spent close to $2M to create a new creek bed/channel so that the habitat for the brook trout could improve. We have had a representative from Biotactic do studies in the creek with a permit from the MNR. His findings were that the habitat has improved and the numbers of brook trout has significantly increased. The temperatures in the creek in close proximity to the field to the north of the proposed Biehn Dr. are still appropriate for the needs of the fish. The Biehn Dr extension puts all of this at risk.
3) I am concerned with the response from Ryan Coady ( BTE) about a replacement wetland to compensate for the removal of the wetland if the road was to go through. I would believe that this would be at a significant additional cost and would not be necessary if no road was to go through but only the water/sewer mains.
4) It was a positive step in the right direction to learn that directional drilling is now an option for the infrastructure, but I am puzzled and concerned that there is still consideration for a "tapered trench" for the proposed road. This will add unnecessary cost!

5) Dewatering- At a significant impact to the surrounding area, the brook trout habitat and any other wildlife that use this corridor. This will be a costly component to the project.
6) The consideration of using a Geotextile membrane with the thought that this will stop salt/grit and toxins from tire rubber from filtering into the wetland and ground water. Additional cost and possibly ongoing maintenance which could be budget impacted.
7) Flood risk- The City has identified that there is a ***high impact on the environment***, but it is also a significant impact on the residents living on Biehn Dr. The additional risk of flooding in these homes could result in ramifications to the City. I have letters from two residents who have detailed their experiences with flooding in their basements with a high cost for repairs.
8) Concerned with the comments that a "wait and see" approach is being taken on the Black Ash trees. The fact that these trees remain despite many that have already died should give everyone a moment of reconsideration. Why not do everything to protect the trees from dying by NOT putting the road in which will surely hasten their demise? The replacement of the trees will not have the cooling effect that the present trees do on the wetland which is crucial for the survival of the trout. Even 1 degree temperature changes the habitat and destroys the fish.
9) I understand that detailed costs will come forward once a detailed design happens but I believe that those costs will rise significantly as I review all of the extra measures that are needed to put in 500 m of road that will connect to Robert Ferrie which Caryndale already does about 200m south.
10) Traffic- The numbers show that Biehn and Caryndale are still not near their capacity and more importantly nothing in the numbers show origin/destination of the traffic. This is a very significant missed opportunity. I believe that once Robert Ferrie is connected to Strasburg Road that the majority of traffic coming from the Robert Ferrie/ Evans Pond/South Creek area will use this road to travel out of the area instead of traveling past a school and through a road that has traffic calming measures installed.
11) Consultants and staff used "safety " as a major reason to put Biehn Dr. through but the short distance of Biehn Dr will have no impact on the school traffic that happens every day. It would be very interesting to see how those numbers would differ if a traffic study was done now that there is no school traffic.

To summarize, although Biehn Dr has been "on the books" for decades so have many other roads including Strasburg Road. There have been significant changes to the

Strasburg alignment which impact where Biehn Dr was originally planned to connect. It will no longer connect to Strasburg. This would have been a more direct route at that time to move the traffic but that is no longer the case. There is developer interest in moving Robert Ferrie forward and once the infrastructure is in place, I sure that development applications will be quickly submitted to the City. The extension of Biehn Dr has been opposed by not only residents( 500 signatures) but even as far back as 1989 when former Councilor Tom Galloway stated his concerns with this extension.

I support Alternative 4 which will use trenchless drilling for the infrastructure to support the future development but leave Biehn Dr as a dead end. The present recommendation to put Biehn Dr through is the most destructive option possible.

**From:** [redacted]>
**Sent:** July 4, 2024 4:48 PM
**To:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Feedback regarding the Biehn Drive Extension and PIC of June 20, 2024

Gentlemen:

I am forwarding my objection to you and all those involved in the decision making process of the Biehn Drive Extension. I have many concerns as you to should all have. It is fine to do all these studies and tests, but these can produce an outcome for whatever way you present them with words such as possible, minimize, not recommended, limit, protect.

I am a resident of this neighborhood for approximately 25 years. I live at the bottom of Caryndale Drive. I have seen the growth in the neighborhood and it is continuing nearby with the development of Doon South. I am not opposed to growth and development but please do it in a smart and wise way. Why would you proceed with a plan to put in a 500 meter road through a provincially significant wetland (PSW30)? There is no desperate need for this road.. Traffic in our area on Caryndale Drive has increased in the past years with the development of Doon South. I know that much of the traffic is coming from/to Doon South via Robert Ferrie, Caryndale Drive and onto Biehn Drive or vice versa. The completed extension of Robert Ferrie Drive to Strasburg Road would eliminate a lot of this traffic. We also have significant traffic during school hours. That is caused by parents dropping off and picking up their kids but this traffic is limited to 2 fifteen to twenty minute periods a day during the school year. All schools in this area are experiencing this and traffic calming has been built especially for the students to cross the streets safely.

I understand a traffic study has been done stating the number of cars but it does not provide details on where the traffic is going or even where it is coming from. I know from my experience that much of the traffic is headed to Huron and Strasburg Roads for Doon South residents wanting to travel west. Going along Robert Ferrie to Strasburg would be a much more direct route especially for these residents and others on Caryndale and Biehn Drives.. As for the further development of the current Hearthwood Hills' subdivision and further behind, there will be accesses created to Robert Ferrie to take to Strasburg Road. So please help me understand who and what significant amount of traffic would be using the Biehn Drive extension?

When you look at the Mitigation Table I see all the concerns and actions needed to be addressed for this road to go through a wetland. Meanwhile Directional Drilling is recommended for sewer and water main to avoid environmental impacts and any potential draw down of the water table but it is ok to trench a road through? In the Class Environmental Assessment for the Biehn Drive Extension under the Geotechnical Investigation it mentions about taking water out. A Permit to Take Water (PTTW) or registration in the Environmental Activity and Sector Registry (EASR) will likely be required. Why would you be taking water from a natural occurring source and alter it, notwithstanding that it is a Provincially Significant Wetland? Currently the requirement for a permit is if you are taking 50,000 litres or more a day from the environment.

There were studies conducted on the Black Ash in the area. There are a number of them in the area of where the road would go through. The trees are a protected species but it seems that the view is that they won't survive the Emerald Ash Borer yet here they are years after the emergence of this bug and still standing strong.

There was no mention on the possible harm to the resident Brook Trout population. Any change in the water table and temperature is going to impact them. And what about species that although have not been observed still may be present? About a kilometer up the road there has been Jefferson salamanders documented. This wetland is also prime habitat for Jefferson salamanders. There have been sightings of blanding turtles present. These are two protected species that inhabit this wetland because of its ideal conditions. And just because they haven't been observed in these short assessments does not mean they are not there. They are both very allusive creatures, just as the observation of the Jefferson salamanders on Stauffer Drive took some time to document.

When you look at all the precautions that must be taken to put in the road, and when I hear the words minimize, avoid, protect, what is the guarantee that this road will not damage this wetland or alter it significantly in some negative way? To put in further mitigation measures in a wetland after it is damaged is a daunting task, if it can be done at all. Why risk it? The damage may not occur overnight but there will be some damage over time. Although the engineers will say we have done things according to policy and protocol there is no guarantee when you are dealing with mother nature.

Please take the time and recommend the right thing to Council in this situation. When you look at all the factors and assess the information, it is clear that it is not advisable to put the Biehn Drive Extension through. We are at a time when we all hear how we must preserve the environment. Doug Ford finally listened to the people when he opened up green belts for development. We need land for development but people were in an uproar because it was prime natural areas that were going to be affected. The same with prime agricultural land that is being expropriated in Wilmot Township. In this situation, we are supportive of the development of more homes but with smart development. When people are fully transparent with their

concerns, it is incumbent on City planners and Engineering firms to listen well and take into consideration what they are saying with thoughtfulness. We are your eyes and ears. Not everything is about NIMBYism.

In closing, why disrupt a natural and Provincially Significant Wetland when we do not need the road in the first place. It is not the best solution considering all the factors and risks involved. Build the Robert Ferrie Extension now and put in the services the developer needs via directional drilling and let the natural wetland be what it was intended for. Everyone wins in this equation...most importantly the Environment wins and the need to retain our green spaces where we can.

Sincerely:

[redacted]

**From:** [redacted]>
**Sent:** July 4, 2024 5:39 PM
**To:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Brigadoon is my home, please help protect its greenspace

Hi,
I'm sure nothing I have to say is new, but since today is the last day to send comments, I figured I would include them anyway.

I understand the need to extend water main and sewage to accommodate much-needed housing for a growing city. I implore you to use direc onal drilling and NOT destruct the green space that would impact protected animals and rising water table levels. Connec ng the Robert Ferrie extension will significantly reduce traffic from Biehn Drive. Once the Robert Ferrie extension is connected, only those who live in this Brigadoon neighbourhood will need to take Biehn. When Robert Ferrie access opened, the traffic increased on Caryndale and Biehn only because all of the folks that live in the Doon area needed an exit - connec ng the Robert Ferrie extension to Strausburg will eliminate that extra Brigadoon traffic.
Brigadoon has greenspace and a school , and the Robert Ferrie connec on will return Brigadoon streets to the calm we use to have.

The green space in the Brigadoon community is no doubt one of the main reasons why people moved here. We were told it was protected land.
I urge you to use direc onal drilling, connect Robert Ferrie extension and protect the wetlands. Please do not build an extended Biehn Drive road.
[redacted]

**From:** [redacted]
**Sent:** July 4, 2024 9:08 PM
**To:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Environmental concerns are the most important considera ons

Dear Eric, Chris & Steven:

We have lived in Brigadoon for 33 years; 10 years on Kilkerran Crescent, 23 years on Kilbirnie Court. We raised our children here & have all spent much time in the wooded areas we are lucky to have so close by. Many friends of our's are amazed that we have this beautiful area right on our doorsteps. We are very concerned & can hardly believe that a road might actually go ahead & be built through a provincially significant wetland! It sounds similar to what Premier Ford recently got himself into hot water over when he proposed building houses on Ontario's Greenbelt.

We would ask that you seriously consider using the safest development methods so as to conserve this gem in Kitchener. While we don't understand all the engineering details, we do know that our neighbour [redacted] & others have asked you to seriously consider using directional drilling underneath the wetlands rather than digging a trench right through them. If, as we've been told, the cost is virtually identical & it could minimize flood risks to existing homes & preserve the existing wildlife, this seems like a no-brainer decision & one that would bode the best for the future.

We truly owe it to the next generation to carefully consider environmental concerns as just as important, actually even more so, than traffic & further development. Please don't "pave paradise" & put a road through the beautiful wetlands of south Kitchener. Surely there are other ways to deal with the traffic that is expected to increase in the future? From having lived here for many years, we haven't actually noticed a significant increase in traffic yet. Is there not time to come up with another solution that respects the environment using data from 2024? We firmly believe that the road should not be built at the end of Biehn Drive through a significant wetland & that the Robert Ferrie extension is the best alternative to moving traffic westerly & taking Doon South people off of Caryndale Road.

We realize that you have a tough job on your hands, but are quite certain that putting environmental concerns first will be something you will never regret.

Sincerely,

[redacted]

**From:** [redacted]
**Sent:** July 4, 2024 9:46 PM
**To:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Subject:** Biehn Dr Extension EA Study

We are strongly opposed to the proposed extension of Biehn Drive, because there doesn't seem to be a traffic need for it, alterna ves don't seem to have been thoroughly explored, and the detriment to the environment is too great. The City needs to protect the remaining natural heritage features and environmental corridors, not put new roads through them. The No ce of PIC clearly acknowledges that at least one species at risk is present and will be impacted by this proposal (Black Ash), but there are numerous others to assess impacts for, including Blanding's Turtle, Bu ernut, Red-headed Woodpecker, Li le Brown Myo s, Northern Myo s, and possibly Eastern Small-footed Myo s and Tri-coloured Bat. As of January 2025 there will also be legal protec on under Ontario's *Endangered Species Act, 2007* (ESA) for Eastern Red Bat, Hoary Bat and Silver-haired Bat and their habitats. The first step in seeking authoriza on under the ESA is to consider alterna ves, and the best alterna ve to choose should be to avoid extending Biehn Drive through this natural heritage feature.

Also, please consider the impacts to wildlife and this natural heritage feature that have already begun since the extension of Strasburg Rd in recent years. Mul ple years of road mortality surveys were completed a. er that road extension was completed and the City should have those reports; is it true that hundreds of rep□le and amphibian road mortali□es have been observed (due to increased traffic and lack of appropriate and effec□ve mi□ga□on measures such as permanent exclusion fencing or an ecopassage)? It doesn't appear as though the City has taken any ac□on to remedy the road mortality or to fix damage to the temporary exclusion fencing currently in place. Poten□ally adding another road extension (i.e. Biehn Drive) without fixing the issues at the Strasburg Rd extension and studying the impacts further is poor planning and quite frustra□ng to witness as a landowner in the area. If the City goes ahead with the extension, it would be very disappoin□ng.

Thank you for the opportunity to comment.

[redacted]

**From:** [redacted]>
**Sent:** July 4, 2024 10:36 PM
**To:** Eric.Riek@kitchener.ca <Eric.Riek@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** stephanie.stretch@kitchener.ca <stephanie.stretch@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>
**Subject:** Biehn Dr. & Sanitary Trunk Sewer Extension Comments following PIC 20th June 2024

Dear Eric and Steve,

It was great to meet with you and some of your staff at the PIC on June 20th. I am providing written comments in the form of this email following the discussions that were had at the PIC in order that my comments on the proposed project as a community stakeholder and taxpayer are added to the public record. There are a number of areas where I found the information provided to be significantly lacking, especially for this stage in the Environmental Assessment, or in contradiction with supporting the selection of Alternative 1 as the preferred alternative.

First, the Environmental Study Report and responses provided by staff at the PIC regarding the Black Ash and wetland compensations lacked detail, which is especially concerning for a road extension being proposed to go through a PSW. There was no plan described about getting an exemption or the nature of the compensation that would be done if the Black Ash trees are still on site at the time of construction. No details were provided on where the replacement trees would be planted, what age of tree would be planted and on what basis the City thinks an exemption request would be successful with the species' return to formal ESA protections. Additionally, besides a rough location identified, there are no details on the area, cost or means of construction of the proposed replacement wetland to compensate for lost wetland from the road extension. What is considered an effective compensation for a wetland? The complexity and number of ecological services a wetland provides would be difficult, or at least very costly, to replace, and I'm concerned that the lack of detail provided on how this would be done reflects an attitude of complacency for the loss of an ecologically important habitat. Considering the high environmental and monetary cost (to address the environmental costs incurred) imposed by Alternative 1, why is the City proposing the most costly and destructive alternative? How is the level of compensation required for the wetland and/or Black Ash trees not a factor weighed in the evaluation of alternatives thus far? This is to say nothing of the flood risk that would be sure to follow with the wetland disturbed, as some of my neighbours have expressed, as the water will get redistributed to nearby homes that are already built in a wet area with a high water table. It's unfathomable that current and anticipated water and saturation levels were not studied or commented on following the geotechnical investigation, which again suggests utter contempt for the ecological impacts of dewatering and property impacts of nearby home owners.

Second, as a taxpayer, I am not at all convinced by the value proposition of the project with the cost estimations of the "investment". There are several impact mitigation measures that have been proposed with the road extension, some of them new as of this PIC (and therefore new added costs). The City has proposed to elevate the road by 2 meters, which will require deep drilling for the footings to be stable in a site that is very wet. There are no cost estimates for the compensatory wetland, which is inexcusable considering Alternative 1 has been the preferred alternative since the beginning of the study where the area of wetland to be impacted by the preferred alignment has been known for some time. Of course, it is difficult to estimate the cost of a compensatory wetland that has no features or design elements described. Geotextile has been proposed to be installed under the road to keep hazardous materials from entering the environment, which is an added cost to install and maintain. Additionally, we can anticipate high maintenance costs for a road through a wetland with frequent asphalt repairs, stormwater management maintenance and wetland management, all of this which will be paid by taxpayers in perpetuity. The value of the extension for about 400 households in a closed neighbourhood is just far too low in light of even the initial estimated cost, and will become eyewatering for the excessive maintenance costs year after year. Furthermore, the capital cost would undoubtedly increase with the additional proposed features listed above, and I don't have any confidence that the increased cost would even buy the community an effective compensation for lost wetland considering the lack of elaboration on the methods and extent of wetland compensation work. It's insulting to taxpayers and restoration workers that in proposing a road extension through the PSW, the hundreds of thousands of dollars spent upstream to ensure the continued survival of Brook Trout, in which the Biehn Drive Tributary was identified as a critical habitat, will effectively have gone to waste with the disturbance of habitat that building a road would entail on a sensitive species. All of this when there exists an alternative that will cost significantly less, promote sustainable active transportation that would build a sense of community, and is more widely supported by the majority of the Brigadoon and surrounding community.

Finally, in light of all information in the ESR and what was presented at the PIC, and after examining the problem from multiple perspectives, I fail to see just who would benefit from Alternative 1 significantly more than Alternative 4. The Brigadoon community has been clear that they do not see value in a road extension but value the wetland as an important part of the community. In 2023, over 500 signatures from Brigadoon and the immediate surrounding community testify to this opposition. More importantly, though, the vast majority of the approximately 400 households the extension would serve do not support Alternative 1. Long time residents can clearly identify that traffic volumes on Caryndale will be drastically reduced once the Robert Ferrie extension is complete, even accounting for the small increase of Brigadoon residents re-routing to access Strasburg Rd. via Caryndale and Robert Ferrie. Caryndale's traffic volumes will be well below its built capacity, and safety will continue to be managed through current traffic calming measures. Meanwhile, thousands of Doon residents such as myself are eagerly waiting for the Robert Ferrie Dr. extension to Strasburg Rd to avoid routing through Caryndale and Marl Meadow to access Strasburg Rd. All of these needed traffic improvements are easily accomplished without the Biehn Dr. extension, which would render an extension a costly, underused redundancy that the City has to maintain. Even more strange is the lack of benefit to future developers planning to build south of the PSW. A road extension through a wetland would destroy the potential for several additional lots to back onto prized greenspace and reduce the appeal of the overall natural area for buyers. It is in a developer's interest to have the maximum number of lots backing onto wooded wetland to sell premium lots. Walk into any builder's sales office of a development with any kind of green space nearby and they are stretching at the smallest opportunity to promote nearby trails as a selling feature. A preserved wetland and natural area with an existing trail network that connects the community is exactly in line with a developer's interests for maximum appeal to potential buyers. The builder would already be able to promote easy access to the 401 or city centre with routes east and west on Robert Ferrie, making the Biehn Dr. extension, once again, redundant. There is very little incentive for future residents to take Biehn Dr. to connect to Homer Watson or Strasburg when they will have more direct and faster routes via Robert Ferrie Dr. Alternative 4 provides certainty and much needed utility connections that allow for the developer to proceed with no lost revenue and provides the benefit of promoting active transportation while preserving a selling feature.

All of the above suggests that Alternative 4 should be considered the preferred alternative in order to meet the needs outlined in the opportunity statement: providing an additional network link via active transportation, which allows for multi-modal transportation, and allowing development to proceed north of the future Robert Ferrie Dr., including planned municipal servicing. In concluding this, I understand that the evaluation of alternatives produced Alternative 1 as the preferred solution in the ESR and remained as such with the revisions discussed at the PIC*. While all of my comments counter the selection of Alternative 1, though grounded in credible observation and logical conclusions, reflect just one community member's perspective, I invite you to recall and consider these two social-political circumstances in your recommendation. One: recall that in 1989, City Council directed that the Biehn Dr. EA weigh environmental factors more heavily than other factors in its evaluation of alternatives. While the evaluation for the Biehn Dr. extension has not reflected this direction to date, environmental factors are as important today as they were thirty-five years ago, and the elected Council's direction still reflects the values of this community today. Second: even without contesting the results of the evaluation of alternatives, it is clear from community cafes, PICs, written comments and continual engagement with the City that the runner up alternative, with a close score to the preferred alternative, is the most valued by the community, and most especially to those of Brigadoon who have the most at stake. Our concern is not about development, nor are we calling for more money to be spent on the backs of taxpayers – far from it! Alternative 4 presents no political disadvantage (certainly not by the majority of voters most impacted by the project), no disadvantage or hindrances to developers, and significant savings to all Kitchener taxpayers in both capital costs and continued maintenance costs. Notwithstanding the results of the evaluation revised and completed most recently, is it not more politically advantageous to recommend the community's preferred alternative?

Sincerely,

*As an aside, it was stated at the PIC that Alternative 4/Do Nothing (which we ought to acknowledge are not the same thing, although they were referred to as if they were by staff) scored "closely behind" Alternative 1 with the

revised evaluation criteria. Although slide 20 in the PIC materials does not match this verbal description with Alternative 2 ranking second instead, so I'm not sure whether to interpret the discrepancy as intentionally misleading or a dreaded Freudian slip.

**From:** [redacted]>
**Sent:** July 5, 2024 6:08 AM
**To:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>; chris.spere@kitchener.ca <chris.spere@kitchener.ca>; Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** Yvonne Fernandes <Yvonne.Fernandes25@gmail.com>
**Subject:** Extending Biehn Drive

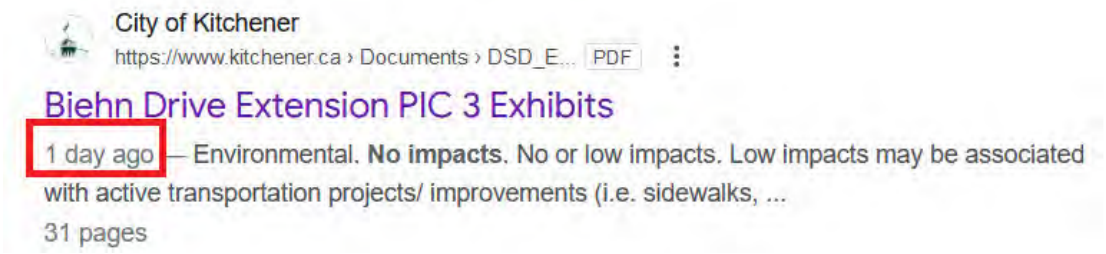
Hello,

I just read this article in The Record and it raised some concerns. I found this environmental assessment online from 2021 which provided additional context. On slide 17 it states that Alternatives 1 and 2 would have "minor impacts" on the Provincially Significant Wetland, and slide 22 includes the evaluation criteria. However, there is no actual analysis in this assessment. For example, for the criterion "water quality - stormwater runoff", what tests were done to determine the impact? Who produced these results and how were they reviewed?

Assessment results should be publicly available and if not included in this particular report, they should be linked to show your work. Simply concluding that there will be a "minor impact" without saying why does not instill faith that proper due diligence is being conducted.

Next, I then found this environmental assessment which was updated 1 day ago which now states that the environmental impact is "low to high". It seems like the geotechnical investigation this year revealed significant obstacles to this planned road extension. The report includes countermeasures such as sewer pipe construction, microtunneling, and an elevated roadway. It begs the question: how could these environmental impacts be missed in the 2021 report? Also, what other environmental impacts are you missing this time? If you proceed with this plan and more environmental impacts occur than expected, who will be accountable?

I understand that the deadline submission for raising concerns was technically yesterday, but I hope you take into consideration that your most recent publication on the matter was updated just yesterday, and citizens need more than one day to review the latest report to submit their comments (screenshot below). I imagine there should be some by-laws around this.




I look forward to your reply.

Regards,

[redacted]

From: [redacted]>
Sent: Saturday, June 29, 2024 9:35 PM
To: Eric Riek <Eric.Riek@kitchener.ca>
Subject: I'm opposed to extending Biehn Drive

[redacted]

Hello,

I would like to voice my opposi on to extending Biehn Drive, due to the threat it imposes on sensi ve wetlands and habitats.

This extension is the most destruc ve op on to alleviate traffic in this area. I urge you to focus on comple ng Robert Ferris to Strasburg and Strasburg to New Dundee first, and then explore other op ons. Given Kitchener's commitment to 15- minute communi es, solving traffic issues by running roads through sensi ve Environmental Areas seems incongruous.

[redacted]

# Appendix D

Comment and Response Log

BT ENGINEERING

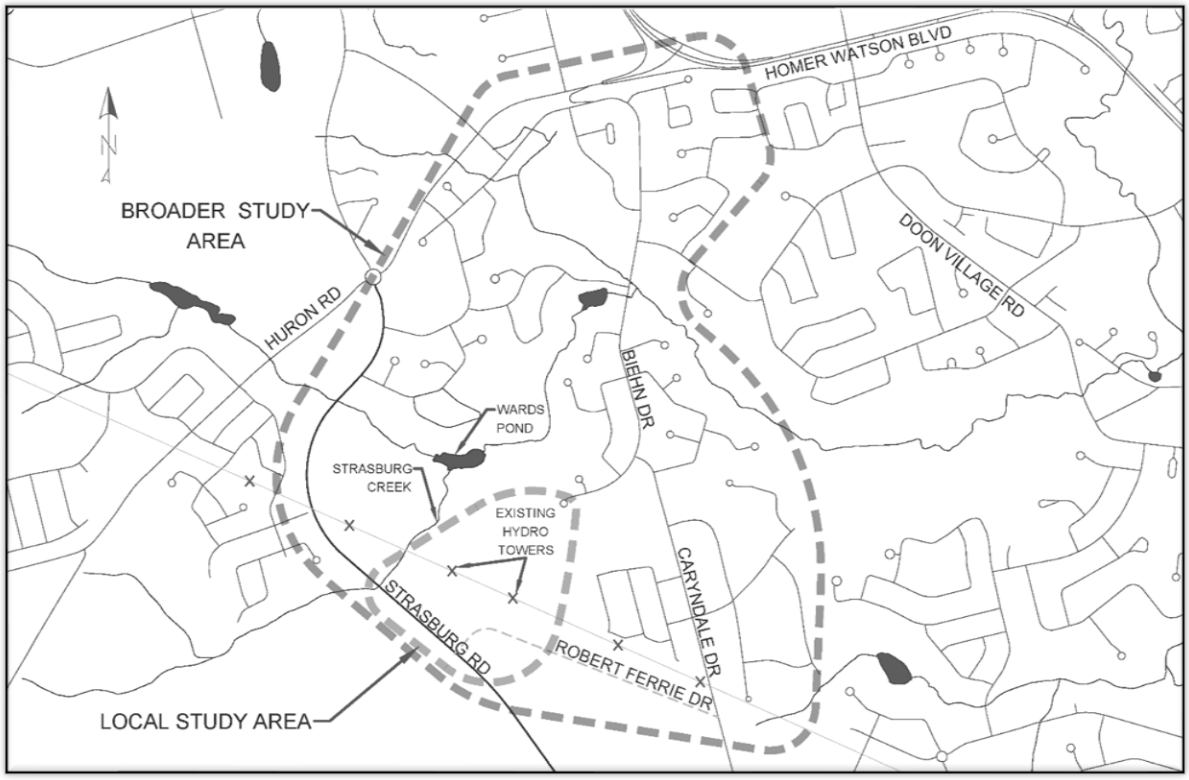
## Comment and Response Log

| Comment Sheet Number | Date of BTE Response |
|---|---|
| 1 | 2024-06-26 |
| 2 | |
| 3 | 2024-06-21 |
| 4-15 (Written Comment Sheets) | |
| 16 | 2024-06-27 |
| 17 | 2024-06-26 |
| 18 | 2024-06-26 |
| 19 | 2024-07-04 |
| 20 | 2024-07-04 |
| 21 | 2024-07-04 |
| 22 | 2024-07-04 |
| 23 | 2024-07-04 |
| 24 | 2024-07-04 |
| 25 | 2024-07-04 |
| 26 | 2024-07-04 & 2024-07-08 |
| 27 | 04-Jul-24 |
| 28 | 2024-07-04 |
| 29 | 2024-07-04 |
| 30 | 2024-07-03 |
| 31 | 2024-07-04 |
| 32 | 2024-07-02 & 2024-07-03 |
| 33 | 2024-07-03 |
| 34 | 2024-07-02 |
| 35 | 2024-07-08 |
| 36 | 2024-07-08 |
| 37 | 2024-07-08 |
| 38 | 2024-07-04 |
| 39 | 2024-07-08 |
| 40 | 2024-07-08 |
| 41 | 2024-07-10 |

# Notice of Study Completion
# City of Kitchener
# Biehn Drive Extension Environmental Assessment Study

**INTRODUCTION**

The City of Kitchener (City) has completed an Environmental Assessment (EA) Study for the extension of Biehn Drive from its existing terminus 300 m west of Caryndale Drive to the future Robert Ferrie Drive extension and the extension of a trunk sanitary sewer and watermain to service future development to the south. The Municipal Class EA Study has evaluated alternatives for alignment, cross sections and active transportation to develop a Recommended Plan to address the needs of the Study Area, see below.




**STUDY PROCESS**

The Biehn Drive Extension EA Study was conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015) and the extension of the trunk sanitary sewer and watermain were carried out as a Schedule B EA Study. An Environmental Study Report (ESR) has been prepared that documents all reasonable alternatives with effects on the natural, social and cultural environments, and the involvement of the public, stakeholders and Indigenous Communities. The Study also considered Provincially Significant Wetland replacement and compensation for Black Ash trees, a species listed in the *Endangered Species Act*.

The study process has proactively involved the public, stakeholders and Indigenous Communities.

**30-DAY PUBLIC REVIEW PERIOD OF ESR**

The ESR will be available online at: https://www.kitchener.ca/en/development-and-construction/construction-projects.aspx , at the City of Kitchener Municipal Office, located at 200 King Street West, Kitchener, Ontario and at the Kitchener Public Library (main branch) 85 Queen Street North Kitchener ON N2H 2H1, from January 15, 2025 until February 13, 2025 during business hours.

**OUTSTANDING ISSUES AFTER ESR REVIEW**

After reviewing the ESR if there are still outstanding issues, a request to the Minister of the Environment, Conservation and Parks for an order imposing additional conditions or requiring an individual environmental assessment may be made on the grounds that the requested order may prevent, mitigate, or remedy adverse impacts on constitutionally protected Aboriginal and treaty rights. Requests to both the Minister and Director should include your full name and contact information. Requests should also be sent by mail or by email to the consultant EA Project Manager and City Project Manager noted below:

Minister Andrea Khanjin
Ministry of the Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON M7A 2J3
minister.mecp@ontario.ca

Director, Environmental Assessment Branch
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, ON M4V 1P5
EABDirector@ontario.ca

Please visit the ministry's website for more information on requests for orders under section 16 of the *Environmental Assessment Act* at:

https://www.ontario.ca/page/class-environmental-assessments-section-16-order#:~:text=Response%20was%20issued.-,If%20the%20minister%20makes%20a%20Section%2016%20Order%2C%20the%20proponent,to%20as%20an%20individual%20EA%20.

If there are any other outstanding concern(s), they should be directed to the EA Project Manager or City Project Manager listed below, no later than February 13, 2025.

**Steve Taylor, P.Eng., M.Eng.**
**EA Project Manager**
**BT Engineering Inc.**
509 Talbot Street
London, ON N6A 2S5
Tel: 519-672-2222
Email: stevenj.taylor@bteng.ca

**Eric Riek, C.E.T.**
**Project Manager**
**City of Kitchener**
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-783-8893
Email: eric.riek@kitchener.ca

Information is being collected in accordance with the *Environmental Assessment Act* and the *Municipal Freedom of information and Protection of Privacy Act* (2009). Personal information you submit will become part of the public record that is available to the general public unless you request that your personal information remain confidential.

# Appendix C

Select Correspondence

BT ENGINEERING
BTE

**Ministry of Heritage, Sport, Tourism and Culture Industries**

Programs and Services Branch
401 Bay Street, Suite 1700
Toronto, ON M7A 0A7
Tel: 437.239.3404

**Ministère des Industries du Patrimoine, du Sport, du Tourisme et de la Culture**

Direction des programmes et des services
401, rue Bay, Bureau 1700
Toronto, ON M7A 0A7
Tél: 437.239.3404

Ontario

April 28, 2021 EMAIL ONLY

Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc. 509 Talbot Street
London, ON N6A 2S5
stevenj.taylor@bteng.ca

| | | |
|---|---|---|
| **MHSTCI File** | **:** | **0013923** |
| **Proponent** | **:** | **City of Kitchener** |
| **Subject** | **:** | **Notice of Commencement – MCEA Schedule C** |
| **Project** | **:** | **Biehn Drive Extension** |
| **Location** | **:** | **City of Kitchener** |

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Dear Steve Taylor:

Thank you for providing the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) with the Notice of Study Commencement and the Draft Study Design Report completed by BTE Engineering Inc. (dated March 2021) for the above-referenced project. MHSTCI's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage.

Under the EA process, the proponent is required to determine a project's potential impact on cultural heritage resources.

**Project Summary**
The Biehn Drive Extension EA Study is being conducted as a Schedule C EA Study under the Municipal Class Environmental Assessment (MCEA) (2015). The Transportation Master Plan (TMP) has previously completed Phases 1 and 2 of the Class EA; this Study will review the previously completed phases and complete Phases 3 and 4.

**Identifying Cultural Heritage Resources**
While some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Cultural heritage resources are often of critical importance to Indigenous communities. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to them.

**Project Comments**
MHSTCI has reviewed the above referenced notice and draft Study Design Report and has the following comments:

*Archaeological Resources*
Section 4.2.3.1.7 of the draft Study Design Report (2nd paragraph) indicates that a Stage 1 archaeological assessment (AA) will be completed as part of this undertaking.

A Stage 1 AA shall be completed prior to any ground disturbing activities and prior to the issuance of the notice of completion. MHSTCI recommends that any additional assessments be completed as early as possible during detailed design phase.

Approval authorities (such as a municipality or MECP) typically wait to receive the ministry's review letter for an archaeological assessment report before issuing a decision on the application as it can be used, for example, to document that due diligence has been undertaken.

Archaeological assessment reports may identify site locations which are considered sensitive and not to be made public. To this end, the licensed archaeologist is required to record sensitive data, such as site location, in a separate Supplementary Documentation Report. MHSTCI understands that the proponents like to share information as part of the environmental assessment process for accountability and transparency purposes. Therefore, MHSTCI recommends that the final report be posted on the website without the Supplementary Documentation and with MHSTCI's letter indicating that the report has been entered into the Ontario Public Register of Archaeological Report.

The results of the AA will be summarized in the ESR, i.e. the Executive Summary of each AA report provides a brief summary of the work completed and the recommendations for next steps, whether for further archaeological assessment, in which case the report will include a map that identifies those areas, or for no further assessment. The ESR must also include clear commitments to undertake any further AA stages recommended, and a timeline for their completion.

We recommend revising the 2nd paragraph as follows:

- Archaeological assessment(s) (AA) will be undertaken by an archaeologist licenced under the *Ontario Heritage Act*, who is responsible for submitting the report directly to MHSTCI for review.
- Stage 1 AA consists of a review of geographic, land use and historical information for the property and the relevant surrounding area, a property visit to inspect its current condition and contacting MHSTCI to find out whether, or not, there are any known archaeological sites on or near the property. Its purpose is to identify areas of archaeological potential and determine whether additional archaeological assessment is necessary (e.g. Stage 2,3,4).

*Built Heritage Resources and Cultural Heritage Landscapes*

Section 4.2.3.1.7 (1st paragraph) indicates that a technical memorandum on cultural heritage resources will be completed as part of this undertaking.

MHSTCI recommends that all known or potential built heritage resources and cultural heritage landscapes be identified prior to the selection of preferred alternatives.

A Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment shall be undertaken for the entire study area (not a technical memo) prior to the selection of preferred alternatives and summarized in the Environmental Study Report. This study will:

1. Describe the existing baseline cultural heritage conditions within the study area by identifying all known or potential built heritage resources and cultural heritage landscapes, including a historical summary of the study area. MHSTCI has developed screening criteria that may assist with this exercise: *Criteria for Evaluating for Potential Built Heritage Resources and Cultural Heritage Landscapes*.

2. Identify preliminary potential project-specific impacts on the known and potential built heritage resources and cultural heritage landscapes that have been identified. The report should include a description of the anticipated impact to each known or potential built heritage resource or cultural heritage landscape that has been identified.

3. Recommend measures to avoid or mitigate potential negative impacts to known or potential built heritage resources and cultural heritage landscapes. The proposed mitigation measures are to inform the next steps of project planning and design.

MHSTCI recommends revising the 1st paragraph as follows:

- A Cultural Heritage Report: Existing Conditions and Preliminary Impact Assessment will be undertaken for the entire study area prior to the selection of preferred alternatives and summarized in the ESR. This study will identify all known or potential built heritage resources and cultural heritage landscapes (BHR/CHLs); and include a historical summary of the study area. Potential project impacts to BHR/CHLs will be identified and strategies will be provided to mitigate identified impacts. These mitigation measures will inform project planning and design.

**Environmental Assessment Reporting**
All technical cultural heritage studies and their recommendations are to be addressed and incorporated into EA projects.

Thank you for consulting MHSTCI on this project and please continue to do so throughout the EA process. If you have any questions or require clarification, do not hesitate to contact me.

Sincerely,

Joseph Harvey
Heritage Planner
joseph.harvey@Ontario.ca

Copied to: Eric Riek, City Project Manager, City of Kitchener
Katherine Scott, BT Engineering Inc

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. MHSTCI makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MHSTCI be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Please notify MHSTCI if archaeological resources are impacted by EA project work. All activities impacting archaeological resources must cease immediately, and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the *Ontario Heritage Act* and the *Standards and Guidelines for Consultant Archaeologists*.

If human remains are encountered, all activities must cease immediately and the local police as well as the Registrar, Burials of the Ministry of Government and Consumer Services (416-326-8800) must be contacted. In situations where human remains are associated with archaeological resources, MHSTCI should also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

Hydro One Networks Inc
483 Bay St
Toronto, ON

May 21, 2021

Re: Biehn Drive Extension Class Environmental Assessment Study

Attention:
Steve Taylor, P.Eng. EA
Project Manager
BT Engineering Inc.

Thank you for sending us notification regarding (Biehn Drive Extension Class Environmental Assessment Study). The Secondary Land Use group is aware of this project. Please continue construction conversations with Lana Kegel, Hydro One Senior Real Estate Coordinator. Please inform us when you have more detailed drawings. Note that this response does not constitute approval for your plans and is being sent to you as a courtesy to inform you that we must continue to be consulted on your project.

In addition to the existing infrastructure mentioned above, the applicable transmission corridor may have provisions for future lines or already contain secondary land uses (e.g., pipelines, watermains, parking). Please take this into consideration in your planning.

Also, we would like to bring to your attention that should (Biehn Drive Extension Class Environmental Assessment Study) result in a Hydro One station expansion or transmission line replacement and/or relocation, an Environmental Assessment (EA) will be required as described under the Class Environmental Assessment for Minor Transmission Facilities (Hydro One, 2016). This EA process would require a minimum of 6 months for a Class EA Screening Process (or up to 18 months if a Full Class EA were to be required) to be completed. Associated costs will be allocated and recovered from proponents in accordance with the Transmission System Code. If triggered, Hydro One will rely on studies completed as part of the EA you are current undertaking.

Consulting with Hydro One on such matters during your project's EA process is critical to avoiding conflicts where possible or, where not possible, to streamlining processes (e.g., ensuring study coverage of expansion/relocation areas within the current EA). Once in receipt of more specific project information regarding the potential for conflicts (e.g., siting, routing), Hydro One will be in a better position to communicate objections or not objections to alternatives proposed.

If possible at this stage, please formally confirm that Hydro One infrastructure and associated rights-of-way will be completely avoided, or if not possible, allocate appropriate lead-time in your project schedule to collaboratively work through potential conflicts with Hydro One, which ultimately could result in timelines identified above.

In planning, note that developments should not reduce line clearances or limit access to our infrastructure at any time. Any construction activities must maintain the electrical clearance from the

transmission line conductors as specified in the Ontario Health and Safety Act for the respective line voltage.

Be advised that any changes to lot grading or drainage within, or in proximity to Hydro One transmission corridor lands must be controlled and directed away from the transmission corridor.

Please note that the proponent will be held responsible for all costs associated with modifications or relocations of Hydro One infrastructure that result from your project, as well as any added costs that may be incurred due to increased efforts to maintain said infrastructure.

We reiterate that this message does not constitute any form of approval for your project. Hydro One must be consulted during all stages of your project. Please ensure that all future communications about this and future project(s) are sent to us electronically to secondarylanduse@hydroone.com

Sent on behalf of,

***Secondary Land Use***
***Asset Optimization***
***Strategy & Integrated Planning***
***Hydro One Networks Inc.***

**Ministry of the Environment, Conservation and Parks**

***Environmental Assessment Branch***

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

**Ministère de l'Environnement, de la Protection de la nature et des Parcs**

***Direction des évaluations environnementales***

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

Ontario

May 20, 2021

Eric Riek
Project Manager
City of Kitchener

Re: **Biehn Drive Extension EA**
**City of Kitchener**
**Municipal Class EA**
**Response to Notice of Commencement**

Dear Eric Riek,

This letter is in response to the Notice of Commencement for the above noted project. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the City of Kitchener has indicated that the study is following the approved environmental planning process for a Schedule C project under the Municipal Class Environmental Assessment (Class EA).

The **updated (February 2021)** attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please address all areas of interest in the EA documentation at an appropriate level for the EA study. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule. **Further information is provided at the end of the Areas of Interest document relating to recent changes to the Environmental Assessment Act through Bill 197, Covid-19 Economic Recovery Act 2020.**

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project:

- Mississaugas of the Credit First Nation
- Six Nations of the Grand River (both Elected Council and Haudenosaunee Confederacy Chiefs Council)

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process". Additional information related to Ontario's Environmental Assessment Act is available online at: www.ontario.ca/environmentalassessments.

**Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information, including the MECP's expectations for EA report documentation related to consultation with communities.**

The proponent must contact the Director of Environmental Assessment Branch (EABDirector@ontario.ca) under the following circumstances subsequent to initial discussions with the communities identified by MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities
- You have reason to believe that your proposed project may adversely affect an Aboriginal or treaty right
- Consultation with Indigenous communities or other stakeholders has reached an impasse
- A Part II Order request is expected on the basis of impacts to Aboriginal or treaty rights

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

---

**A draft copy of the report should be sent directly to me prior to the filing of the final report, allowing a minimum of 30 days for the ministry's technical reviewers to provide comments.**

**Please also ensure a copy of the final notice is sent to the ministry's West Central Region EA notification email account (eanotification.swregion@ontario.ca) after the draft report is reviewed and finalized.**

Should you or any members of your project team have any questions regarding the material above, please contact me at joan.delvillarcuicas@ontario.ca or 365-889-1180.

Yours truly,

Joan Del Villar C
Regional Environmental Assessment Coordinator – West Central Region

cc Katy Potter, Supervisor, Environmental Assessment Services, MECP
Steve Taylor, P. Eng. EA Project Manager, BT Engineering Inc

Attach: Areas of Interest
A Proponent's Introduction to the Delegation of Procedural Aspects of Consultation with Aboriginal Communities

**AREAS OF INTEREST (v. February 2021)**

*It is suggested that you check off each section after you have considered / addressed it.*

☐ **Planning and Policy**

- Projects located in MECP Central Region are subject to **A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020).** Parts of the study area may also be subject to the Oak Ridges Moraine Conservation Plan (2017), Niagara Escarpment Plan (2017), Greenbelt Plan (2017) or Lake Simcoe Protection Plan (2014). Applicable plans and the applicable policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.

- The **Provincial Policy Statement (2020)** contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

☐ **Source Water Protection**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

- If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use this mapping tool: http://www.applications.ene.gov.on.ca/swp/en/index.php. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the "Map Legend" bar on the left. The mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information
For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario's website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional "local" threat activities, as approved by the MECP.

**Climate Change**

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

1. Consider during the assessment of alternative solutions and alternative designs, the following:
    a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
    b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

**Air Quality, Dust and Noise**

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

**Ecosystem Protection and Restoration**

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
    - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands,

significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.
  - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
  - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, you may consider the provisions of the Rouge Park Management Plan if applicable.

**Species at Risk**

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

**Surface Water**

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

    - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
    - Watershed information, drainage conditions, and other relevant background information
    - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
    - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

**Groundwater**

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16.* These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

**Excess Materials Management**

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

**Contaminated Sites**

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP's D-4 guideline for land use considerations near landfills and dumps.
  - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada's website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

**Servicing, Utilities and Facilities**

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP's Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

**Mitigation and Monitoring**

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the

project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

**Consultation**

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

**Class EA Process**

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Part II Order Requests under the Environmental Assessment Act, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

**Amendments to the EAA through the Covid-19 Economic Recovery Act, 2020**

Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address (for projects in MECP Southwest Region, the email is eanotification.swregion@ontario.ca).

The public has the ability to request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters should be addressed in writing to:

Minister Jeff Yurek
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

# A PROPONENT'S INTRODUCTION TO THE DELEGATION OF PROCEDURAL ASPECTS OF CONSULTATION WITH ABORIGINAL COMMUNITIES

**DEFINITIONS**

The following definitions are specific to this document and may not apply in other contexts:

**Aboriginal communities** – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

**Consultation** – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

**Crown** – the Ontario Crown, acting through a particular ministry or ministries.

**Procedural aspects of consultation** – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

**Proponent** – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

## I. PURPOSE

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

## II. WHY IS IT NECESSARY TO CONSULT WITH ABORIGINAL COMMUNITIES?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers issuing a permit, authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

## III. THE CROWN'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

## IV. THE PROPONENT'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent's consultation activities and documentation of those activities. The consultation process informs the Crown's decision of whether or not to approve a proposed project or activity.

A proponent's role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

**a) What might a proponent be required to do in carrying out the procedural aspects of consultation?**

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;
- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

**b) What documentation and reporting does the Crown need from the proponent?**

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;
- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;
- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

**c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?**

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

## V. WHAT ARE THE ROLES AND RESPONSIBILITIES OF ABORIGINAL COMMUNITIES' IN THE CONSULTATION PROCESS?

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:

- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;
- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

## VI. WHAT IF MORE THAN ONE PROVINCIAL CROWN MINISTRY IS INVOLVED IN APPROVING A PROPONENT'S PROJECT?

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

**Ministry of the Environment, Conservation and Parks**

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
**Tel.**: 416 314-8001
**Fax.**: 416 314-8452

**Ministère de l'Environnement, de la Protection de la nature et des Parcs**

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
**Tél.** : 416 314-8001
**Téléc.** : 416 314-8452

*(Via E-mail Only)*

October 16, 2024

Gordon Bell
Senior Environmental Planner
BTEng. Inc
gord.bell@bteng.ca

Steve Taylor
Project Manager
BTEng Inc
stevenj.taylor@bteng.ca

**Re: City of Kitchener, Biehn Drive Extension EA**
**Municipal Class Environmental Assessment – Schedule C**
**Project Review Unit Comments – Final Draft Environmental Study Report**

Dear Project Team,

Thank you for providing the ministry with an opportunity to comment on the draft Environmental Study Report (Report) for the above noted Class Environmental Assessment (EA) project. Our understanding is that in order to improve accessibility to the local community; accommodate the required and previously planned sanitary sewer extension; and allow development to proceed on lands that currently require the roadway ROW plan to be defined prior to developing the land use plan, The City of Kitchener (the proponent) has determined that the preferred solution is to extend Biehn Drive and connect it to Robert Ferrie Drive east of Hydro Tower. The Biehn Drive extension will include a trunk sanitary sewer, storm sewer/ditches and watermain.

The Ministry of the Environment, Conservation and Parks (ministry) provides the following comments for your consideration.

**Notice of Completion**

**1.** The Notice of completion and any follow- up correspondence should be included in the final Environmental Study Report.

**Groundwater**

**2.** No detailed hydrogeologic assessment was provided in the EA report. The Section 3.3.3 Hydrogeologic Assessment in the EA report provided some discussion regarding possible dewatering requirements as part of the construction project. It is reported that "The proposed trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area. Refer to Appendix J. Trenchless construction would normally require less or no dewatering than traditional open cut installations.". However, Appendix J in the EA report is about Hydrological Investigation, but no dewatering related discussion was provided.

**3.** The Section 7.4.1.1 Groundwater in the EA report mentioned that "A trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area. There will only be dewatering requirements for the road construction for the north culvert and oil grit separator". At the end of Appendix A Borehole Logs, a report titled "Dewatering Assessment, Biehn Drive Extension, City of Kitchener, Ontario, dated March 14, 2024, Prepared by Cambium Inc for BT Engineering" was provided. There should be a specific reference (i.e., a specific Appendix) for this dewatering assessment in the EA report.

**4.** The above dewatering assessment report provided detailed hydrogeologic information including dewatering calculations and assumptions for dewatering calculations. The report also discusses the possible dewatering permits (i.e., EASR verses Category 3 PTTW Application) to be required during construction phases. The dewatering assessment report provides Dewatering Estimates for 50 m Trench segment and Receiving Pit, where maximum dewatering volume is estimated to be less than 125,000 l/day with a zone of influence of 70 m. A safety factor of 2 was applied and the estimated dewatering rate per each receiving pit (i.e., 50 m trench) is estimated at 235,000 L/day or 2.72 L/sec. However, the safety factor 2 and projected dewatering rate was not considered for the predicted ZOI (i.e., 70 m). The report considers overland flow to natural environment as a possible dewatering discharge option, which needs to consider treatment of groundwater due to exceedance of several metals including arsenic comparing PWQO.

Overall, the preliminary dewatering assessment seems reasonable.

5. It is understood that a detailed hydrogeologic investigation report will be submitted during the Category 3 PTTW application. MECP will provide comments as part of the proposed Category 3 PTTW application, specifically impacts of dewatering on the surrounding water resources including the PSW and required monitoring (i.e., surface water and groundwater monitoring) and contingency plan for the protection of applicable receptors including PSW and other water users within the projected zone of influence due to dewatering. It is important to highlight that a groundwater and surface water monitoring program and contingency plan is required before, during, and after the proposed dewatering/construction activities irrespective of the dewatering/construction methods to be implemented due to the sensitivity of the PSW.

6. MECP will also comment on the treatment of dewatering discharge and impact of dewatering discharge on the natural environment/aquatic environments within the PSW. The proposed dewatering discharge option (i.e., discharge on natural environment) needs to acquire appropriate permits, where applicable.

**Species at Risk**

7. Though the ESR provides information on Black Ash and some mitigation information, further action should be considered to avoid impacts to Black Ash within the development footprint. Please refer to the Black Ash assessment guidelines to ensure proper actions are taken to avoid contravening the ESA, 2007.

8. The assessment of Black Ash was conducted in December, which is outside of the appropriate window for a full health evaluation. Ideally, this should have been done between late spring and early fall when the trees are in leaf, and key health indicators are visible. A follow-up assessment during the growing season would provide a more accurate evaluation of the trees' condition.

9. Butternut has been identified as a species at risk within the study area; however, no further information or mitigation measures are provided in the ESR. It is recommended that butternut surveys be conducted by a qualified Butternut Health Expert (BHE) during the appropriate timing window to confirm the absence or presence of this species. Please refer to the Butternut assessment guidelines.

10. There is no clear commitment to ensuring that construction activities occur outside of the bat active window (May to October). MECP would expect the project to follow timing restrictions to avoid disturbing SAR bats during sensitive periods.

11. The document touches on long-term monitoring to assess the effectiveness of bat mitigation measures but does not give much detail. MECP would expect ongoing monitoring to ensure that the mitigation strategies, like the installation of roosting structures, are effective in supporting SAR bats and that adaptive management strategies are in place to address any unforeseen impacts.

**12.** MECP has records of Blanding's Turtle presence within the project area, including Category 2 and 3 habitats identified within the study boundaries. The ESR does not address potential impacts or include any mitigation measures for this species. It is recommended that the project include an assessment of Blanding's Turtle habitat and appropriate mitigation strategies to ensure compliance with the ESA, 2007.

**13.** Given the potential impacts this project may have on species at risk, I recommend that an an Information Gathering Form (IGF) be completed and submitted to the Species at Risk Branch (SAROntario@ontario.ca). This step will help ensure that proper authorization is secured under the ESA, 2007 before proceeding with the project. It is ultimately the client's responsibility to ensure that their activities do not contravene the ESA, 2007.

**Surface Water**

**14.** The site is located in the Upper Grand River watershed. Strasburg Creek, a cold waterbody is located in the study area but not directly affected but the road extension. A portion of the proposed roadway would cross the Strasburg Creek Provincially Significant Wetland (PSW) Complex. The Strasburg Creek PSW is a wooded swamp dominated by mature hardwoods and the report notes it is a cold-water system.

**15.** Approximately 2,690 m2 of wetlands will be permanently lost through the construction of the roadbed. In response, it is proposed to restore two areas adjacent to the wetland of ~1,285 m2, and 2,543 m2 (for a total 3,828 m2), plus the retained 10 m wide forest edge. Specifics would be discussed in the detailed design, but the area is noted to well exceed the minimum 1:1 goal. GRCA's permits might be required regarding this wetland destruction and compensation.

**16.** Direct impacts during construction are noted to be mitigated with trenchless construction for the municipal services, with dewatering only required for the north culvert and oil grit separator. The discharge location is to be decided and may be overland with flow to the wetland. This activity may require MECP permit/approval.

**17.** During construction, erosion and sedimentation measures are required and are noted in the ESR. The concentrations of most metals, including zinc, thallium, lead, nickel, iron, cadmium, arsenic, and silver in the unfiltered groundwater sample exceeded the PWQO values. A discharge and sampling program was recommended including a limit of total suspended solids (TSS) of 25 mg/L.

**18.** As part of the Permit to Take Water application, or any EASR registration, confirmation of hydrogeologic conditions, sedimentation and erosion controls in a discharge plan, and exact design of the compensative wetland should be provided. GRCA's concurrence on the compensation wetland will be required. A monitoring and sampling plan should be created to ensure there is no discharge to the natural environment of groundwater with metals exceeding the PWQO.

**19.** Stormwater quality control will be provided with the existing stormwater management pond as well as an oil grit separator at the northern outlet to the PSW. Current and future drainage volumes to be accommodated by the new road were not described, but Item 2.2 of Table 9 Effects and Mitigation notes stormwater management plan is being developed to reduce chloride loading into the watercourse and to cool stormwater prior to its outlet. It is not clear where this stormwater pond outlets into and could be clarified to ensure all required measures are taken. The ESR includes the Integrated Stormwater Management Master Plan which recommends control of the 25-year and 100-year storm events post-development volumes and peak flows to pre-development levels, and notes enhanced (Level 1) water quality protection for the watershed. All these stormwater works will require MECP approval since they outlet to the natural environment.

**Noise and Vibration**

**20.** In comments on the draft ESR from 2022 the ministry inquired whether the City of Kitchener was planning on reassessing the noise after construction in response to community concern, your response (in the 'comments response' memo sent in August 2022) was as follows, "In Noise and Vibration in Table 8, under a new Factor for Cultural Environment, a commitment will be made to monitor noise complaints with the opening of Biehn Drive. If the noise complaints last beyond the initial experience of the road opening, then traffic counts will be undertaken to compare with the ESR noise calculation traffic projections. Based on the comparison, the City will assess if any noise mitigation measures are required, technically feasible and cost effective." The 2024 ESR does not contain the above commitment or an equivalent statement in either Table 9 (the equivalent of Table 8 in the 2022 ESR) or in section 3.2.3 Noise.

---

Thank you for circulating this draft Report for the ministry's consideration. Please document the provision of the draft Report to the ministry as well as this Project Review Unit Comments letter in the final report, and please provide an accompanying response letter to support our review of the final report. A copy of the final Notice should be sent to the ministry's West Central Region EA notification email account (eanotification.wcregion@ontario.ca).

Should you or any members of your project team have any questions regarding the material above, please contact me at Joan.DelVillarCuicas@ontario.ca.

Sincerely,

**Joan Del Villar Cuicas**
Regional Environmental Planner
Project Review Unit, Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Park

Grand River Conservation Authority

Administration Centre: 400 Clyde Road, P.O. Box 729 Cambridge, ON N1R 5W6

Phone: 519-621-2761 Toll free: 1-866-900-4722 Fax: 519-621-4844 www.grandriver.ca

April 14, 2021

Eric Riek, C.E.T., Project Manager
City of Kitchener
Via email: eric.riek@kitchener.ca

**Re: Biehn Drive Extension Municipal Class Environmental Assessment Schedule C**
**Biehn Drive to future Robert Ferrie Drive, City of Kitchener**

Dear Mr. Riek,

Grand River Conservation Authority (GRCA) staff have received a Notice of Study Commencement in regards to the above-noted Municipal Class Environmental Assessment (Class EA). The study area contains features of interest to the GRCA, including the Provincially Significant Strasburg Creek Wetland Complex, tributaries of the Grand River, floodplain, slope erosion hazard, and the associated allowances to these features. Please allow this correspondence to act as notice that we have an interest in the Class EA and wish to participate in the study review.

Please be further advised that a GRCA permit pursuant to Ontario Regulation 150/06 will be required for any of the proposed works that fall within the GRCA regulated areas. We recommend that you contact our office early in the study process to discuss permitting requirements.

If you have any questions or concerns, please do not hesitate to contact **Jenn Simons, Intermediate Planner, at 519-621-2763 ext. 2230** or jsimons@grandriver.ca.

Sincerely,

Melissa Larion, MCIP, RPP
Supervisor of Resource Planning
Grand River Conservation Authority

JS/ml

c.c. Steve Taylor, BT Engineering Inc.(via email)

# Fw: Biehn Drive Extension Class Environmental Assessment Study | Notice

Steve Taylor (London) <stevenj.taylor@bteng.ca>

Mon 2021-04-12 8:28 AM

**To:** Julia Hoglund <julia.hoglund@bteng.ca>
**Cc:** Katherine Scott <katherine.scott@bteng.ca>

Save this in the select correspondence appendix.
Steve

BT ENGINEERING
BTE

Steve Taylor P.Eng., M.Eng., CVS-LIFE, P.E.
President
509 Talbot Street
London, Ontario
N6A 2S5
**E-Mail:** stevenj.taylor@bteng.ca
**Phone:** 519-672-2222
**FAX:** 1-613-280-1305
**Toll Free:** 1-855-228-4813
[www.bteng.ca]www.bteng.ca

---

**From:** Kevin Schimus <Kevin.Schimus@enbridge.com>
**Sent:** April 12, 2021 7:36 AM
**To:** Katherine Scott <katherine.scott@bteng.ca>
**Cc:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; Eric Riek <Eric.Riek@kitchener.ca>; Gord Bell <gord.bell@bteng.ca>
**Subject:** RE: Biehn Drive Extension Class Environmental Assessment Study | Notice

Good morning Katherine,

Enbridge Gas Inc. does not have any existing or proposed infrastructure in this area. Please contact Kitchener Utilities Gas for gas information in this area. I can be removed from distribution list and future communications re: this project. Thanks.

Regards,

**Kevin Schimus**
**Sr. Advisor, Construction and Project Management**
Southeast Region Construction and Growth

**Enbridge Gas Inc**
Cell: 519-635-9488 | Kevin.Schimus@enbridge.com
603 Kumpf Drive, Waterloo, Ontario, N2V 1K3

enbridgegas.com
**Safety. Integrity. Respect. Inclusion.**

**From:** Katherine Scott <katherine.scott@bteng.ca>
**Sent:** Wednesday, March 31, 2021 8:55 AM
**Cc:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; Eric Riek <Eric.Riek@kitchener.ca>; Gord Bell <gord.bell@bteng.ca>
**Subject:** [External] Biehn Drive Extension Class Environmental Assessment Study | Notice

**EXTERNAL: PLEASE PROCEED WITH CAUTION.**
This e-mail has originated from outside of the organization. Do not respond, click on links or open attachments unless you recognize the sender or know the content is safe.

Good morning,

The City of Kitchener has initiated a Class Environmental Assessment for the Biehn Drive Extension and Sanitary Trunk Sewer Extension. The attached Notice provides additional information on the Study and the availability of background materials.

Please let me know if you have any additional questions or concerns.

Thanks,

Katherine Scott

BT ENGINEERING

509 Talbot Street
London, Ontario N6A 2S5
katherine.scott@bteng.ca
(519) 672-2222

## Katherine Scott

**From:** MNRF Ayl Planners (MNRF) <MNRF.Ayl.Planners@ontario.ca>
**Sent:** April 15, 2021 1:56 PM
**To:** Steve Taylor (London); Eric Riek
**Cc:** Gord Bell; Katherine Scott
**Subject:** RE: Biehn Drive Extension Class Environmental Assessment Study | Notice
**Attachments:** 21-003 Kitchener Biehn Dr Commencement-Café Letters Laura W, MNRF QC.pdf; NHGuide_MNRF_2019-04-01.pdf

**Ministry of Natural Resources and Forestry** **Ministère des Richesses naturelles et des Forêts**

Ontario

April 15, 2021

Steve Taylor, P.Eng.
EA Project Manager
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5
Tel: 519-672-2222
Email: stevenj.taylor@bteng.ca

Eric Riek, C.E.T.
City Project Manager
City of Kitchener
200 King Street West
Kitchener, ON N2G 4G7
Tel: 519-741-2200 ext. 7330
Email: eric.riek@kitchener.ca

**Subject: Biehn Drive Extension Class Environmental Assessment Study | Notice**

The Ministry of Natural Resources and Forestry (MNRF) received the attached notice for the proposed Biehn Drive Extension project. Thank you for circulating this information to our office, however, please note that we have not completed a screening of natural heritage or other resource values for the project at this time. Please also note that it is your responsibility to be aware of and comply with all relevant federal or provincial legislation, municipal by-laws or other agency approvals.

This response provides information to guide you in identifying and assessing natural features and resources as required by applicable policies and legislation, and engaging with the MNRF for advice as needed.

**Natural Heritage & Endangered Species Act**

In order to provide the most efficient service possible, the attached Natural Heritage Information Request Guide has been developed to assist you with accessing natural heritage data and values from convenient online sources.

It remains the proponent's responsibility to complete a preliminary screening for each project, to obtain available information from multiple sources, to conduct any necessary field studies, and to consider any potential environmental impacts that may result from an activity. We wish to emphasize the need for the proponents of development activities to complete screenings prior to contacting the Ministry or other agencies for more detailed technical information and advice.

The Ministry continues to work on updating data housed by Land Information Ontario and the Natural Heritage Information Centre, and ensuring this information is accessible through online resources. Species at risk data is regularly being updated. To ensure access to reliable and up to date information, please contact the Ministry of the Environment, Conservation and Parks at SAROntario@ontario.ca.

**Petroleum Wells & Oil, Gas and Salt Resource Act**

There may be petroleum wells within the proposed project area. Please consult the Ontario Oil, Gas and Salt Resources Library website (www.ogsrlibrary.com) for the best known data on any wells recorded by MNRF. Please reference the 'Definitions and Terminology Guide' listed in the publications on the Library website in order to better understand the well information available. Any oil and gas wells in your project area are regulated by the *Oil, Gas and Salt Resource Act*, and the supporting regulations and operating standards. If any unanticipated wells are encountered during development of the project, or if the proponent has questions regarding petroleum operations, the proponent should contact the Petroleum Operations Section at POSRecords@ontario.ca or 519-873-4634.

**Public Lands Act & Lakes and Rivers Improvement Act**

Some projects may be subject to the provisions of the *Public Lands Act* or the *Lakes and Rivers Improvement Act*. Please review the information on MNRF's web pages provided below regarding when an approval is required or not. Please note that many of the authorizations issued under the *Lakes and Rivers Improvement Act* are administered by the local Conservation Authority.

- For more information about the *Public Lands Act*: https://www.ontario.ca/page/crown-land-work-permits
- For more information about the *Lakes and Rivers Improvement Act*: https://www.ontario.ca/document/lakes-and-rivers-improvement-act-administrative-guide

The MNRF would appreciate the opportunity to review any draft reporting completed in support of this project when it becomes available.

If you have any questions or concerns, please feel free to contact me.

Sincerely,
Karina

**Karina Černiavskaja, District Planner**
Ministry of Natural Resources and Forestry
Email: MNRF.Ayl.Planners@ontario.ca

Ontario

*As part of providing accessible customer service, please let me know if you have any accommodation needs or require communication supports or alternate formats.*

---

**From:** Katherine Scott <katherine.scott@bteng.ca>
**Sent:** March-31-21 8:48 AM
**To:** MNRF Ayl Planners (MNRF) <MNRF.Ayl.Planners@ontario.ca>
**Cc:** Steve Taylor (London) <stevenj.taylor@bteng.ca>; Gord Bell <gord.bell@bteng.ca>; Eric Riek <Eric.Riek@kitchener.ca>
**Subject:** Biehn Drive Extension Class Environmental Assessment Study | Notice

**CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.**

Good morning,

The City of Kitchener has initiated a Class Environmental Assessment for the Biehn Drive Extension and Sanitary Trunk Sewer Extension. The attached Notice provides additional information on the Study and the availability of background materials.

Please let me know if you have any additional questions or concerns.

Thanks,

Katherine Scott

BT ENGINEER

509 Talbot Street

London, Ontario N6A 2S5

katherine.scott@bteng.ca

(519) 672-2222

**From:** Ron <ronmckelvie85@gmail.com>
**Sent:** January 3, 2022 2:45 PM
**To:** Steve Taylor (London) <stevenj.taylor@bteng.ca>
**Cc:** eric.riek@kitchener.ca <eric.riek@kitchener.ca>
**Subject:** Biehn Drive Extension

Hello Steven and Eric,

We do not believe that the Biehn Extension is needed at this time. A more sensible approach is to allow the connection of Robert Ferrie Dr to Strasburg Rd. Once that has been done, then another study can be completed if necessary.

We need to protect wet lands and environmental protected areas as the city is expecting taxpayers to do. We are referring to the new “Natural Heritage Conservation” zoning that effects private property of landowners. We, as well as our neighbours, have been good stewards of our properties yet have seen the city approve development that has destroyed many acres of natural area.

We remember the sales pitch regarding LRT. This was to curb urban sprawl and development and here we are finding more ways to build more and more roads to accommodate vehicular traffic using polluting fossil fuels!

Gentleman, it’s time to do the right thing for us and future generations.

Thankyou for your time.

Ron&Diane Mckelvie

**Hydro One Networks Inc.**
**Facilities & Real Estate Services**
P.O. Box 4300
Markham, ON L3R 5Z5
www.HydroOne.com

**Courier:**
185 Clegg Road
Markham, ON L6G 1B7

## Technical Considerations for Hydro One Electrical Transmission Corridors

Your project may involve proposed works on Hydro One electrical transmission corridors or rights-of-way (ROW). Hydro One strives to work with proponents to review secondary land use proposals on the ROWs so that they are compatible with the safety and maintenance requirements of its high-voltage equipment. The Hydro One transmission network can consist of steel lattice towers, monopoles, twin wood poles, overhead conductors.

When preparing a proposal, there are a number of technical considerations that should be kept in mind. A number of these are outlined below. Please note that this is not intended to be a comprehensive list of requirements, but aims to serves as a guideline to prepare a proposal. Reviews for each proposal are conducted individually by Hydro One and may require several weeks or months to complete depending on the complexity of the proposal.

### Technical Considerations:

#### Grading, Drainage and Stormwater Management

- Grading changes must not result in standing water anywhere along the corridor, and especially not within 15m radial zone of transmission structures.
- No fill material may be placed on the ROW without written approval from Hydro One.
- Catch basins that are not positioned within a paved roadway are not permitted.
- Stormwater management (SWM) ponds placed under 115 and 230 kV transmission lines cannot exceed two-thirds of the corridor width.
- SWM ponds under 500 kV transmission lines cannot exceed one-third of the corridor width.
- SWM ponds must be designed to withstand the effects of 100-year storm conditions.

#### Roads and Parking

- Roads crossing the ROW should be perpendicular to the hydro corridor.
- Roads off ROW should stay 15m clear of transmission structures.
- Curb cuts or access gates should be provided for Hydro One maintenance vehicles.
- Parking facilities on 115 kV and 230 kV ROWs should be restricted to passenger vehicles only. Large truck and trailer parking is generally not permitted.
- Parking facilities are generally not permitted under 500 kV ROWs.
- Transmission towers near roads and parking areas must be protected by standard highway barriers.

#### Vertical Clearances

- Transmission conductors (wires) are dynamic in nature. They can sag lower to the ground depending on parameters such as ambient temperature and operating conditions.
- Minimum vertical clearances must be maintained from the maximum design sag levels of the conductors (worst-case scenario). Hydro One will review these clearances as they are case-specific and not immediately apparent by observation alone.

Access to Structures

- An unhindered, minimum 6-metre wide access path to facilities on the corridor must be provided for maintenance vehicles.
- A 15-metre clear working radius around transmission structures is required in order to maintain access for vehicles carrying out routine maintenance.
- A 3-metre radius around each tower footing must be left unpaved for access to the footing.

Pipelines & Underground Facilities

- All underground facilities must be designed to withstand the loading conditions created by heavy maintenance vehicles that may be used by Hydro One.
- The ROW must be restored to pre-construction condition once the project is completed.
- Excavation using heavy machinery is prohibited within 10 metres of tower footings to protect foundations. Within 10 metres, excavation must be carried out by hand or by use of a VAC system.
- Pipelines on ROWs must adhere to the provisions of CSA Standard C22.3 No. 6.

Landscape Plantings

- Plantings which grow to a maturity height over 4 metres are not permitted on the ROW. Hydro One has a 'Compatible Species List' which can be provided. It must be noted that plantings should not be planted in such a way as to impede access to the transmission towers. An area of 15 metres around transmission towers should be kept clear of shrubs to permit Hydro One access to towers.

Other Requirements

- Buildings and permanent structures are not permitted on corridor lands.
- Flammable or hazardous materials may not be stored on ROWs.
- Consideration should be given to minimizing the use of conductive (metallic) material where alternatives exist (e.g. fences).
- The proponent is responsible for all costs of modifying, relocating, or monitoring Hydro One assets as a result of the proposal.
- Grounding studies, induction studies, spark discharge and / or step touch potential studies may be required to confirm that the proposal will not conflict with the Hydro One electrical infrastructure. The cost of these studies, our review of the completed studies, and any mitigation measures required as a result of these studies, will be will be borne by the Proponent.

Property Rights: Who is the landowner?

- Transmission corridor lands can be owned by private landowners, Municipalities, Province of Ontario (Infrastructure Ontario), railway companies, and First Nations and Métis communities.
- Hydro One Networks Inc. owns the transmission components/network.
- Hydro One Networks Inc. has rights either registered on land title or by legislation to operate the transmission network.

Property Rights: What Agreements do you require?

Contact Hydro One Real Estate Services at 1.888.231.6657 for the Real Estate Coordinator for your municipality. The Real Estate Coordinator arranges for Hydro One review of your proposal, advises of documentation and provides the Agreements.

# Appendix D

Geotechnical Investigation

BT ENGINEERING

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# Geotechnical Investigation - Proposed Trunk Sewer, Biehn Drive South Extension, Kitchener

March 14, 2024

Prepared for:
BT Engineering

Cambium Reference: 11969-002

CAMBIUM INC.

866.217.7900

cambium-inc.com

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6



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# 1.0 Introduction

Cambium Inc. (Cambium) was retained by BT Engineering (Client) to complete a geotechnical investigation in support of the Class EA & Preliminary Design for Biehn Drive Extension and Sanitary Trunk Sewer Extension in Kitchener, Ontario. A site location plan is appended as Figure 1 of this report.

It is understood that the City of Kitchener is proposing to install new 525 mm diameter trunk sewer to support the upcoming residential construction along the proposed roadway extension and to connect to the existing sewer on Biehn Drive from its current terminus, approximately 60 metres west of Spencer Court, southerly to the future Robert Ferrie Drive Extension. It is also understood that the proposed construction of the trunk sewer will be using trenchless technology through the known wetland area present on the Site. Based on preliminary design, the approximate length of the alignment within wetland will be 188 m (from station 10+338 to 10+526). And the trunk sewer is expected to be installed to depths of 2.5 to 3.5 m below existing grade in this section.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions by means of a number of boreholes and based on the findings to provide geotechnical recommendations for the design and construction of the proposed sanitary trunk sewer.

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# 2.0 Methodology

## 2.1 Previous Investigation

Cambium completed a geotechnical investigation in 2022 on the property south of wetland to determine the subsurface and groundwater conditions. The previous investigation consisted of six boreholes at the Site to a maximum depth of 8.2 m below ground surface (mbgs), cumulating in our report entitled "*Geotechnical Investigation Report – Biehn Drive Extension, Kitchener, ON*" dated April 14, 2022. Four of these boreholes were outfitted with monitoring wells, one of which (BH101-22) is located near the southern edge of the wetland. In the preparation of this report and in addition to the borehole investigation under the current assignment, reference has been made to factual information contained in that report.

## 2.2 Borehole Investigation

Cambium completed a borehole investigation at the Site in August and September 2023. A total of six boreholes, designated as BH201-23 through BH206-23, were advanced into the subsurface at predetermined locations. These boreholes were terminated depths of 6.7 to 9.8 m below ground surface (mbgs). The locations and elevations of the boreholes were obtained using a Realtime Kinematic Unit (RTK) using a site benchmark (BM). The BM is recognized as the top of BH101-22, which was corrected to geodetic elevation during previous investigation. The borehole locations are shown on Figure 2 of this report.

Drilling and sampling was completed using a track-mounted drill rig operating under the supervision of a Cambium technician. The boreholes were advanced to the sampling depths by means of continuous flight solid stem augers with 50 mm O.D. split spoon samplers. Standard Penetration Test (SPT) N values were recorded for the sampled intervals as the number of blows required to drive a split spoon sampler 305 mm into the soil, using a 63.5 kg drop hammer falling 750 mm, as per ASTM D1586 procedures. The SPT N values are used in this report to assess consistency of cohesive soils and relative density of non-cohesive soils. Soil samples were collected at approximately 0.75 m intervals to 3 m deep and 1.5 m intervals after.

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The encountered soil units were logged in the field using visual and tactile methods, and samples were placed in labelled plastic bags for transport, future reference, possible laboratory testing, and storage.

Open boreholes were checked for groundwater and general stability prior to backfilling. Monitoring wells were installed in boreholes BH202-23, BH203-23, and BH206-23 in order to measure stabilized groundwater levels. The other boreholes were backfilled and sealed in accordance with Ontario Regulation (O.Reg.) 903, as amended, and the property was reinstated to pre-existing conditions.

Borehole logs are provided in Appendix A. Site soil and groundwater conditions are described, and geotechnical recommendations are discussed in the following sections of this report.

## 2.3 Physical Laboratory Testing

Physical laboratory testing, including six particle size distribution analyses (LS-702, 705), was completed on selected soil samples to confirm textural classification and to assess geotechnical parameters. Moisture content testing was completed on all soil samples. Testing results are presented in Appendix B and are discussed in Section 3.0.

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# 3.0 Subsurface Conditions

The detailed soil profiles encountered in the boreholes are indicated on the attached borehole logs in Appendix A. It should be noted that the conditions indicated on the borehole logs are for specific locations only and can vary between and beyond the borehole locations.

In summary, the subsurface conditions consist of a peat or fill underlain by a sand to silty sand soil which is interbedded with silt and sand and silt deposits. A brief description of each soil type was provided in following sections.

## 3.1 Pavement Structure

Borehole BH202-23 was advanced in the existing pavement on Biehn Drive. 70 mm of asphalt was observed at the surface, overlying approximately 2.4 m of sand and gravel fill material. This sand and gravel was brown in colour and appears to be granular fill. SPT N values in the fill ranged from 20 to 42 indicating a compact to dense relative density. The moisture contents in the fill ranged from 4% to 7%.

## 3.2 Peat

In most of the boreholes advanced within wetland, the surficial soil consisted of a black peat material containing high amounts of organic material. The thickness of the peat ranged from 0.3 to 1.5 m deep with an average thickness of approximately 0.8 m. SPT N values of 2 to 3 in the peat indicated a very loose relative density.

## 3.3 Sand Fill

In borehole BH201-23, a layer of sand fill was observed at the surface extending to a depth of approximately 1.5 mbgs. The sand fill contained some gravel and was described as moist at the time of the investigation. Moisture contents in the sand fill were approximately 5%. SPT N values observed in this material ranged from 8 to 13 indicating a loose to compact relative density.

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## 3.4 Sand, Silty Sand

A non-cohesive sand to silty sand was observed in all boreholes. This sand to silty sand appears to be the dominant soil type across the Site, and boreholes BH201-23, BH203-23, BH204-23, and BH205-23 terminate in this soil. The sand to silty sand was generally described as light brown to brown in colour and had trace to some gravel and clay inclusions. At the time of the investigation, the soil was described as moist to wet with natural moisture contents ranging from 12% to 21%. The SPT N values in the material on average range from 2 to 34, however on average the SPT N values were between 10 and 20. This generally indicates a compact relative density.

Laboratory particle size distribution analyses were completed for one sample of the sand and silty sand deposits. The analysis results are summarized in Table 1 with details provided in Appendix B.

**Table 1 Particle Size Distribution Analysis – Sand, Silty Sand**

| Borehole and Sample | Depth (mbgs) | Soil | % Gravel | % Sand | % Silt | % Clay | % Moisture Content |
|---|---|---|---|---|---|---|---|
| BH202-23 SS5 | 3.0 – 3.5 | Sand some Silt trace Clay | 0 | 80 | 17 | 3 | 18.9 |

## 3.5 Sandy Silt, Silt, Silt and Sand

Non-cohesive deposits described as silt, sandy silt, and silt and sand were observed in all boreholes except borehole BH203-23. This silt to sandy silt was observed at varying depths within the boreholes and was either interbedded in the sand to silty sand, or a transitionary layer between the sand to silty sand and the surficial peat. These deposits were brown in colour and described as moist to wet at the time of the investigation. Moisture contents in the sandy silt and silt soils ranged from 14% to 23%. SPT N values ranged from 7 to 15 indicating a loose to compact relative density.

A laboratory particle size distribution analysis was completed for three samples of the sandy silt, silt, and sand and silt soil. The analysis results are summarized in Table 2 with details provided in Appendix B.

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**Table 2 Particle Size Distribution Analysis – Sandy Silt, Silt, Silt and Sand**

| Borehole and Sample | Depth (mbgs) | Soil | % Gravel | % Sand | % Silt | % Clay | % Moisture Content |
|---|---|---|---|---|---|---|---|
| BH204-23 SS6 | 4.6 – 5.2 | Sandy Silt some Clay | 0 | 24 | 62 | 14 | 20.3 |
| BH205-23 SS4 | 2.3 – 2.9 | Silt and Sand some Clay | 0 | 38 | 44 | 18 | 16.9 |
| BH206-23 SS7 | 6.1 – 6.7 | Sand and Silt trace Clay trace Gravel | 5 | 45 | 41 | 9 | 19.0 |

## 3.6 Cohesive Deposits

Pockets of cohesive deposit described as clay and silt, silt were observed in BH101-23 and BH104-23 through BH106-23, interbedded in the sand to silty sand soils. In borehole BH204-23, this cohesive silt soil underlying the peat contained trace organic matter and ash. These cohesive deposits were generally grey in colour, with moisture contents ranging from 15% to 27%. SPT N-values measured within the cohesive deposits ranged from 1 to 10 indicating a very soft to firm consistency.

A laboratory particle size distribution analysis was completed for two samples of the cohesive deposits. The analysis results are summarized in Table 3 with details provided in Appendix B.

**Table 3 Particle Size Distribution Analysis – Cohesive Deposits**

| Borehole and Sample | Depth (mbgs) | Soil | % Gravel | % Sand | % Silt | % Clay | % Moisture Content |
|---|---|---|---|---|---|---|---|
| BH201-23 SS6 | 4.6 – 5.2 | Clay and Silt trace Sand trace Gravel | 1 | 6 | 46 | 47 | 26.0 |
| BH206-23 SS3 | 1.5 – 2.1 | Silt some Clay some Sand | 0 | 11 | 75 | 14 | 27.7 |

## 3.7 Groundwater

Short term groundwater was observed in four boreholes upon completion of drilling from depths of approximately 0.6 to 0.9 mbgs.

Monitoring wells were installed in boreholes BH202-23, BH203-23, and BH206-23 and the stabilized groundwater was measured. A monitoring well was also installed in the previous

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geotechnical investigation on site, denoted BH101-22, and the stabilized groundwater was also measured in this well. Groundwater levels are outlined in Table 4. It should be noted that groundwater levels at the site may fluctuate seasonally and in response to climatic events.

**Table 4 Groundwater Level in Monitoring Wells**

| Borehole | Date | Water Level (mbgs) | Groundwater Elevation (masl) |
|---|---|---|---|
| BH202-23 | October 13, 2023<br>March 11, 2024 | 0.95<br>0.67 | 311.63<br>311.91 |
| BH203-23 | October 13, 2023<br>March 11, 2024 | 0.26<br>0.15 | 312.69<br>312.80 |
| BH206-23 | October 13, 2023<br>March 11, 2024 | 0.19<br>-0.14 | 312.38<br>312.71 |
| BH101-22 | October 13, 2023<br>March 11, 2024 | 0.60<br>0.38 | 312.82<br>313.04 |

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# 4.0 Geotechnical Considerations

The following recommendations are based on the borehole information and are intended to assist the client and its designer. Recommendations should not be construed as providing instructions to contractors, who should form their own opinions about site conditions. It is possible that subsurface conditions beyond the borehole locations may vary from those observed. If significant variations are found before or during construction, Cambium should be contacted so that we can reassess our findings, if necessary.

## 4.1 Excavations

It is anticipated that the installation of the proposed trunk sewer pipe will be using trenchless technique. In some cases, if open trench excavations are used, all excavations must be carried out in accordance with the latest edition of the Occupational Health and Safety Act (OHSA). Due to shallow groundwater table, any loose silty sand, sand, sandy silt, silt should be classified as Type 4 soils. Open trenches in such soils below the water table will be unstable and the base of the excavations will be disturbed, therefore the excavation will likely require shoring and dewatering/depressurization using advance well-point dewatering system to lower the groundwater to below the base of the excavations. Shoring should be designed in accordance with the latest Canadian Foundation Engineering Manual and must be reviewed by a qualified geotechnical engineer.

While use of trench boxes is an effective and economical trench-support method, it is not usually intended to shore up or otherwise support trench walls, they are meant to protect workers in case of a cave-in. When using the trench boxes, excavation should be done so that the space between the trench box and the excavation is minimized. Any space between the box and the trench wall needs to be backfilled and compacted. Trench boxes need to be installed expediently.

## 4.2 Dewatering

A Permit to Take Water (PTTW) or registration in the Environmental Activity and Sector Registry (EASR) will likely be required depending on the volume of water displaced from the

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site. Excavation work, particularly any trench excavation, should be carried out in sections to control the daily volume of seepage. The elevation of the groundwater table will vary due to seasonal conditions and in response to heavy precipitation events. In order to minimize predictable water issues and costs, it is recommended that excavation and in-ground construction be performed in drier seasons. It is noted that incident precipitation into an excavation would also need to be handled along with the expected groundwater and included in the dewatering rate.

The detailed dewatering assessment was provided in Cambium's Dewatering and Discharge Plan report submitted under separate cover.

## 4.3 Bedding and Cover

The native subgrade (with inspection and approval) will provide adequate support for pipes with the bedding requirements. The bedding material should consist of OPSS Granular A material, placed in accordance with City Standards. The bedding and cover material shall be placed in maximum 150 mm thick lifts and should be compacted to at least 100% of SPMDD. For wet trench conditions, Clear stone bedding wrapped in filter fabric is required. Clear stone bedding placed directly on subgrade is prohibited. In both cases, particular care must be taken to ensure adequate compaction below the haunches of the new pipe. The cover material shall be a minimum of 300 mm over the top of the pipe and compacted to 100% of SPMDD.

## 4.4 Trench Backfill and Compaction

The non-cohesive soils encountered on site such as sand, silty sand, sand, and silt not containing organics or any other deleterious material, are expected to be suitable as backfill in trenches provided that the actual or adjusted moisture content at the time of construction is within a range that permits compaction to required densities. Some moisture content adjustments may be required depending upon seasonal conditions. Geotechnical inspections and testing are required to confirm acceptable quality.

Some cohesive soils including clayey silt, sandy clayey silt, and silt soils, however, will be difficult to handle and will require the use of heavy compactors for proper compaction, which

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will be difficult to operate within the narrow confines of service trenches and in such conditions, it may be more economical to use imported backfill.

The backfill should be placed in maximum 200 mm thick loose lifts and compacted to a minimum of 98% SPMDD to within 1.0 metre of the final grade. The upper 1.0 metre below the final grade should be compacted to a minimum of 98% SPMDD. In confined areas the layer thickness will have to be reduced to utilize smaller compaction equipment efficiently.

## 4.5 Trenchless Through Known Wetland

### 4.5.1 Geotechnical Conditions

The anticipated subsurface conditions for the proposed 525 mm trunk sewer installed at an invert elevation between 309.5 m and 310.5 m are very loose to compact silty sand, sand, sandy silt, as observed in boreholes along the proposed alignment. The tunneling for the trunk sewer will be located approximately 2 m to 3 m below the prevailing groundwater level. In general, the subsurface soils consisting of sand, silty sand, and sand and silt could yield considerable seepage. Specific excavation requirements must be evaluated in terms of the expected mixed soil and groundwater seepage conditions. Inferred subsurface profiles along the tunneling alignment are presented in Figure 3.

Based on Terzaghi's Classification for Soils in Tunnelling, the very loose to compact silty sand, sand, sandy silt below the groundwater table falls within the "flowing" soil type. The soil lacks sufficient cohesion or cementation, and the behavior is more subjective and can easily run or flow into the excavation.

### 4.5.2 Trenchless Methods

Tunnelling shall be undertaken in accordance with OPSS 415 and any applicable regional standards. Consideration was given to tunnelling methods such as horizontal directional drilling, pipe ramming, jack-and-bore, and microtunnelling. The feasibility of the following methods was evaluated:

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- Horizontal Directional Drilling (HDD) is not recommended in view of size of tunneling and the potential for frac-out to the sensitive environment of the wetland.
- Pipe ramming method is not recommended due to the need for advance dewatering to maintain the stability of the tunnel face.
- Jack-and-bore is not viable option due to its open face nature which will not cope with flowing ground conditions.
- Microtunnelling (MTBM) will be the preferred tunneling methodology subject to equipment availability. MTBM consists of a relatively small diameter tunnelling boring machine advanced at the lead end of the pipe which is steered from the entry shaft to the exit shaft. MTBM is typically capable of balancing the earth and water pressures at the tunnel face and would not require the use of advance dewatering to prevent excessive ground disturbance or settlement of the ground above.

Selection of an appropriate methodology for trenchless installation should be the responsibility of the specialized contractor and will depend upon the relative costs and risks associated with each method. The experience of the contractor is of primary importance. The contractor must submit a detailed work plan, including the proposed methodology for boring, maintenance of alignment, and disposal of cuttings.

All trenchless work should be carried out by a specialized contractor with similar experience. It is recommended that the geotechnical aspects of the contractor's work plan for the proposed undercrossing be reviewed by Cambium, prime consultant and the City. The proposed procedures should include a description of the potential loss of ground, and calculation of the maximum settlement in relation to the Contractor's method and equipment, alternative/remedial measures when review level of measurement is reached, and contingency/remedial measures when alert level of measurement is reached Settlement monitoring of the ground surface at critical locations would need to be carried out prior to, during and subsequent to tunneling to document any effects of installing the undercrossing. In addition, it would be prudent to have the tunneling operations supervised by the geotechnical engineer.

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### 4.5.3 Shaft Structure

It is assumed that 6 metres diameter entrance and exit shafts are proposed to construct the trunk sewer. For the proposed shaft excavations, overburden soils above the ground water table may be cut back to a stable inclination if space restrictions permit. OHSA soil types for open cut excavations are provided in Section 4.1. Where excavations cannot be sloped, or where sloped cuts are not economical, the excavations may be supported through a completely shored excavation. An experienced shoring engineer must be retained to design the shoring system prior to commencement of construction. The shoring system should be designed in accordance with OPSS 539 and Canadian Foundation Engineering Manual (4th edition). Soil parameters for use in the shoring design are provided in Table 5. Appropriate surcharge such as a uniform loading of minimum 12 kPa should also be considered in the design.

**Table 5 Soil Parameters for Shoring Design**

| Soil | Bulk Unit Weight γ (kN/m3) | Internal Friction Angle Φ' (°) | Active earth pressure coefficient Ka (Rankine) | Passive earth pressure coefficient Kp (Rankine) | At-rest earth pressure coefficient Ko (Rankine) |
|---|---|---|---|---|---|
| Peat / Loose Fill | 16.0 | 24 | 0.42 | 2.37 | 0.59 |
| Loose to Compact Sand, Silty Sand, Sandy Silt. Silt | 19.0 | 26 | 0.39 | 2.56 | 0.56 |

Basal instability can occur when a high hydraulic gradient is created as a result of water flowing into the excavation through the base of the excavation. In consideration of existing pore pressure heads, basal instability of the shaft excavations must be considered, and depressurization of the underlying materials may be required. The subsoils are loose to compact such that poses certain risk, also it may contain pressurized layers that may cause localized instability and heave of the base, and related construction problems. In general, the porewater pressure at the top of the pervious layer should not exceed 70% of the total vertical stress at the top of the pervious layer. If this condition cannot be satisfied, then a greater penetration depth of shoring (sheet pile or caisson wall) and dewatering at greater depth will

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be required. The lower layers of the soil may be difficult to dewater due to low hydraulic conductivity nature, therefore, eductor (or ejector) well system may be required in the shaft areas to reduce pressure head to the base level of the excavation or to a minimum level to preclude basal heave.

## 4.6 Site Preparation for Potential New Road

Whether a new road will be built on top of the trunk sewer is under discussion. Based on the current design, a grade raise up to 2.5 m in wetland area may be anticipated.

Topsoil or organic material (i.e. peat, organic silt, or other soils with organic matter) should be removed completely regardless of depth. The subgrade should be proof rolled with heavy roller and identified with the unacceptable deformed areas. The identified areas should be repaired by additional sub-excavation and placement of acceptable granular material. Consideration may be given to stabilizing the poor subgrade by placing a non-woven geotextile (Terrafix 270R or equivalent) and a biaxial geogrid (Terrafix TBX2000 or equivalent) at the pavement subgrade (bottom of the subbase). The geotextile should be placed below the geogrid to avoid interfering with confinement of the subbase material. During subgrade preparation, care must be taken not to unnecessarily disturb the layer below the designed pavement subgrade, as the geogrid and relatively thick base course / stabilization layer are intended to account for marginal subgrade conditions. Also, it is recommended that a geotechnical engineer evaluate the pavement subgrade during construction to ensure the proper preparation of subgrade and installation of geogrid. The geogrid should be extended minimum 500 mm beyond edge of granular base on both sided of roadway. A minimum overlap of 300 mm is recommended for adjacent geogrids. Geogrids are recommended to be installed in accordance with the manufacturer guidelines.

An alternative option is to retain a specialized contractor to utilize various techniques to improve the existing soil. One of the typical methods, Controlled Modulus Columns (CMC), this improvement option involves boring columns to competent soil and backfilling with either pumped grout or concrete. The installed CMC elements are overlain with a

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structural/engineered fill pad (typically 150 – 300 mm thick compacted granular material) prior to construction of the road bases.

## 4.7 Design Review and Inspections

Cambium should be provided the opportunity to review the design drawings, prior to next stage of tendering and construction, to ensure that all pertinent geotechnical-related factors have been addressed.

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## 5.0 Closing

Please note that this report is governed by the attached qualifications and limitations. If you have questions or comments regarding this document, please do not hesitate to contact the undersigned.

**Cambium Inc.**

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# 6.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

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# Appended Figures

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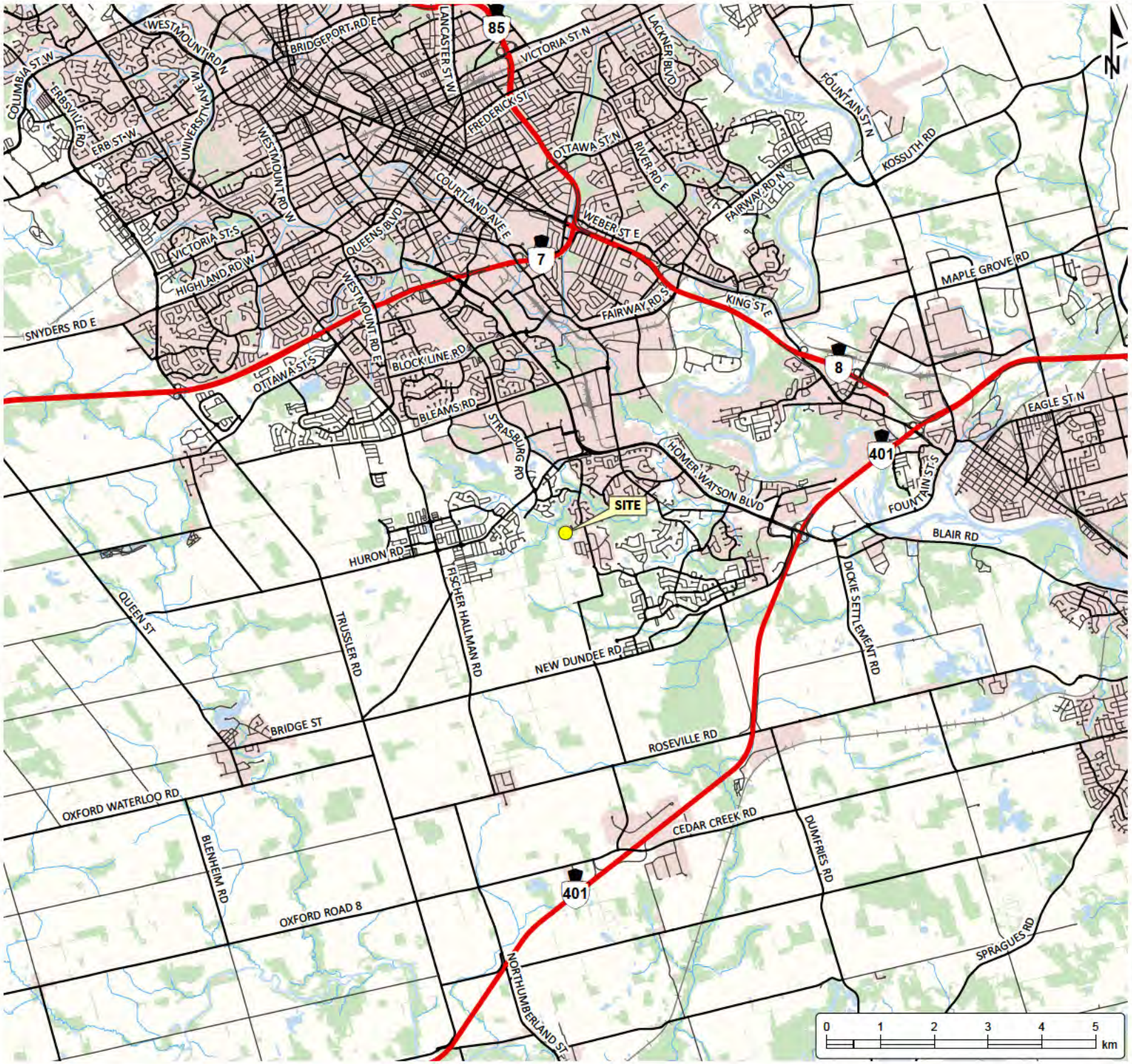


# GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

**LEGEND**

- Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- First Nations Reserve
- Provincial Park
- Water Area
- Wooded Area
- Built Up Area

**Notes:**
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- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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## SITE LOCATION PLAN

| | | | |
|---|---|---|---|
| Project No.: 11969-002 | | Date: December 2023 | Rev.: |
| Scale: 1:100,000 | | Projection: NAD 1983 UTM Zone 17N | |
| Created by: MAT | Checked by: ZL | Figure: 1 | |

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# GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

**LEGEND**

- Benchmark
- Borehole
- Monitoring Well
- Contours (5m Interval)
- Provincially Significant Wetlands
- Section Profile

**Notes:**
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- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

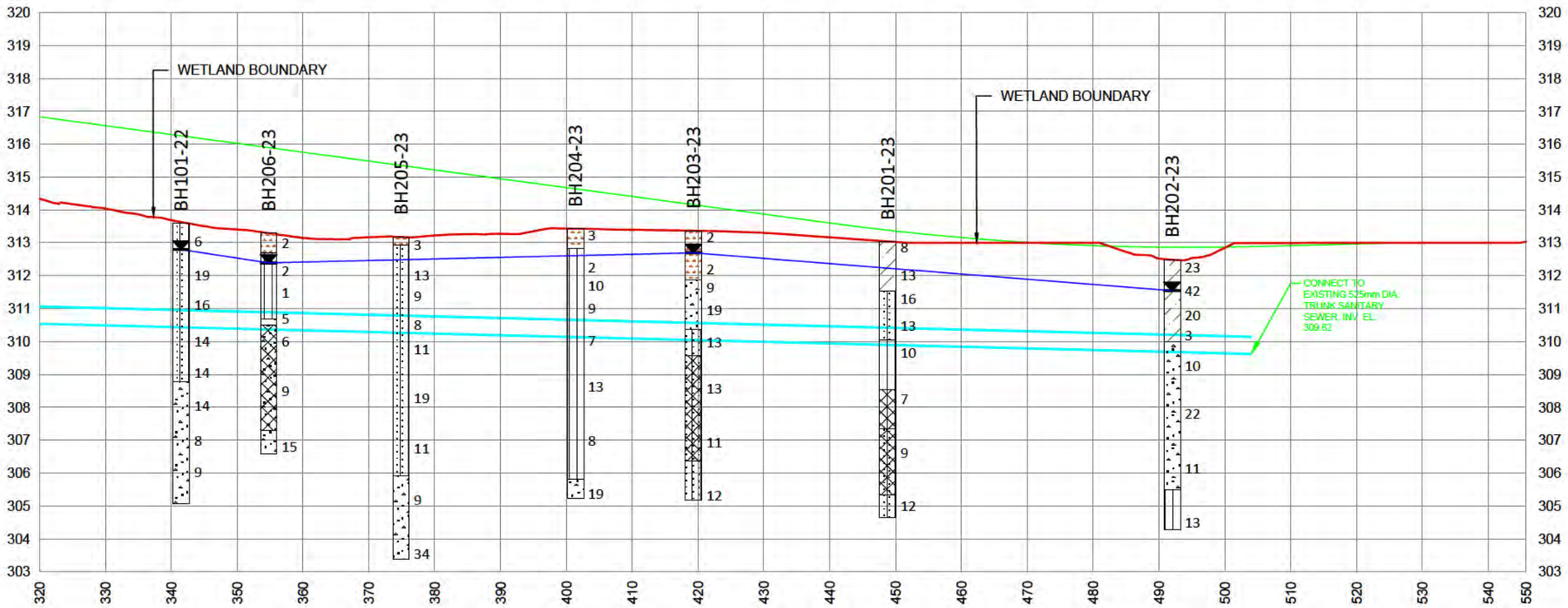
CAMBIUM
194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: (705) 742.7900 Fax: (705) 742.7907
www.cambium-inc.com

## BOREHOLE LOCATION PLAN

| | | | |
|---|---|---|---|
| Project No.: 11969-002 | | Date: December 2023 | |
| | | Rev.: | |
| Scale: 1:1,500 | | Projection: NAD 1983 UTM Zone 17N | |
| Created by: MAT | Checked by: ZL | Figure: 2 | |

O:\G\SM\X\d\11900-11999\11969-002 BT Eng (London) - Geo & Hydro - Kitchener\2023-12-14 Geotechnical Investigation.aprx

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

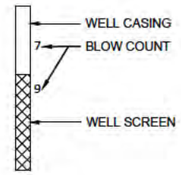



# GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

LEGEND

- WATER LEVEL INDICATOR
- FILL
- PEAT
- SILT
- SILTY SAND
- SAND
- WATER LEVEL
- GROUND SURFACE
- PROPOSED SURFACE GRADING
- PROPOSED SEWER




Notes:
1. Survey completed by Cambium Inc. December 6, 2023
2. Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.

194 Sophia Street
Peterborough, Ontario, K9H 1E5
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www.cambium-inc.com

## PROFILE CROSS SECTION

| Project No.: | Date: December 2023 |
|---|---|
| 11969-002 | Rev.: |
| Horizontal Scale: N/A | Vertical Scale: N/A |
| Drawn By: MAT | Checked By: ZL |
| Figure: 3 | |

P:\11900 to 11999\11969-002 BT Eng (London) - Geo & Hydro\5 - Kitchener\Graphics\Drawings\CAD\2023-12-14 Cross Section Profile.dwg

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6



# Appendix A
# Borehole Logs

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.8 mASL
**UTM:** 17T **N:** 4803760 **E:** 543814

**Log of Borehole:** BH201-23
Page: 1 of 2
**Date Completed** September 29, 2023

| Elevation (m) / Depth | Lithology | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.) — 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.8 / 0 | | **FILL:** (SP) SAND, some gravel; brown (FILL); non-cohesive, moist, loose | | 1 | SS | 50 | 8 | 4.9% | 8 | | |
| 312.3 / 0.5 | | | | | | | | | | | |
| 311.8 / 1 | | | | 2 | SS | 0 | 13 | | 13 | | Borehole caved to ~0.9 mbgs upon completion of drilling |
| | | | 311.35 / 1.45 | | | | | | | | |
| 311.3 / 1.5 | | **(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact | | 3 | SS | 100 | 16 | 14.2% | 16 | | Borehole caved multiple times at ~1.5 mbgs during drilling. |
| 310.8 / 2 | | | | | | | | | | | |
| 310.3 / 2.5 | | | | 4 | SS | 75 | 13 | 16.9% | 13 | | Groundwater level first encountered at ~2.3 mbgs during drilling |
| | | | 309.83 / 2.97 | | | | | | | | |
| 309.8 / 3 | | **(ML) sandy SILT:** (ML) Sandy SILT, trace clay; brown; non-cohesive, wet, compact | | 5 | SS | 75 | 10 | 20.5% | 10 | | |
| | | | 309.29 / 3.51 | | | | | | | | |
| 309.3 / 3.5 | | **(ML) SILT:** (CL/ML) CLAY and SILT, trace sand, trace gravel; grey; cohesive, W~PL, stiff to firm | | | | | | | | | |
| 308.8 / 4 | | | | | | | | | | | |
| 308.3 / 4.5 | | Cobbles removed during augering | | 6 | SS | 10 | 7 | 26.0% | 7 | | |
| 307.8 / 5 | | | | | | | | | | | |
| 307.3 / 5.5 | | | 307.16 / 5.64 | | | | | | | | |
| 306.8 / 6 | | **(SM) SILTY SAND:** (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact | | 7 | SS | 50 | 9 | 15.5% | 9 | | |
| 306.3 / 6.5 | | Cobbles removed during augering | | | | | | | | | |
| 305.8 / 7 | | | | | | | | | | | |
| 305.3 | | | 305.3 / 7.5 | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 1 | 6 | 46 | 47 |

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.8 mASL
**UTM:** 17T **N:** 4803760 **E:** 543814

**Log of Borehole:** BH201-23
Page: 2 of 2
**Date Completed:** September 29, 2023

| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 305.3 — 7.5 | | | | | | | | | | |
| 304.8 — 8 | | **(SM) SILTY SAND:** (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact — 304.57 | 8 | SS | 0 | 12 | 16.9% | 12 | | |
| 304.3 — 8.5 | | Borehole terminated @ 8.2 mbgs due to target depth achieved. — 8.23 | | | | | | | | |
| 303.8 — 9 | | | | | | | | | | |
| 303.3 — 9.5 | | | | | | | | | | |
| 302.8 — 10 | | | | | | | | | | |
| 302.3 — 10.5 | | | | | | | | | | |
| 301.8 — 11 | | | | | | | | | | |
| 301.3 — 11.5 | | | | | | | | | | |
| 300.8 — 12 | | | | | | | | | | |
| 300.3 — 12.5 | | | | | | | | | | |
| 299.8 — 13 | | | | | | | | | | |
| 299.3 — 13.5 | | | | | | | | | | |
| 298.8 — 14 | | | | | | | | | | |
| 298.3 — 14.5 | | | | | | | | | | |
| 297.8 | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 1 | 6 | 46 | 47 |

1m = 24 units

**Logged By:** EC **Input By:** EC

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Tricone
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803766 **E:** 543859

**Log of Borehole:** BH202-23
Page: 1 of 2
**Date Completed:** August 1, 2023

| Elevation (m) | Depth | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.6 | 0 | **ASPHALT:** ~70 mm thick | 312.52 / 0.08 | 1 | SS | 45 | 25 | 4.9% | 25 | Cap | |
| 312.1 | 0.5 | **FILL:** (SP/GP) SAND and GRAVEL; brown (Granular Fill); non-cohesive, moist, compact to very loose | | 2 | SS | 90 | 42 | 5.4% | 42 | Bentonite Plug | Groundwater level measured in monitoring well at a depth of ~0.95 mbgs on October 13, 2023 |
| 311.6 | 1 | | | | | | | | | | |
| 311.1 | 1.5 | | | 3 | SS | 45 | 20 | 6.8% | 20 | | |
| 310.6 | 2 | | | | | | | | | | |
| 310.1 | 2.5 | **(SM) SILTY SAND:** (SM) SILTY SAND; light brown; non-cohesive, wet, very loose | 310.16 / 2.44 | 4 | SS | 90 | 3 | 34.5% | 3 | Riser | Groundwater level first encountered at a depth of ~2.3 mbgs during drilling |
| 309.6 | 3 | **(SW) SAND:** (SP) SAND, trace to some silt, trace clay, none to trace gravel/cobble; brown to light brown; non-cohesive, wet, loose to compact | 309.7 / 2.9 | 5 | SS | 35 | 10 | 18.9% | 10 | | |
| 309.1 | 3.5 | | | | | | | | | | |
| 308.6 | 4 | | | | | | | | | | |
| 308.1 | 4.5 | | | 6 | SS | 65 | 22 | 15.4% | 22 | Sand Pack | |
| 307.6 | 5 | | | | | | | | | | |
| 307.1 | 5.5 | | | | | | | | | | |
| 306.6 | 6 | | | | | | | | | | |
| 306.1 | 6.5 | | | 7 | SS | 100 | 11 | 16.8% | 11 | PVC Screen | |
| 305.6 | 7 | | 305.51 | | | | | | | | |
| 305.1 | | **(ML) SILT:** (ML) SILT, some sand; brown; non-cohesive, wet, compact | 7.09 / 305.1 / 7.5 | | | | | | | | |

| GRAINSIZE DISTRIBUTION | SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|---|
| | SS 5 | 0 | 80 | 17 | 3 |

1m = 24 units

**Logged By:** SN **Input By:** EC

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Tricone
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803766 **E:** 543859

**Log of Borehole:** BH202-23
Page: 2 of 2
**Date Completed:** August 1, 2023

| Elevation (m) | Depth | Lithology | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa nat V. rem V. 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 305.1 | 7.5 | | **(ML) SILT:** (ML) SILT, some sand; brown; non-cohesive, wet, compact | 304.52 | 8 | SS | 100 | 13 | 23.8% | 13 | Sand Pack, PVC Screen | |
| 304.6 | 8 | | Borehole terminated @ 8.1 mbgs due to target depth achieved. | 8.08 | | | | | | | | |
| 304.1 | 8.5 | | | | | | | | | | | |
| 303.6 | 9 | | | | | | | | | | | |
| 303.1 | 9.5 | | | | | | | | | | | |
| 302.6 | 10 | | | | | | | | | | | |
| 302.1 | 10.5 | | | | | | | | | | | |
| 301.6 | 11 | | | | | | | | | | | |
| 301.1 | 11.5 | | | | | | | | | | | |
| 300.6 | 12 | | | | | | | | | | | |
| 300.1 | 12.5 | | | | | | | | | | | |
| 299.6 | 13 | | | | | | | | | | | |
| 299.1 | 13.5 | | | | | | | | | | | |
| 298.6 | 14 | | | | | | | | | | | |
| 298.1 | 14.5 | | | | | | | | | | | |
| 297.6 | | | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 5 | 0 | 80 | 17 | 3 |

1m = 24 units

**Logged By:** SN **Input By:** EC

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 313 mASL
**UTM:** 17T **N:** 4803744 **E:** 543791

**Log of Borehole:** BH203-23
Page: 1 of 2
**Date Completed** September 29, 2023

| Elevation (m) | Depth | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 313 | 0 | **(PT) PEAT:** PEAT, none to trace sand; black; non-cohesive, moist, very loose | | 1 | SS | 5 | 2 | 31.8% | 2 | Cap | Groundwater level measured in monitoring well at a depth of ~0.26 mbgs on October 13, 2023 |
| 312.5 | 0.5 | | | | | | | | | | |
| 312 | 1 | | | 2 | SS | 40 | 2 | 33% | 2 | | Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling |
| 311.5 | 1.5 | | 311.55 / 1.45 | | | | | | | Bentonite Plug | |
| | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet, loose to compact | | 3 | SS | 60 | 9 | 16.9% | 9 | Riser | |
| 311 | 2 | | | | | | | | | | Borehole caved to a depth of ~2.1 mbgs upon completion of drilling |
| 310.5 | 2.5 | | | 4 | SS | 60 | 19 | 14.6% | 19 | | |
| 310 | 3 | | 310.03 / 2.97 | | | | | | | | Groundwater first encountered at a depth of ~3.0 mbgs during drilling |
| | | **(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact | | 5 | SS | 50 | 13 | 15.2% | 13 | | |
| 309.5 | 3.5 | | | | | | | | | | |
| 309 | 4 | | | | | | | | | | |
| 308.5 | 4.5 | | | 6 | SS | 60 | 13 | 16.9% | 13 | Sand Pack | |
| 308 | 5 | | | | | | | | | | |
| 307.5 | 5.5 | | | | | | | | | PVC Screen | |
| 307 | 6 | | | | | | | | | | |
| 306.5 | 6.5 | | | 7 | SS | 50 | 11 | 17.7% | 11 | | |
| 306 | 7 | | | | | | | | | | |
| 305.5 | | | 305.5 / 7.5 | | | | | | | Cap | |

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 313 mASL
**UTM:** 17T **N:** 4803744 **E:** 543791

**Log of Borehole:** BH203-23
Page: 2 of 2
**Date Completed** September 29, 2023

| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.) — 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 305.5 / 7.5 | | | | | | | | | | |
| 305 / 8 | | **(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact — 304.77 | 8 | SS | 60 | 12 | 15.6% | 12 | | |
| | | Borehole terminated @ 8.2 mbgs due to target depth achieved. — 8.23 | | | | | | | | |
| 304.5 / 8.5 | | | | | | | | | | |
| 304 / 9 | | | | | | | | | | |
| 303.5 / 9.5 | | | | | | | | | | |
| 303 / 10 | | | | | | | | | | |
| 302.5 / 10.5 | | | | | | | | | | |
| 302 / 11 | | | | | | | | | | |
| 301.5 / 11.5 | | | | | | | | | | |
| 301 / 12 | | | | | | | | | | |
| 300.5 / 12.5 | | | | | | | | | | |
| 300 / 13 | | | | | | | | | | |
| 299.5 / 13.5 | | | | | | | | | | |
| 299 / 14 | | | | | | | | | | |
| 298.5 / 14.5 | | | | | | | | | | |
| 298 | | | | | | | | | | |

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803730 **E:** 543781

**Log of Borehole:** BH204-23
Page: 1 of 2
**Date Completed** September 28, 2023

| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V. / rem V.) — SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 312.6 / 0 | | **(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose — 311.91 / 0.69 | 1 | SS | 5 | 3 | 21% | 3 | | Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling |
| 312.1 / 0.5 | | **(ML) SILT:** (ML) SILT and ASH; white to light grey, trace organic matter; cohesive, W~PL, very soft — 311.58 / 1.02 | 2 | SS | 60 | 2 | 50.4% | 2 | | |
| 311.6 / 1 | | **(SW) SAND:** (SP) SAND, trace silt; grey; non-cohesive, wet, very loose — 311.15 / 1.45 | | | | | | | | |
| 311.1 / 1.5 | | **(SM) SILTY SAND:** (SM) SILTY SAND; brown, trace organics, oxidation stains; non-cohesive, moist, stiff — 310.39 / 2.21 | 3 | SS | 65 | 10 | 17.6% | 10 | | |
| 310.6 / 2 | | **(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey; cohesive, W<PL, stiff — 309.86 / 2.74 | 4 | SS | 75 | 9 | 17.6% | 9 | | |
| 310.1 / 2.5 | | **(ML) sandy SILT:** (ML) Sandy SILT, some clay; brown; non-cohesive, wet, loose | 5 | SS | 75 | 7 | 19.8% | 7 | | Groundwater first encountered at a depth of ~3.0 mbgs during drilling |
| 309.6 / 3 | | | | | | | | | | |
| 309.1 / 3.5 | | | | | | | | | | |
| 308.6 / 4 | | | | | | | | | | |
| 308.1 / 4.5 | | | 6 | SS | 60 | 13 | 20.3% | 13 | | Borehole caved to a depth of ~4.6 mbgs upon completion of drilling |
| 307.6 / 5 | | | | | | | | | | |
| 307.1 / 5.5 | | | | | | | | | | |
| 306.6 / 6 | | | | | | | | | | |
| 306.1 / 6.5 | | | 7 | SS | 50 | 8 | 14.5% | 8 | | |
| 305.6 / 7 | | 305.44 | | | | | | | | |
| 305.1 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact — 305.1 / 7.5 | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 0 | 24 | 62 | 14 |

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803730 **E:** 543781

**Log of Borehole:** BH204-23
Page: 2 of 2
**Date Completed** September 28, 2023

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
| 305.1 / 7.5 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact — 304.37 | 8 | SS | 25 | 19 | 15.3% | 19 | | |
| 304.6 / 8 | | | | | | | | | | |
| | | Borehole terminated @ 8.2 mbgs due to target depth achieved. — 8.23 | | | | | | | | |
| 304.1 / 8.5 | | | | | | | | | | |
| 303.6 / 9 | | | | | | | | | | |
| 303.1 / 9.5 | | | | | | | | | | |
| 302.6 / 10 | | | | | | | | | | |
| 302.1 / 10.5 | | | | | | | | | | |
| 301.6 / 11 | | | | | | | | | | |
| 301.1 / 11.5 | | | | | | | | | | |
| 300.6 / 12 | | | | | | | | | | |
| 300.1 / 12.5 | | | | | | | | | | |
| 299.6 / 13 | | | | | | | | | | |
| 299.1 / 13.5 | | | | | | | | | | |
| 298.6 / 14 | | | | | | | | | | |
| 298.1 / 14.5 | | | | | | | | | | |
| 297.6 | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 0 | 24 | 62 | 14 |

1m = 24 units

**Logged By:** EC **Input By:** EC

DocuSign Envelope ID: 2B32C20A-ACBC-41DA-AB02-984A7D6D0DC6

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.7 mASL
**UTM:** 17T **N:** 4803712 **E:** 543759

**Log of Borehole:** BH205-23
Page: 1 of 2
**Date Completed** September 28, 2023

| Elevation (m) / Depth | Lithology | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.7 — 0 | | **(PT) PEAT:** PEAT; black; non-cohesive, moist, loose | 312.4 / 0.3 | 1 | SS | 10 | 3 | 77.8% | 3 | | |
| 312.2 — 0.5 | | **(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey to dark grey, some organic matter; cohesive, W<PL, very soft | 312.01 / 0.69 | | | | | | | | |
| 311.7 — 1 | | **(SM) SILTY SAND:** (SM) SILTY SAND, trace clay, trace gravel; brown; non-cohesive, wet compact to loose | | 2 | SS | 70 | 13 | 14.5% | 13 | | Groundwater level at ~0.9 mbgs upon completion of drilling |
| 311.2 — 1.5 | | | 310.92 / 1.78 | 3 | SS | 50 | 9 | 13.4% | 9 | | |
| 310.7 — 2 | | **(ML) SILT:** (ML/SP) SILT and SAND, some clay; brown to light brown; non-cohesive, moist, stiff | | | | | | | | | Borehole caved to ~2.1 mbgs upon completion of drilling |
| 310.2 — 2.5 | | | | 4 | SS | 60 | 8 | 16.9% | 8 | | |
| 309.7 — 3 | | **(SM) SILTY SAND:** (SM) SILTY SAND, trace to some clay; light brown to brown; non-cohesive, wet, compact | 309.73 / 2.97 | 5 | SS | 85 | 11 | 17.9% | 11 | | Groundwater first encountered at a depth of ~3.0 mbgs during drilling |
| 309.2 — 3.5 | | | | | | | | | | | |
| 308.7 — 4 | | | | | | | | | | | |
| 308.2 — 4.5 | | | | 6 | SS | 50 | 19 | 19.5% | 19 | | |
| 307.7 — 5 | | | | | | | | | | | |
| 307.2 — 5.5 | | | | | | | | | | | |
| 306.7 — 6 | | | | 7 | SS | 50 | 11 | 21% | 11 | | |
| 306.2 — 6.5 | | | | | | | | | | | |
| 305.7 — 7 | | | 305.54 / 7.16 | | | | | | | | |
| 305.2 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense | 305.2 / 7.5 | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 4 | 0 | 38 | 44 | 18 |

1m = 24 units

**Logged By:** EC **Input By:** EC

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**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.7 mASL
**UTM:** 17T **N:** 4803712 **E:** 543759

**Log of Borehole:** BH205-23
Page: 2 of 2
**Date Completed:** September 28, 2023

| Elevation (m) | Depth | Lithology | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 305.2 | 7.5 | | | | | | | | | | | |
| 304.7 | 8 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense | | 8 | SS | 50 | 9 | 14.6% | 9 | | |
| 304.2 | 8.5 | | | | | | | | | | | |
| 303.7 | 9 | | | | | | | | | | | |
| 303.2 | 9.5 | | | 302.95 | 9 | SS | 0 | 34 | 14.8% | 34 | | Second spoon completed in this sample depth due to low recovery |
| 302.7 | 10 | | Borehole terminated @ 9.8 mbgs due to target depth achieved. | 9.75 | | | | | | | | |
| 302.2 | 10.5 | | | | | | | | | | | |
| 301.7 | 11 | | | | | | | | | | | |
| 301.2 | 11.5 | | | | | | | | | | | |
| 300.7 | 12 | | | | | | | | | | | |
| 300.2 | 12.5 | | | | | | | | | | | |
| 299.7 | 13 | | | | | | | | | | | |
| 299.2 | 13.5 | | | | | | | | | | | |
| 298.7 | 14 | | | | | | | | | | | |
| 298.2 | 14.5 | | | | | | | | | | | |
| 297.7 | | | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 4 | 0 | 38 | 44 | 18 |

1m = 24 units

**Logged By:** EC **Input By:** EC

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CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803696 **E:** 543750

**Log of Borehole:** BH206-23
Page: 1 of 1
**Date Completed** September 30, 2023

| Elevation (m) | Depth | Lithology | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa nat V. rem V. — 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.6 | 0 | | **(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose | 311.99 | 1 | SS | 5 | 2 | 65% | 2 | Cap | Groundwater level measured in monitoring well at a depth of ~0.19 mbgs on October 13, 2023 |
| 312.1 | 0.5 | | | | | | | | | | | |
| 311.6 | 1 | | **(ML) SILT:** (ML) SILT, some clay, some sand; dark grey to grey, trace to no organics; cohesive, W~PL to W>PL, very soft to firm | 0.61 | 2 | SS | 10 | 2 | 18.9% | 2 | Bentonite Plug | Groundwater level at a depth of ~0.6 mbgs upon completion of drilling |
| 311.1 | 1.5 | | | | | | | | | | Riser | |
| 310.6 | 2 | | | | 3 | SS | 20 | 1 | 27.7% | 1 | | |
| 310.1 | 2.5 | | | 309.91 | 4 | SS | 50 | 5 | 15.8% | 5 | | Groundwater level at a depth of ~2.3 mbgs during drilling |
| 309.6 | 3 | | **(SM) SILTY SAND:** (SM) SILTY SAND, some clay; brown; non-cohesive, wet, loose | 2.69 / 309.63 | | | | | | | | Borehole caved to a depth of ~3.0 mbgs upon completion of drilling |
| 309.1 | 3.5 | | **(SW) SAND:** (SP) SAND, some clay; brown; non-cohesive, very saturated, loose | 2.97 | 5 | SS | 20 | 6 | 12% | 6 | | |
| 308.6 | 4 | | | | | | | | | | Sand Pack | |
| 308.1 | 4.5 | | | | | | | | | | PVC Screen | |
| 307.6 | 5 | | | | 6 | SS | 0 | 9 | 18.1% | 9 | | |
| 307.1 | 5.5 | | | 306.96 | | | | | | | | |
| 306.6 | 6 | | **(SW) SAND:** (SP/ML) SAND and SILT, trace clay, trace gravel; brown; non-cohesive, wet, compact | 5.64 | | | | | | | | |
| 306.1 | 6.5 | | | 305.89 | 7 | SS | 50 | 15 | 19% | 15 | | |
| 305.6 | 7 | | Borehole terminated @ 6.7 mbgs due to target depth achieved. | 6.71 | | | | | | | Cap | |
| 305.1 | | | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 7 | 5 | 45 | 41 | 9 |
| SS3 | 0 | 11 | 75 | 14 |

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

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Barrie
Oshawa
Kingston
T: 866-217-7900
www.cambium-inc.com

# Log of Borehole: BH101-22



| | | | | | |
|---|---|---|---|---|---|
| **Client:** | BT Engineering, London | **Project Name:** | Geotechnical Investigation | **Project No.:** | 11969-001 |
| **Contractor:** | Drilltech | **Method:** | Solid Stem Auger | **Date Completed:** | January 20, 2022 |
| **Location:** | Biehn Drive Extension | **UTM:** | 17T 543732 E, 4803683 N | **Elevation:** | 313.42 mASL |

| Elevation (m) / Depth | Lithology | Description | Number | Type | % Recovery | SPT (N) / DCPT | % Moisture (25 50 75) | SPT (N) / DCPT (10 20 30 40) | Well Installation | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 314 / -1 | | | | | | | | | | |
| 313 / 0 | | TOPSOIL: Dark brown silt topsoil, some organics, moist, loose | 1A | SS | | | | | Cap | |
| | | | 1B | SS | 50 | 6 | | | Monument | |
| | | SILTY SAND: Brown silty sand, moist, loose | | | | | | | Water level at 0.41 mbgs on on Feb 04, 2022 | |
| 312 / 1 | | SAND: Brown sand, some silt, trace gravel, wet, compact | 2 | SS | 65 | 19 | | | | |
| 311 / 2 | | SILTY SAND: Brown silty sand, some gravel, trace clay, APL, stiff | 3 | SS | 35 | 16 | | | PVC Riser | |
| | | | | | | | | | Bentonite Plug | GSA SS3: 19% Gravel 52% Sand 26% Silt 3% Clay |
| | | | 4 | SS | 50 | 14 | | | | |
| 310 / 3 | | | 5 | SS | 80 | 14 | | | | |
| 309 / 4 | | | | | | | | | | |
| | | SAND: Reddish brown sand, moist, compact | 6 | SS | 100 | 14 | | | | |
| 308 / 5 | | | | | | | | | | |
| 307 / 6 | | -Wet, loose | 7 | SS | 80 | 8 | | | Sand Pack | |
| | | | | | | | | | PVC Screen | |
| 306 / 7 | | | | | | | | | | |
| | | | 8 | SS | 50 | 9 | | | Cap | Water level at 2.1 mbgs upon completion |
| 305 / 8 | | Borehole terminated at 8.2 mbgs in SAND | | | | | | | | |

**Logged By:** TA **Input By:** KL

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# Appendix B
# Physical Laboratory Results

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# Grain Size Distribution Chart

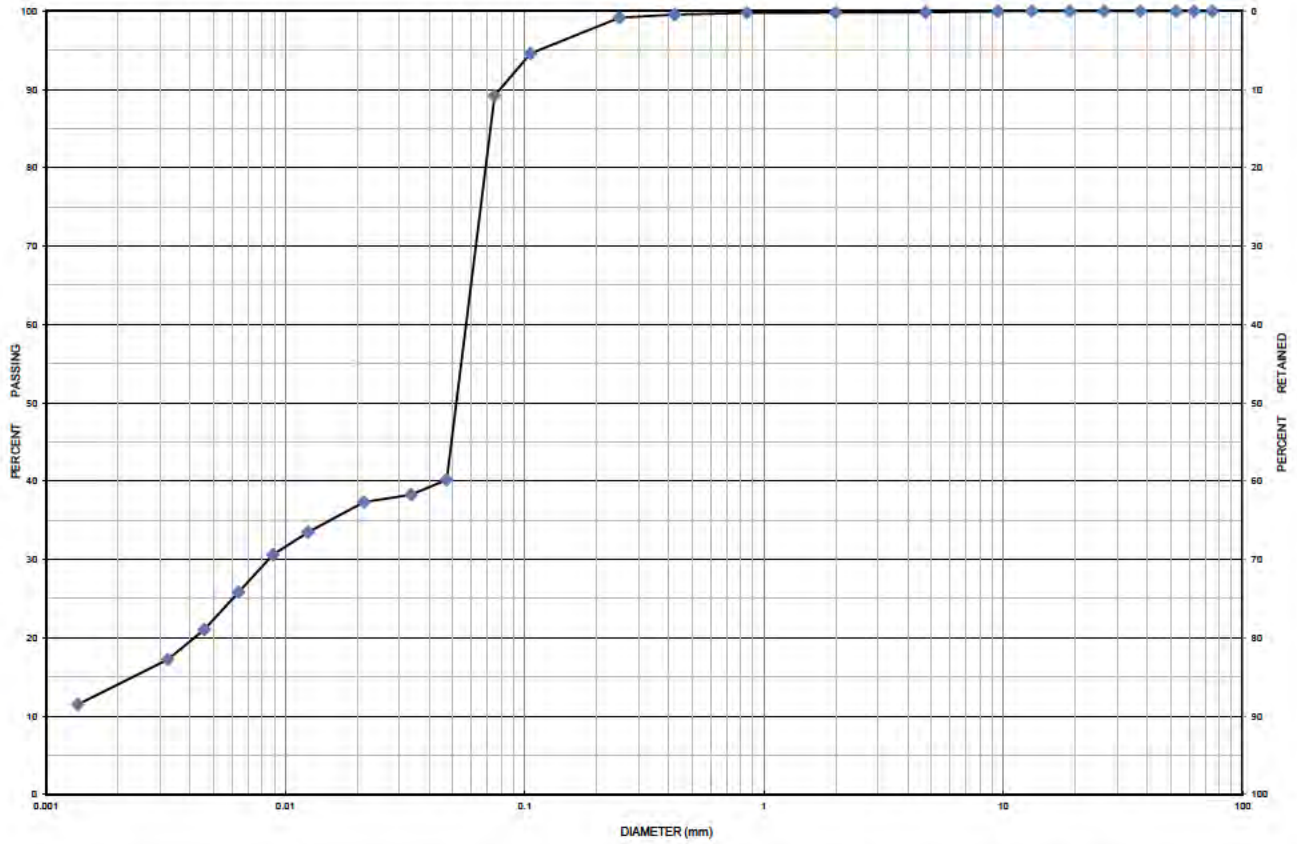
**Project Number:** *11969-002* **Client:** *BT Engineering (London)*

**Project Name:** *Biehn Dr Trunk Sewer, Kitchener*

**Sample Date:** *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

**Location:** *BH 206-23 SS 3* **Depth:** *1.5 m to 2.1 m* **Lab Sample No:** *S-23-1719*

| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |
|---|---|---|---|---|---|
| CLAY & SILT (<0.075 mm) | SAND (<4.75 mm to 0.075 mm) | | | GRAVEL (>4.75 mm) | |
| | FINE | MEDIUM | COARSE | FINE | COARSE |




| MIT SOIL CLASSIFICATION SYSTEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CLAY | SILT | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | BOULDERS |
| | | SAND | | | GRAVEL | | | |

| Borehole No. | Sample No. | Depth | Gravel | Sand | Silt | Clay | Moisture |
|---|---|---|---|---|---|---|---|
| BH 206-23 | SS 3 | 1.5 m to 2.1 m | 0 | 11 | 75 | 14 | 27.7 |

| Description | Classification | $D_{60}$ | $D_{30}$ | $D_{10}$ | $C_u$ | $C_c$ |
|---|---|---|---|---|---|---|
| Silt some Clay and Sand | ML | 0.0570 | 0.0086 | - | - | - |

Additional information available upon request

*Issued By:* _____ *Date Issued:* *October 31, 2023*

(Senior Project Manager)

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# Grain Size Distribution Chart

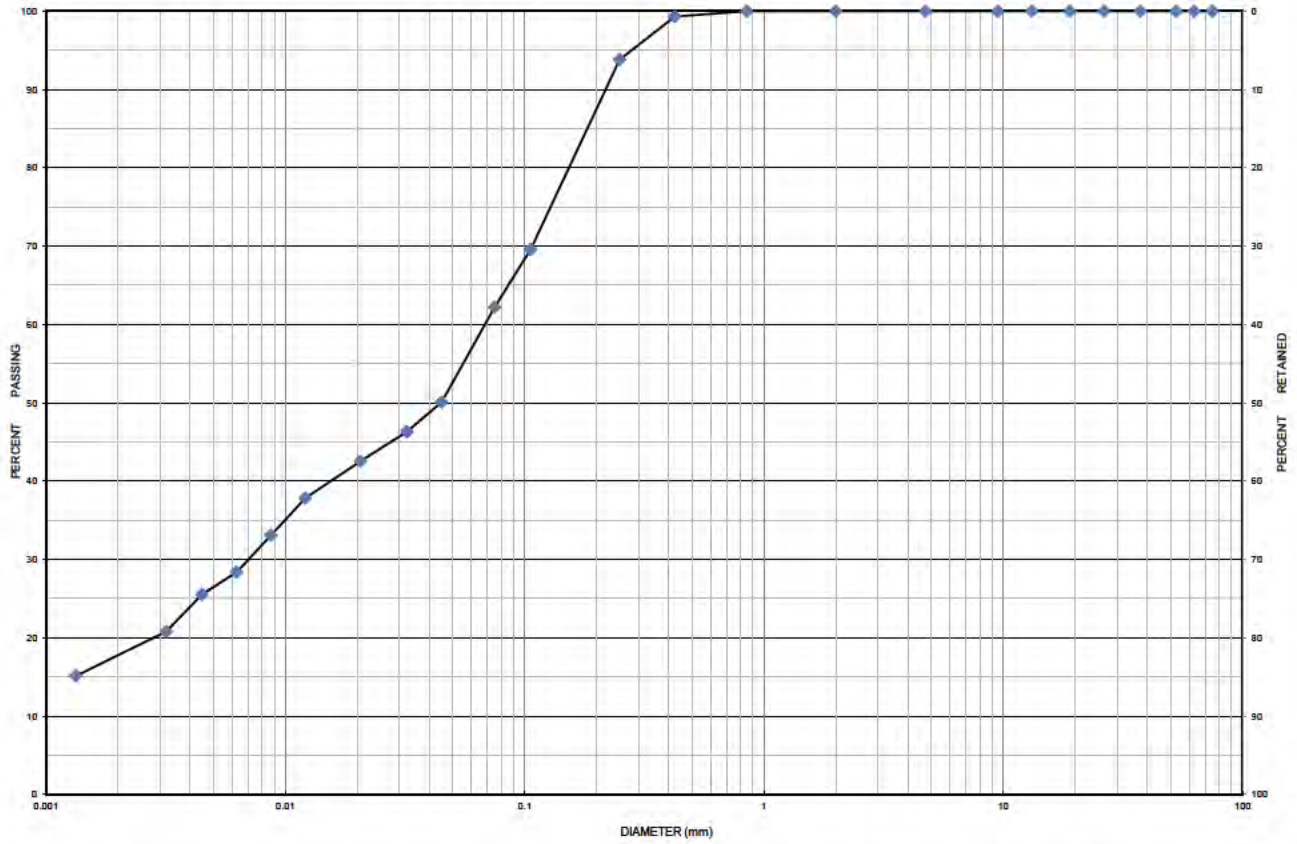
**Project Number:** *11969-002* **Client:** *BT Engineering (London)*

**Project Name:** *Biehn Dr Trunk Sewer, Kitchener*

**Sample Date:** *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

**Location:** *BH 205-23 SS 4* **Depth:** *2.3 m to 2.9 m* **Lab Sample No:** *S-23-1720*

| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |
|---|---|---|---|---|---|
| CLAY & SILT (<0.075 mm) | SAND (<4.75 mm to 0.075 mm) | | | GRAVEL (>4.75 mm) | |
| | FINE | MEDIUM | COARSE | FINE | COARSE |




| MIT SOIL CLASSIFICATION SYSTEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CLAY | SILT | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | BOULDERS |
| | | SAND | | | GRAVEL | | | |

| Borehole No. | Sample No. | Depth | Gravel | Sand | Silt | Clay | Moisture |
|---|---|---|---|---|---|---|---|
| BH 205-23 | SS 4 | 2.3 m to 2.9 m | 0 | 38 | 44 | 18 | 16.9 |

| Description | Classification | $D_{60}$ | $D_{30}$ | $D_{10}$ | $C_u$ | $C_c$ |
|---|---|---|---|---|---|---|
| Silt and Sand some Clay | ML | 0.069 | 0.007 | - | - | - |

Additional information available upon request

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# Grain Size Distribution Chart

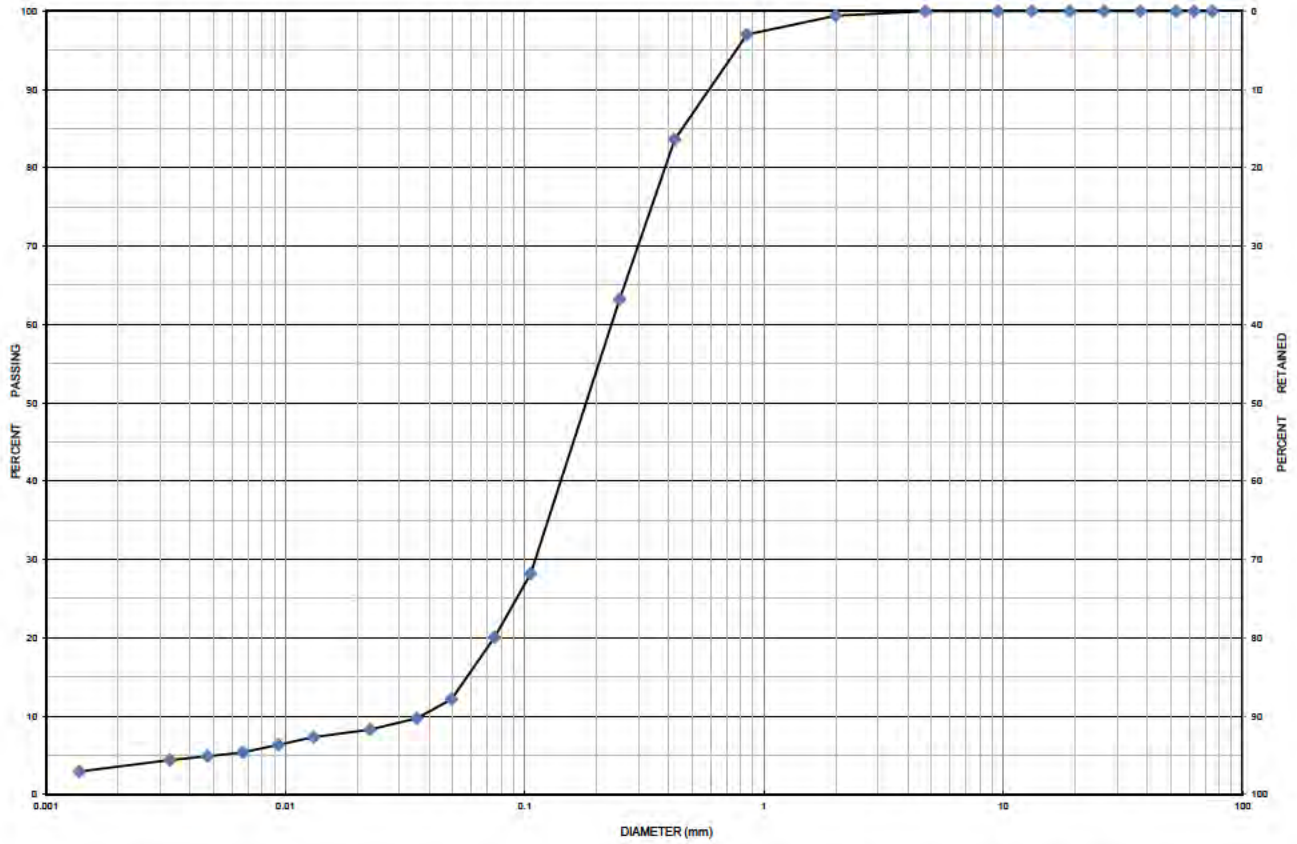
**Project Number:** *11969-002* **Client:** *BT Engineering (London)*

**Project Name:** *Biehn Dr Trunk Sewer, Kitchener*

**Sample Date:** *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

**Location:** *BH 202-23 SS 5* **Depth:** *3 m to 3.5 m* **Lab Sample No:** *S-23-1716*

| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |
|---|---|---|---|---|---|
| CLAY & SILT (<0.075 mm) | SAND (<4.75 mm to 0.075 mm) | | | GRAVEL (>4.75 mm) | |
| | FINE | MEDIUM | COARSE | FINE | COARSE |




| MIT SOIL CLASSIFICATION SYSTEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CLAY | SILT | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | BOULDERS |
| | | SAND | | | GRAVEL | | | |

| Borehole No. | Sample No. | Depth | Gravel | Sand | Silt | Clay | Moisture |
|---|---|---|---|---|---|---|---|
| BH 202-23 | SS 5 | 3 m to 3.5 m | 0 | 80 | 17 | 3 | 18.9 |

| Description | Classification | $D_{60}$ | $D_{30}$ | $D_{10}$ | $C_u$ | $C_c$ |
|---|---|---|---|---|---|---|
| Sand some Silt trace Clay | SM | 0.240 | 0.120 | 0.037 | 6.49 | 1.62 |

Additional information available upon request

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# Grain Size Distribution Chart

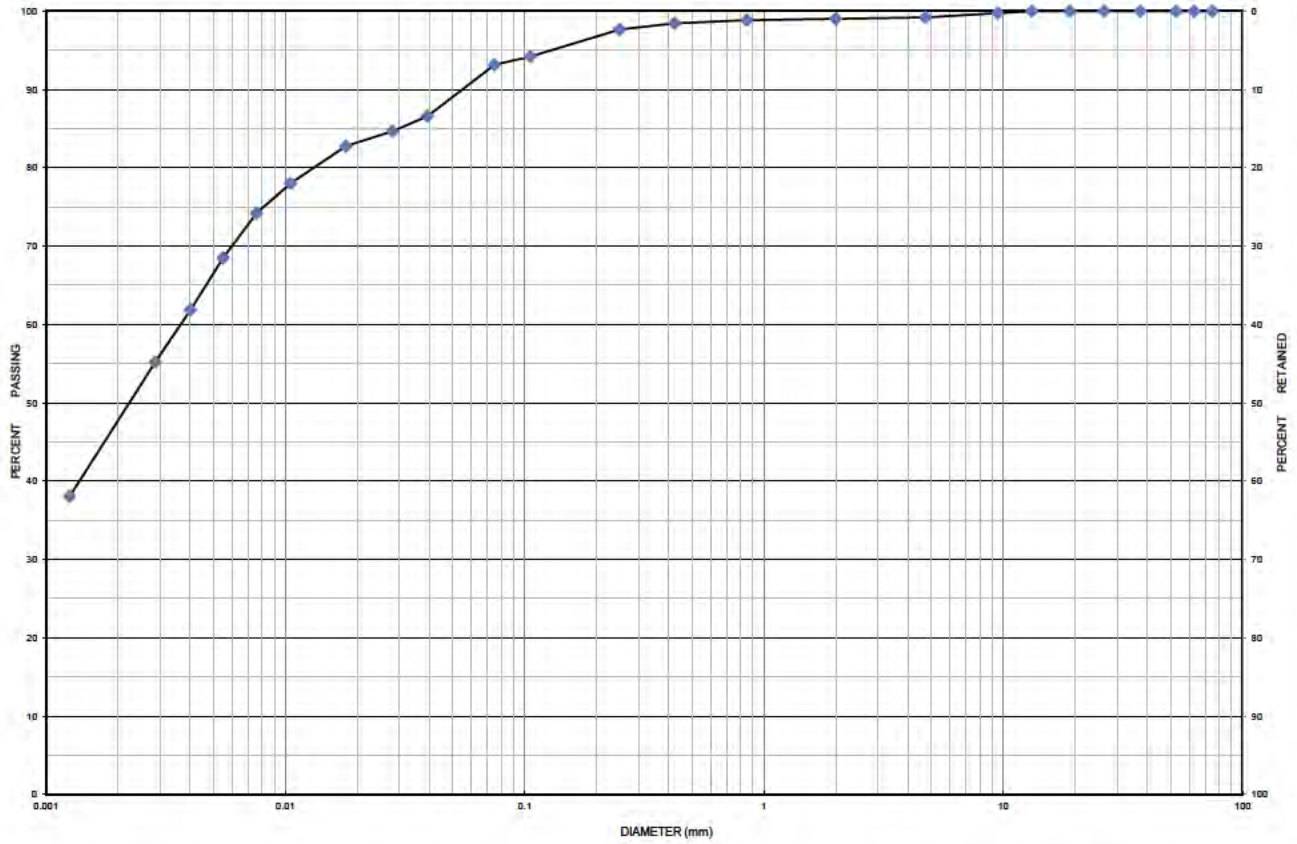
**Project Number:** *11969-002* **Client:** *BT Engineering (London)*

**Project Name:** *Biehn Dr Trunk Sewer, Kitchener*

**Sample Date:** *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

**Location:** *BH 201-23 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-23-1715*

| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |
|---|---|---|---|---|---|
| CLAY & SILT (<0.075 mm) | SAND (<4.75 mm to 0.075 mm) | | | GRAVEL (>4.75 mm) | |
| | FINE | MEDIUM | COARSE | FINE | COARSE |




| MIT SOIL CLASSIFICATION SYSTEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CLAY | SILT | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | BOULDERS |
| | | SAND | | | GRAVEL | | | |

| Borehole No. | Sample No. | Depth | Gravel | Sand | Silt | Clay | Moisture |
|---|---|---|---|---|---|---|---|
| BH 201-23 | SS 6 | 4.6 m to 5.2 m | 1 | 6 | 46 | 47 | 26.0 |

| Description | Classification | $D_{60}$ | $D_{30}$ | $D_{10}$ | $C_u$ | $C_c$ |
|---|---|---|---|---|---|---|
| Clay and Silt trace Sand trace Gravel | CL | 0.0036 | - | - | - | - |

Additional information available upon request

*Issued By:* _____ (Senior Project Manager) *Date Issued:* *October 31, 2023*

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# Grain Size Distribution Chart

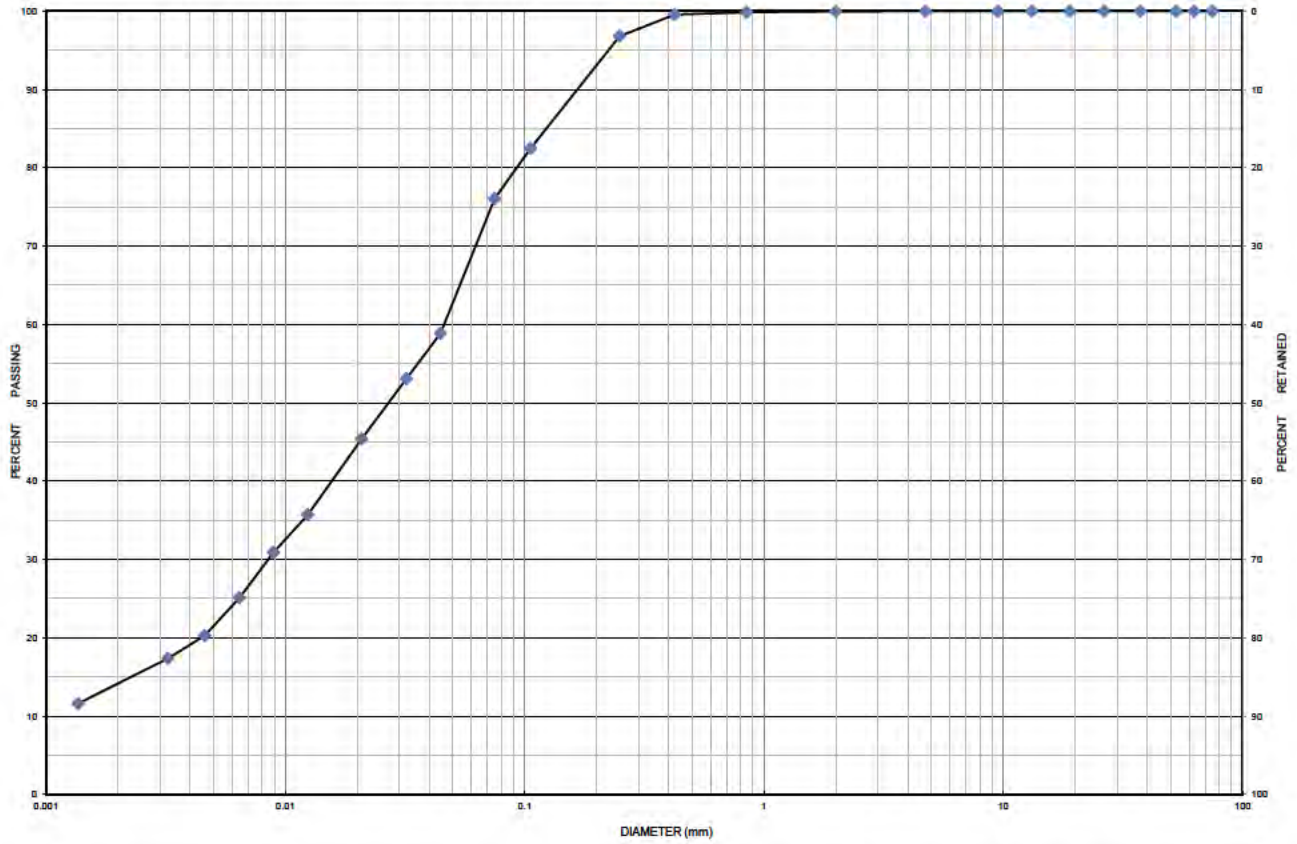
**Project Number:** *11969-002* **Client:** *BT Engineering (London)*

**Project Name:** *Biehn Dr Trunk Sewer, Kitchener*

**Sample Date:** *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

**Location:** *BH 204-23 SS 6* **Depth:** *4.6 m to 5.2 m* **Lab Sample No:** *S-23-1717*

| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |
|---|---|---|---|---|---|
| CLAY & SILT (<0.075 mm) | SAND (<4.75 mm to 0.075 mm) | | | GRAVEL (>4.75 mm) | |
| | FINE | MEDIUM | COARSE | FINE | COARSE |




| MIT SOIL CLASSIFICATION SYSTEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CLAY | SILT | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | BOULDERS |
| | | SAND | | | GRAVEL | | | |

| Borehole No. | Sample No. | Depth | Gravel | Sand | Silt | Clay | Moisture |
|---|---|---|---|---|---|---|---|
| BH 204-23 | SS 6 | 4.6 m to 5.2 m | 0 | 24 | 62 | 14 | 20.3 |

| Description | Classification | $D_{60}$ | $D_{30}$ | $D_{10}$ | $C_u$ | $C_c$ |
|---|---|---|---|---|---|---|
| Sandy Silt some Clay | ML | 0.0460 | 0.0085 | - | - | - |

Additional information available upon request

*Issued By:* _____ *Date Issued:* *October 31, 2023*

(Senior Project Manager)

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# Grain Size Distribution Chart

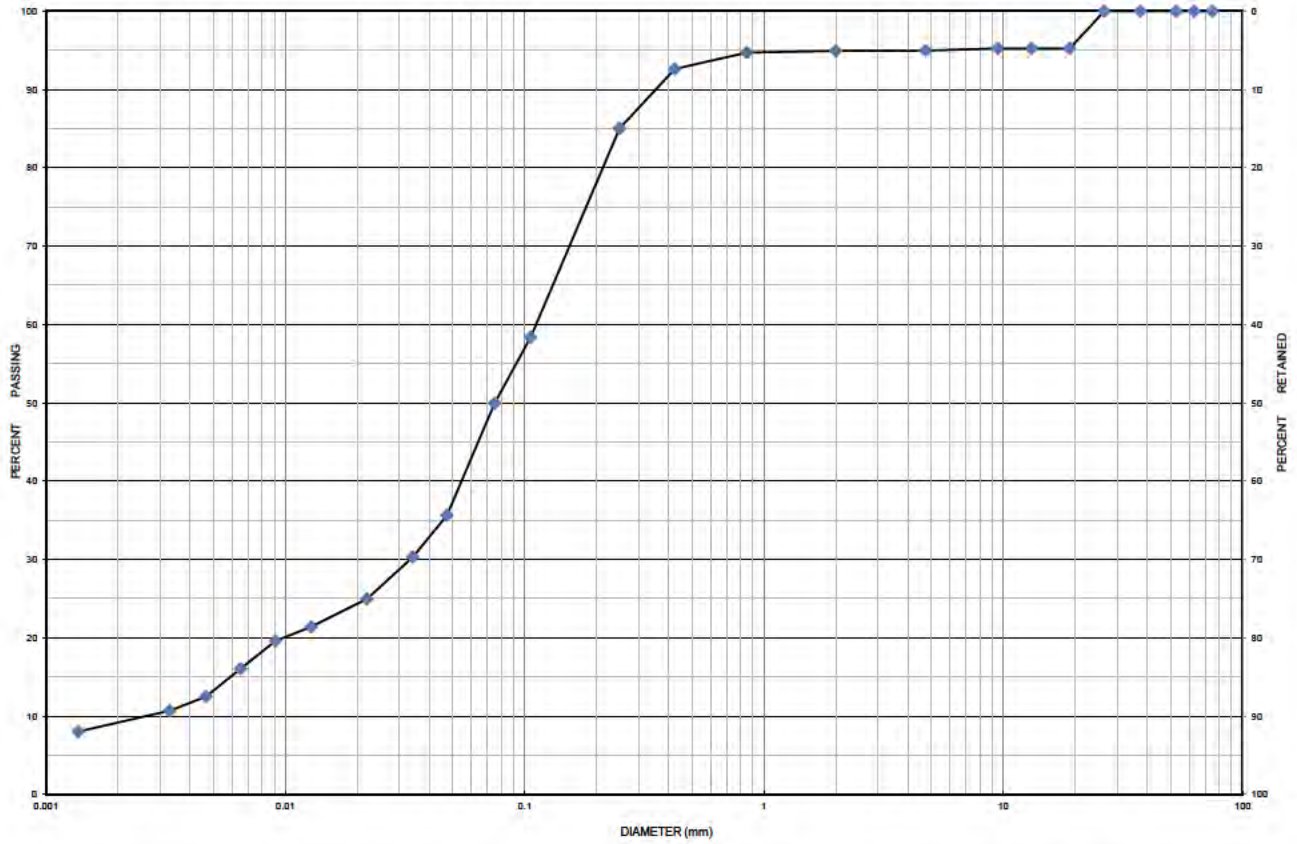
**Project Number:** *11969-002* **Client:** *BT Engineering (London)*

**Project Name:** *Biehn Dr Trunk Sewer, Kitchener*

**Sample Date:** *August 1, September 28-29, 2023* **Sampled By:** *Emily Couperthwaite - Cambium Inc.*

**Location:** *BH 206-23 SS 7* **Depth:** *6.1 m to 6.7 m* **Lab Sample No:** *S-23-1718*

| UNIFIED SOIL CLASSIFICATION SYSTEM | | | | | |
|---|---|---|---|---|---|
| CLAY & SILT (<0.075 mm) | SAND (<4.75 mm to 0.075 mm) | | | GRAVEL (>4.75 mm) | |
| | FINE | MEDIUM | COARSE | FINE | COARSE |




| MIT SOIL CLASSIFICATION SYSTEM | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| CLAY | SILT | FINE | MEDIUM | COARSE | FINE | MEDIUM | COARSE | BOULDERS |
| | | SAND | | | GRAVEL | | | |

| Borehole No. | Sample No. | Depth | Gravel | Sand | Silt | Clay | Moisture |
|---|---|---|---|---|---|---|---|
| BH 206-23 | SS 7 | 6.1 m to 6.7 m | 5 | 45 | 41 | 9 | 19.0 |

| Description | Classification | $D_{60}$ | $D_{30}$ | $D_{10}$ | $C_u$ | $C_c$ |
|---|---|---|---|---|---|---|
| Sand and Silt trace Clay trace Gravel | SM | 0.1200 | 0.0340 | 0.0026 | 46.15 | 3.71 |

Additional information available upon request

*Issued By:* _____ *Date Issued:* *October 31, 2023*

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# Appendix E

Environmental Investigations

BT ENGINEERING

BT ENGINEERING
509 Talbot Street
London, ON N6A 2S5
519-672-2222

# MEMORANDUM

| | | | |
|---|---|---|---|
| **TO:** | File | **DATE:** | November 8, 2024 |
| **FROM:** | Ryan Coady, Biologist, BT Engineering Inc. | **PROJECT #:** | 21-003 |
| **PROJECT:** | Kitchener Biehn Drive Extension Class Environmental Assessment | | |
| **SUBJECT:** | Black Ash Tree Identification Update - October 23, 2024 | | |

## 1.0 INTRODUCTION

The City of Kitchener (City) has retained BT Engineering Inc. (BTE) for the Class Environmental Assessment (EA) and Preliminary Design for the Biehn Drive extension project. The Biehn Drive Extension project in the City of Kitchener aims to extend the local road west and south through a portion of the Strasburg Creek Provincially Significant Wetland (PSW) to connect with Robert Ferrie Drive. A Municipal Class Environmental Assessment (MCEA) has been conducted, confirming the necessity of the project, and selecting a technically preferred alternative for the corridor alignment. The Study Area encompasses a wooded swamp within the PSW unit, surrounded by privately owned land slated for residential development. Recent biological surveys identified potential Black Ash (*Fraxinus nigra*) within the Study Area which are likely to be impacted by the proposed alignment for the Biehn Drive extension (**Figure 1**).

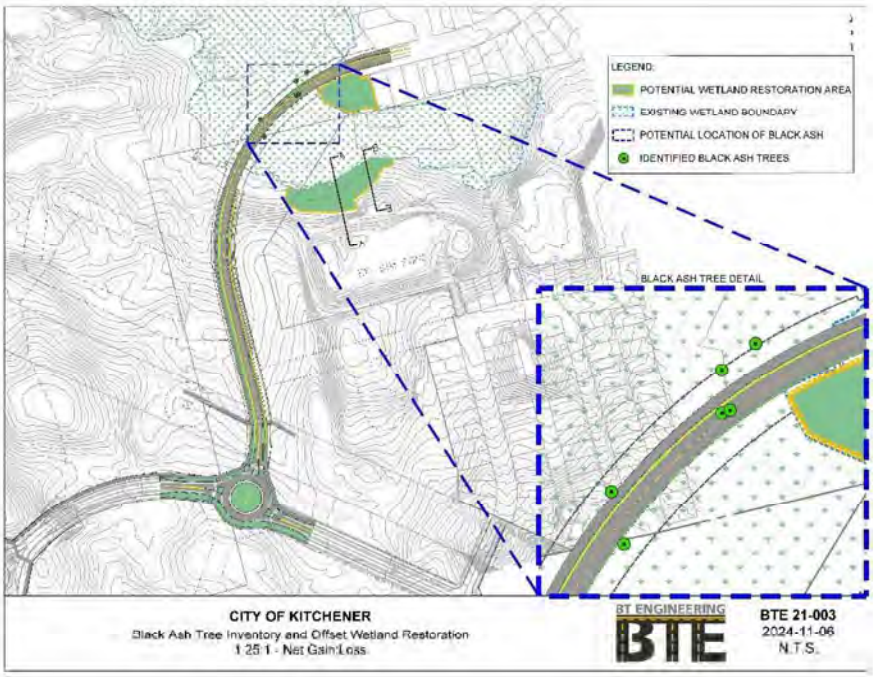



**Figure 1: Study Area with Detail Design and Potential Black Ash Tree Locations**

**Endangered Species Act**

The Endangered Species Act, 2007 (ESA) protections for Black Ash underwent a two-year temporary suspension upon its inclusion in the Species at Risk in Ontario (SARO) list in January 2022, according to Ontario Regulation 23/22. The purpose of this suspension was to create a strategy for the protection and recovery of Black Ash, considering the threat posed by the invasive Emerald Ash Borer (EAB - *Agrilus planipennis*). EAB is an invasive beetle that destroys over 99% of trees it infests. Once infested, trees usually succumb within two to three years, though they can die within months of the initial EAB detection.

Following the end of the temporary suspension on January 25, 2024, Ontario has implemented regulations that will set out how ESA protections will apply to Black Ash: O. Reg. 6/24: Limitations on Section 9 Prohibitions and O. Reg. 7/24: Amending O. Reg. 832/21 (Habitat). These regulations were filed on January 24, 2024, and they came into force on January 26, 2024. A summary is provided below.

Ontario's new regulations apply a targeted approach to Black Ash protection by restricting the application of species protection prohibitions outlined in subsection 9(1)(a) of the ESA to healthy Black Ash that appear to have survived exposure to the EAB. A healthy Black Ash is characterized by having survived EAB exposure, maintaining a healthy condition, and possessing a trunk diameter at breast height of at least 8 cm. In addition, ESA protection is limited to specific areas within the province that have witnessed notable EAB-caused mortality of Black Ash. These regions encompass various municipalities, counties, townships, and cities, including Kitchener in the region of Waterloo.

Ontario's habitat protection prohibitions outlined in subsection 10(1) of the ESA are applicable to a radial distance of 30 meters around Black Ash protected under clause 9(1)(a) of the ESA. This means activities within this radius would be subject to restrictions to protect the habitat of Black Ash. Certain existing conditional exemptions are available for eligible activities that impact Black Ash. Ontario Regulation 242/08 sets out the guidelines pertaining to these exemptions based on section 9(1)(a) and 10(1) of the ESA. To assist proponents with planning for their activities, the Ministry of the Environment, Conservation and Parks (MECP) has added Black Ash to the list of species under the eligible conditional exemptions within the registration system.

During the Kitchener Biehn Drive Extension Environmental Assessment (EA) & Preliminary Design project the Ontario governments temporary suspension on ESA protections for Black Ash was still on going (Ontario Regulation 230/08). During this time, proponents were not required to seek authorizations for activities that impact Black Ash and its habitat.

**The City's Response to EAB**

Upon the initial identification of EAB in the City, approximately 1,400 ash species were treated with TreeAzin®. TreeAzin is a botanical insecticide developed by the Canadian Forest Service and works by making trees less appealing to EAB, ultimately reducing damage from the reproductive process of the beetle. The goal of treatments from TreeAzin is to extend the trees life as long as possible, but the insecticide can't stop eventual decline and death from EAB. To reduce the risk posed by trees near properties affected by EAB the City has also removed approximately 5,000 trees as of 2022.

Within the group of trees initially treated with TreeAzin, the rapid decline of trees due to EAB was evident. By 2017 of the original 1,400 treated trees only 1,000 trees remained alive, and by the end of 2021, fewer than 300 trees were still alive and under treatment.

## 2.0 PURPOSE

The City requested that BTE provide an inventory of Black Ash on the proposed alignment and update the existing Environmental Impact Study (EIS).

A Site Reconnaissance along the Biehn Drive proposed alignment, as well as a 3 m strip adjacent to the east and west sides of the alignment was undertaken on December 11, 2023, and October 23, 2024, to identify Black Ash. The tree identification in December 2023 was conducted for BTE by an Ecologist in accordance with A Field Guide to Trees of Ontario - Royal Ontario Museum (ROM) (2023). Black Ash trees and saplings were identified based on bark, bud, and leaf scar patterns. In October 2024, a Biologist at BTE conducted a follow-up review of these trees, applying the same methodology as the previous site visit. This assessment also included additional leaf identification, made possible by the increased presence of foliage due to the time of year. Identification was further aided by new guidelines made available by the Ministry of Natural Resources (MNR) in June 2024, titled "How to Conduct a Health Assessment of Black Ash (*Fraxinus nigra*) for the Purposes of the Endangered Species Act, 2007 (ESA)". This Technical Memorandum provides a summary of the results of the Black Ash ID within the Study Area included in the Preliminary Design for the Biehn Drive extension.

## 3.0 RESULTS

In December 2023, approximately 21 candidate Black Ash trees and saplings were identified based on bark, bud, and leaf scar patterns. A full description, including location details and a representative photo of the candidate Black Ash trees, is provided in the December 11, 2023, Black Ash Identification Memo (**Attachment 1**).

On October 23, 2024, these trees were reviewed to confirm their identification and further assess their health. After re-evaluation of these trees, it was determined that several were misidentified and are not Black Ash. Trembling Aspen (*Populus tremuloides*), Sugar Maple (*Acer saccharum*) and American Elms (*Ulmus americana*) include some of the species which were mistakenly identified as Black Ash. Fifteen trees were therefore screened from further analysis.

Currently, six trees are considered potential Black Ash within the preferred road alignment, four were classified as potential Black Ash due to the absence of leaves, which limits identification, and two exhibit stronger potential based on distinct bark characteristics. Two representative photos of each of the remaining 6 trees can be found below (see **Photo 1** through **Photo 12**).

Latitude, longitude, and UTM coordinates for each tree are listed in **Table 1**.

If Alternative 1 proceeds, BTE recommends a comprehensive field assessment during the detail design phase to reassess the health and confirm the Black Ash status of trees over 8 cm within the Study Area. This assessment will inform any subsequent submissions to the Ministry of the Environment, Conservation and Parks for Species at Risk approvals.

**Photo 1: Tree 3 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.**

**Photo 2: Tree 3 - Candidate Black Ash, October 23, 2024. Photo 1 of 2. The red circle identifies the potential Black Ash.**

**Photo 3: Tree 5 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.**

**Photo 4: Tree 5 - Candidate Black Ash, October 23, 2024. Photo 2 of 2.**

**Photo 5: Tree 10 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.**

**Photo 6: Tree 10 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.**

**Photo 7: Tree 12 - Candidate Black Ash, October 23, 2024. Photo 1 of 2. Note the flagging tape to indicate a black ash tree applied in 2023 was not present when this photo was taken.**

**Photo 8: Tree 12 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.**

**Photo 9: Tree 18 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.**

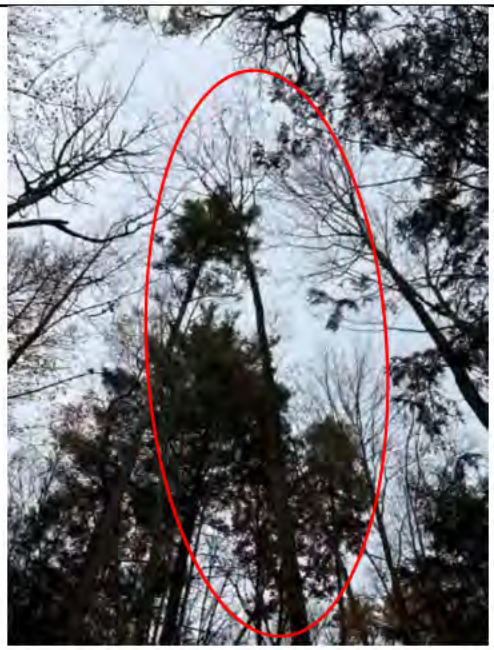


**Photo 10: Tree 18 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.**

**Photo 11: Tree 19 - Candidate Black Ash, October 23, 2024. Photo 1 of 2.**

**Photo 12: Tree 19 - Candidate Black Ash, October 23, 2024. Photo 2 of 2. The red circle identifies the potential Black Ash.**

**Table 1: Potential Black Ash Tree Approximate Location Information**

| Identifier | Latitude | Longitude | UTM Zone | UTM Easting | UTM Northing |
|---|---|---|---|---|---|
| **Tree 3** | 43.385545 | -80.459164 | 17 T | 543806.07 | 4803772.38 |
| **Tree 5** | 43.385469 | -80.459297 | 17 T | 543795.35 | 4803763.87 |
| **Tree 10** | 43.385124 | -80.459732 | 17 T | 543760.36 | 4803725.33 |
| **Tree 12** | 43.384972 | -80.459684 | 17 T | 543764.36 | 4803708.47 |
| **Tree 18** | 43.385345 | -80.459298 | 17 T | 543795.36 | 4803750.10 |
| **Tree 19** | 43.385353 | -80.459265 | 17 T | 543798.02 | 4803751.01 |

## 4.0 CLOSING

The Black Ash tree identification update, conducted on October 23, 2024, confirmed the presence of six candidate Black Ash along the proposed Biehn Drive alignment that met the identification criteria according to the Royal Ontario Museum's Tree Identification Guide and health assessments based on Ministry of Natural Resources (MNR) guidelines published in June 2024. As recommended, a comprehensive assessment during the detail design phase is advised to confirm species identification and assess tree health to ensure compliance with the *Endangered Species Act*. This information will also support the preparation of subsequent submissions to MECP regarding Species at Risk authorizations for the Biehn Drive extension project.

Prepared by:

Ryan Coady, M.Sc., Biologist
BT Engineering Inc.

Reviewed by:

Shawn R Taylor, M.Sc., R.P.Bio.
BT Engineering Inc.

*Attachments:* 1. Black Ash Tree Identification Memorandum - December 11, 2023

BT ENGINEERING
509 Talbot Street
London, ON N6A 2S5
519-672-2222

# MEMORANDUM

| | | | |
|---|---|---|---|
| **TO:** | Eric Riek, Project Manager, Development Engineering, City of Kitchener | **DATE:** | August 19, 2024 |
| **FROM:** | Steve Taylor, CEO, BT Engineering Inc. | **PROJECT #:** | 21-003 |
| **PROJECT:** | Kitchener Biehn Drive Extension Class Environmental Assessment | | |
| **SUBJECT:** | Wetland Restoration Candidate Site Evaluation and Conceptual Design | | |

## 1.0 INTRODUCTION

The City of Kitchener (City) retained BT Engineering Inc. (BTE) to complete a Class Environmental Assessment (EA) and Preliminary Design for a proposed extension of Biehn Drive. The Biehn Drive Extension in the City of Kitchener has been a long-standing part of the area's transportation plan that would extend the major collector road west and south through a portion of the Strasburg Creek Provincially Significant Wetland (PSW) to connect with Robert Ferrie Drive. A Municipal Class Environmental Assessment (MCEA) has been conducted, confirming the need for the project, and selecting a technically preferred alternative for the corridor alignment. The Study Area encompasses a forested swamp, one lobe within the larger PSW complex, surrounded by urban areas and privately owned land slated for residential development (**Figure 1**).

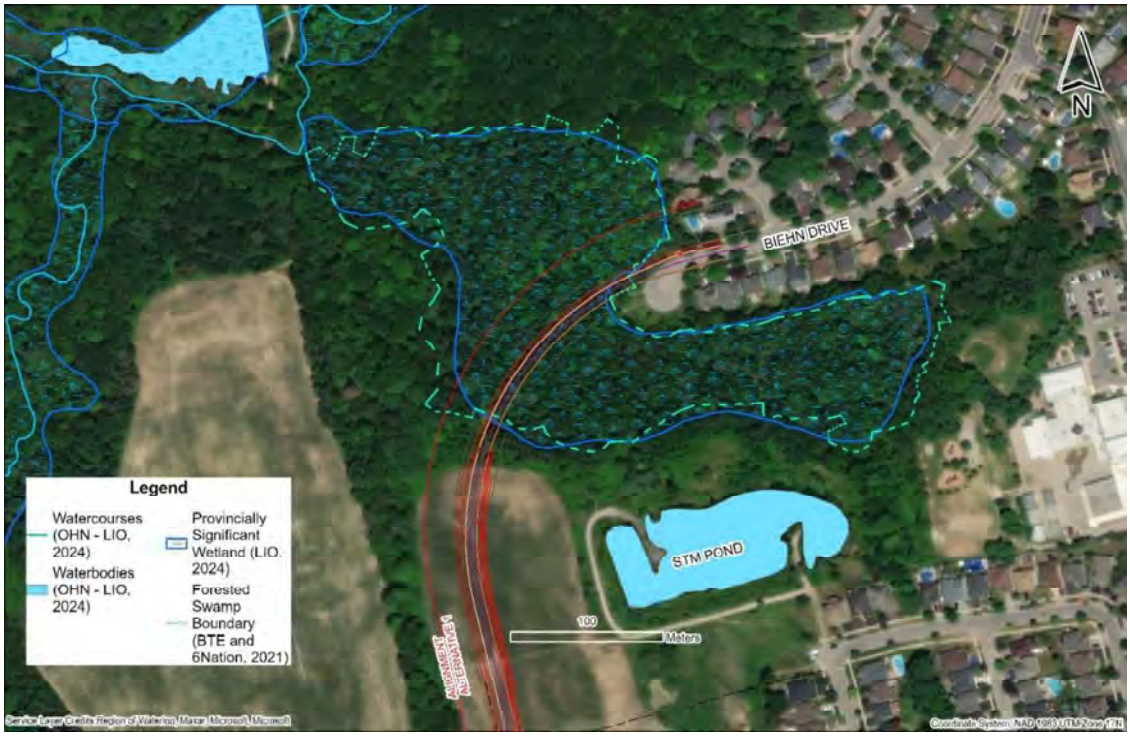



**Figure 1: Study Area - Strasburg Creek Provincially Significant Wetland Complex**

Through discussions with the Six Nations of the Grand River (**Attachment 4**) and holding three public consultations, one of the most frequent comments we received was regarding the concern over the removal of PSW. To compensate for this wetland loss, BTE is now exploring the creation of new wetland restoration areas, ensuring at least a 1:1 wetland replacement ratio, to meet the objective of "No net loss of habitat". A critical component is to identify sites that have access to a consistent, sustainable supply of flowing water, and that are contiguous with the existing wetlands, given the long-term plans for development of the area.

## 2.0 PURPOSE

On July 9, 2024, BTE's Senior and Junior biologists conducted a site reconnaissance to investigate potential areas for wetland restoration. The reconnaissance included areas along the Biehn Drive proposed alignment, as well as a 3 m strip adjacent to the east and west sides of the alignment. Adjacent lands, including the perimeter of the nearby Hearthwood Storm Water Management (SWM) wetland (**Figure 1**) were investigated. The results of the geotechnical investigations (Cambium, April 2024) along the road alignment were reviewed to aid in understanding the surrounding geophysical region, surface and subsurface soil structure, and the relative elevations of the water table below ground level (**Attachment 2**). These are important considerations in the siting and construction of offset wetlands as generally it may be said that if the hydraulics and soils are suitable, a wetland will come about naturally.

Specifically, following a high-level review of consultation input, digital terrain mapping, air photography, technical reports, the vegetation surveys (EIS - BTE, 2024), field experience and the discussions held during the public and agency reviews, BTE focussed on four potential areas for siting the offset wetlands. The review was not restricted to just the roadway alignment, but the overall wetland ecosystem south of Strasburg Creek, where enhancing the wetland through direct action would be the most beneficial to the ecosystem, but also actions removing hinderances to water and nutrient flows (dam, midden, placed soils and abandoned fences) can also be an effective restoration tool.

During the high-level review, BTE investigated where reductions in road construction impacts to the wetland could be made to avoid unnecessary loss of productive wetland. As a result, BTE staff have proposed adjusting the vertical road profile to reduce the lateral fill requirements, narrowing the roadway cross section where feasible and considering restrictive methods of construction through the wetland. BTE staff has determined that following these adjustments, roughly 2,690 $m^2$ of PSW will be permanently impacted. Loss of PSW is not a prohibited activity while undertaking transportation infrastructure in Ontario, as BTE has detailed elsewhere, but consultation has suggested that at least a 1:1 offset ratio be considered. Impacts to the wetland ecosystem resulting from the potential road construction, are detailed in the Environmental Impact Study report under separate cover; however, some of the mitigation recommendations found within the EIS may be implemented as part of the wetland restoration work identified here.

It is our objective therefore to identify one or more potential sites where offsetting wetlands may be constructed that are contiguous with the existing wetlands, are sustainable with a reliable water source and meet with the existing wetland type. The 'type', is a mineral forest swamp wetland of decomposed leaf and wood detritus over sand, supported by groundwater static below ground. These are typically seasonally wet wetlands, with little free water or pooling at the surface, that may be expected to be quite dry and fully shaded during the summer months, depending on local weather conditions, runoff from snow melt or event

flows and the density of the tree cover. Being under a canopy of deciduous trees in dense shade, the plant community is comprised of water-tolerant herbaceous plants (e.g. ferns, Jewelweed, Herb Robert) rather than aquatic macrophytes (e.g. Cattail, Bulrush, pond weeds, etc.) which depend on permanently standing or flowing water in full sunlight. The constructed wetlands should be of similar nature to match the ecological processes of the existing PSW and avoid the introduction of new plant species. Collection of native seeds, at the time of maturity, from the existing wetland is an appropriate part of the restoration strategy.

Four potential sites were chosen following our high-level review (**Figure 2**):

- Area 1 - removal of engineered granular fill placed on the west side of the alignment to create the *cul de sac* where Biehn Drive currently ends.
- Area 2a - east of Biehn Road below the Hearthwood Natural Area stormwater wetland management facility which discharges to the edge of the wetland; modifying the infiltration trench system (Stantec designed, 1999).
- Area 2b – an opening in the canopy west of the proposed Biehn Road extension below a future storm drainage outlet.
- Area 3 - an historic roadbed built along the property line west of the alignment, extending north to the Strasburg Mill Pond dam; an old roadbed with fence lines may persist that inhibits natural resource (flora, fauna, nutrients) flows through the wetland.

This Technical Memorandum provides a summary of the results of the site reconnaissance, preliminary interpretations of the physical environment as they relate to siting an offset wetland, or where other actions may be taken to benefit the wetland ecosystem and conceptual layouts of feasible wetland designs.

**Figure 2: Potential Wetland Restoration Areas**

## 3.0 OBSERVATIONS AND ASSESSMENT

A portion of the proposed alignment was cleared during the fall of 2023 to provide access for geotechnical boreholes. Additional clearing will be necessary for construction to proceed once the final alignment profile has been determined. Boreholes had also been advanced in 2022 along the edge of the wetland and have similar relevance herein. After a lengthy period of stabilization, ground water levels were measured in the observation wells on March 11, 2024 (Cambium, 2024). As a result of the recent clearing, the surficial soils are exposed and the availability of free water at the surface could be easily determined during the field investigations on July 9, 2024.

### Area 1 - *Cul de Sac*

Borehole BH 202-23 within the *cul de sac* is most relevant to Area 1 investigations. It was advanced through asphalt into compacted fill, showing no underlying organic peat, which would have been stripped when the roadway was originally built. Not surprisingly, blow counts are relatively high (42 / 20) because of the compacted fill, but these rapidly reduce (<10) when encountering the underlying silty sand. Groundwater was observed at elevation 311.8, below the original ground elevation of 312.5, so roughly 0.7mbgs (meters below ground surface). The road profile is planned to match existing at 312.9 m with minimal side slopes.

There is no significant vegetation or other natural resources within this potential area that would be of concern if removed or altered. Google Earth™ images from 1985 show this area as former wetland, so the pre-existing hydraulic conditions are favourable for restoration of the wetland here. A sustainable water supply will result as the road is constructed, oil / grit separators are installed, and runoff is directed here. It is therefore feasible to create a forested swamp wetland system here with the removal of the asphalt and fill, replaced with suitable soil layers over a high-water table and suitable plantings. The area available is 1,488 $m^2$, however roughly 15-20% of this space will be for side slopes and to save existing trees around the outer margin. Where trees are removed, reuse of the root mass (e.g., root wads, tree tangles, inverted roots, mammal den) to create habitat for amphibians, small mammals including bats and birds will be used to diversify the habitat until the transplanted trees have grown in. Turtle species are not known to reside in this part of the wetland complex (ESR by BTE, 2024) so enhancement of their generalized habitat (open water) will not be an objective.

Due to the proximity of a residence immediately adjacent, gentle sloping with a denser vegetative screen / buffer zone is recommended along the northeast side. Consultation with the landowner of this residence is suggested to discuss the opportunities and constraints of living beside the constructed wetland ecosystem. For example, we would not want his or her grass clippings and yard waste dumped here to decompose, ultimately encroaching on the wetland, yet they may be helpful in anecdotal monitoring of the use of the area by wildlife.

Based on the expected proximity to the road, and adjacent residence, and the necessary grading of the slopes, we expect the net area of restored functional wetland at approximately 1,200 $m^2$ or 0.12 ha.

### Area 2a - Hearthwood Stormwater Wetland Outlet

Borehole BH206-23 is the closest to Areas 2a and 2b, although BH 205-23, BH 204-23 and BH101-22 are also representative (Cambium, 2024). The boreholes in the previously undisturbed wetland indicate roughly 80

cm of peat overlying numerous layers of fine sand to silty sands consistent with the sand-dune nature of the Waterloo Sand Hills geophysical region. The drill blow counts in BH 206-23 are very low (<5) suggesting the subsurface soils are very loose and uncompacted. Initial groundwater readings were taken when advancing the boreholes, but the readings in March 2024 after a lengthy period of stabilization are expected to better reflect the actual field conditions today. Ferns and jewelweed are abundant indicating a water table close to the surface. No groundwater discharge (ie. springs) were observed. Groundwater ranged from 0.15 – 0.67 mbgs (Cambium Borehole logs: **Attachment 2**). The spring and early summer of 2024 has been consistently wet, so these levels may be somewhat higher than the norm, but there was very little free water at the ground surface on July 10 2024, other than where machinery had disturbed the surface. No standing water, springs or flowing watercourse was observed in this lobe of the wetland. Rather than pure peat as reported by Cambium, which is a derivation of decomposed sphagnum moss, the organic soils at the surface have been generated from deciduous leaf litter and wood mass decomposition, accumulated over many centuries. These soils will retain and hold water when saturated but will also readily dry out when water is not present. Shade nears 100% throughout most of the growing months, so the understory components of the wetland are relatively sporadic.

The Hearthwood Stormwater Management (SWM) wetland has a unique outlet design seldom seen elsewhere within Southern Ontario. The design shown in **Figure 3** (Stantec, 1999) was quite advanced at the time of implementation around the year 2001. Rather than a standard surface discharge from a concrete storm sewer outlet to a receiving watercourse, this design created an infiltration chamber comprised of a 'T' shaped 25 m perforated pipe lain within a 1X1m stone filled gabion basket, wrapped with geotextile and backfilled with the native sand. It is apparent, seeing it in the field today that the system has worked well, although it is slowly being overgrown with a few large Crack Willow trees and the flow spreader, intended to disperse high flow (Regional Storm) discharge, was circumvented long ago. A clear flow path to the north now exists that circumvents this barrier. **Photo 7** and **Photo 8** in **Attachment 1** show the area of exfiltration, and the swale where water has been coming to the surface for many years, effecting the pattern of herbaceous plant growth. **Photo 9** shows a detailed picture of a hole where the gabion stone can be seen below the rootzone of the swale.

The design by Stantec (**Attachment 5**) specifies the dimensions of the side slopes (5:1 around pond; backside 3:1 to swale), top elevation (217.7) and top width (4.0m) that control high event flows from exiting the pond. These must be maintained to sustain the integrity of the fill slopes, but a considerable volume of sand fill exists outside of these requirements, from an overly wide top width and shallow slopes down towards the forest edge and wetland. Several planted specimen trees (<10), specifically Black Walnut and White Pine grow on these slopes but can be relocated if necessary, using a tree-spade if staged well. We have walked the area to define the edge of the tree line and to describe a general area that could be utilized as a wetland.

Storm event water, up to the 5-year storm event, clarified by the stormwater wetland above, would be the water source through gravity flow with some modifications to the outlet chamber and infiltration trench. Small storm event flows will continue to infiltrate to the soils below the restored wetland and into the groundwater reserves. Larger event flows will overflow the infiltration trench once the underlying soils are saturated and be routed broadly over the wetland. Once the proposed wetland basin fills to capacity, water will flow through the existing tree line at specified locations managed to reduce the risk of erosion.

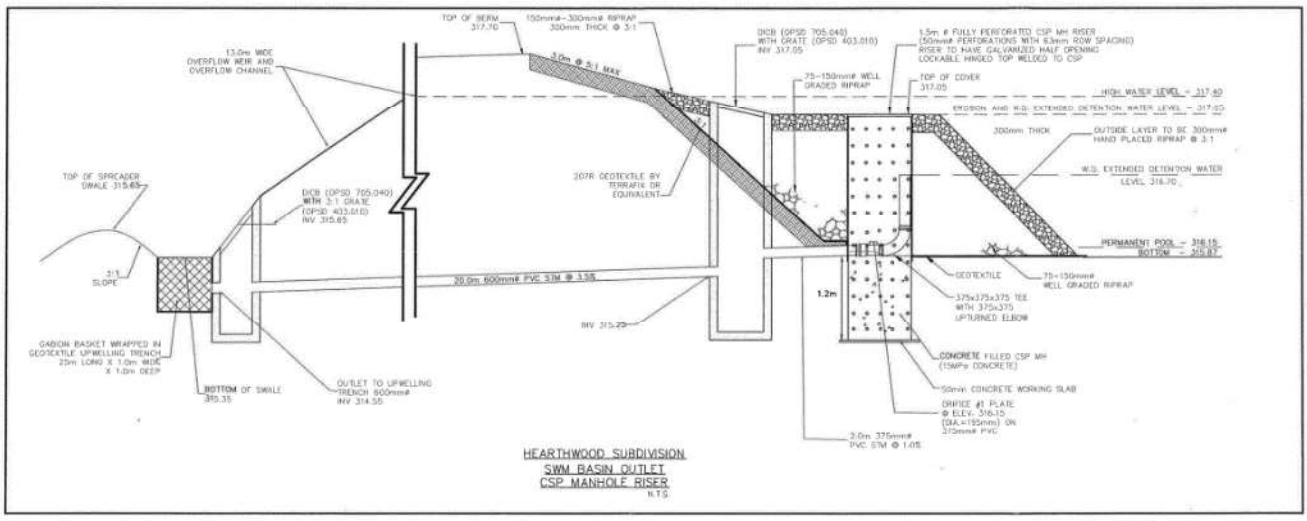



**Figure 3: Hearthwood Subdivision SWM Basin Outlet Configuration**
**Design Credit: Stantec Consultants, 1999.**

Given the underlying loose sandy soils of high porosity, creating a wetland with a water level at the same elevation as the swale (315.35) would require lining the constructed wetland basin with an impervious layer, either 1.0 m of clay or an artificial membrane (HDPE plastic, butylated rubber) to inhibit downward percolation of water. This would inevitably create a perched marsh wetland that would not function either hydraulically nor ecologically to be the same type as the existing wetland and may conflict with the objectives of offset compensation on a like-for-like 1:1 basis. Ideally, the offset wetland outside of the delineated wetland edge should closely match the elevations of the existing topography within the limits of the delineated wetland, and that runs parallel to the area disturbed for the SWM creation 20+ years ago. Based on the 1985 Google Earth™ image, which is unclear, it appears that although the SWM facility was not constructed on the wetland, it is likely that the excavated fill disposed along the north side was very close to impacting the wetland, or at a minimum into the forested edges.

The top of the infiltration chamber/bottom of the swale is currently at an elevation of 315.35, and the invert of the connecting pipe is 314.55, which sets the upper range of the wetland to avoid backwater effects restricting the outlet of the SWM outfall. Therefore, the upper water levels of the wetland grading should be restricted to below this range.

Reviewing available topography data from high resolution air photo interpretation, and survey data from the road alignment at 313.0 and considering the gradient of the valley fading south to north, we estimate the nearby wetland elevations are approximately 313.3 +/- 0.2 m. More accurate survey data will be required if this potential site moves forward to detailed design.

Field work identified open areas in the tree canopy that were explored to site a wetland. Several (4-5) large Crack Willow are rooted in the existing infiltration trench, reducing its' effectiveness, but evidence on the ground show that the trench remains operational despite this obstruction. The trees and roots should be removed in either case to ensure the free flow of water. Few other trees exist in this open area.

**Concept Design Components - Area 2a**

A plan view of the conceptual wetland is provided in **Attachment 3**, along with two sections. These are highly schematic drawings intended for discussion. They would be refined further during detailed design, and from input of the ongoing consultation with stakeholders. The conceptual area covers 2,543 $m^2$ of which approximately 5- 10% of the area would be required for side slope adjustments along the south side. Additional to this area is a 10 m wide band of existing trees that are to be maintained as a buffer to the native wetland. As portions of the native wetland were filled during the SWM pond construction, we do expect to expose native organic soils that are likely to be saturated and under anaerobic decomposition. Once exposed to oxygen again, they can be revitalized as part of the base wetland soil resources moving forward. Generally, during construction the soils will be graded relatively level, but not precisely, allowing for the natural lumps and mounds that make good wetland ground conditions. We therefore expect the finished wetland net area could be approximately 2,300 $m^2$ or 0.23 ha at a finished surface elevation of 313.3 +/- 0.2 m.

BTE suggests replacing the existing infiltration trench (which worked well) with one of our own design, that extends through the middle of the new wetland rather than along one side tight to the toe of slope. The working concept plans for a future water level elevation of 313.3 as this is slightly higher up the valley than at the road crossing and below the range noted above. The existing trench elevation would be lowered so the top of the pipe/ gabion is at 313.2 down the centre of the wetland, encouraging both exfiltration to the surface and infiltration to the groundwater reserves depending on the rate of gravity discharge from the upstream SWM facility. Lateral branching may be incorporated, like a reverse leaching tile bed, to disperse the flows over a wide area during moderate to high flow events. High flow events will be routed over the wetland and through the surrounding tree buffer. A hydraulic analysis will be required during detailed design to confirm the necessary flow rates originating in the SWM facility water source, modified for this purpose.

Organic soil stripped from the existing alignment could be reused here - 300 mm deep over the native sand base to meet the finished grade of 313.3; 100 mm over the infiltration trench. The objective is to have water upwelling into the wetland sporadically throughout the length, not flowing overland from a single point source as it is today. This arrangement may allow for much lower gradient slopes around the wetland edges - which ideally should be on the order of 12:1 or 8:1 max.

The wetland footprint would seek to reduce tree cutting within the existing edge that currently buffers the wetland. A 10 m vegetative buffer zone of existing pioneer tree species, measured from the existing wetland delineation, is proposed to help manage water and nutrients flowing between the restored and native wetlands. Water flows in the wetland should go predominantly south from the existing SWM outlet, rather than to the north, to maintain a longer flow path and keep the placed soils moist. A south outlet squeezed through the tree edge to retain the root mass will be configured not more than 300 mm width & depth. Outlet banks will be around 313.6 masl - so storm event water is initially held, then slowly discharged at a trickle, but release moderate intensity storm events at a greater rate of discharge. Higher storm event flows, occasionally released overland by the SWM pond, would require splitting the outflows going north (consistent along the existing flow path) as well as south through the tree buffer. A north outlet swale will be set higher around 313.7 +/- 0.2. If suitable, the existing flow path that is already well protected with stone, tree roots and

vegetation will continue to be used without modification. Hydraulic velocities, tractive forces, outlet dimensions and impact on valley flood lines would be determined during detailed design.

Optimally, creation of a wetland with standing water like a cattail marsh is not needed as that is not the character of the natural wetlands here, but as the soils settle, the planted vegetation matures, and animals manipulate the environment, the restored wetland can be expected to develop some shallow pools, hummocks, holes and naturally formed channels. These random occurrences help create biodiversity and should be allowed to form. Shallow pools within forested wetlands can over time become valuable habitats, known as vernal pools which are critically important for amphibians such as frogs, toads and salamanders. We have observed young frogs and toads here, but salamanders at the present time do not seem to have enough pooled-water habitat resources to occupy this lobe of the Strasburg Creek Wetland Complex.

Native organic soils, stripped from the road alignment would be reused as the primary soil source, and will contain a variable seed bank to emerge following construction. The success of this can be sporadic however, and preferably maturing seed of the native wetlands should be collected during the summer and fall seasons and then broadcast over the restored wetlands to supplement the tree plantings. Agency consultation has identified a local service providing seed collection and the type of restoration services that may be employed here; Kayanase Plant Nursery is located in the Grand River Watershed in Ohsweken Ontario, Southeast of Brantford. For seed collection, timing is critical, suggesting that a short-term, separate contract will need to be established which proceeds well before the principal infrastructure contract.

With an already mature, retained 10 m tree buffer along the northern edge and with long, shallow slopes on the southern edge, the wetland would be primarily exposed to morning shade and mid-day to afternoon sunlight until grown in. Native tree species that tolerate wet conditions, and thrive in sandy soils (e.g., Red Maple, Yellow Birch, American Beech, Black Walnut, Eastern Cottonwood, etc.) are to be considered for planting. Shrubs should be avoided in favour of trees, maintaining consistency with the type of wetland to be restored. As with Area 1, habitat structures can be created through the re-use of tree roots, large woody debris and stone. Above-ground habitat can be created for bird perching, insect-predator avoidance, small mammals (dens) as well as below-ground hibernaculum established for reptiles (snakes), some amphibians and ground nesting small mammals. Habitat structures will be located and specified during detailed design using previously implemented configurations.

A considerable volume of fill, of mixed origin will need to be removed from site for disposal or use elsewhere. The volumes, haul route and destination will be determined during detailed design.

**Supporting Threatened Bat Species**

A baseline species-level field survey of bat presence was conducted on the evening of August 14, 2024, to identify the species of bat present over the wetlands near the proposed alignment. Acoustic monitoring identified the following species: Big Brown Bat (*Eptesicus fuscus*), Eastern Red Bat (*Lasiurus borealis*), Hoary Bat *(Lasiurus cinereus*), Little Brown Myotis (*Myotis lucifugus*), Silver-haired Bat (*Lasionycteris noctivagans*) and Tri-Colored bat (*Perimyotis subflavus*). As of August 15, 2024, the Eastern Red Bat, Hoary Bat, and Silver-haired Bat are designated as Species at Risk (SAR) under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Additionally, the Tri-colored Bat and Little Brown Myotis are listed as Species at Risk in Ontario (SARO).

During field surveys several cavity trees were observed along the historic property line west of the proposed alignment. These will not be impacted by this infrastructure expansion work, however cavity trees and old buildings (e.g., barns, cabins, sheds) are well known to provide roosting habitat for several bat species. Many bat species are threatened or endangered due to loss of habitat and other issues. For example, most old barns and sheds in urbanizing areas are removed for space, safety or aesthetic reasons during land development, resulting in a loss of habitat for bats, barn swallows, rodents and snakes. The most significant component of disappearing bat habitat are large empty cavities that provide maternal roosting spaces as they nurse their young.

As restored wetland 2a will be relatively isolated from human interaction and away from the new roadway, a bat condo structure similar to that shown in **Figure 4** is proposed for construction at the southeastern corner of the wetland, along the edge of the treeline. Bat condos are capable of providing roosting spaces for up to 6,000 individuals and are considered appropriate for community scale projects such as a wetland restoration. Depending on the location, the structure may be partially shaded (< 6 hrs/day) yet with open flyways over the restored wetland and the stormwater wetland above which should provide optimal forage habitat for bats. The structures may also provide habitat for barn swallows and other species that prefer old buildings to nest. Owls also like to roost in cavities, but to avoid predation of the bats, the owls are excluded from entry. Protection from domestic cats and vandalism is also a factor in the design and siting. Wetland 2a is close to open water, but also well away from ambient light sources, both important considerations in siting bat habitats. The bats are not expected to overwinter in the bat condo, but in a Region where natural caves may not be readily available; by insulating the bat condo with a double outer wall and suitable organic fibre filling, this structure may provide a new overwintering site, however this factor should be considered experimental and not a well researched expectation.

**Figure 4: Maternal Bat Roosting (Bat Condo) Built at the Rouge River National Park**

**Area 2b - North Outlet Swale**

This area was walked by staff biologists on July 9. Area 2b has a small area, about 250 sq m east of the property line which is a shrub thicket - so not a highly valued vegetation unit. A natural swale runs along the property line here for a short distance and can be used for low level treatment of drainage. A well used, broad (unmanaged) pathway runs on the east side. Area 2b is perched well above the wetland elevation, and being so small, high and dry, the area could not be effectively graded for use as decent sized wetland offset. On the other side of the pathway there is a very nice stand of semi-mature maple trees, densely spaced; preferably this should be retained as part of the existing wetland complex and not be further disturbed.

Area 2b therefore is not a good potential site for an offset wetland, but if looking for a runoff destination, it could be built as a bioremediation swale/rain garden, or a vegetated infiltration gallery to treat the road runoff with spill to the existing swale. Any of these options are feasible here.

**Area 3 - Historic Road Wetland Rehabilitation**

Area 3 we were looking at because, from the archaeology documents, it appeared there may be an old farm laneway, with a remnant roadbed running through the wetland that could be rehabilitated. Often the old corduroy roads cross wetlands, with old fences, barbed wire and trash middens along the way. A cleanup and rehabilitation of these features can sometimes be used in *lieu* of constructed works. We walked this route, but it is thickly treed, very biodiverse and we could find nothing to warrant further interest.

## 4.0 MONITORING

A three-year post-construction monitoring program is recommended for implementation. The monitoring program is to start following a one-year grow-in period to allow the seeded areas and salvage wetland soils the opportunity to begin the process of recovery before a critical assessment is made. Many of the planted trees will be deciduous, which are difficult to establish, particularly in wet organic soils. A mandatory replanting / overplanting schedule should be included in the detailed design to optimise the wetland area coverage, and so that there is more than one generation of plant materials to improve survival in case of drought / excessive wet conditions. Up to 20 % of the plant material may need replanting annually during the monitoring period, with the rates being determined by the results of the monitoring.

Monitoring of the habitat structures created can be more challenging as they may be below ground (ie. herpetofauna hibernaculum) or are only used at night (ie. fox den). Monitoring the bat species using the bat condo, best done around sunset, will chart the population using the structure during the month of June when roosting is most prevalent. Mid-winter surveys may also be warranted if the structure is insulated and occupied.

Monitoring reports will be due by December 31$^{st}$ of each year, and pending disclosure rules under the Endangered Species Act, will be made public on the City website and reported to https://batwatch.ca/.

## 5.0 CLOSING

Four potential sites were reviewed for construction of offsetting wetlands that could be created to closely match the forested swamp lobe encountered in this part of the Strasburg Creek Provincially Significant Wetland Complex. A primary requirement is a consistent supply of water, which will exist for three of the potential sites. Two of the potential sites show good promise and we have conceptualized designs that seem feasible and able to offset the wetland impacts of the Biehn Drive extension. Area 1 and Area 2a is therefore recommended to move forward to preliminary and detailed design as the infrastructure project proceeds.

The restoration of Area 1 will net approximately 1,200 $m^2$ after accounting for slope losses and tree preservation. The restoration of Area 2a will net approximately 2,300 $m^2$ outside of the retained existing forest edge. These areas will be further refined during detailed design. Together these two areas net approximately 3,500 $m^2$ of restored wetlands, more than offsetting the loss of 2,690 $m^2$ of Provincially Significant Wetlands, resulting in a finished gain : loss ratio of roughly 1.3 : 1. The surplus proposed herein is

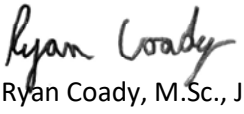
intended to recover a small amount of the wetland losses that have occurred historically in the region as a result of land and infrastructure development. By adding in key habitat structures such as herptile hibernaculum, woody perches and a bat maternal roosting house the overall objectives of mitigating the impacts caused by the Trunk Sewer and Biehn Drive roadway expansion as it crosses the Strasburg Creek PSW would be effectively met or exceeded.

A three-year post-implementation monitoring program is recommended, beginning one full year after construction has ended to allow for a grow-in period. Annual reporting is recommended, to assess the success of the wetland plants, hydraulic functions, habitat features, natural plant regeneration. The use of the bat maternal roosting structure is an additional element that the monitoring program should emphasize.

Prepared by:

Shawn R. Taylor, M.Sc., R.P.Bio., Senior Biologist
BT Engineering Inc.

Reviewed by:



Ryan Coady, M.Sc., Junior Biologist
BT Engineering Inc.

**Attachments***:*
1. Wetland Restoration Photographic Record
2. Geotechnical Investigation, Borehole Locations and Bore Logs (Cambium, 2024)
3. Conceptual Layout Drawings: Area 2a Plan and Sections
4. Meeting Notes: Consultation with Six Nations General Wildlife Trust Group (July 4, 2024, Zoom Call)
5. Two Schematic Drawings of Hearthwood SWM Wetland Layout (Stantec, 1999)

**List of References:**

Bat Watch Canada, Undated. Citizen counts of bat communities within Canada and United States. Accessed Aug 7, 2024. https://batwatch.ca/.

Cambium, March 14 2024. Geotechnical Investigation, Proposed Trunk Sewer, Biehn Drive South Extension, Kitchener. March 14, 2024.

City of Kitchener, 2024. Scoped Environmental Impact Study (EIS) Report, Biehn Drive Municipal Class Environmental Assessment. BT Engineering, March 2024.

Community Bat Programs of B.C., 2017. Building Homes for Bats.

Kayanase Plant Nursery see https://www.kayanase.ca/ecological-services/

Parks Canada, Undated. Helping Bats Find a Home. https://parks.canada.ca/nature/science/especes-species/domicile-home. Accessed July 16, 2024.

Stantec, 1999. Design drawings; Hearthwood Stormwater Wetland, City of Kitchener; Plan view grading plan and layout of outlet control schematic.

Zammitt, A.E and Tupman, K. M., 2019. Spatial relationships between key natural heritage and hydrological features within the Grand River Watershed. Grand River Conservation Authority Technical Memorandum, Sept 13, 2019.

# Attachment 1

Wetland Restoration Photographic Record

BT ENGINEERING

# Wetland Restoration Photo Record

**Photo 1: Hearthwood Stormwater Wetland Main Embayment**

**Photo 2: Hearthwood Stormwater Wetland - Outlet Point**

**Photo 3: Hearthwood Stormwater Wetland - Main Embayment Looking South from Split**

**Photo 4: Hearthwood Stormwater Wetland - Main Embayment Looking West from Outlet**

## Wetland Restoration Photo Record

**Photo 5: Hearthwood Stormwater Wetland - Main Embayment Looking Northwest**

**Photo 6: Hearthwood Stormwater Wetland Outlet - Signs of Excessive Debris Collection Being Removed**

**Photo 7: Hearthwood SWM Infiltration Trench - Underlies the Darker Patches**

**Photo 8: Hearthwood SWM Infiltration Trench - Flow Spreader on Right Side**

## Wetland Restoration Photo Record

**Photo 9: Hearthwood SWM Infiltration Trench - Gabion Stone can be seen Through Hole**

**Photo 10:Hearthwood SWM Infiltration Trench - Four Large Crack Willows Rooted in Gabion; Flow Path Around the Spreader**

**Photo 11: Fill Slope Mounded Up Outside of SWM Pond**

**Photo 12: White Pines and Black Walnut that could be Tree Spaded and Replanted**

## Wetland Restoration Photo Record

**Photo 13: Area 2b Shrub Tangle - Small 250 $m^2$ Area of Opportunity for LID Water Treatment**

**Photo 14: Dense Stand of Semi-Mature Maple Trees - Avoid Development**

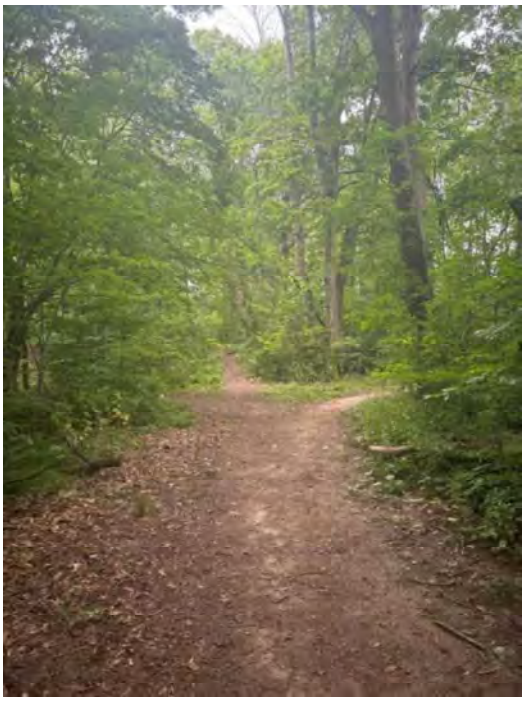


**Photo 15: Natural Unmanaged Trail**

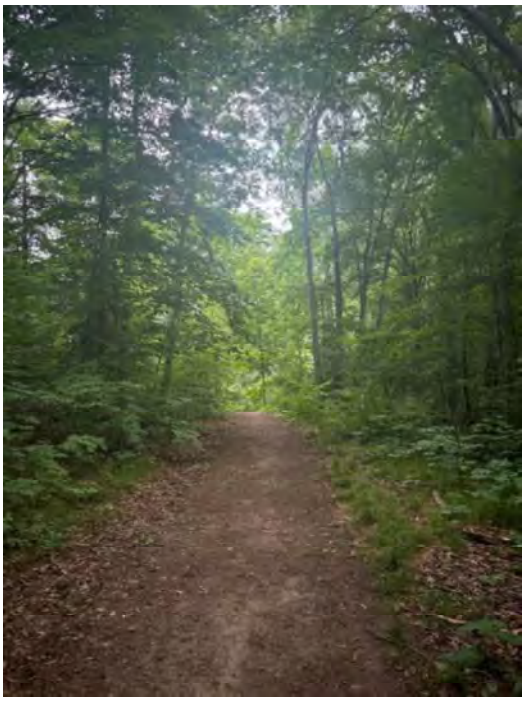


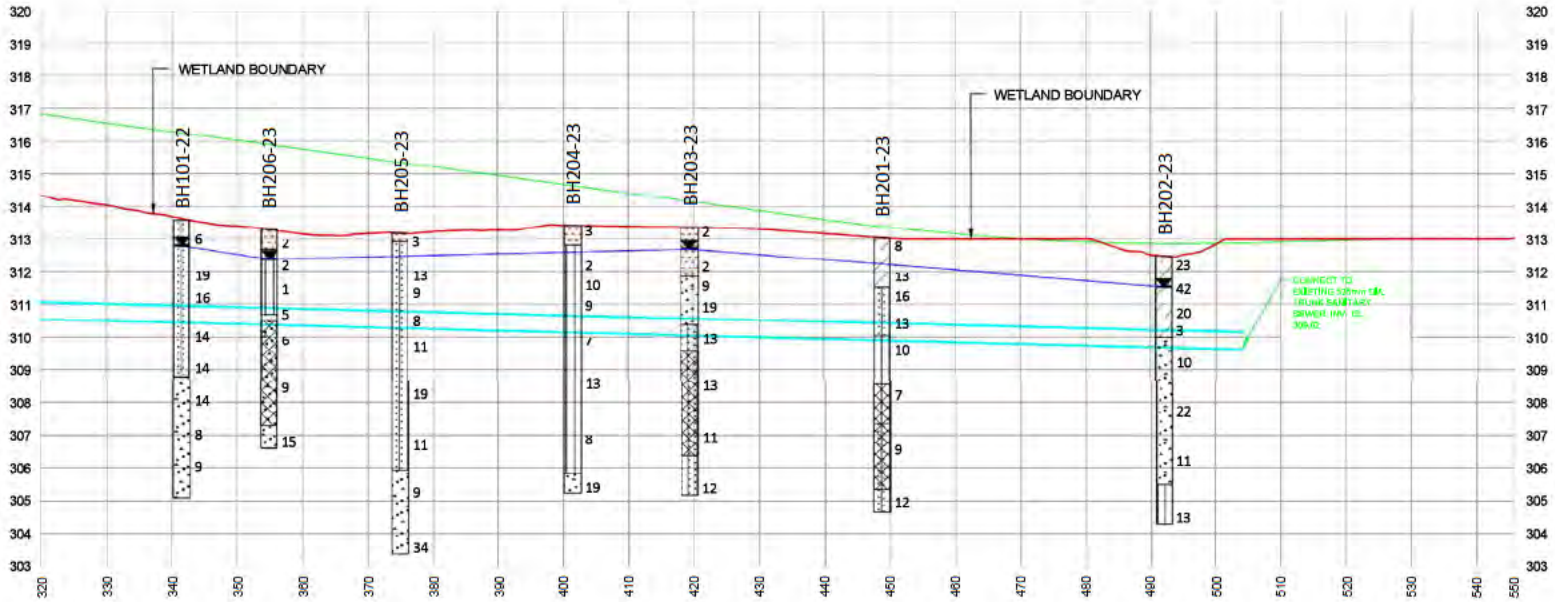
**Photo 16: Natural Unmanaged Trail**

# Attachment 2

Geotechnical Investigation, Borehole Locations and Bore Logs
(Cambium, 2024)

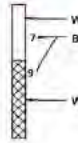
# GEOTECHNICAL INVESTIGATION

BT ENGINEERING
Biehn Drive
Kitchener, Ontario




LEGEND

- WATER LEVEL INDICATOR
- FILL
- PEAT
- SILT
- SILTY SAND
- SAND
- WATER LEVEL
- GROUND SURFACE
- PROPOSED SURFACE GRADING
- PROPOSED SEWER




Notes:
1. Survey completed by Cambium Inc. December 6, 2023
2. Distances on this plan are in metres and can be converted to feet by dividing by 3.3048.

194 Sophia Street
Peterborough, Ontario, K9H 1E5
Tel: 705-742-7900 Fax: 705-742-7907
www.cambium-inc.com

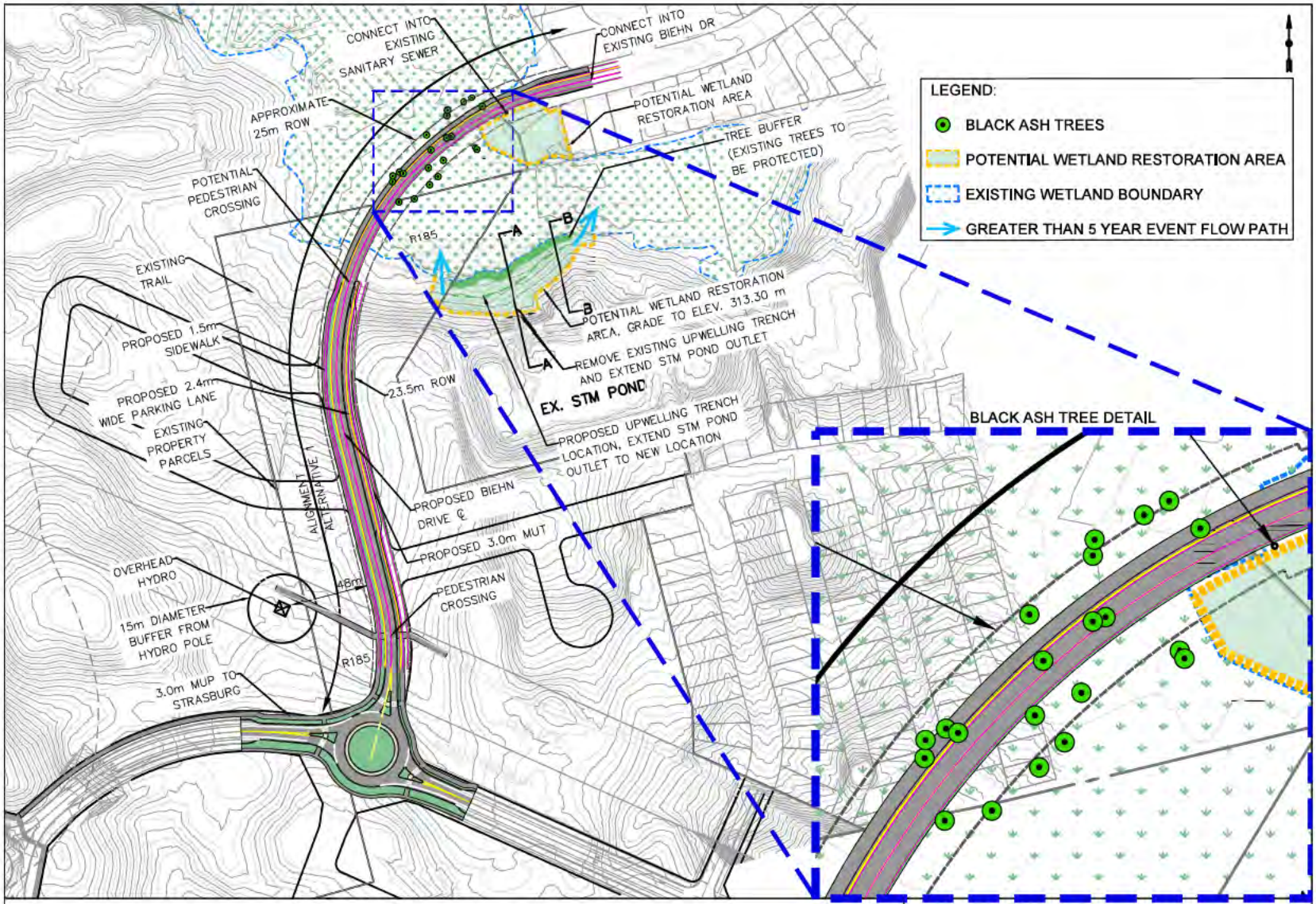
## PROFILE CROSS SECTION

| Project No. | Date: |
|---|---|
| 11969-002 | December 2023 |
| Horizontal Scale: N/A | Vertical Scale: N/A |
| Drawn By: MAT | Checked By: ZL |
| | Figure: 3 |

# Attachment 3

Conceptual Layout Drawings: Area 2a Plan and Sections

BT ENGINEERING




**CITY OF KITCHENER**

Black Ash Tree Inventory and Offset Wetland Restoration

1.25:1 - Net Gain:Loss

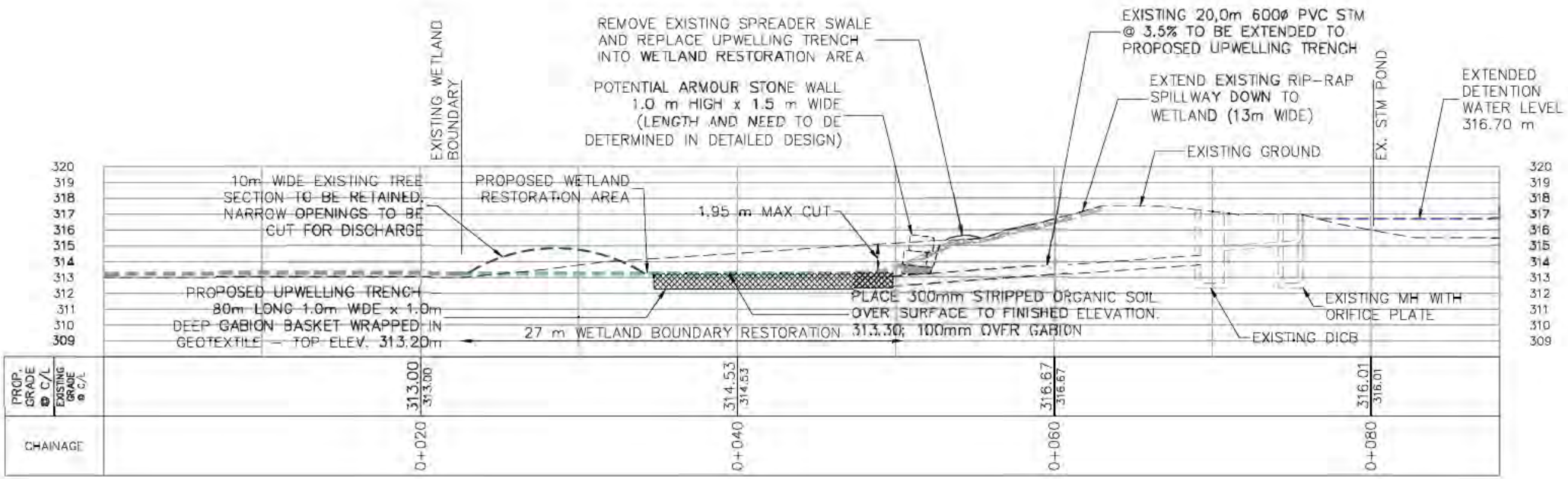
BT ENGINEERING

**BTE 21-003**

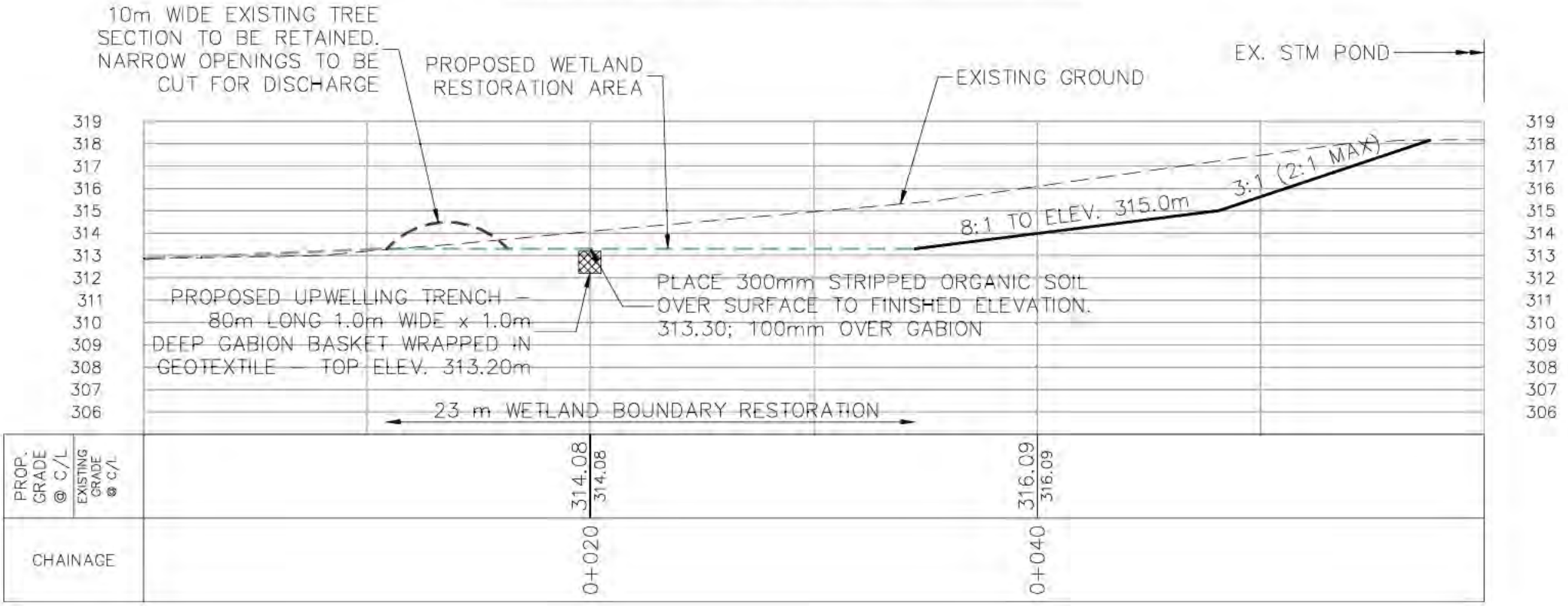
2024-07-29

N.T.S.

# SECTION A–A


EXISTING WETLAND BOUNDARY
REMOVE EXISTING SPREADER SWALE AND REPLACE UPWELLING TRENCH INTO WETLAND RESTORATION AREA
POTENTIAL ARMOUR STONE WALL 1.0 m HIGH x 1.5 m WIDE (LENGTH AND NEED TO DE DETERMINED IN DETAILED DESIGN)
EXISTING 20.0m 600ø PVC STM @ 3.5% TO BE EXTENDED TO PROPOSED UPWELLING TRENCH
EXTEND EXISTING RIP-RAP SPILLWAY DOWN TO WETLAND (13m WIDE)
EXISTING GROUND
EX. STM POND
EXTENDED DETENTION WATER LEVEL 316.70 m
10m WIDE EXISTING TREE SECTION TO BE RETAINED. NARROW OPENINGS TO BE CUT FOR DISCHARGE
PROPOSED WETLAND RESTORATION AREA
1.95 m MAX CUT
PROPOSED UPWELLING TRENCH – 80m LONG 1.0m WIDE x 1.0m DEEP GABION BASKET WRAPPED IN GEOTEXTILE – TOP ELEV. 313.20m
27 m WETLAND BOUNDARY RESTORATION
PLACE 300mm STRIPPED ORGANIC SOIL OVER SURFACE TO FINISHED ELEVATION. 313.30; 100mm OVER GABION
EXISTING MH WITH ORIFICE PLATE
EXISTING DICB
320 319 318 317 316 315 314 313 312 311 310 309
PROP. GRADE @ C/L
EXISTING GRADE @ C/L
313.00 313.00
314.53 314.53
316.67 316.67
316.01 316.01
CHAINAGE
0+020
0+040
0+060
0+080

# SECTION B–B


10m WIDE EXISTING TREE SECTION TO BE RETAINED. NARROW OPENINGS TO BE CUT FOR DISCHARGE
PROPOSED WETLAND RESTORATION AREA
EXISTING GROUND
EX. STM POND
8:1 TO ELEV. 315.0m
3:1 (2:1 MAX)
PROPOSED UPWELLING TRENCH – 80m LONG 1.0m WIDE x 1.0m DEEP GABION BASKET WRAPPED IN GEOTEXTILE – TOP ELEV. 313.20m
PLACE 300mm STRIPPED ORGANIC SOIL OVER SURFACE TO FINISHED ELEVATION. 313.30; 100mm OVER GABION
23 m WETLAND BOUNDARY RESTORATION
319
318
317
316
315
314
313
312
311
310
309
308
307
306
PROP. GRADE @ C/L
EXISTING GRADE @ C/L
314.08
314.08
316.09
316.09
CHAINAGE
0+020
0+040

# Attachment 4

Meeting Notes: Consultation with Six Nations General Wildlife Trust Group (July 4, 2024, Zoom Call)

BT ENGINEERING

# MEETING NOTES

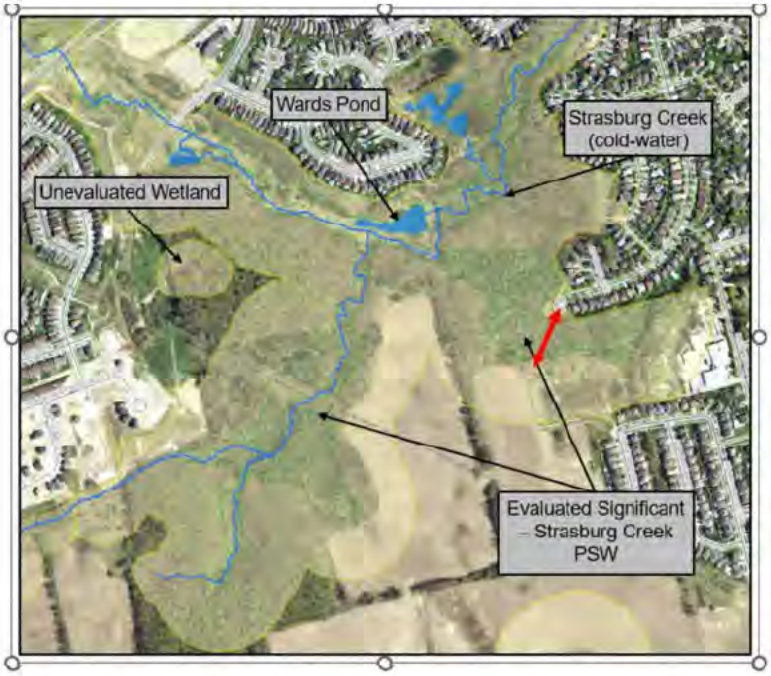
| | | |
|---|---|---|
| BT ENGINEERING BTE | **Project Name:** Biehn Drive and Sanitary Sewer Extension - Class Environmental Assessment | **Project Number:** 21-003 |

| | |
|---|---|
| TYPE/NUMBER: | Six Nations of the Grand River (SNGR) Meeting No. 3 |
| DATE: | July 4, 2024 |
| LOCATION/TIME: | Zoom Virtual Meeting, 9:00 am |
| PURPOSE: | Public Information Centre (PIC) #3 Meeting |

| NAME | COMPANY | PROJECT ROLE |
|---|---|---|
| PRESENT: | | |
| Peter Graham | Six Nations of the Grand River (SNGR) | Consultation Supervisor |
| Lauren Jones | SNGR | Manager Wildlife Institute Office |
| Lauren Vanderlingen | SNGR | Wildlife and Stewardship Office Technician |
| Daylon Gee | SNGR | Land Use Technician |
| Dawn Russell | SNGR | Consultation Administrative |
| Steve Taylor | BT Engineering Inc. (BTE) | Project Manager |
| Kristine Dimoff | BTE | Environmental Planner |
| Stephen Brook | BTE | Traffic Lead |
| Ryan Coady | BTE | Terrestrial |
| Shawn Taylor | BTE | Senior Biologist |
| Sonia Fiorini | BTE | Environmental Planner |
| DISTRIBUTION: | | |
| All Present | | |

| Item | | Action |
|---|---|---|
| **1.0** | **Introductions and Project Update** | |
| 1.1 | The consultant provided an overview presentation of the history of the EA and environmental elements. See **Attachment 1** for the presentation. | BTE |
| | It was explained that the land over which the project is located is privately held. Environmental studies have been completed by the developers' consultants. These studies have been reviewed and utilized by BTE but are the property of the developers. Both archaeological and natural environmental studies were completed and are illustrated in the presentation. The archaeological studies have been shared with Six Nations. WSP completed the detailed Environmental Impact Statement (EIS) and BTE will request permission for it to be shared with the Six Nations. | BTE |
| **2.0** | **Environmental** | |

| Item | | Action |
|---|---|---|
| 2.1 | The presentation illustrated the detailed EIS survey by WSP of the natural environment in the Provincially Significant Woodlot (PSW) including:<br>• Vegetation and Woodlots<br>• Wildlife survey<br>From the EIS detailed surveys Black Ash was identified as a Threatened species within the Study Area. In January 2025 the Black Ash was elevated to an Endangered Species. BTE have completed more detailed surveys of the Black Ash and have presented these findings at the third PCC.<br><br>The existing Stormwater management pond to the east of the new road alignment treats stormwater from adjacent subdivisions before | |
| 2.2 | With respect to the sensitivity of crossing a Provincially Significant Wetland the final recommendations included several mitigation measures including:<br>• an alignment as close to the eastern boundary of the PSW as possible,<br>• narrowing the road design within the PSW<br>• providing a wildlife passage under the road<br>• using micro-tunnelling of municipal services to avoid changes to the water table<br>• innovative road design which will float the new road on top of the existing wetland soils using geotextile and geogrid.<br>• Restoration of wetland<br>The design will be a demonstration project for environmental engineering best practices. The Provincial Policy Statement precludes development within PSW's but for road and utility infrastructure can be constructed in a PSW were justified by an Environmental Assessment.<br><br>One of the most significant changes that has occurred over the last 30 years is to change the alignment of the road crossing from preceding directly westerly from Biehn Drive across the larger wetland to Strasburg Road. It has been modified to cross the most eastern boundary possible as illustrated below in red. Doing so avoids the large centroid of the wetland complex | |

| Item | | Action |
|---|---|---|
| |  | |
| 2.3 | The profile of the new road is proposed to be elevated to be above the ground water to avoid influencing the water table near adjacent houses. Further mitigation for the road extension will be the removal of the existing cul-de-sac to reinstate PSW in this area. We are also investigating wetland restoration/creation opportunities to balance the wetland loss from the project. | |
| 2.4 | Mr. Taylor explained that the need for this project is two-fold including providing water and sanitary connections for development areas to the south and for transportation linkages for the community.<br><br>The trigger for the development is the Province's Places to Grow Act, which mandates levels of population and employment (2051 plan). A major development area in the City of Kitchener is south of this area. | |
| **3.0** | **Evaluation of Alternatives** | |
| 3.1 | The City completed a Transportation Master Plan (TMP) identifying this project. The current EA is completing the remaining phases of the Class EA. This includes identification of alternatives, evaluation of alternatives and public, stakeholder and rights holder consultation.<br><br>The technical recommendation is for Alternative 1 with mitigation. | |
| **4.0** | **Discussions** | |
| 4.1 | The Six Nations requested a copy of the EIS | |

| Item | | Action |
|---|---|---|
| 4.2 | It was agreed that the Draft Environmental Study Report (ESR) can be circulated for their review. The draft is planned to be completed in 2025. | |
| 4.3 | The Provincial Policy Statement (PPS) exempts a road project which is defined as Infrastructure, not Development. | |
| 4.4 | Black Ash Trees have been treated with insecticide within the City but are in decline. The Emerald Ash Bore is infesting trees in the City.<br>Lauren encourages the data to be inclusive with Black Ash Tree, as trees [under 8cm diameter at breast height (DBH)] can be the key to reestablish the Black Ash Trees.<br>BTE will monitor all Black Ash Trees (through growth) and will include data in the ESR and commitments for future monitoring. | BTE |
| 4.5 | Lauren suggested that Six Nations has a resource company– Kayanase (on reserve restoration company and greenhouse). They can help with the wetland restoration including providing planting material or seed harvesting /seed capturing.<br>The use of this company can help to build relationship and trust with Six Nations) | |
| 4.6 | Lauren asked if the road structure will be above the native peat. Will the ESR document how the road would handle flooding. How flooding will impact the soil.<br><br>Steve answered that the road profile is elevated to both allow a wildlife crossing culvert and to be above the wetland. Based on it being above the wetland surface the road will not flood. The design is predicated on returning rainwater back to the wetland (Low Impact Design (LID) principles). The wildlife culvert would equalize the water elevation on both sides of the road in any substantial rainfall event. | BTE |
| 4.7 | Lauren requested a bat assessment (provincially the Little Brown Myotis bat is designated). Four federally listed species to be confirmed if in the area. Encouraging species specific mitigation. | BTE |
| 4.8 | Request wildlife fencing to direct species to the wildlife crossing. It should be maintained regularly. Or usage of signage seasonally for when wildlife crossings are present. | |
| **5.0** | **Mitigation** | |
| 5.1 | Six Nation's desired compensation requirements:<br>a. 10:1 tree replacement<br>b. 1:1 wetland replacement (on-site)<br>c. 2:1 wetland replacement (off-site) | |

| Item | | Action |
|---|---|---|
| | It was confirmed that the restoration of the wetland from the cul-de-sac will not achieve the 1:1 replacement. Further areas will be investigated and added if possible. This area is the first restoration area to be considered as it was formerly wetland. | |
| 5.2 | Lauren, asking about survey's done in the area, Ecological Land Classification (ELC). The EIS to be provided if permission is obtained.<br>Lauren commented, putting a road through a PSW there is the impact from winter maintenance. Can that stretch of road not be salted, or seasonal closures. Can the effect be monitored pre and post construction.<br><br>Steve said there are different approaches to reducing salt and there is no known means to remove the road salt from the runoff. The most practical means are use of sand (which has a low percentage of salt to remove moisture) or "pre-wetting the road" to reduce the volume of salt applied. Those are the two common approaches. As a collector street the use of salt is low. These alternate approaches to winter maintenance will be noted in the ESR. | BTE |
| **6.0** | **Next Steps** | |
| | • Refinements to Technically Preferred Plan will be investigated based on input from PIC 3. This will include consideration of the feasibility of secondary areas for wetland restoration<br>• Document the recommendations in the ESR<br>• 30 Day public review<br>• EA Clearance to proceed with detail design | BTE |

Prepared by:

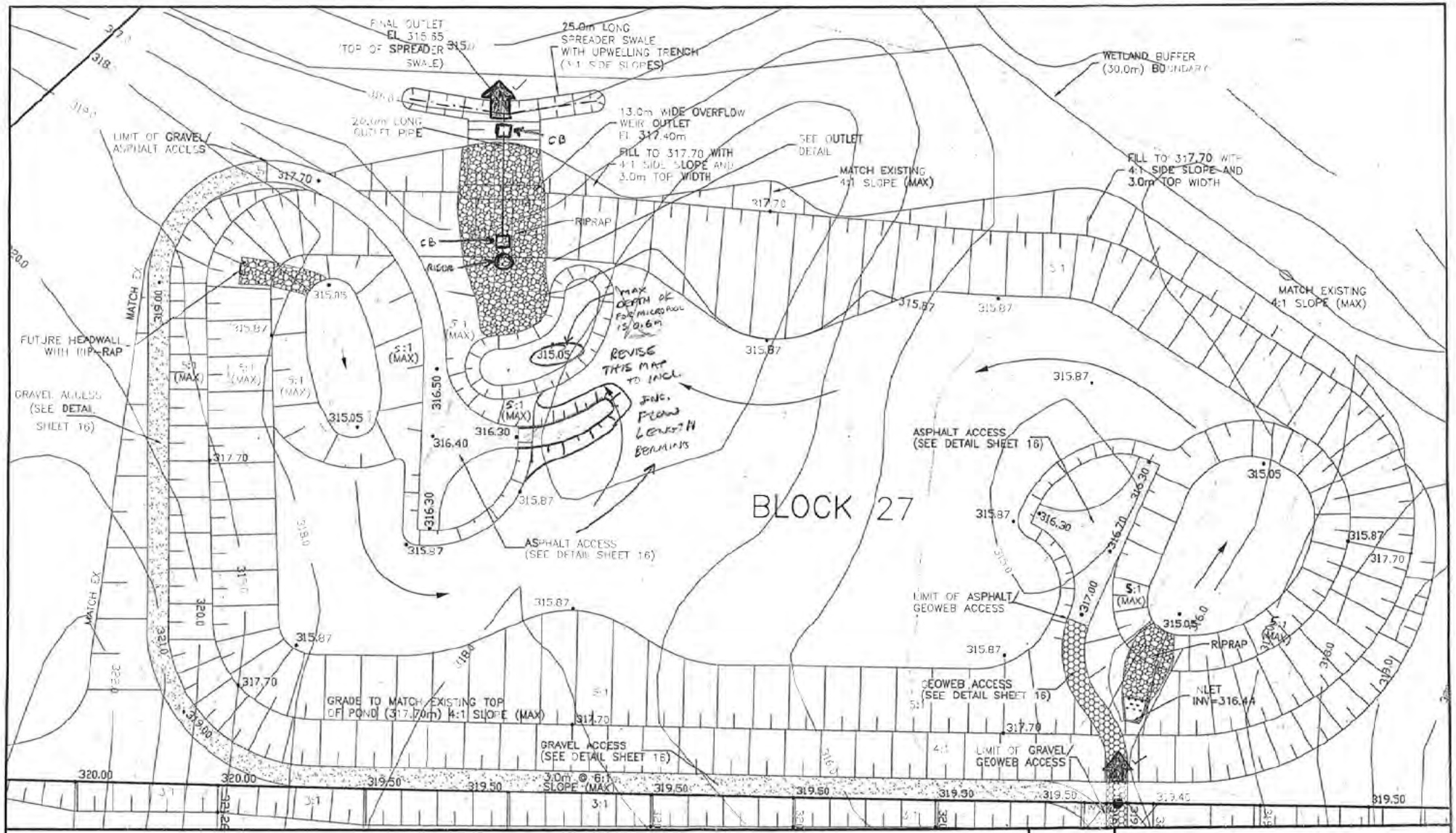
Sonia Fiorini
Environmental Planner

*Sent via email*

*Attachments:* 1. Meeting Presentation

# Attachment 5

Two Schematic Drawings of Hearthwood SWM Wetland Layout
(Stantec, 1999)




LEGEND:

TOP OF FACILITY (TOP OF QUANTITY STORAGE) = 317.70m
QUANTITY STORAGE VOLUME = 6958m³
W.D. EXTENDED DETENTION EL. = 316.30m SEE FIG. O/C
W.D. EXTENDED DETENTION STORAGE = 1516m³
TOP OF W.D./EROSION EXTENDED DETENTION STORAGE (EDWL) = 317.05m
TOTAL EXTENDED DETENTION STORAGE = 9242m³

TOP OF PERMANENT POOL (PPWL) = 316.15m
BOTTOM OF PERMANENT POOL = 315.87m
PERMANENT POOL (DEAD STORAGE = 2828m³

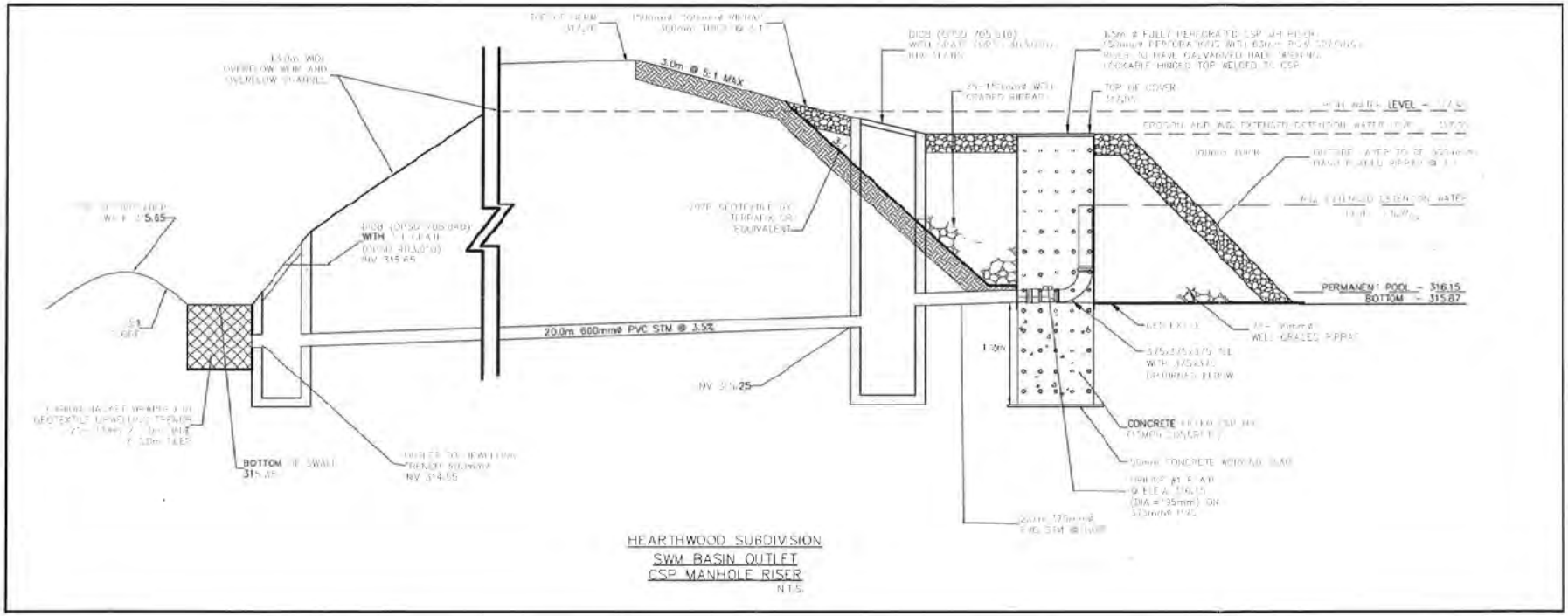
MAJOR FLOW ROUTE THRU FACILITY

Stantec

HEARTHWOOD SUBDIVISION

STORMWATER MANAGEMENT
WETLAND SWM FACILITY

| DATE: | SCALE: | PROJECT No. | FIGURE No. |
|---|---|---|---|
| 99.09.23 | 1:500 | 60309383 | FIGURE 1 |




HEARTHWOOD SUBDIVISION
SWM BASIN OUTLET
CSP MANHOLE RISER
N.T.S.

| | | | | |
|---|---|---|---|---|
| Stantec | HEARTHWOOD SUBDIVISION<br>STORMWATER MANAGEMENT OUTLET DETAILS<br>WETLAND SWM FACILITY | | | |
| | DATE:<br>99.09.24 | SCALE:<br>N.T.S. | PROJECT No.<br>60309383 | FIGURE No:<br>FIGURE 2 |

AP 99.04.23-93835WM

BT ENGINEERING
509 Talbot Street
London, ON N6A 2S5
519-672-2222

# MEMORANDUM

| | | | |
|---|---|---|---|
| **TO:** | File | DATE: | April 8, 2022 |
| **FROM:** | Rudi Warmé, P.Eng., BTE | PROJECT #: | 21-003 |
| **CC:** | Steve Taylor, Stephen Brook, BTE | | |
| **PROJECT:** | City of Kitchener Biehn Drive Extension Municipal Class Environmental Assessment | | |
| **SUBJECT:** | Natural Environment Overview and Assessment | | |

## 1.0 BACKGROUND

Biehn Drive is a local road at present in a residential area of the City of Kitchener with its southern terminus currently located on the edge of a unit of the Strasburg Creek Provincially Significant Wetland (PSW) Complex. The Study Area is illustrated in **Figure 1**. The City proposes to extend Biehn Drive west and south through a portion of the PSW to connect with a pre-defined alignment of Robert Ferrie Drive. A Municipal Class Environmental Assessment (MCEA) has recently been completed for the project, which confirmed the need for the undertaking, identified alternative solutions, and selected a technically preferred alternative (TPA) for the corridor alignment.

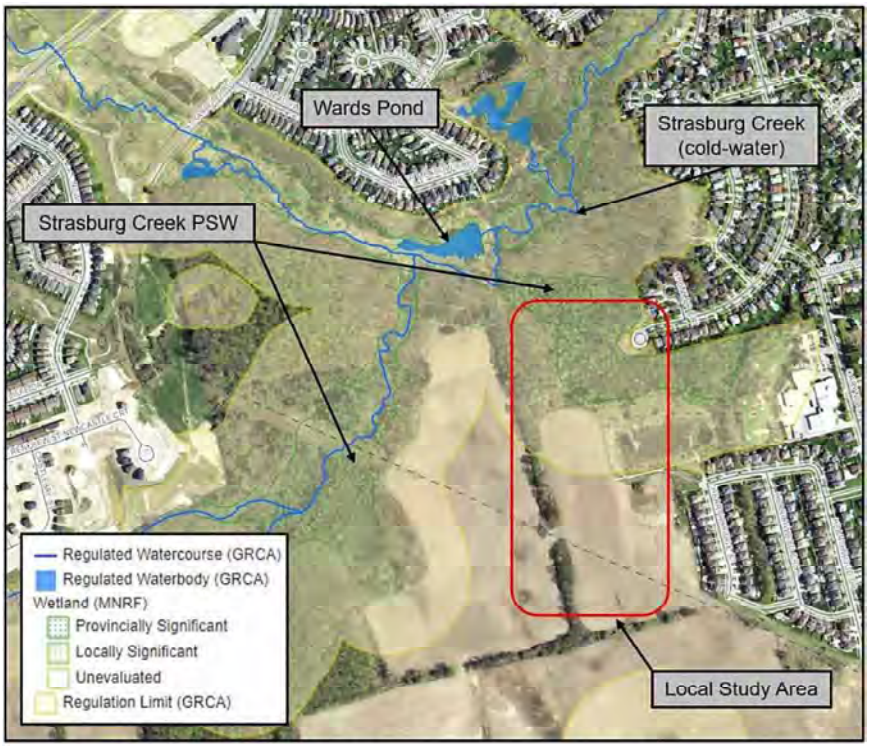



**Figure 1: Study Area**

A March 25, 2021, site visit was undertaken by BT Engineering Inc. (BTE) biologists to identify aquatic and terrestrial features of the natural environment within and adjacent to the roadway extension corridor to Robert Ferrie Drive. The site was inspected once more on August 26, 2021 with City of Kitchener, Grand River Conservation Authority (GRCA) and the landowners' representatives, including biologists from WSP Canada Group. The PSW

boundaries were delineated and staked in the vicinity of the proposed road extension to accurately define the drip lines of the adjacent woodlot edges.

An additional visit was completed on February 18, 2022, with Six Nations of the Grand River (SNGR) representatives to walk the staked centreline alignment of the road corridor and discuss potential wetland offsetting suggestions. The alignment of a proposed multi use trail (MUT) through the PSW within the west right-of-way was also discussed.

## 2.0 DISCUSSION

The Strasburg Creek PSW unit at Biehn Drive appears as a wooded swamp, with mature hardwoods dominant. The PSW, surrounding woodlands and farmlands are privately owned and slated for residential development in the future. Black Ash (*Fraxinus nigra*), Barn Swallow (*Hirunda rustica*) and Eastern Wood Pewee (*Satophaga ruticilla*) were identified in recent biological surveys of surrounding areas by the landowners' representatives. A BTE desktop background information review did not identify the presence of any other terrestrial or aquatic species at risk (SAR); however, the site reviews did identify suitable habitat conditions for bats within the swamp (roosting trees throughout) and for a variety of SAR listed songbirds including Eastern Meadowlark (*Sturnella magna*) and Bobolink (*Dolichonyx oryzivorus*) on the lands currently under cultivation to the south.

A concrete headwall with twin 1.2 m culvert inlets in the wetland boundary at the south end of the roadway directs wetland drainage and local storm sewer flows from Biehn Drive to an outlet pipe 25 m north of the road, where it becomes a permanently flowing tributary connecting with Strasburg Creek. The floor of the wetland in the immediate vicinity of the culvert entrance was wet with scattered ephemeral pools extending south. Several seasonal channels could be made out within the wetland approaching the culverts from the southwest and southeast. It appears unlikely that fish habitat extends into the PSW, although the culvert approaches were lined with small diameter river stone following the culvert installation.

No permanent open bodies of water are in the vicinity that would indicate possible year round turtle presence in the area. Their occurrence in this PSW unit would probably be only transitory due to the closed canopy and lack of basking areas. Other reptiles and amphibians (frogs, salamanders, snakes, etc.) would, however, be expected to be common. Yellow Birch (*Betula alleghaniensis*), now an uncommon tree species in many parts of southern Ontario, is well represented in the wetland and surrounding woodlands, as are Eastern Hemlock (*Tsuga canadensis*), Black Ash (Threatened) and White Pine (*Pinus strobus*), all of which include large specimens. A grouping of mature Aspen Poplars (*Populus spp*) occurs at the south boundary of the woodlot where the roadway extension will exit the PSW.

The land elevation rises immediately south of the wetland boundary where it abuts to the east the Hearthwood Park stormwater pond and a well-used multi use trail. Informal, connecting pathways presently wind through the wetland and adjacent wooded areas linking neighborhoods.

The TPA centreline and ROW limits have now been staked through the PSW and continue southwest over the gently rolling terrain of cultivated fields and across the hydro corridor before connecting to the future Robert Ferrie Drive.

## 3.0 IMPACTS, MITIGATION AND WETLAND OFFSETTING OPPORTUNITIES

The cleared ROW width of the Biehn Drive extension will be limited to approximately 10 m through the PSW section to minimize tree removal and wetland impacts beyond the roadway. A semi urban roadway (mountable curbs/gutters, no storm sewer) is recommended for the approximate 160 m length through

the PSW to maintain the natural setting (see **Figure 2**). Sidewalks will not extend through the PSW section. Rather, a proposed multi use trail will meander through the PSW avoiding specimen trees and connect at each end with paved pathway/sidewalk. The roadway surface will be slightly elevated above the surrounding wetland to permit placement of cross culverts to minimize surface drainage interference. Use of porous pavement through the PSW should be further explored. A suitably designed wildlife passage beneath the roadway will also be accommodated.

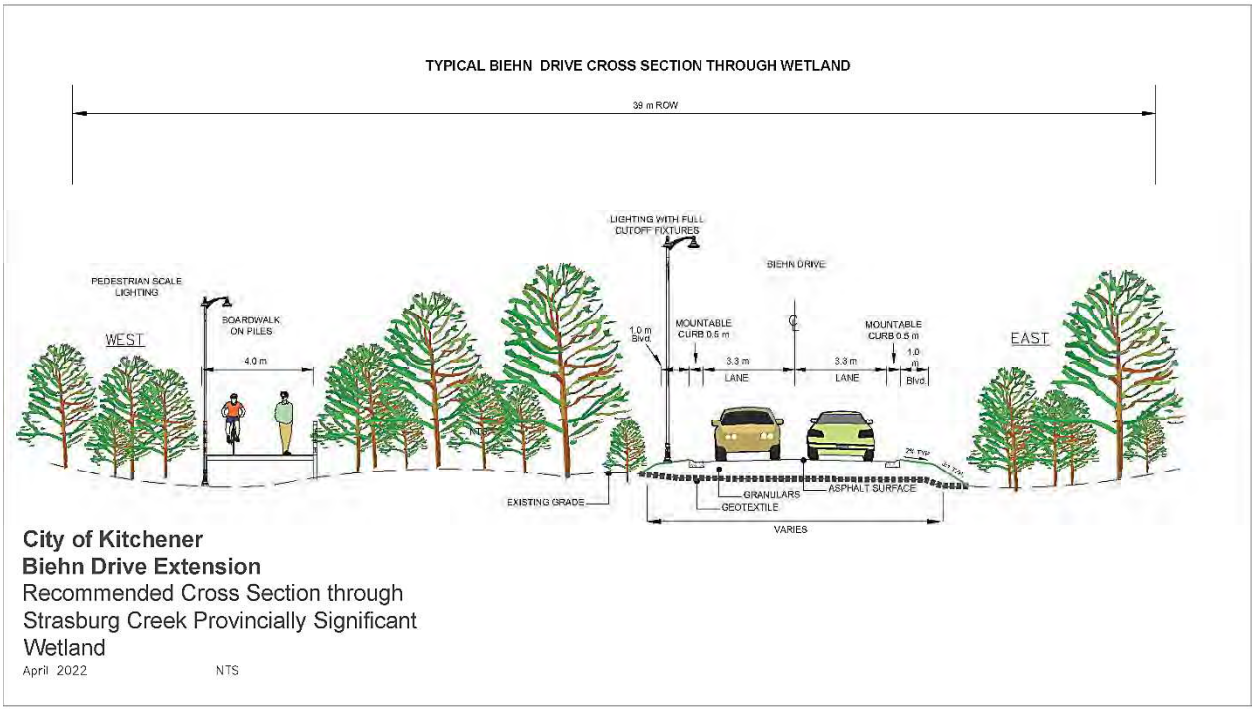



**Figure 2: Typical Recommended Roadway Section**

The road extension will be constructed to "float" on a geomembrane system placed over the wetland surface. The actual road alignment may be adjusted closer to the east ROW to maximize undisturbed woodlot width to the west and accommodate the MUT. The recommended, municipally owned ROW width will be 39 m through the PSW and beyond to Robert Ferrie Drive.

Although it appears the selected roadway extension alignment will miss much of the significant vegetation within the PSW, there will inevitably some removal of mature trees, disturbances to surface drainage, and loss of habitat features for resident fauna within the identified corridor. In addition to the new Biehn Drive extension, the work will also include installation of a sanitary sewer. Care will be required during its installation to avoid contamination impacts and impacts to the identified regional aquifer. A trenchless installation methodology is recommended.

SNGR suggestions from their site walk include investigations into alternatives to the use of asphalt or stone dust for construction of the MUT (an elevated boardwalk has been illustrated), considerations that the proposed wildlife crossing be sized to accommodate up to medium sized mammals, a preferred 10:1 tree replacement, and 1:1 wetland replacement on-site or 2:1 wetland replacement off-site.

There may be some opportunity to provide offsetting for wetland area and tree losses by re-using salvaged wetland soils/vegetation for re-naturalization in areas adjacent to the extension that will become undevelopable as a result of the works. Three potential locations have been initially identified:

the remnant Biehn Drive cul-de-sac; the isolated lands between PSW and Hearthwood stormwater pond and the current PSW boundary; and, tree plantings in suitable wetland setback buffer areas between the new housing and the PSW.

## 4.0 CONCLUSIONS

The Biehn Drive roadway extension will result in limited impacts to the PSW following the application of the recommended mitigation and offsetting measures, which will be further developed during detail design stage.

*Attachments*: A – Site Photographs

**Attachment A - Site Photographs**

Twin 1.2 m culverts (above) with a river stone entrance apron at the headwall (below) cross under the Biehn Drive cul-de-sac and connect to a permanent Strasburg Creek tributary to the north

A concrete headwall and twin culverts at the PSW drainage outlet can just be seen in the shade in the centre background (above). The Strasburg Creek tributary channel extends north and west (below) meandering through the woodland to eventually connect with the main creek

The floor of the wetland in the immediate vicinity of the culvert entrance was wet, with scattered ephemeral pools in the surrounding area

Several channels could be made out within the wetland approaching the culverts from the southwest (above) and southeast (below)

Bat roosting trees were noted throughout the PSW (above). Yellow Birch, an uncommon species, is well represented (below)

Eastern Hemlock (above, with young tree below) and White Pine are also represented in the PSW, including several large specimens

The land elevation quickly rises (below) as one moves south across the wetland boundary. The Hearthwood Park stormwater pond (below) and well used public trail are immediately south of the PSW

Pedestrian trails (above) and informal connecting pathways through the wetland and woodlot areas (below) link neighborhoods

Numerous mature trees are scattered through the PSW (above), including a grouping of large aspens beginning to leaf out at the approximate location where the road extension will exit the wetland. Note the trail along the edge of the woods (below)

View southwest across the corn fields towards the Robert Ferrie Drive roundabout location beyond along the proposed extension alignment

View north along the newly constructed, closed section of Strasburg Road (above). View northeast along the Robert Ferrie Drive alignment towards the Biehn Drive extension connection (below)

Stakes identify the roadway ROW limits (red, above) and centreline alignment (yellow, below) through the PSW at the Biehn Drive cul-de-sac

Staked alignment in the central portion of the PSW. A large Yellow Birch appears to be one of the few mature trees which will be lost (below)

Roadway extension alignment as it exits the PSW south boundary (above). Alignment stakes and borehole/monitoring well locations extend south across the fields towards the Robert Ferrie Drive alignment (below)

# Appendix F

Cultural Heritage

BT ENGINEERING

Ontario

**Ministry of Tourism, Culture and Sport**

Programs & Services Branch
401 Bay Street, Suite 1700
Toronto ON M7A 0A7

# Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes

## A Checklist for the Non-Specialist

The **purpose of the checklist** is to determine:

- if a property(ies) or project area:
  - is a recognized heritage property
  - may be of cultural heritage value
- it includes all areas that may be impacted by project activities, including – but not limited to:
  - the main project area
  - temporary storage
  - staging and working areas
  - temporary roads and detours

**Processes covered** under this checklist, such as:

- *Planning Act*
- *Environmental Assessment Act*
- *Aggregates Resources Act*
- *Ontario Heritage Act* – Standards and Guidelines for Conservation of Provincial Heritage Properties

**Cultural Heritage Evaluation Report (CHER)**

If you are not sure how to answer one or more of the questions on the checklist, you may want to hire a qualified person(s) (see page 5 for definitions) to undertake a cultural heritage evaluation report (CHER).

The CHER will help you:

- identify, evaluate and protect cultural heritage resources on your property or project area
- reduce potential delays and risks to a project

**Other checklists**

Please use a separate checklist for your project, if:

- you are seeking a Renewable Energy Approval under Ontario Regulation 359/09 – separate checklist
- your Parent Class EA document has an approved screening criteria (as referenced in Question 1)

Please refer to the Instructions pages for more detailed information and when completing this form.

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Project or Property Name

Biehn Drive Extension and Sanitary Trunk Inc.

Project or Property Location (upper and lower or single tier municipality)

City of Kitchener, Regional Municipality of Waterloo

Proponent Name

BT Engineering

Proponent Contact Information

Katherine Scott, katherine.scott@bteng.ca

## Screening Questions

| | Yes | No |
|---|---|---|
| 1. Is there a pre-approved screening checklist, methodology or process in place? | ☐ | ☑ |

**If Yes,** please follow the pre-approved screening checklist, methodology or process.

**If No,** continue to Question 2.

## Part A: Screening for known (or recognized) Cultural Heritage Value

| | Yes | No |
|---|---|---|
| 2. Has the property (or project area) been evaluated before and found **not** to be of cultural heritage value? | ☐ | ☑ |

**If Yes,** do **not** complete the rest of the checklist.

The proponent, property owner and/or approval authority will:

- summarize the previous evaluation and
- add this checklist to the project file, with the appropriate documents that demonstrate a cultural heritage evaluation was undertaken

The summary and appropriate documentation may be:

- submitted as part of a report requirement
- maintained by the property owner, proponent or approval authority

**If No**, continue to Question 3.

| | Yes | No |
|---|---|---|
| 3. Is the property (or project area): | | |
| a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value? | ☐ | ☑ |
| b. a National Historic Site (or part of)? | ☐ | ☑ |
| c. designated under the *Heritage Railway Stations Protection Act*? | ☐ | ☑ |
| d. designated under the *Heritage Lighthouse Protection Act*? | ☐ | ☑ |
| e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)? | ☐ | ☑ |
| f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site? | ☐ | ☑ |

**If Yes** to any of the above questions, you need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report, if a Statement of Cultural Heritage Value has not previously been prepared or the statement needs to be updated

If a Statement of Cultural Heritage Value has been prepared previously and if alterations or development are proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

**If No**, continue to Question 4.

## Part B: Screening for Potential Cultural Heritage Value

| | Yes | No |
|---|---|---|
| 4. Does the property (or project area) contain a parcel of land that: | | |
| a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque? | ☐ | ☑ |
| b. has or is adjacent to a known burial site and/or cemetery? | ☐ | ☑ |
| c. is in a Canadian Heritage River watershed? | ☐ | ☑ |
| d. contains buildings or structures that are 40 or more years old? | ☐ | ☑ |

## Part C: Other Considerations

| | Yes | No |
|---|---|---|
| 5. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area): | | |
| a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area? | ☐ | ☑ |
| b. has a special association with a community, person or historical event? | ☐ | ☑ |
| c. contains or is part of a cultural heritage landscape? | ☐ | ☑ |

**If Yes** to one or more of the above questions (Part B and C), there is potential for cultural heritage resources on the property or within the project area.

You need to hire a qualified person(s) to undertake:

- a Cultural Heritage Evaluation Report (CHER)

If the property is determined to be of cultural heritage value and alterations or development is proposed, you need to hire a qualified person(s) to undertake:

- a Heritage Impact Assessment (HIA) – the report will assess and avoid, eliminate or mitigate impacts

**If No** to all of the above questions, there is low potential for built heritage or cultural heritage landscape on the property.

The proponent, property owner and/or approval authority will:

- summarize the conclusion
- add this checklist with the appropriate documentation to the project file

The summary and appropriate documentation may be:

- submitted as part of a report requirement e.g. under the *Environmental Assessment Act, Planning Act* processes
- maintained by the property owner, proponent or approval authority

## Instructions

Please have the following available, when requesting information related to the screening questions below:

- a clear map showing the location and boundary of the property or project area
  - large scale and small scale showing nearby township names for context purposes
- the municipal addresses of all properties within the project area
- the lot(s), concession(s), and parcel number(s) of all properties within a project area

For more information, see the Ministry of Tourism, Culture and Sport's Ontario Heritage Toolkit or Standards and Guidelines for Conservation of Provincial Heritage Properties.

In this context, the following definitions apply:

- **qualified person(s)** means individuals – professional engineers, architects, archaeologists, etc. – having relevant, recent experience in the conservation of cultural heritage resources.
- **proponent** means a person, agency, group or organization that carries out or proposes to carry out an undertaking or is the owner or person having charge, management or control of an undertaking.

### 1. Is there a pre-approved screening checklist, methodology or process in place?

An existing checklist, methodology or process may already be in place for identifying potential cultural heritage resources, including:

- one endorsed by a municipality
- an environmental assessment process e.g. screening checklist for municipal bridges
- one that is approved by the Ministry of Tourism, Culture and Sport (MTCS) under the Ontario government's Standards & Guidelines for Conservation of Provincial Heritage Properties [s.B.2.]

## Part A: Screening for known (or recognized) Cultural Heritage Value

### 2. Has the property (or project area) been evaluated before and found not to be of cultural heritage value?

Respond 'yes' to this question, if all of the following are true:

A property can be considered not to be of cultural heritage value if:

- a Cultural Heritage Evaluation Report (CHER) - or equivalent - has been prepared for the property with the advice of a qualified person and it has been determined not to be of cultural heritage value and/or
- the municipal heritage committee has evaluated the property for its cultural heritage value or interest and determined that the property is not of cultural heritage value or interest

A property may need to be re-evaluated, if:

- there is evidence that its heritage attributes may have changed
- new information is available
- the existing Statement of Cultural Heritage Value does not provide the information necessary to manage the property
- the evaluation took place after 2005 and did not use the criteria in Regulations 9/06 and 10/06

**Note**: Ontario government ministries and public bodies [prescribed under Regulation 157/10] may continue to use their existing evaluation processes, until the evaluation process required under section B.2 of the Standards & Guidelines for Conservation of Provincial Heritage Properties has been developed and approved by MTCS.

To determine if your property or project area has been evaluated, contact:

- the approval authority
- the proponent
- the Ministry of Tourism, Culture and Sport

### 3a. Is the property (or project area) identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value e.g.:

i. designated under the *Ontario Heritage Act*

- individual designation (Part IV)
- part of a heritage conservation district (Part V)

**Individual Designation – Part IV**

A property that is designated:

- by a municipal by-law as being of cultural heritage value or interest [s.29 of the *Ontario Heritage Act*]
- by order of the Minister of Tourism, Culture and Sport as being of cultural heritage value or interest of provincial significance [s.34.5]. **Note**: To date, no properties have been designated by the Minister.

**Heritage Conservation District – Part V**

A property or project area that is located within an area designated by a municipal by-law as a heritage conservation district [s. 41 of the *Ontario Heritage Act*].

For more information on Parts IV and V, contact:

- municipal clerk
- Ontario Heritage Trust
- local land registry office (for a title search)

---

ii. subject of an agreement, covenant or easement entered into under Parts II or IV of the *Ontario Heritage Act*

An agreement, covenant or easement is usually between the owner of a property and a conservation body or level of government. It is usually registered on title.

The primary purpose of the agreement is to:

- preserve, conserve, and maintain a cultural heritage resource
- prevent its destruction, demolition or loss

For more information, contact:

- Ontario Heritage Trust - for an agreement, covenant or easement [clause 10 (1) (c) of the *Ontario Heritage Act*]
- municipal clerk – for a property that is the subject of an easement or a covenant [s.37 of the *Ontario Heritage Act*]
- local land registry office (for a title search)

---

iii. listed on a register of heritage properties maintained by the municipality

Municipal registers are the official lists - or record - of cultural heritage properties identified as being important to the community.

Registers include:

- all properties that are designated under the *Ontario Heritage Act* (Part IV or V)
- properties that have not been formally designated, but have been identified as having cultural heritage value or interest to the community

For more information, contact:

- municipal clerk
- municipal heritage planning staff
- municipal heritage committee

---

iv. subject to a notice of:

- intention to designate (under Part IV of the *Ontario Heritage Act*)
- a Heritage Conservation District study area bylaw (under Part V of the *Ontario Heritage Act*)

A property that is subject to a **notice of intention to designate** as a property of cultural heritage value or interest and the notice is in accordance with:

- section 29 of the *Ontario Heritage Act*
- section 34.6 of the *Ontario Heritage Act.* **Note**: To date, the only applicable property is Meldrum Bay Inn, Manitoulin Island. [s.34.6]

An area designated by a municipal by-law made under section 40.1 of the *Ontario Heritage Act* as a **heritage conservation district study area**.

For more information, contact:

- municipal clerk – for a property that is the subject of notice of intention [s. 29 and s. 40.1]
- Ontario Heritage Trust

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v. included in the Ministry of Tourism, Culture and Sport's list of provincial heritage properties

Provincial heritage properties are properties the Government of Ontario owns or controls that have cultural heritage value or interest.

The Ministry of Tourism, Culture and Sport (MTCS) maintains a list of all provincial heritage properties based on information provided by ministries and prescribed public bodies. As they are identified, MTCS adds properties to the list of provincial heritage properties.

For more information, contact the MTCS Registrar at registrar@ontario.ca.

**3b. Is the property (or project area) a National Historic Site (or part of)?**

National Historic Sites are properties or districts of national historic significance that are designated by the Federal Minister of the Environment, under the *Canada National Parks Act*, based on the advice of the Historic Sites and Monuments Board of Canada.

For more information, see the National Historic Sites website.

**3c. Is the property (or project area) designated under the *Heritage Railway Stations Protection Act*?**

The *Heritage Railway Stations Protection Act* protects heritage railway stations that are owned by a railway company under federal jurisdiction. Designated railway stations that pass from federal ownership may continue to have cultural heritage value.

For more information, see the Directory of Designated Heritage Railway Stations.

**3d. Is the property (or project area) designated under the *Heritage Lighthouse Protection Act*?**

The *Heritage Lighthouse Protection Act* helps preserve historically significant Canadian lighthouses. The Act sets up a public nomination process and includes heritage building conservation standards for lighthouses which are officially designated.

For more information, see the Heritage Lighthouses of Canada website.

**3e. Is the property (or project area) identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office?**

The role of the Federal Heritage Buildings Review Office (FHBRO) is to help the federal government protect the heritage buildings it owns. The policy applies to all federal government departments that administer real property, but not to federal Crown Corporations.

For more information, contact the Federal Heritage Buildings Review Office.

See a directory of all federal heritage designations.

**3f. Is the property (or project area) located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?**

A UNESCO World Heritage Site is a place listed by UNESCO as having outstanding universal value to humanity under the Convention Concerning the Protection of the World Cultural and Natural Heritage. In order to retain the status of a World Heritage Site, each site must maintain its character defining features.

Currently, the Rideau Canal is the only World Heritage Site in Ontario.

For more information, see Parks Canada – World Heritage Site website.

## Part B: Screening for potential Cultural Heritage Value

**4a. Does the property (or project area) contain a parcel of land that has a municipal, provincial or federal commemorative or interpretive plaque?**

Heritage resources are often recognized with formal plaques or markers.

Plaques are prepared by:

- municipalities
- provincial ministries or agencies
- federal ministries or agencies
- local non-government or non-profit organizations

For more information, contact:

- municipal heritage committees or local heritage organizations – for information on the location of plaques in their community
- Ontario Historical Society's Heritage directory – for a list of historical societies and heritage organizations
- Ontario Heritage Trust – for a list of plaques commemorating Ontario's history
- Historic Sites and Monuments Board of Canada – for a list of plaques commemorating Canada's history

**4b. Does the property (or project area) contain a parcel of land that has or is adjacent to a known burial site and/or cemetery?**

For more information on known cemeteries and/or burial sites, see:

- Cemeteries Regulations, Ontario Ministry of Consumer Services – for a database of registered cemeteries
- Ontario Genealogical Society (OGS) – to locate records of Ontario cemeteries, both currently and no longer in existence; cairns, family plots and burial registers
- Canadian County Atlas Digital Project – to locate early cemeteries

In this context, adjacent means contiguous or as otherwise defined in a municipal official plan.

**4c. Does the property (or project area) contain a parcel of land that is in a Canadian Heritage River watershed?**

The Canadian Heritage River System is a national river conservation program that promotes, protects and enhances the best examples of Canada's river heritage.

Canadian Heritage Rivers must have, and maintain, outstanding natural, cultural and/or recreational values, and a high level of public support.

For more information, contact the Canadian Heritage River System.

If you have questions regarding the boundaries of a watershed, please contact:

- your conservation authority
- municipal staff

**4d. Does the property (or project area) contain a parcel of land that contains buildings or structures that are 40 or more years old?**

A 40 year 'rule of thumb' is typically used to indicate the potential of a site to be of cultural heritage value. The approximate age of buildings and/or structures may be estimated based on:

- history of the development of the area
- fire insurance maps
- architectural style
- building methods

Property owners may have information on the age of any buildings or structures on their property. The municipality, local land registry office or library may also have background information on the property.

**Note**: 40+ year old buildings or structure do not necessarily hold cultural heritage value or interest; their age simply indicates a higher potential.

A building or structure can include:

- residential structure
- farm building or outbuilding
- industrial, commercial, or institutional building
- remnant or ruin
- engineering work such as a bridge, canal, dams, etc.

For more information on researching the age of buildings or properties, see the Ontario Heritage Tool Kit Guide Heritage Property Evaluation.

## Part C: Other Considerations

**5a. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) is considered a landmark in the local community or contains any structures or sites that are important to defining the character of the area?**

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has potential landmarks or defining structures and sites, for instance:

- buildings or landscape features accessible to the public or readily noticeable and widely known
- complexes of buildings
- monuments
- ruins

**5b. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) has a special association with a community, person or historical event?**

Local or Aboriginal knowledge may reveal that the project location is situated on a parcel of land that has a special association with a community, person or event of historic interest, for instance:

- Aboriginal sacred site
- traditional-use area
- battlefield
- birthplace of an individual of importance to the community

**5c. Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area) contains or is part of a cultural heritage landscape?**

Landscapes (which may include a combination of archaeological resources, built heritage resources and landscape elements) may be of cultural heritage value or interest to a community.

For example, an Aboriginal trail, historic road or rail corridor may have been established as a key transportation or trade route and may have been important to the early settlement of an area. Parks, designed gardens or unique landforms such as waterfalls, rock faces, caverns, or mounds are areas that may have connections to a particular event, group or belief.

For more information on Questions 5.a., 5.b. and 5.c., contact:

- Elders in Aboriginal Communities or community researchers who may have information on potential cultural heritage resources. Please note that Aboriginal traditional knowledge may be considered sensitive.
- municipal heritage committees or local heritage organizations
- Ontario Historical Society's "Heritage Directory" - for a list of historical societies and heritage organizations in the province

An internet search may find helpful resources, including:

- historical maps
- historical walking tours
- municipal heritage management plans
- cultural heritage landscape studies
- municipal cultural plans

Information specific to trails may be obtained through Ontario Trails.

## 1.0 SCREENING FOR KNOWN CULTURAL HERITAGE VALUE

**Has the property (or project area) been evaluated before and found not to be of cultural heritage value?**

No; the Subject Property has never been previously evaluated and found not to be of cultural heritage value.

**Is the property (or project area):**

**a. identified, designated or otherwise protected under the *Ontario Heritage Act* as being of cultural heritage value?**

No; the Subject Property has not been designated under the *Ontario Heritage Act* (OHA). There are no Ontario Heritage Trust conservation easements on or adjacent to the Subject Property.[1] The Subject Property is not included on the City of Kitchener Heritage Inventory.[2] It is not subject to a notice of intention to designate under Part IV of the OHA, or notice of a Heritage Conservation District study area bylaw under Part V of the OHA. There are no provincial heritage properties located on the Subject Property.

**b. a National Historic Site (or part of)?**

No; the Subject Property has not been identified as a National Historic Site. There are three National Historic Sites in Kitchener; they are not located on the Subject Property.[3]

**c. designated under the Heritage Railway Stations Protection Act?**

No; the Subject Property has not designated under the Heritage Railway Stations Protection Act. There is one Historic Railway Station in Kitchener (126 Weber Street); it is not located on the Subject Property.[4]

**d. designated under the Heritage Lighthouse Protection Act?**

No; the Subject Property has not been designated under the Heritage Lighthouse Protection Act. There are no Heritage Lighthouses located in Kitchener.[5]

---

[1] OHT n.d.: Ontario Heritage Act Register
[2] City of Kitchener n.d.
[3] Parks Canada n.d.
[4] Parks Canada n.d.
[5] Parks Canada n.d.

**e. identified as a Federal Heritage Building by the Federal Heritage Buildings Review Office (FHBRO)?**

No; the Subject Property has not been identified as a Federal Heritage Building. There are four Federal Heritage Buildings in Kitchener (15 Duke Street, 528 Wellington Street North, 437 Tower Road, and 166 Frederick Street); it is not located on the Subject Property.[6]

**f. located within a United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Site?**

No; the Subject Property is not located within a UNESCO World Heritage site. There are no UNESCO World Heritage sites located in Kitchener.[7]

[6] Parks Canada n.d.
[7] UNESCO n.d.

## 2.0 SCREENING FOR POTENTIAL CULTURAL HERITAGE VALUE

**Does the property (or project area) contain a parcel of land that:**

**a. is the subject of a municipal, provincial or federal commemorative or interpretive plaque?**

No; the Subject Property is not the subject of a municipal, provincial, or federal commemorative or interpretive plaque. Of the 8 federal plaques in Kitchener, none is located on the subject property.[8] Of the provincial plaques in Kitchener, none is located on the subject property.[9] There are currently no municipal plaques located on the subject property.

**b. has or is adjacent to a known burial site and/or cemetery?**

No; the Subject Property does not contain, nor is it adjacent to, a known burial site and/or cemetery.[10]

**c. is in a Canadian Heritage River watershed?**

No; The Subject Property contains a portion of Strasburg Creek, until its confluence with a downstream with Schneider Creek. Schneider Creek, in turn, is a tributary of the Grand River, which was designated as a Canadian Heritage River in 1994.[11] The designation refers to "the 290 km-long Grand River and its major tributaries, the Nith, Conestogo, Speed and Eramosa." As Strasburg Creek is tributary of Schneider Creek which is not included in the designation as a major tributary, the Subject Property does not meet this criterion.

**d. contains buildings or structures that are 40 or more years old?**

No; there are no buildings or structures located on the Subject Property. Structures were present until the 1950s associated with the road allowance that transects the study area from north to south. These structures are no longer present.

[8] Parks Canada n.d.
[9] OHT n.d.: Plaque Database
[10] BAO n.d.; CanadaGenWeb n.d.
[11] Canadian Heritage Rivers System 2017; Grand River Conservation Authority n.d.

## 3.0 OTHER CONSIDERATIONS

**Is there local or Aboriginal knowledge or accessible documentation suggesting that the property (or project area):**

**a. is considered a landmark in the local community or contains any structures or sites that are important in defining the character of the area?**

No; the Subject Property is not considered a landmark.

**b. has a special association with a community, person or historical event?**

No; it is not known or suggested that the Subject Property meets this criterion.

**c. contains or is part of a cultural heritage landscape?**

No; the Subject Property does not contain, nor is it part of, a cultural heritage landscape as identified by the City of Kitchener.[12]

[12] City of Kitchener 2014

## 4.0 RECOMMENDATION

Based on the assessment of the Subject Property against the MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes, the Subject Property was not found to meet the screening criteria for either known or potential heritage value. No further heritage studies are recommended.

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# Appendix G

## Hydrological Investigation

BT ENGINEERING

# TECHNICAL MEMORANDUM

| | | | |
|---|---|---|---|
| **TO:** | Steve Taylor, P.Eng. | **OUR REF.:** | SN0441 |
| **FROM:** | Leonardo Sanchez, P.Eng. | **DATE:** | April 7, 2022 |
| **COPY:** | Katherine Scott, P.Eng. | | |

**RE:** **City of Kitchener, Biehn Drive Extension**
**Drainage and Stormwater Management**

The purpose of this Technical Memorandum is to present the results of the Drainage and Stormwater Management Study for the Biehn Drive Extension EA.

## Background Information

***Hearthwood Subdivision, Detailed Stormwater Management Design Report, Stantec Consulting Ltd., September 1999.***

This report provides the stormwater management design for the subdivision and the existing stormwater management facility. The subdivision extent as it was originally planned in 1999 is shown in Figure 1. Only a part of the subdivision was constructed.

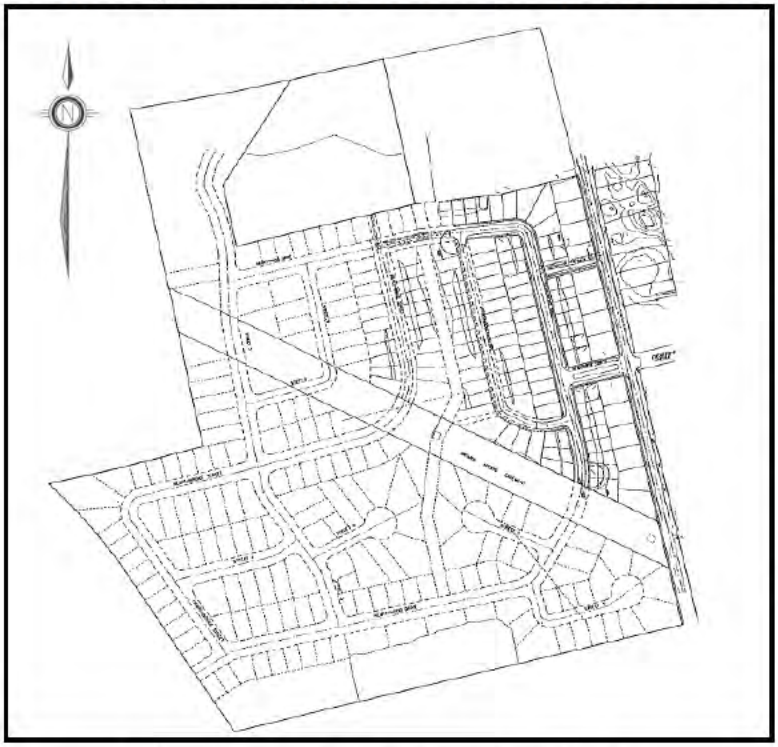

**Figure 1 - Hearthwood Subdivision - June 1999**

The stormwater management wetland SWM facility was designed, according to the 1999 report, to provide control of post-development flows and runoff volumes for all events up to and including the 5-year storm event for a total developed land area of 37.75 ha, and to provide control of all storms greater than the 5-year storm event, up to the 100-year storm event, for a total of 44.4 ha.

The stormwater management criteria used for the design are discussed below.

**Water Quality and Watercourse Erosion Control**

Due to the Provincially Significant Wetland that receives the runoff, Enhanced (Level 1) water quality protection was selected for the site.

The recommendation of the Strasburg Creek Master Watershed Plan (MWP) was to intercept through infiltration or extended detention the runoff generated by a 25 mm two-hour rainfall.

Also based on the MWP, runoff volumes and peak flows were to be controlled to pre-development values for the 5-year storm, to minimize the erosion potential of post-development flows.

The MWP also recommended providing 236 $m^3$ of extended detention for a hectare of development with a runoff coefficient of 0.55.

**Stormwater Quantity Control**

The Strasburg Creek MWP recommended control of the 25-year and 100-year storm events post-development volumes and peak flows to pre-development levels.

**At-Source Infiltration**

Based on the requirements of the MWP, infiltration was to be provided for 12 mm of runoff from impervious land uses within 4 days following each rainfall event.

***Integrated Stormwater Management Master Plan (ISWM-MP), Aquafor Beech Ltd., May 2016***

The purpose of the ISWM-MP was to serve as a decision support tool and methodology for the prioritization of works, and to provide the means for establishing stormwater management guidelines to 2030. It addressed existing urban areas of the City and recommended remedial measures to improve overall environmental performance, increases efficiencies and reduce costs. Although the ISWM-MP was not focused on new development, it provided guidance for future policies.

The report also recommended the City's current approach to stormwater management, which focuses on runoff prevention, natural system preservation, and provision of green infrastructure in combination with conventional SWM approaches. The report also addressed the effects of climate change and the methods to manage its impacts within the City.

The ISWM-MP has six elements that are the core of the plan:

a. Pollution prevention and municipal practices that can help to prevent impacts before they occur.
b. Supporting existing neighbourhoods, homes and businesses while managing stormwater

at the same time.

c. Improving the way local roads and laneways treat runoff by constructing Low Impact Development controls such as bioswales or perforated pipes as part of routine road works.
d. Maintaining and improving existing stormwater management facilities, as well as constructing new ones as part of park rehabilitations.
e. Restoring local creeks.
f. Better managing urban flooding particularly with the threat of climate change.

***Stormwater Management Policy, Policy MUN-UTI-2003, approved November 21, 2016***

This policy applies to all decision making related to any form of construction on municipal and private lands. The policy addresses:

a. Stormwater Infiltration in the context of source protection planning.
This component defines where and how LID controls can safely be implemented in the context of the approved source protection policy under the *Clean Water Act*.

b. Stormwater Volume Criteria and Targets
This component outlines the minimum stormwater volume criteria and the application of general stormwater management targets for new development, redevelopment, and linear projects.

c. Stormwater Management Fee
This component addresses the financial contributions required from proponents that cannot meet the stormwater management targets due to site restrictions (e.g. shallow bedrock, high groundwater, brownfields, etc.).

## Existing Conditions

The study area is located within the Strasburg Creek watershed. The catchments draining to the end of the existing Biehn Drive are shown on **Figure 2**. Catchment EX1 drains directly to the provincially significant wetland, while Catchment EX2 drains to the outlet to the PSW via the existing Hearthwood stormwater management facility.

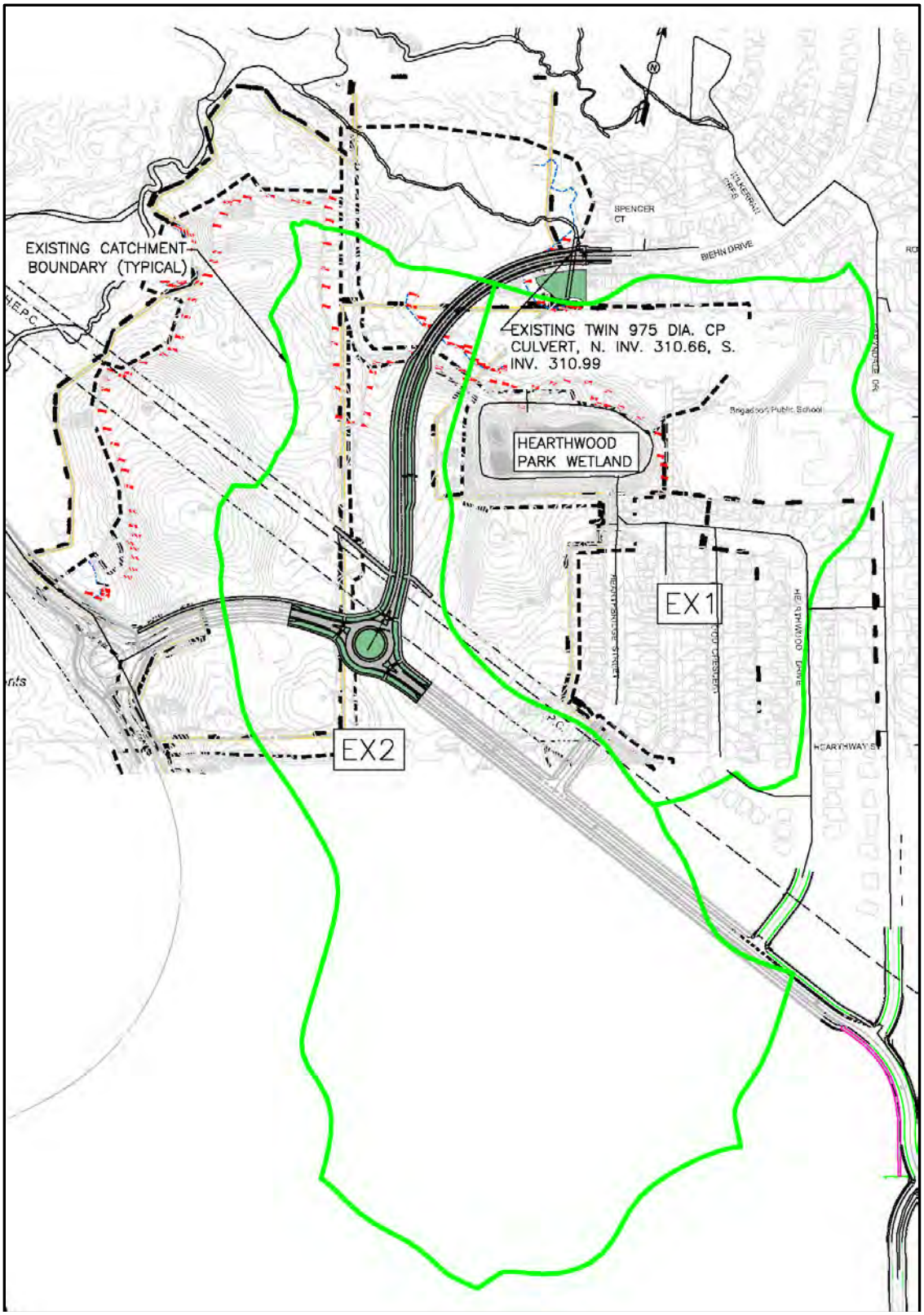


**Figure 2 - Existing Catchments**

## Proposed Conditions

The future development, shown on **Figure 3**, includes part of the proposed Biehn Drive extension. Stormwater from the future development, including the length of Biehn Drive located therein, will be managed by directing runoff to the existing Hearthwood SWM wetland. It is understood that the SWM wetland will be modified if required to accommodate the runoff from the subdivision.

The proposed profile of the Biehn Drive extension is shown on **Figure 4**. The segment of Biehn Drive between the roundabout at Robert Ferrie Drive and Station 10+300 will drain to the existing Heathwood SWM wetland. From Station 10+300 to Station 10+532 (the connection to the existing Biehn Drive), the road will drain via a storm sewer to the outlet at the road sag.

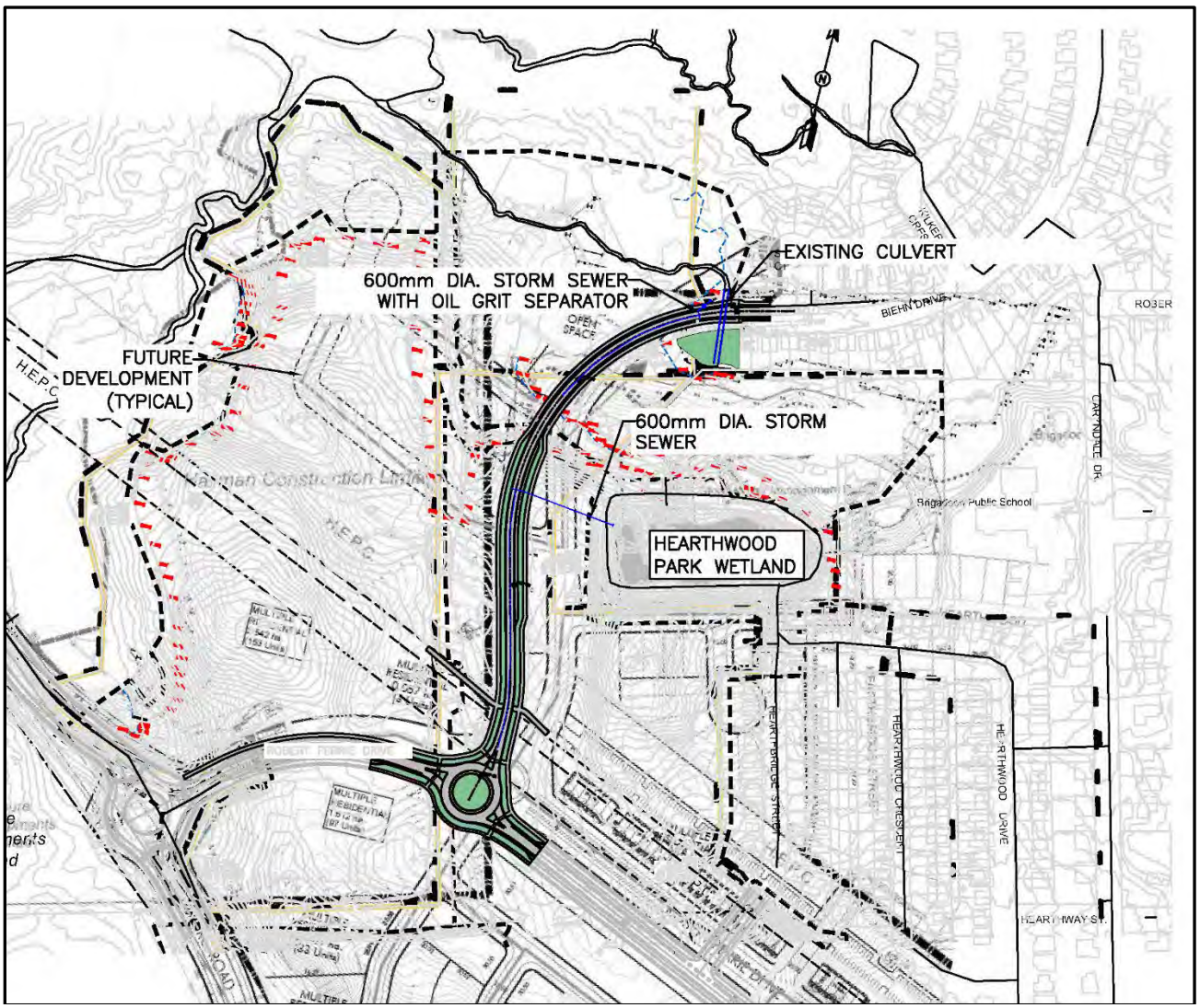


**Figure 3 - Proposed Conditions**

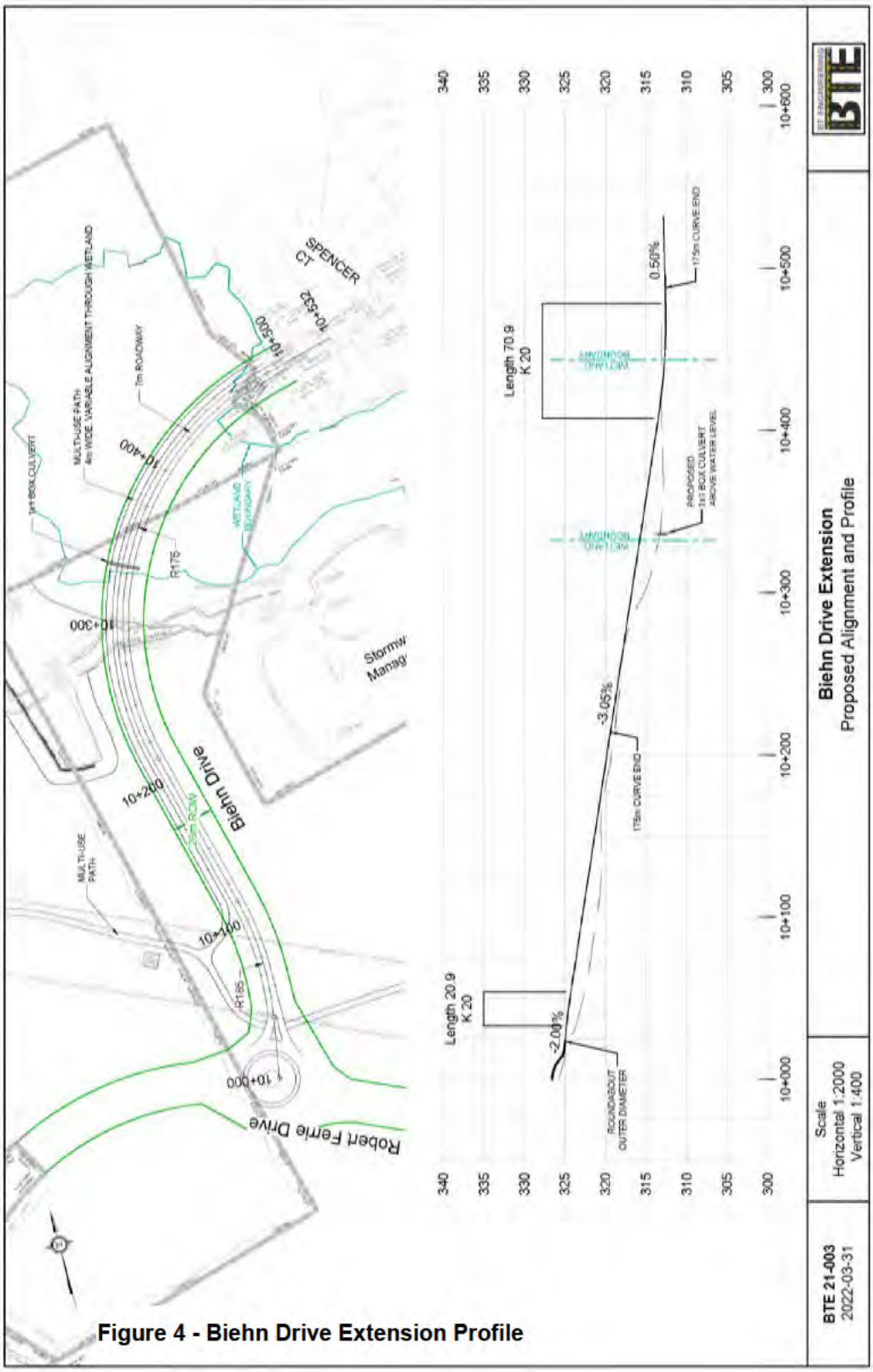


**Figure 4 - Biehn Drive Extension Profile**

## Stormwater Management Measures

### Station 10+000 to Station 10+300

The normal water level in the Hearthwood SWM wetland is 316.00 m. Therefore, it is proposed to provide a storm pipe to drain from the Biehn Drive extension to the pond. The proposed arrangement is shown on **Figure 5**. The peak flow for the 5-year storm is 210 l/s.

The 100-year storm peak flow is 392 l/s. It will be intercepted by providing inlets capable of conveying 200 l/s on each side of the road. Based on a road grade of 3.05%, double catch basins on each side of the road will be required to capture the 100-year storm flow into the proposed storm sewer.

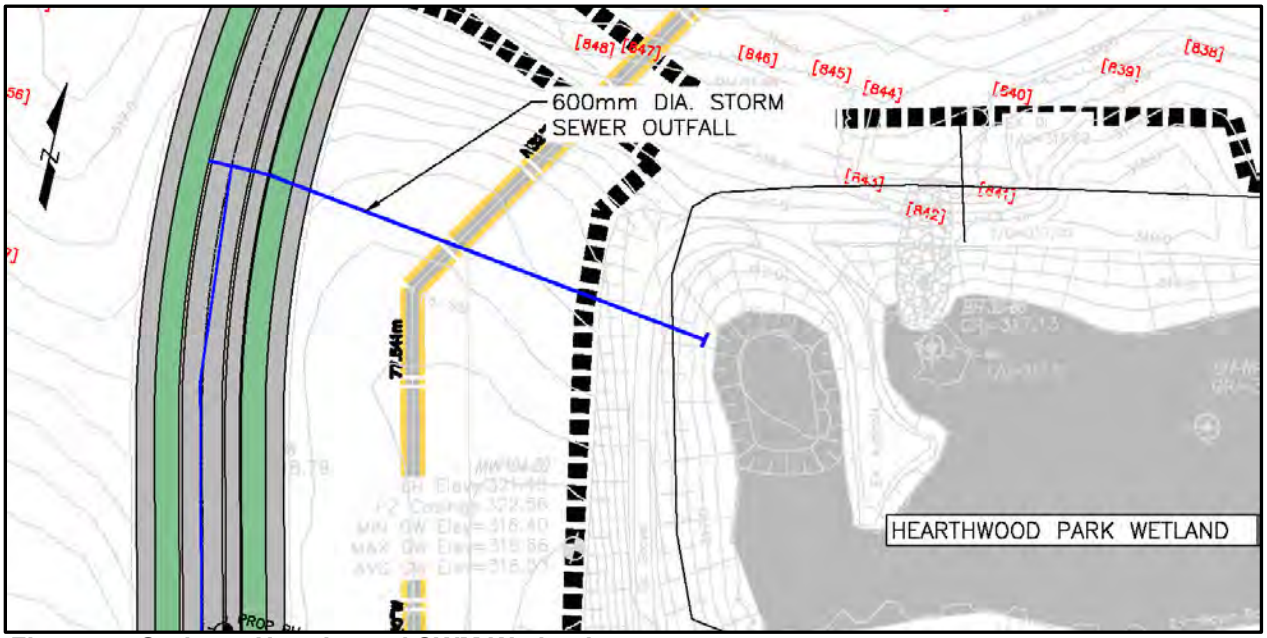


**Figure 5 - Outlet to Hearthwood SWM Wetland**

### Station 10+300 to Station 10+532

The segment of road will require conveyance to the sag at Station 10+470±, where it will be discharged to the creek. There is no opportunity to provide stormwater quantity control for this road segment. However, it may be possible to reduce the effect of the pavement imperviousness by using permeable pavement in this segment. Stormwater quality control can be provided by discharging to the creek via an oil-grit separator. The proposed arrangement is shown in **Figure 6**.

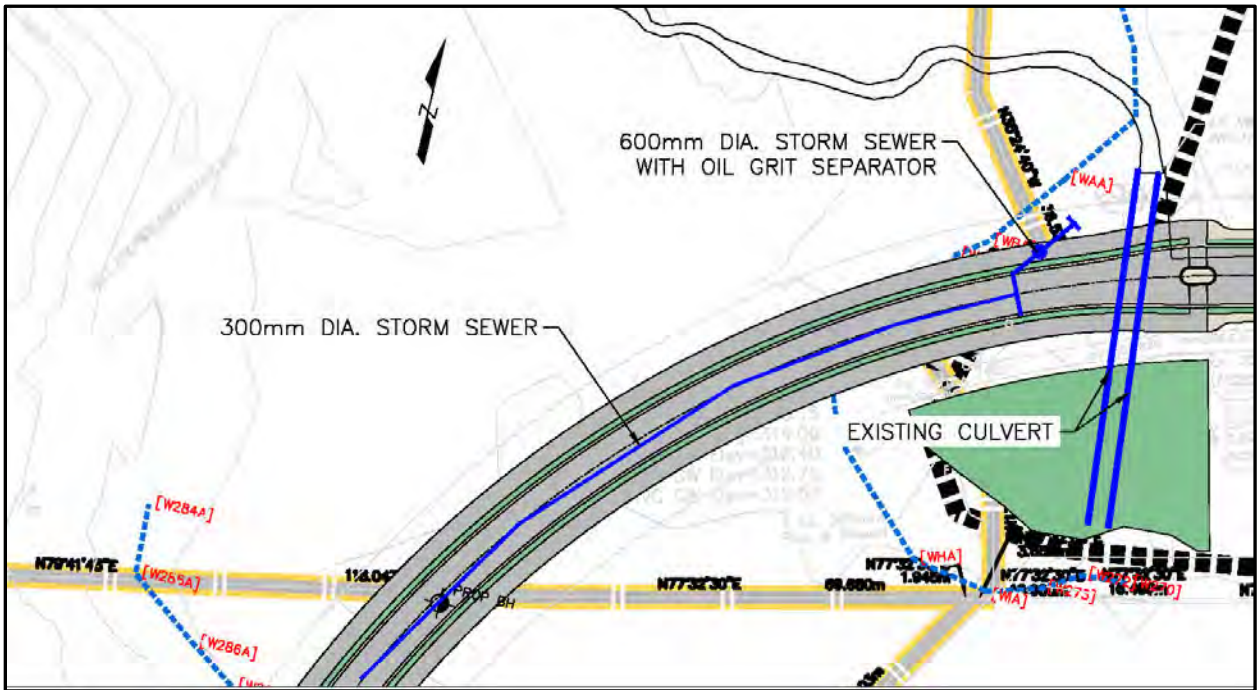


**Figure 6 - Outlet to Creek**

## Conclusions and Recommendations

The following are the main conclusions of the Drainage and Stormwater Management study for the Biehn Drive Extension:

1. The existing Hearthwood Park SWM wetland can be used to provide stormwater quantity and quality control for the section of the Biehn Drive extension between Station 10+000 and Station 10+255. A storm sewer can be extended to direct the runoff up to the 100-year design storm flow to the SWM wetland.

2. From Station 10+255 to the connection to the existing Biehn Drive, the drainage from the proposed extension can be provided with stormwater quality by passing the flow through an oil-grit separator. However, it may be possible to provide additional storage and infiltration under the road.

It is recommended that the proposed drainage system be discussed with the City to obtain their agreement.

Prepared by

Leonardo Sanchez, P.Eng.

***Sanchez Engineering Inc.***

# Appendix H

Noise Report

BT ENGINEERING

# Noise Assessment Report

## Biehn Drive Municipal Class Environmental Assessment

March 2022

**Submitted by:**
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5

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3.0 TRAFFIC INPUT DATA ..... 3
4.0 ANALYSIS OF EXISTING AND FUTURE SOUND LEVELS ..... 4
5.0 MITIGATION REQUIREMENTS ..... 5
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Appendix B STAMSON Outputs

## 1.0 INTRODUCTION

The City of Kitchener (City) is conducting a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The purpose of this report is to review the noise impacts from vehicular sources on existing noise sensitive land uses for the proposed Biehn Drive Extension. The Study Area is shown on **Figure 1**.

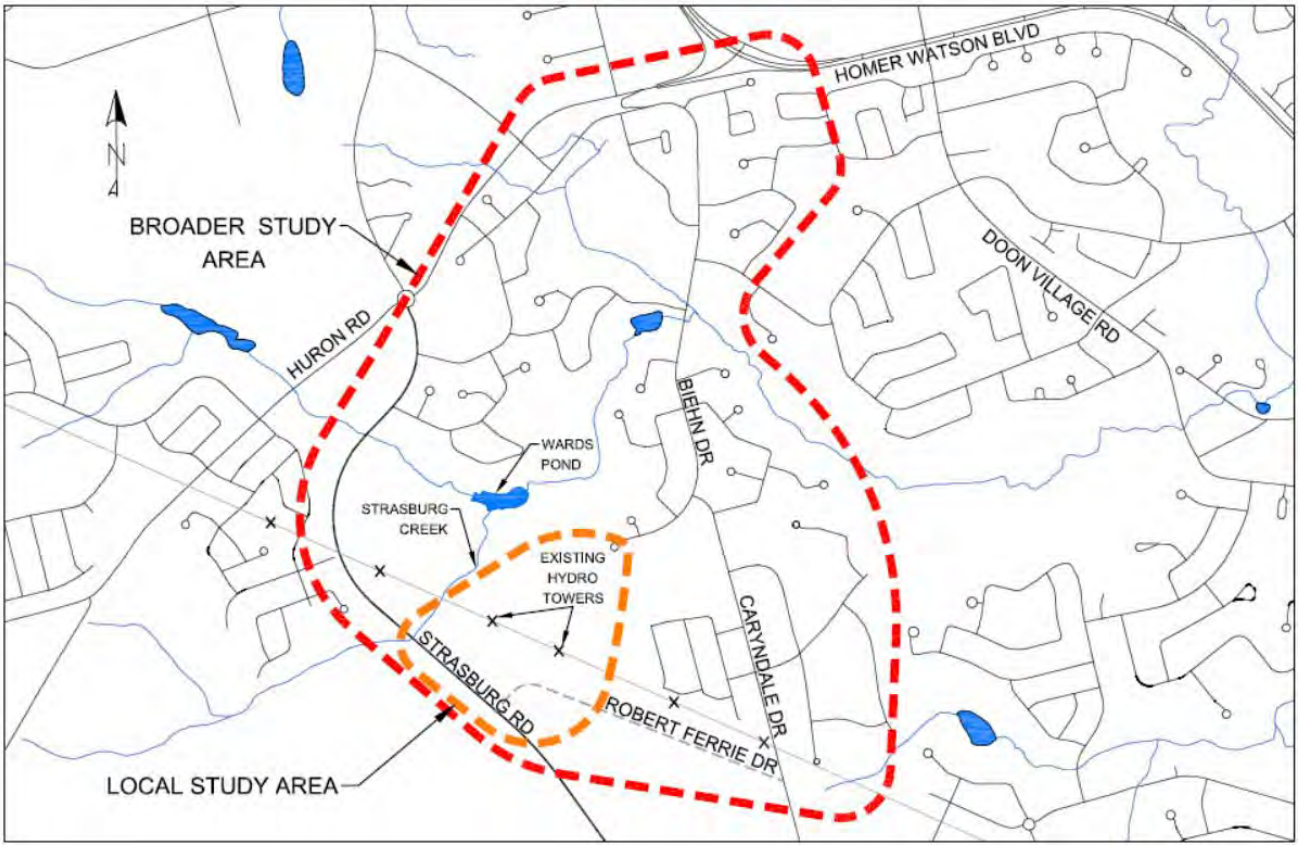


**Figure 1: Site Location**

Since the mid-2000's, the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener have planned for area development and evolving transportation needs. Several planning documents including the Official Plan and Transportation Master Plan (TMP) have identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension and ultimately to Strasburg Road. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan Amendment. This link would accommodate vehicles to and from the Brigadoon community and would help mitigate cut-through traffic on local streets within the community. It would function as a collector street, which collects traffic from local streets within the community and provides connectivity to high tier arterial streets including Strasburg Road.

## 2.0 METHODOLOGY

This evaluation was conducted within the Study Area to determine the impact to adjacent residential dwelling units as well as what (if any) mitigation measures should be incorporated in the final design, as a component of the EA process.

The noise assessment utilized the STAMSON 5.04 noise software program to determine 16-hour daytime and 8-hour nighttime equivalent sound levels (Leq) for the roadway traffic. The assessment was performed in accordance with the Ministry of the Environment, Conservation and Park's (MECP's) Noise Assessment Criteria (NPC-300) and MTO's Environmental Guide for Noise. The noise assessment was completed using three representative receiver sites, as shown in **Figure 2**. The receiver sites were located in an Outdoor Living Area (OLA) in the backyard during the day and the plane of the window of a bedroom for nighttime assessments.

**Figure 2: Representative Receiver Sites**

A mitigation assessment is carried out for any receiver sites where the proposed roadworks will result in a noise level increase of greater than 5 dBA 10 years after construction (2040), or above 65 dBA. This assesses mitigation (noise control) measures within the right-of-way for noise sensitive receivers.

## 3.0 TRAFFIC INPUT DATA

Traffic volumes were provided by the City of Kitchener, see **Appendix A**. The traffic counts were completed in 2018/2019. Biehn Drive and Caryndale are collector roads and are not truck routes, therefore only local deliveries will travel on the roads. Heavy truck volumes are assumed to be 0% and medium truck volumes are assumed to be 3%. An 80/20 daytime/nighttime split for traffic volumes was used for the acoustical assessment.

The construction of the Biehn Drive Extension is expected to change vehicular traffic patterns in the neighbourhood. It is likely that the extension will result in a more balanced redistribution of area traffic volumes, providing relief (reducing the traffic volumes) on other area roads including Caryndale Drive and the north segment of Biehn Drive. **Table 1** summarizes the AADT volumes at the three representative receiver sites within the study area.

**Table 1: AADT Volumes at Representative Receiver Sites**

| Receiver Site | Future AADT (Without Extension) | Future AADT (With Extension) |
|---|---|---|
| 371 Biehn Drive | 960 | 3000 |
| 260 Biehn Drive | 5900 | 2950 |
| 453 Caryndale Drive | 3000 | 1500 |

Additional input to the STAMSON model included:

- The intermediate ground surface (hard surface reflects sound, soft surface absorbs sound);
- Distance, in metres, from the source to the receiver, using the centreline of the road as the source;
- The angle at which the receiver (apartment) intercepts the source (roadway and/or railway), measured relative to the perpendicular line between the source and the receiver;
- Receiver height (standard is 1.5 m above ground level during the daytime and 4.5 m above ground or storey level bedroom during the nighttime);
- Existing buildings which provide effective shielding of roadway or railway noise;
- Posted speed limit – the speed limit for Biehn Drive and Caryndale Drive is 50 km/h within the study limits;

- Depth of woods (0-30 m, 30-60 m, 60 m or more);
- Roadway grade (slope);
- Topography (hills, flatlands); and
- Existing attenuation due to shielding from barriers (natural or man-made).

Biehn Drive is a 2-lane collector roadway extending from Old Heron Road and terminating within the Study Area west of Caryndale Drive. Caryndale Drive is a 2-lane collector roadway extending from Biehn Drive to Stauffer Drive. The speed limit of both roadways is 50 km/h.

## 4.0 ANALYSIS OF EXISTING AND FUTURE SOUND LEVELS

A future year was selected with and without the Biehn Drive extension. The 16-hour equivalent daytime sound levels and 8-hour nighttime sound levels were forecast for three receiver sites with and without the project, calculated using the STAMSON noise software program. These are shown in **Table 2.**

**Table 2: Existing and Future Sound Levels**

| Receiver Site | Existing Daytime Without Extension (16 h) Sound Level, Leq (dBA) | Existing Nighttime Without Extension (8 h) Sound Level, Leq (dBA) | Future Daytime With Extension (16 h) Sound Level, Leq (dBA) | Future Nighttime With Extension (8 h) Sound Level, Leq (dBA) |
|---|---|---|---|---|
| 371 Biehn Drive | 45* | 45 | 50 | 48 |
| 260 Biehn Drive | 51 | 49 | 48 | 46 |
| 453 Caryndale Drive | 48 | 46 | 45* | 43 |

* Sound levels are estimated to be 45 dBA and reflect south level measurements obtained on site by BTE. 45 dBA is the minimum urban daytime sound level standard accepted by MECP.

The forecast ambient sound levels at the proposed site have been reviewed comparing equivalent sound level criterion from MECP's Noise Assessment Criteria (NPC-300) for noise sensitive areas. The MECP criteria are summarized below in **Table 3**. The STAMSON outputs are included in **Appendix B**.

**Table 3: MECP's Noise Assessment Criteria (NPC-300)**

| | |
|---|---|
| Criteria 1: | Outdoor Sound Level Criteria: The significance of a noise impact for day-time noise levels is assessed by using the objective of 55 dBA (7 a.m. to 11 p.m.) for both road and rail sources combined. These levels are established as acceptable noise levels for outdoor recreation areas of developments adjacent to transportation noise (roads, transit, light rail, and rail). |
| Criteria 2: | Plane of Window (Sleeping Quarters): Outdoor nighttime (8 h) roadway and rail noise levels at the plane of a bedroom (3rd storey) window must not exceed 60 dBA, otherwise air conditioning is required. If the nighttime rail noise exceeds 55 dBA or the roadway rail noise exceeds 60 dBA, acoustical materials are required in the design and construction of the building. |

## 5.0 MITIGATION REQUIREMENTS

The criterion for mitigation has utilized the MECP Provincial guideline for sound levels in a residential area. Based on all daytime and nighttime sound levels being below 55 dBA, no mitigation is required.

## 6.0 CONCLUSIONS

The forecast sound levels for daytime and nighttime are below 55 dBA and no mitigation is required.

Report prepared by:

Darcie Dillon, P.Eng.

Reviewed and approved by:

Steven Taylor, P.Eng.

# Appendix A

Traffic Counts

BT ENGINEERING

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - ##Demo?##, Biehn Drive btwn Kilkerran & Caryndale Rd (##)<50>
**Date** - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

| Volume | | | | | | |
|---|---|---|---|---|---|---|
| | **Total** | **Weekday** | **Weekend** | **ADT** | **AWDT** | **AWET** |
| **Combined** | ##Demo?## | 11468 | 3520 | 2498 | 2867 | ##Demo?## |
| **East** | 7125 | 5460 | 1665 | ##Demo?## | 1365 | 833 |
| **West** | 7863 | ##Demo?## | 1855 | 1311 | 1502 | 928 |
| **Days** | ##Demo?## | 4 | 2 | 6 | 4 | ##Demo?## |

| Speed | | | | |
|---|---|---|---|---|
| | **All Days** | **Weekdays** | **Weekend** | |
| **Mean speed** | 47.8 | 47.9 | 47.6 | km/h |
| **Median speed** | ##Demo?## | 48.4 | 48.1 | km/h |
| **85% speed** | 54.8 | ##Demo?## | 55.0 | km/h |

*PSL = 60 km/h*

| Class | | | | |
|---|---|---|---|---|
| **Class (*##Demo?##*)** | **All Days** | **%** | **Weekdays** | **Weekend** |
| **1 - CYCLE** | 585 | 3.903% | 496 | ##Demo?## |
| **2 - PC** | 7547 | 50.35% | 5637 | ##Demo?## |
| **3 - 2A-4T** | 976 | 6.512% | 791 | ##Demo?## |
| **4 - BUS** | 41 | 0.274% | 38 | ##Demo?## |
| **5 - 2A-6T** | 138 | 0.921% | 122 | ##Demo?## |
| **6 - 3A-SU** | 509 | 3.396% | 352 | ##Demo?## |
| **7 - 4A-SU** | 5132 | 34.24% | 3977 | ##Demo?## |
| **8 - <5A DBL** | 3 | 0.020% | 3 | ##Demo?## |
| **9 - 5A DBL** | 6 | 0.040% | 6 | ##Demo?## |
| **10 - >6A DBL** | 3 | 0.020% | 3 | ##Demo?## |
| **11 - <6A MULTI** | 0 | 0.000% | 0 | ##Demo?## |
| **12 - 6A MULTI** | 0 | 0.000% | 0 | ##Demo?## |
| **13 - >6A MULTI** | 48 | 0.320% | 43 | ##Demo?## |

| Average Daily Volume | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Mon** | **Tue** | **Wed** | **Thu** | **##Demo?##** | **Sat** | **Sun** |
| **East** | 804 | ##Demo?## | 0 | 1601 | 1311 | 871 | ##Demo?## |
| **West** | 805 | 1929 | 0 | ##Demo?## | 1543 | 1031 | 824 |
| **Combined** | 1609 | ##Demo?## | 0 | 3332 | 2854 | 1902 | ##Demo?## |
| **AM Pk East** | 54 | 154 | - | ##Demo?## | 68 | 64 | 48 |
| **PM Pk East** | ##Demo?## | 195 | - | 228 | 138 | ##Demo?## | 71 |
| **AM Pk West** | 60 | 245 | ##Demo?## | 187 | 145 | 96 | 85 |
| **PM Pk ##Demo?##** | 77 | 209 | - | 155 | ##Demo?## | 80 | 75 |
| **Days** | 1 | 1 | ##Demo?## | 1 | 1 | 1 | 1 |

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - Biehn Dr, Biehn Dr btwn Marl Meadow & Mcleod Crt <50 kmh>(13)
**Date** - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

## Volume

| | Total | Weekday | Weekend | ADT | AWDT | AWET |
|---|---|---|---|---|---|---|
| **Combined** | 28021 | 21223 | 6798 | 4670 | 5306 | 3399 |
| **East** | 16862 | 12767 | 4095 | 2810 | 3192 | 2048 |
| **West** | 11159 | 8456 | 2703 | 1860 | 2114 | 1352 |
| **Days** | 6 | 4 | 2 | 6 | 4 | 2 |

## Speed

| | All Days | Weekdays | Weekend | |
|---|---|---|---|---|
| **Mean speed** | 52.6 | 52.7 | 52.3 | km/h |
| **Median speed** | 52.6 | 52.6 | 52.2 | km/h |
| **85% speed** | 58.6 | 58.6 | 58.5 | km/h |

*PSL = 60 km/h*

## Class

| Class (*Scheme F3*) | All Days | % | Weekdays | Weekend |
|---|---|---|---|---|
| **1 - CYCLE** | 213 | 0.760% | 171 | 42 |
| **2 - PC** | 24192 | 86.34% | 18251 | 5941 |
| **3 - 2A-4T** | 1745 | 6.227% | 1369 | 376 |
| **4 - BUS** | 57 | 0.203% | 52 | 5 |
| **5 - 2A-6T** | 281 | 1.003% | 238 | 43 |
| **6 - 3A-SU** | 94 | 0.335% | 72 | 22 |
| **7 - 4A-SU** | 1397 | 4.986% | 1029 | 368 |
| **8 - <5A DBL** | 1 | 0.004% | 1 | 0 |
| **9 - 5A DBL** | 12 | 0.043% | 12 | 0 |
| **10 - >6A DBL** | 3 | 0.011% | 3 | 0 |
| **11 - <6A MULTI** | 0 | 0.000% | 0 | 0 |
| **12 - 6A MULTI** | 0 | 0.000% | 0 | 0 |
| **13 - >6A MULTI** | 26 | 0.093% | 25 | 1 |

## Average Daily Volume

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| **East** | 1795 | 3798 | 0 | 3921 | 3253 | 2145 | 1950 |
| **West** | 1210 | 2542 | 0 | 2520 | 2184 | 1457 | 1246 |
| **Combined** | 3005 | 6340 | 0 | 6441 | 5437 | 3602 | 3196 |
| **AM Pk East** | 135 | 326 | - | 294 | 195 | 164 | 137 |
| **PM Pk East** | 180 | 409 | - | 468 | 301 | 165 | 177 |
| **AM Pk West** | 98 | 277 | - | 226 | 186 | 128 | 117 |
| **PM Pk West** | 120 | 266 | - | 233 | 182 | 117 | 105 |
| **Days** | 1 | 1 | - | 1 | 1 | 1 | 1 |

*Report created 10:52 Monday, September 9, 2019 using MTE version 5.0.2.0 - Template not certified by MetroCount*

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - Caryndale Drive, Caryndale Drive btwn Chapel Hill Drive @ Hearthway Street (17) <50km.h>
**Date** - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

## Volume

| | Total | Weekday | Weekend | ADT | AWDT | AWET |
|---|---|---|---|---|---|---|
| **Combined** | 12962 | 9656 | 3306 | 2160 | 2414 | 1653 |
| **East** | 5796 | 4261 | 1535 | 966 | 1065 | 768 |
| **West** | 7166 | 5395 | 1771 | 1194 | 1349 | 886 |
| **Days** | 6 | 4 | 2 | 6 | 4 | 2 |

## Speed

| | All Days | Weekdays | Weekend | |
|---|---|---|---|---|
| **Mean speed** | 47.9 | 47.8 | 48.1 | km/h |
| **Median speed** | 50.0 | 50.0 | 50.8 | km/h |
| **85% speed** | 60.8 | 60.5 | 61.2 | km/h |

*PSL = 60 km/h*

## Class

| Class (*Scheme F3*) | All Days | % | Weekdays | Weekend |
|---|---|---|---|---|
| **1 - CYCLE** | 264 | 2.0% | 174 | 90 |
| **2 - PC** | 9250 | 71.4% | 6710 | 2540 |
| **3 - 2A-4T** | 1932 | 14.9% | 1480 | 452 |
| **4 - BUS** | 83 | 0.6% | 79 | 4 |
| **5 - 2A-6T** | 239 | 1.8% | 194 | 45 |
| **6 - 3A-SU** | 147 | 1.1% | 115 | 32 |
| **7 - 4A-SU** | 1040 | 8.0% | 899 | 141 |
| **8 - <5A DBL** | 0 | 0.0% | 0 | 0 |
| **9 - 5A DBL** | 1 | 0.0% | 0 | 1 |
| **10 - >6A DBL** | 0 | 0.0% | 0 | 0 |
| **11 - <6A MULTI** | 0 | 0.0% | 0 | 0 |
| **12 - 6A MULTI** | 0 | 0.0% | 0 | 0 |
| **13 - >6A MULTI** | 6 | 0.0% | 5 | 1 |

## Average Daily Volume

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| **East** | 1111 | 1017 | 0 | 1114 | 1019 | 854 | 681 |
| **West** | 1315 | 1241 | 0 | 1444 | 1395 | 995 | 776 |
| **Combined** | 2426 | 2258 | 0 | 2558 | 2414 | 1849 | 1457 |
| **AM Pk East** | 87 | 81 | - | 75 | 73 | 51 | 42 |
| **PM Pk East** | 119 | 122 | - | 123 | 92 | 75 | 57 |
| **AM Pk West** | 152 | 147 | - | 143 | 134 | 74 | 72 |
| **PM Pk West** | 141 | 124 | - | 152 | 139 | 81 | 60 |
| **Days** | 1 | 1 | - | 1 | 1 | 1 | 1 |

*Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0*

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - Caryndale Drive, Caryndale Drive btwn Robertson Crescent @ Chapel Hill Drive (19) <40km.h>
**Date** - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

## Volume

| | Total | Weekday | Weekend | ADT | AWDT | AWET |
|---|---|---|---|---|---|---|
| **Combined** | 16449 | 12546 | 3903 | 2742 | 3137 | 1952 |
| **East** | 7980 | 6070 | 1910 | 1330 | 1518 | 955 |
| **West** | 8469 | 6476 | 1993 | 1412 | 1619 | 997 |
| **Days** | 6 | 4 | 2 | 6 | 4 | 2 |

## Speed

| | All Days | Weekdays | Weekend | |
|---|---|---|---|---|
| **Mean speed** | 45.3 | 44.2 | 49.0 | km/h |
| **Median speed** | 46.8 | 45.7 | 49.3 | km/h |
| **85% speed** | 54.4 | 53.6 | 55.8 | km/h |

*PSL = 60 km/h*

## Class

| Class (*Scheme F3*) | All Days | % | Weekdays | Weekend |
|---|---|---|---|---|
| **1 - CYCLE** | 247 | 1.5% | 167 | 80 |
| **2 - PC** | 13812 | 84.0% | 10430 | 3382 |
| **3 - 2A-4T** | 2013 | 12.2% | 1619 | 394 |
| **4 - BUS** | 139 | 0.8% | 133 | 6 |
| **5 - 2A-6T** | 201 | 1.2% | 167 | 34 |
| **6 - 3A-SU** | 22 | 0.1% | 22 | 0 |
| **7 - 4A-SU** | 12 | 0.1% | 7 | 5 |
| **8 - <5A DBL** | 0 | 0.0% | 0 | 0 |
| **9 - 5A DBL** | 2 | 0.0% | 0 | 2 |
| **10 - >6A DBL** | 0 | 0.0% | 0 | 0 |
| **11 - <6A MULTI** | 0 | 0.0% | 0 | 0 |
| **12 - 6A MULTI** | 0 | 0.0% | 0 | 0 |
| **13 - >6A MULTI** | 1 | 0.0% | 1 | 0 |

## Average Daily Volume

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| **East** | 1493 | 1556 | 0 | 1538 | 1483 | 1077 | 833 |
| **West** | 1536 | 1661 | 0 | 1642 | 1637 | 1107 | 886 |
| **Combined** | 3029 | 3217 | 0 | 3180 | 3120 | 2184 | 1719 |
| **AM Pk East** | 134 | 128 | - | 130 | 125 | 68 | 55 |
| **PM Pk East** | 142 | 153 | - | 162 | 141 | 98 | 74 |
| **AM Pk West** | 176 | 171 | - | 159 | 160 | 88 | 77 |
| **PM Pk West** | 181 | 179 | - | 178 | 164 | 83 | 68 |
| **Days** | 1 | 1 | - | 1 | 1 | 1 | 1 |

*Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0*

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - ##Demo?##, Biehn Drive btwn Kilkerran & Caryndale Rd (##)<50>
**Date** - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

| Volume | | | | | | |
|---|---|---|---|---|---|---|
| | **Total** | **Weekday** | **Weekend** | **ADT** | **AWDT** | **AWET** |
| **Combined** | ##Demo?## | 11468 | 3520 | 2498 | 2867 | ##Demo?## |
| **East** | 7125 | 5460 | 1665 | ##Demo?## | 1365 | 833 |
| **West** | 7863 | ##Demo?## | 1855 | 1311 | 1502 | 928 |
| **Days** | ##Demo?## | 4 | 2 | 6 | 4 | ##Demo?## |

| Speed | | | | |
|---|---|---|---|---|
| | **All Days** | **Weekdays** | **Weekend** | |
| **Mean speed** | 47.8 | 47.9 | 47.6 | km/h |
| **Median speed** | ##Demo?## | 48.4 | 48.1 | km/h |
| **85% speed** | 54.8 | ##Demo?## | 55.0 | km/h |

*PSL = 60 km/h*

| Class | | | | |
|---|---|---|---|---|
| **Class (*##Demo?##*)** | **All Days** | **%** | **Weekdays** | **Weekend** |
| **1 - CYCLE** | 585 | 3.903% | 496 | ##Demo?## |
| **2 - PC** | 7547 | 50.35% | 5637 | ##Demo?## |
| **3 - 2A-4T** | 976 | 6.512% | 791 | ##Demo?## |
| **4 - BUS** | 41 | 0.274% | 38 | ##Demo?## |
| **5 - 2A-6T** | 138 | 0.921% | 122 | ##Demo?## |
| **6 - 3A-SU** | 509 | 3.396% | 352 | ##Demo?## |
| **7 - 4A-SU** | 5132 | 34.24% | 3977 | ##Demo?## |
| **8 - <5A DBL** | 3 | 0.020% | 3 | ##Demo?## |
| **9 - 5A DBL** | 6 | 0.040% | 6 | ##Demo?## |
| **10 - >6A DBL** | 3 | 0.020% | 3 | ##Demo?## |
| **11 - <6A MULTI** | 0 | 0.000% | 0 | ##Demo?## |
| **12 - 6A MULTI** | 0 | 0.000% | 0 | ##Demo?## |
| **13 - >6A MULTI** | 48 | 0.320% | 43 | ##Demo?## |

| Average Daily Volume | | | | | | | |
|---|---|---|---|---|---|---|---|
| | **Mon** | **Tue** | **Wed** | **Thu** | **##Demo?##** | **Sat** | **Sun** |
| **East** | 804 | ##Demo?## | 0 | 1601 | 1311 | 871 | ##Demo?## |
| **West** | 805 | 1929 | 0 | ##Demo?## | 1543 | 1031 | 824 |
| **Combined** | 1609 | ##Demo?## | 0 | 3332 | 2854 | 1902 | ##Demo?## |
| **AM Pk East** | 54 | 154 | - | ##Demo?## | 68 | 64 | 48 |
| **PM Pk East** | ##Demo?## | 195 | - | 228 | 138 | ##Demo?## | 71 |
| **AM Pk West** | 60 | 245 | ##Demo?## | 187 | 145 | 96 | 85 |
| **PM Pk ##Demo?##** | 77 | 209 | - | 155 | ##Demo?## | 80 | 75 |
| **Days** | 1 | 1 | ##Demo?## | 1 | 1 | 1 | 1 |

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - Biehn Dr, Biehn Dr btwn Marl Meadow & Mcleod Crt <50 kmh>(13)
**Date** - 0:00 Thursday, August 29, 2019 to 0:00 Wednesday, September 4, 2019 (6 days of data)

## Volume

| | Total | Weekday | Weekend | ADT | AWDT | AWET |
|---|---|---|---|---|---|---|
| **Combined** | 28021 | 21223 | 6798 | 4670 | 5306 | 3399 |
| **East** | 16862 | 12767 | 4095 | 2810 | 3192 | 2048 |
| **West** | 11159 | 8456 | 2703 | 1860 | 2114 | 1352 |
| **Days** | 6 | 4 | 2 | 6 | 4 | 2 |

## Speed

| | All Days | Weekdays | Weekend | |
|---|---|---|---|---|
| **Mean speed** | 52.6 | 52.7 | 52.3 | km/h |
| **Median speed** | 52.6 | 52.6 | 52.2 | km/h |
| **85% speed** | 58.6 | 58.6 | 58.5 | km/h |

*PSL = 60 km/h*

## Class

| Class (*Scheme F3*) | All Days | % | Weekdays | Weekend |
|---|---|---|---|---|
| **1 - CYCLE** | 213 | 0.760% | 171 | 42 |
| **2 - PC** | 24192 | 86.34% | 18251 | 5941 |
| **3 - 2A-4T** | 1745 | 6.227% | 1369 | 376 |
| **4 - BUS** | 57 | 0.203% | 52 | 5 |
| **5 - 2A-6T** | 281 | 1.003% | 238 | 43 |
| **6 - 3A-SU** | 94 | 0.335% | 72 | 22 |
| **7 - 4A-SU** | 1397 | 4.986% | 1029 | 368 |
| **8 - <5A DBL** | 1 | 0.004% | 1 | 0 |
| **9 - 5A DBL** | 12 | 0.043% | 12 | 0 |
| **10 - >6A DBL** | 3 | 0.011% | 3 | 0 |
| **11 - <6A MULTI** | 0 | 0.000% | 0 | 0 |
| **12 - 6A MULTI** | 0 | 0.000% | 0 | 0 |
| **13 - >6A MULTI** | 26 | 0.093% | 25 | 1 |

## Average Daily Volume

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| **East** | 1795 | 3798 | 0 | 3921 | 3253 | 2145 | 1950 |
| **West** | 1210 | 2542 | 0 | 2520 | 2184 | 1457 | 1246 |
| **Combined** | 3005 | 6340 | 0 | 6441 | 5437 | 3602 | 3196 |
| **AM Pk East** | 135 | 326 | - | 294 | 195 | 164 | 137 |
| **PM Pk East** | 180 | 409 | - | 468 | 301 | 165 | 177 |
| **AM Pk West** | 98 | 277 | - | 226 | 186 | 128 | 117 |
| **PM Pk West** | 120 | 266 | - | 233 | 182 | 117 | 105 |
| **Days** | 1 | 1 | - | 1 | 1 | 1 | 1 |

*Report created 10:52 Monday, September 9, 2019 using MTE version 5.0.2.0 - Template not certified by MetroCount*

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - Caryndale Drive, Caryndale Drive btwn Chapel Hill Drive @ Hearthway Street (17) <50km.h>
**Date** - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

## Volume

| | Total | Weekday | Weekend | ADT | AWDT | AWET |
|---|---|---|---|---|---|---|
| **Combined** | 12962 | 9656 | 3306 | 2160 | 2414 | 1653 |
| **East** | 5796 | 4261 | 1535 | 966 | 1065 | 768 |
| **West** | 7166 | 5395 | 1771 | 1194 | 1349 | 886 |
| **Days** | 6 | 4 | 2 | 6 | 4 | 2 |

## Speed

| | All Days | Weekdays | Weekend | |
|---|---|---|---|---|
| **Mean speed** | 47.9 | 47.8 | 48.1 | km/h |
| **Median speed** | 50.0 | 50.0 | 50.8 | km/h |
| **85% speed** | 60.8 | 60.5 | 61.2 | km/h |

*PSL = 60 km/h*

## Class

| Class (*Scheme F3*) | All Days | % | Weekdays | Weekend |
|---|---|---|---|---|
| **1 - CYCLE** | 264 | 2.0% | 174 | 90 |
| **2 - PC** | 9250 | 71.4% | 6710 | 2540 |
| **3 - 2A-4T** | 1932 | 14.9% | 1480 | 452 |
| **4 - BUS** | 83 | 0.6% | 79 | 4 |
| **5 - 2A-6T** | 239 | 1.8% | 194 | 45 |
| **6 - 3A-SU** | 147 | 1.1% | 115 | 32 |
| **7 - 4A-SU** | 1040 | 8.0% | 899 | 141 |
| **8 - <5A DBL** | 0 | 0.0% | 0 | 0 |
| **9 - 5A DBL** | 1 | 0.0% | 0 | 1 |
| **10 - >6A DBL** | 0 | 0.0% | 0 | 0 |
| **11 - <6A MULTI** | 0 | 0.0% | 0 | 0 |
| **12 - 6A MULTI** | 0 | 0.0% | 0 | 0 |
| **13 - >6A MULTI** | 6 | 0.0% | 5 | 1 |

## Average Daily Volume

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| **East** | 1111 | 1017 | 0 | 1114 | 1019 | 854 | 681 |
| **West** | 1315 | 1241 | 0 | 1444 | 1395 | 995 | 776 |
| **Combined** | 2426 | 2258 | 0 | 2558 | 2414 | 1849 | 1457 |
| **AM Pk East** | 87 | 81 | - | 75 | 73 | 51 | 42 |
| **PM Pk East** | 119 | 122 | - | 123 | 92 | 75 | 57 |
| **AM Pk West** | 152 | 147 | - | 143 | 134 | 74 | 72 |
| **PM Pk West** | 141 | 124 | - | 152 | 139 | 81 | 60 |
| **Days** | 1 | 1 | - | 1 | 1 | 1 | 1 |

*Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0*

City of Kitchener – Transportation Services
200 King Street Kitchener, ON N2G 4G7
Tel: 519 741 2200

# Traffic Summary

**Station #** - Caryndale Drive, Caryndale Drive btwn Robertson Crescent @ Chapel Hill Drive (19) <40km.h>
**Date** - 0:00 Thursday, June 08, 2017 to 0:00 Wednesday, June 14, 2017 (6 days of data)

## Volume

| | Total | Weekday | Weekend | ADT | AWDT | AWET |
|---|---|---|---|---|---|---|
| **Combined** | 16449 | 12546 | 3903 | 2742 | 3137 | 1952 |
| **East** | 7980 | 6070 | 1910 | 1330 | 1518 | 955 |
| **West** | 8469 | 6476 | 1993 | 1412 | 1619 | 997 |
| **Days** | 6 | 4 | 2 | 6 | 4 | 2 |

## Speed

| | All Days | Weekdays | Weekend | |
|---|---|---|---|---|
| **Mean speed** | 45.3 | 44.2 | 49.0 | km/h |
| **Median speed** | 46.8 | 45.7 | 49.3 | km/h |
| **85% speed** | 54.4 | 53.6 | 55.8 | km/h |

*PSL = 60 km/h*

## Class

| Class (*Scheme F3*) | All Days | % | Weekdays | Weekend |
|---|---|---|---|---|
| **1 - CYCLE** | 247 | 1.5% | 167 | 80 |
| **2 - PC** | 13812 | 84.0% | 10430 | 3382 |
| **3 - 2A-4T** | 2013 | 12.2% | 1619 | 394 |
| **4 - BUS** | 139 | 0.8% | 133 | 6 |
| **5 - 2A-6T** | 201 | 1.2% | 167 | 34 |
| **6 - 3A-SU** | 22 | 0.1% | 22 | 0 |
| **7 - 4A-SU** | 12 | 0.1% | 7 | 5 |
| **8 - <5A DBL** | 0 | 0.0% | 0 | 0 |
| **9 - 5A DBL** | 2 | 0.0% | 0 | 2 |
| **10 - >6A DBL** | 0 | 0.0% | 0 | 0 |
| **11 - <6A MULTI** | 0 | 0.0% | 0 | 0 |
| **12 - 6A MULTI** | 0 | 0.0% | 0 | 0 |
| **13 - >6A MULTI** | 1 | 0.0% | 1 | 0 |

## Average Daily Volume

| | Mon | Tue | Wed | Thu | Fri | Sat | Sun |
|---|---|---|---|---|---|---|---|
| **East** | 1493 | 1556 | 0 | 1538 | 1483 | 1077 | 833 |
| **West** | 1536 | 1661 | 0 | 1642 | 1637 | 1107 | 886 |
| **Combined** | 3029 | 3217 | 0 | 3180 | 3120 | 2184 | 1719 |
| **AM Pk East** | 134 | 128 | - | 130 | 125 | 68 | 55 |
| **PM Pk East** | 142 | 153 | - | 162 | 141 | 98 | 74 |
| **AM Pk West** | 176 | 171 | - | 159 | 160 | 88 | 77 |
| **PM Pk West** | 181 | 179 | - | 178 | 164 | 83 | 68 |
| **Days** | 1 | 1 | - | 1 | 1 | 1 | 1 |

*Report created 10:24 Friday, June 23, 2017 using MTE version 4.0.6.0*

# Appendix B

STAMSON Outputs

BT ENGINEERING

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:08:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260DNO Time Period: 16 hours
Description: 260 Biehn Drive Daytime No Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 4578 veh/TimePeriod
Medium truck volume : 142 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 50.73 + 0.00) = 50.73 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.66 | 58.30 | 0.00 | -6.11 | -1.46 | 0.00 | 0.00 | 0.00 | 50.73 |

Segment Leq : 50.73 dBA

Total Leq All Segments: 50.73 dBA

↟

TOTAL Leq FROM ALL SOURCES: 50.73
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:51:12
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260DYES Time Period: 16 hours
Description: 260 Biehn Drive Daytime with Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 2289 veh/TimePeriod
Medium truck volume : 71 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 47.72 + 0.00) = 47.72 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.66 | 55.29 | 0.00 | -6.11 | -1.46 | 0.00 | 0.00 | 0.00 | 47.72 |

Segment Leq : 47.72 dBA

Total Leq All Segments: 47.72 dBA

↟

TOTAL Leq FROM ALL SOURCES: 47.72
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:17:01
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260NNO Time Period: 8 hours
Description: 260 Biehn Drive Nighttime No Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 1145 veh/TimePeriod
Medium truck volume : 35 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 48.65 + 0.00) = 48.65 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.60 | 55.27 | 0.00 | -5.26 | -1.35 | 0.00 | 0.00 | 0.00 | 48.65 |

Segment Leq : 48.65 dBA

Total Leq All Segments: 48.65 dBA

↟

TOTAL Leq FROM ALL SOURCES: 48.65
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:52:24
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 260NYES Time Period: 8 hours
Description: 260 Biehn Drive Nighttime with Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 572 veh/TimePeriod
Medium truck volume : 18 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 45.67 + 0.00) = 45.67 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.60 | 52.29 | 0.00 | -5.26 | -1.35 | 0.00 | 0.00 | 0.00 | 45.67 |

Segment Leq : 45.67 dBA

Total Leq All Segments: 45.67 dBA

↟

TOTAL Leq FROM ALL SOURCES: 45.67
↟

STAMSON 5.0 NORMAL REPORT Date: 08-02-2022 09:07:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371DNO Time Period: 16 hours
Description: 371 Biehn Drive Daytime No Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 621 veh/TimePeriod
Medium truck volume : 19 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Results segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 44.76 + 0.00) = 44.76 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.66 | 49.60 | 0.00 | -3.39 | -1.46 | 0.00 | 0.00 | 0.00 | 44.76 |

Segment Leq : 44.76 dBA

Total Leq All Segments: 44.76 dBA

↟

TOTAL Leq FROM ALL SOURCES: 44.76
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:50:23
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371DYES Time Period: 16 hours
Description: 371 Biehn Drive Daytime with Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 2328 veh/TimePeriod
Medium truck volume : 72 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 50.51 + 0.00) = 50.51 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.66 | 55.36 | 0.00 | -3.39 | -1.46 | 0.00 | 0.00 | 0.00 | 50.51 |

Segment Leq : 50.51 dBA

Total Leq All Segments: 50.51 dBA

↟

TOTAL Leq FROM ALL SOURCES: 50.51
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:17:35
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371NNO Time Period: 8 hours
Description: 371 Biehn Drive Nighttime No Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 310 veh/TimePeriod
Medium truck volume : 10 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 45.05 + 0.00) = 45.05 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.60 | 49.67 | 0.00 | -3.27 | -1.35 | 0.00 | 0.00 | 0.00 | 45.05 |

Segment Leq : 45.05 dBA

Total Leq All Segments: 45.05 dBA

↟

TOTAL Leq FROM ALL SOURCES: 45.05
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:51:56
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 371NYES Time Period: 8 hours
Description: 371 Biehn Drive Nighttime with Extension

Road data, segment # 1: Biehn Drive
---
Car traffic volume : 582 veh/TimePeriod
Medium truck volume : 18 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Biehn Drive
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 24.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Biehn Drive
---

Source height = 0.50 m

ROAD (0.00 + 47.72 + 0.00) = 47.72 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.60 | 52.35 | 0.00 | -3.27 | -1.35 | 0.00 | 0.00 | 0.00 | 47.72 |

Segment Leq : 47.72 dBA

Total Leq All Segments: 47.72 dBA

↟

TOTAL Leq FROM ALL SOURCES: 47.72
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:09:38
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 453DNO Time Period: 16 hours
Description: 453 Caryndale Daytime No Extension

Road data, segment # 1: Caryndale Dr
---
Car traffic volume : 2328 veh/TimePeriod
Medium truck volume : 72 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Caryndale Dr
---

Source height = 0.50 m

ROAD (0.00 + 47.79 + 0.00) = 47.79 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.66 | 55.36 | 0.00 | -6.11 | -1.46 | 0.00 | 0.00 | 0.00 | 47.79 |

Segment Leq : 47.79 dBA

Total Leq All Segments: 47.79 dBA

↟

TOTAL Leq FROM ALL SOURCES: 47.79
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:53:06
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 453DYES Time Period: 16 hours
Description: 453 Caryndale Daytime with Extension

Road data, segment # 1: Caryndale Dr
---
Car traffic volume : 1164 veh/TimePeriod
Medium truck volume : 36 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Caryndale Dr
---

Source height = 0.50 m

ROAD (0.00 + 44.78 + 0.00) = 44.78 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.66 | 52.35 | 0.00 | -6.11 | -1.46 | 0.00 | 0.00 | 0.00 | 44.78 |

Segment Leq : 44.78 dBA

Total Leq All Segments: 44.78 dBA

↟

TOTAL Leq FROM ALL SOURCES: 44.78
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:13:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: 453NNO Time Period: 8 hours
Description: 453 Caryndale Nighttime No Extension

Road data, segment # 1: Caryndale Dr
---
Car traffic volume : 582 veh/TimePeriod
Medium truck volume : 18 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↟
Segment # 1: Caryndale Dr
---

Source height = 0.50 m

ROAD (0.00 + 45.73 + 0.00) = 45.73 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.60 | 52.35 | 0.00 | -5.26 | -1.35 | 0.00 | 0.00 | 0.00 | 45.73 |

Segment Leq : 45.73 dBA

Total Leq All Segments: 45.73 dBA

↟

TOTAL Leq FROM ALL SOURCES: 45.73
↟

STAMSON 5.0 COMPREHENSIVE REPORT Date: 08-02-2022 09:54:10
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: Time Period: 8 hours
Description:

Road data, segment # 1: Caryndale Dr
---
Car traffic volume : 310 veh/TimePeriod
Medium truck volume : 10 veh/TimePeriod
Heavy truck volume : 0 veh/TimePeriod
Posted speed limit : 50 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Caryndale Dr
---
Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.00 m
Receiver height : 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Segment # 1: Caryndale Dr
---

Source height = 0.50 m

ROAD (0.00 + 43.05 + 0.00) = 43.05 dBA

| Angle1 | Angle2 | Alpha | RefLeq | P.Adj | D.Adj | F.Adj | W.Adj | H.Adj | B.Adj | SubLeq |
|---|---|---|---|---|---|---|---|---|---|---|
| -90 | 90 | 0.60 | 49.67 | 0.00 | -5.26 | -1.35 | 0.00 | 0.00 | 0.00 | 43.05 |

Segment Leq : 43.05 dBA

Total Leq All Segments: 43.05 dBA

↑

TOTAL Leq FROM ALL SOURCES: 43.05
↑
↑

# Final Environmental Study Report (ESR)
# Volume 3 - Technical Appendices

City of Kitchener
Biehn Drive Municipal Class Environmental Assessment

November 2024

**Submitted by:**
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5

# Appendix I

City of Kitchener Doon South Community Area Transportation Study

BT ENGINEERING

# City of Kitchener Doon South Community

# Area Transportation Study

Paradigm Transportation Solutions Limited

2024-02
230376

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Project Summary

# City of Kitchener Doon South Community Area Transportation Study

**Project Number:**

230376

**Date and Version:**

2024-02
1.0.0

**Client:**

**City of Kitchener**
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Kitchener, ON N2G 4V6

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<< Original Signed By >>

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# Executive Summary

## Content

The Doon South area in Kitchener has undergone many long-range transportation studies over the past 20 years. In September 2016, BA Consulting Group Limited (BA Group) updated the analyses in the Doon South Community Plan which reconfirmed the transportation infrastructure plan for the area.[1] This analysis led to Municipal Class Environmental Assessments (EAs) being completed for the extensions of Robert Ferrie Drive and Strasburg Road, both of which are under construction.

The City has also begun work on the Municipal Class EA for the Biehn Drive extension. As part of that process, the City wishes to update the previous work completed for the Doon South Community to reflect the most current development plans and committed infrastructure. Most importantly the City is seeking confirmation on the need and justification for the Biehn Drive extension and the implications of not proceeding with this project.

## Findings and Conclusions

Based on the analyses contained herein, the findings of this report are as follows:

### Transportation Impact Assessment

- Under existing (2023) conditions, most study intersections are operating at acceptable levels of service and within capacity. In both the AM peak hour and PM peak hour, there are critical movements at Homer Watson Boulevard and Manitou Drive/Doon Village Road, and Homer Watson Boulevard and New Dundee Road/Highway 401 Off-Ramp;
- Under future background traffic conditions (2028 and 2033), most study intersections are forecast to continue to operate at acceptable levels of service and within capacity. In both the AM peak hour and PM peak hour, critical movements are forecast at:
  - Homer Watson Boulevard and Manitou Drive/Doon Village Road;

[1] BA Consulting Group Limited, *Update to Doon South Community and Broader Study Area Traffic Impact Study*, (Toronto: BA Group, 2016).

  - Homer Watson Boulevard and Conestoga College Boulevard; and
  - Homer Watson Boulevard and New Dundee Road/Highway 401 Off-Ramp.

- Approximately 2,841 units remain outstanding in the Doon South and Brigadoon areas of the City. This comprises 1,652 units in Doon South and 1,189 units in Brigadoon.
- Build-out of these remaining units is estimated to generate 1,593 trips in the weekday AM peak hour and 2,297 trips in the weekday PM peak hour.
- Under future total traffic conditions (2028 and 2033), including several planned roadway and intersection improvements, traffic operations throughout the Homer Watson Boulevard corridor are forecast to further deteriorate.

  Several critical movements are forecast at Homer Watson Boulevard and its intersections with Manitou Drive/Doon Village Road, Doon South Drive, Conestoga College Boulevard, and New Dundee Road/Highway 401 Off-Ramp. Critical movements are also forecast at New Dundee Road and its intersections with Pinnacle Drive, and Reidel Drive.
- Traffic control signals are not warranted at New Dundee Road and Reidel Drive, New Dundee Road and Pinnacle Drive, or Doon Mills Road and Apple Ridge Drive.

**Biehn Drive Extension Need and Justification**

- Within the existing road network (and without the extension of Robert Ferrie Drive) Caryndale Drive is functioning as a major neighborhood community collector (despite being classified as a minor neighbourhood collector street). It provides the only westerly connection between Biehn Drive and Robert Ferrie Drive;
- Caryndale Drive in combination with Biehn Drive and Robert Ferrie Drive provides the only continuous route through the western area of the Doon South neighbourhood between New Dundee Road and Huron Road;
- The future extension of Robert Ferrie Drive west to Strasburg Road, and the extension of Strasburg Road south to New Dundee Road is likely to redistribute traffic volumes on Caryndale Drive by providing a parallel north-south route to Caryndale Drive; and
- Without the Biehn Drive extension to Robert Ferrie Drive, Caryndale Drive is expected to continue functioning as a major

community collector street because Biehn Drive (which itself is classified as a major community collector street) will not connect to another major community collector street or higher order road; it will only connect to Huron Road.

Based on the findings of this report it is concluded that:

- The Homer Waston Boulevard and New Dundee Road corridors offer insufficient capacity to accommodate future traffic volumes associated with the remaining units in Doon South and Brigadoon; and
- Overall, an extension of Biehn Drive to Robert Ferrie Drive is justified to:
  - Provide a diversion route around the Caryndale Drive corridor for residents living on and adjacent to Biehn Drive; and
  - Ensure Carnydale Drive better serves its function as a minor neighbourhood collector street, as detailed in the City of Kitchener Official Plan, and based on existing design details (such as traffic calming and the presence of schools) in the corridor.

## Recommendations

Based on the findings and conclusions of this study, it is recommended:

- The City of Kitchener coordinate with the Region of Waterloo to identify remedial measures in the Homer Watson Boulevard and New Dundee corridors; and
- The City of Kitchener proceed with an extension of Biehn Drive from Robert Ferrie Drive to its current terminus west of Caryndale Drive.

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# 1 Introduction

## 1.1 Overview

The City of Kitchener retained Paradigm Transportation Solutions Limited (Paradigm) to prepare this Area Transportation Study to evaluate the effects of the planned area development on the transportation system and recommend improvements, if necessary, to address potential impacts.

## 1.2 Background

The Doon South area in Kitchener has undergone many long-range transportation studies over the past 20 years. In September 2016, BA Consulting Group Limited (BA Group) updated the analyses in the Doon South Community Plan which reconfirmed the transportation infrastructure plan for the area.[2] This analysis led to Municipal Class Environmental Assessments (EAs) being completed for the extensions of Robert Ferrie Drive and Strasburg Road, both of which are under construction.

The City has also begun work on the Municipal Class EA for the Biehn Drive extension. As part of that process, the City wishes to update the previous work completed for the Doon South Community to reflect the most current development plans and committed infrastructure. Most importantly the City is seeking confirmation on the need and justification for the Biehn Drive extension and the implications of not proceeding with this project.

## 1.3 Purpose and Scope

This scope of this study includes:

- An analysis of current traffic conditions and operations at:
  - Huron Road and Strasburg Road
  - Doon Village Road and Homer Watson Boulevard
  - Doon Village Road and Pioneer Drive
  - Doon South Drive and Homer Watson Boulevard
  - Homer Watson Boulevard and Conestoga College Boulevard

[2] BA Consulting Group Limited, *Update to Doon South Community and Broader Study Area Traffic Impact Study,* (Toronto: BA Group, 2016).

  - Homer Watson Boulevard and New Dundee Road/Highway 401 Off-Ramp
  - New Dundee Road and Thomas Slee Drive (Pinnacle Drive)
  - New Dundee Road and Robert Ferrie Drive
  - New Dundee Drive and Reidel Drive/Cameron Road
  - Doon Mills Road and Apple Ridge Drive
  - Robert Ferrie Drive and South Creek Drive
  - Biehn Drive and Caryndale Drive
- Estimates of the trip generation of outstanding development in the Doon South study area;
- An analysis of future traffic operations at the study intersections for two horizon years (five- and ten-years from the date of this study) with and without the Biehn Drive extension; and
- A review of the need and justification for the Biehn Drive extension from Robert Ferrie Drive to its current terminus west of Caryndale Drive.

Paradigm confirmed the scope of work with City staff via a meeting in September 2023. This study has been completed in general accordance with the Region's *Transportation Impact Study Guidelines*[3] and comments received from the City during pre-study consultation. **Figure 1.1** illustrates the study area and intersections included in this study.

[3] Region of Waterloo, *Transportation Impact Study Guidelines*, (Kitchener: Region of Waterloo, 2014).

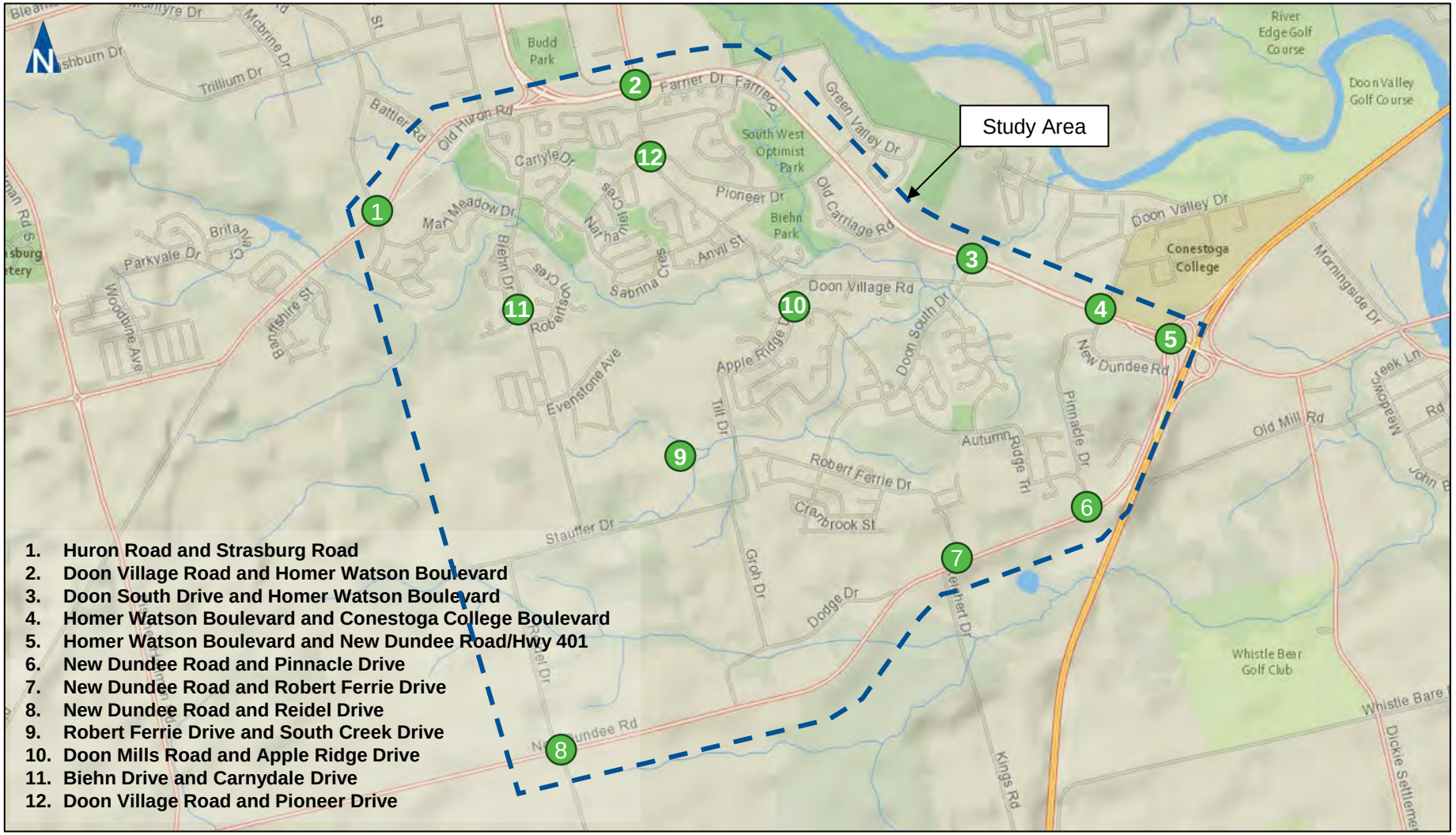


Image Source: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

paradigm TRANSPORTATION SOLUTIONS LIMITED

# Study Area and Study Intersections

# 2 Existing Conditions

## 2.1 Road Network

The main roadways in the study area comprise the following:

- **Huron Road** is an east-west, city arterial street[4] with a four-lane urban cross-section. At the east end, the road terminates at an interchange with Homer Watson Boulevard. The posted speed limit is 60 km/h east of Battler Road and 50 km/h west of Battler Road.
- **Homer Watson Boulevard** is a predominantly north-south regional road, with a four-lane urban cross-section. The road widens to a six-lane urban cross-section at Conestoga College Boulevard. The posted speed limit is 70 km/h.
- **New Dundee Road** is an east-west regional road with a two-lane rural cross-section, which operates as Regional Road 12. The posted speed limit is 50 km/h.
- **Conestoga College Boulevard** is an east-west road with a four-lane urban cross-section. The segment between New Dundee Road and Homer Watson Boulevard operates under Region jurisdiction as Regional Road 12. The segment east of Homer Watson Boulevard is major community collector street under City of Kitchener jurisdiction.
- **Strasburg Road** is a north-south city arterial street with a four-lane urban cross-section. At the time of writing Strasburg Road terminates at Rockcliffe Drive. The posted speed limit is 60 km/h.
- **Doon Village Road, Pioneer Drive, Doon South Drive, Thomas Slee Drive, Biehn Drive and Robert Ferrie Drive** are major community collector streets each with a two-lane urban cross-section. The maximum speed limit on each road varies, although several roads operate with a posted speed limit of 40 km/h through AREA signage at entrances to the Doon South Area.
- **Apple Ridge Roa**d and **Caryndale Drive** are minor neighbourhood collector streets. Each street operates with a two-lane urban cross-section and a posted speed limit of 30 km/h.

[4] City of Kitchener, *Official Plan A Complete and Healthy Kitchener, Mapp 1 Integrated Transportation System*, (Kitchener: City of Kitchener, 2019).

- **Reidel Drive** is a north-south local street with a two-lane rural cross-section. The posted speed limit is 50 km/h.

**Figure 2.1** and **Figure 2.2** illustrate the existing lane configurations and traffic control at the signalized and unsignalized study intersections, respectively.

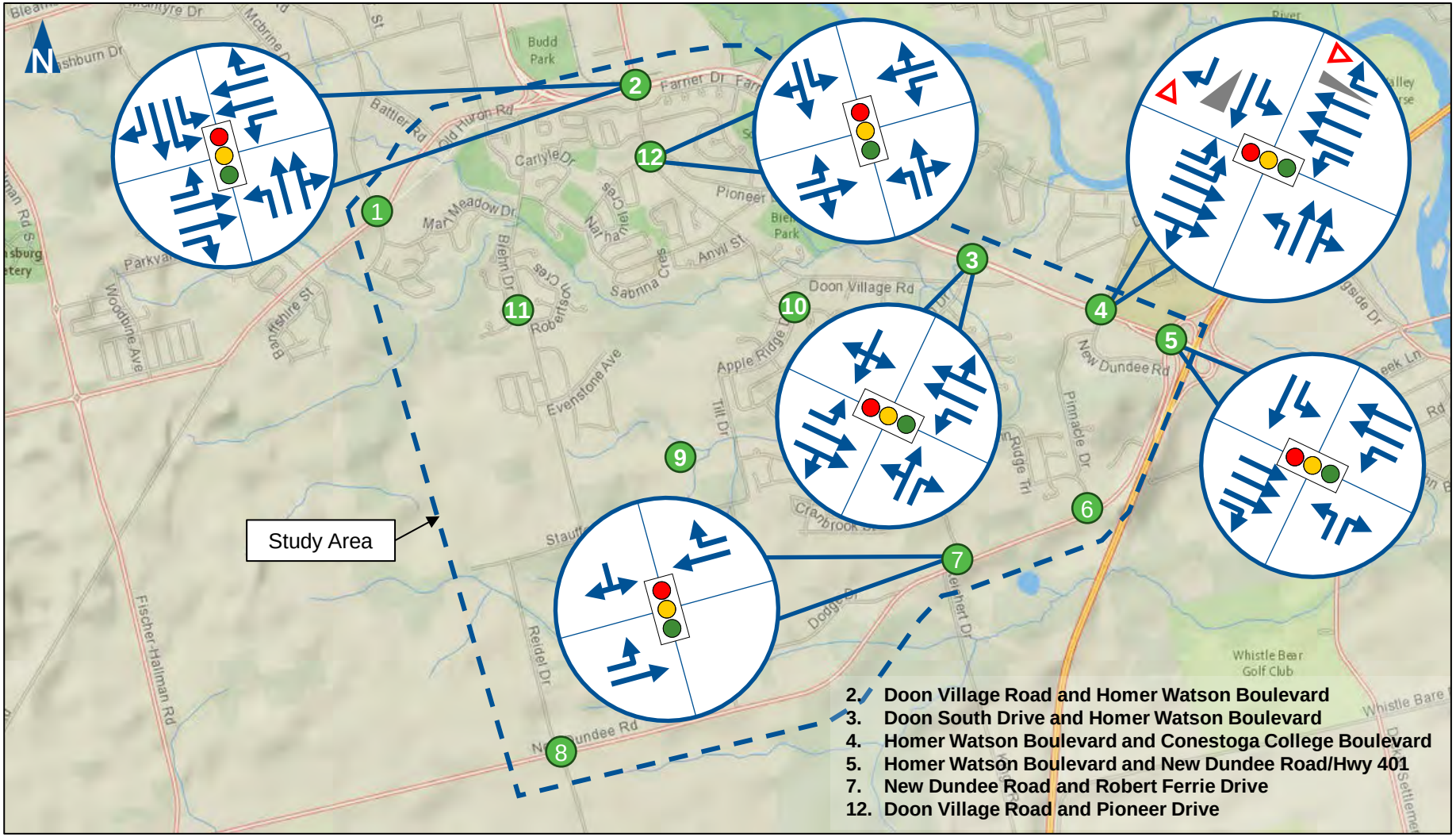


Image Source: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

# Existing Lane Configurations and Traffic Control Signalized Intersections

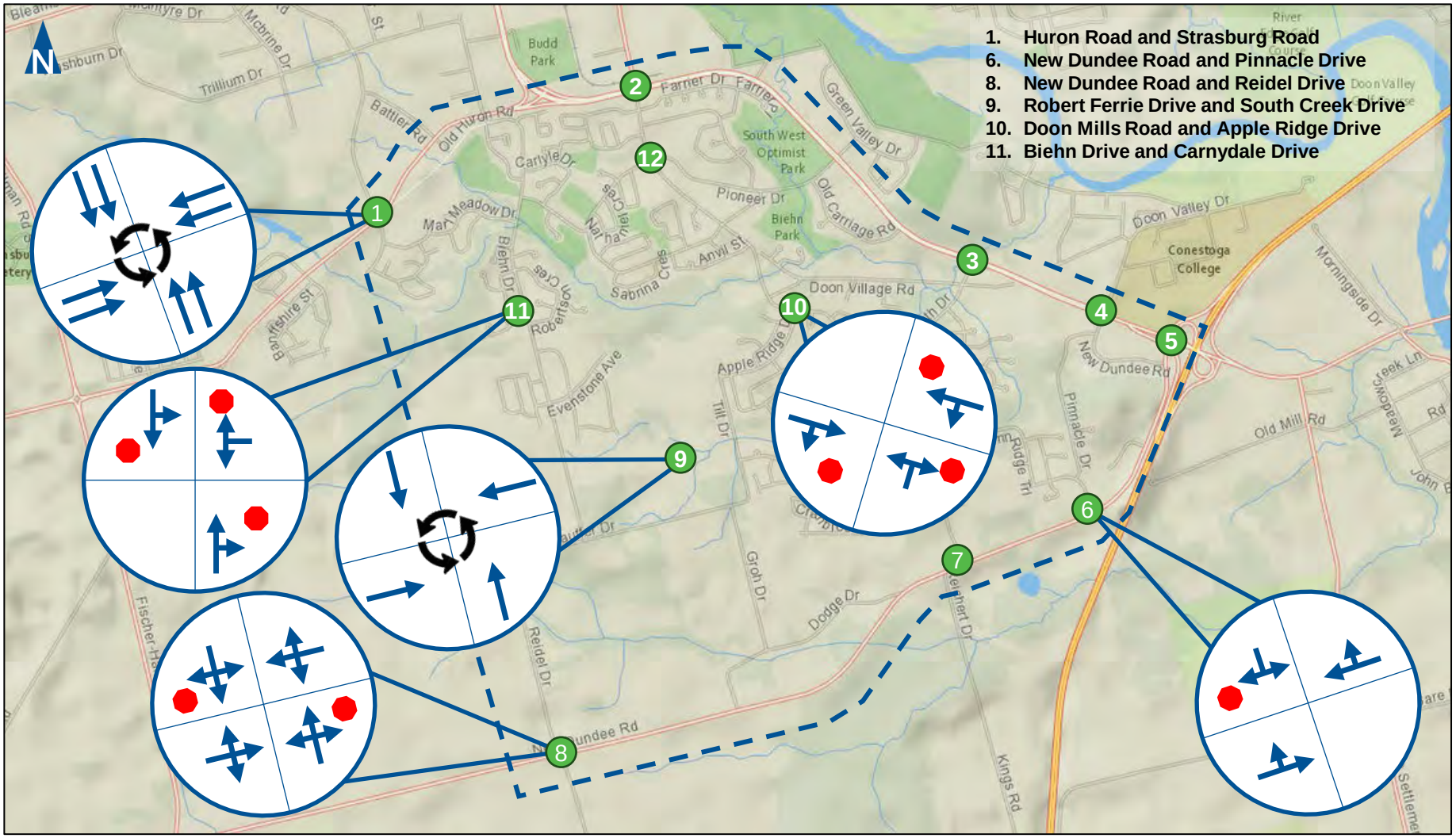


Image Source: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.

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# Existing Lane Configurations and Traffic Control Unsignalized Intersections

## 2.2 Transit Services

Grand River Transit (GRT) is the public transit operator in the Region of Waterloo and its constituent municipalities. GRT operates nine transit routes out of the Conestoga College Doon transit hub. Routes 16, 36, and 76 connect to transit stops in the Doon South neighbourhood, whereas the other routes primarily operate along Homer Watson Boulevard and Fountain Street (south of Highway 401).

**Figure 2.3** illustrates the existing transit services in and surrounding the study area.

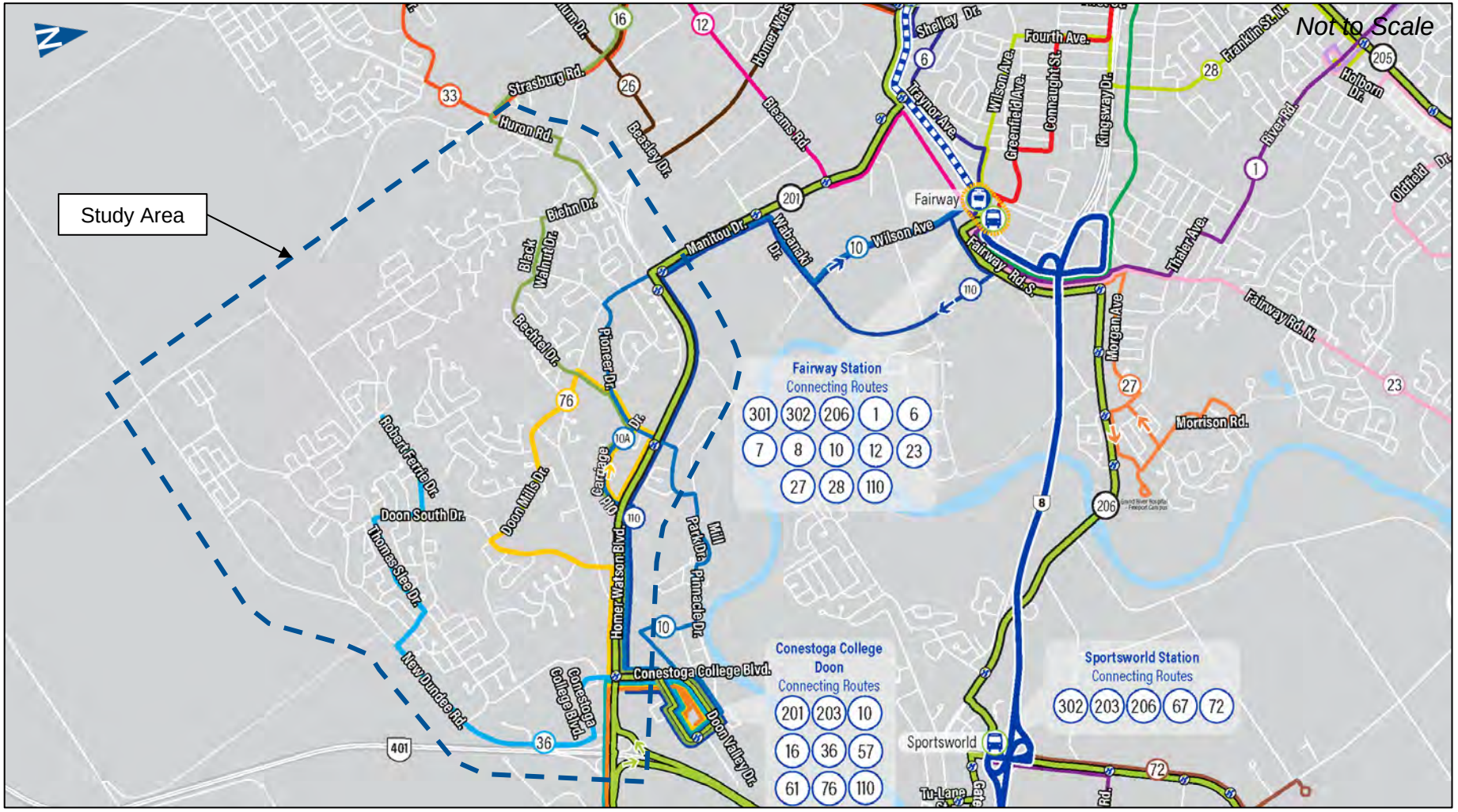


Image Source: Grand River Transit System Map (September 26, 2023) from https://www.grt.ca/en/schedules-maps/resources/2023-09-26-2023-system-map_09262023-web.pdf

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# Existing Transit Services

# 3 Traffic Conditions

## 3.1 Existing Traffic Volumes

Due to the extent of the study area, Paradigm relied on a combination of historical turning movement count (TMC) data and more recent TMC data collected on Wednesday October 11, 2023. Table 3.1 summarizes the date and source of each TMC. All TMCs were conducted on a typical weekday from 7:30 AM to 10:30 AM, noon to 2:00 PM, and 3:00 PM to 6:00 PM.

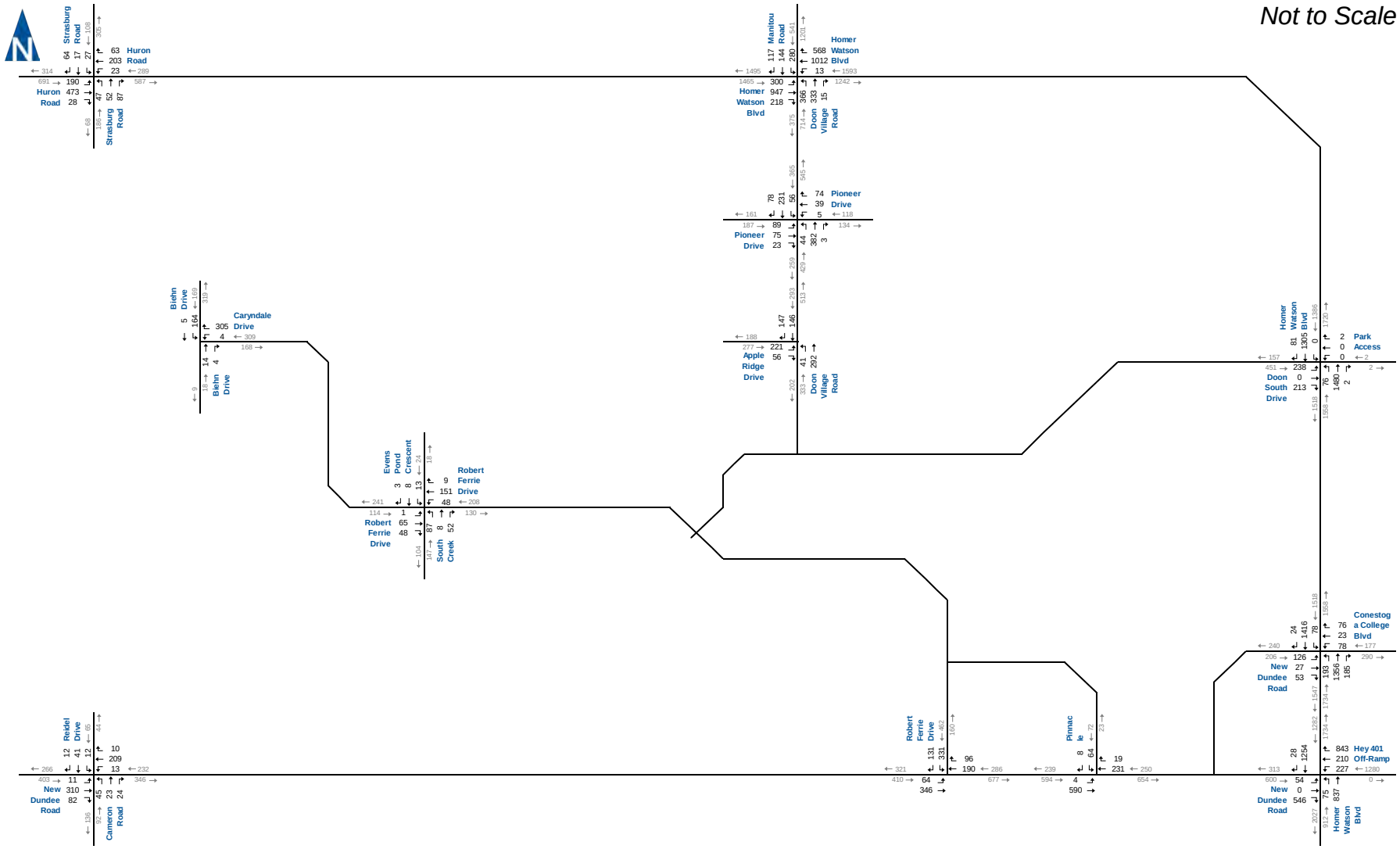
Because the AM peak hour and PM peak hour varied by intersection, traffic volumes were not balanced between all intersections in the study area. Volume balancing was also not applied where there were a significant number of intersecting streets or businesses between two intersections. Traffic volumes were only balanced on Homer Watson Boulevard between Doon South Drive and New Dundee Road/Westbound Highway 401 Off-Ramp.

**Figure 3.1** and **Figure 3.2** illustrate the existing AM peak hour and PM peak hour traffic volumes, respectively. **Appendix A** contains the detailed turning movement count data.

## TABLE 3.1: DATE AND SOURCE OF TRAFFIC DATA

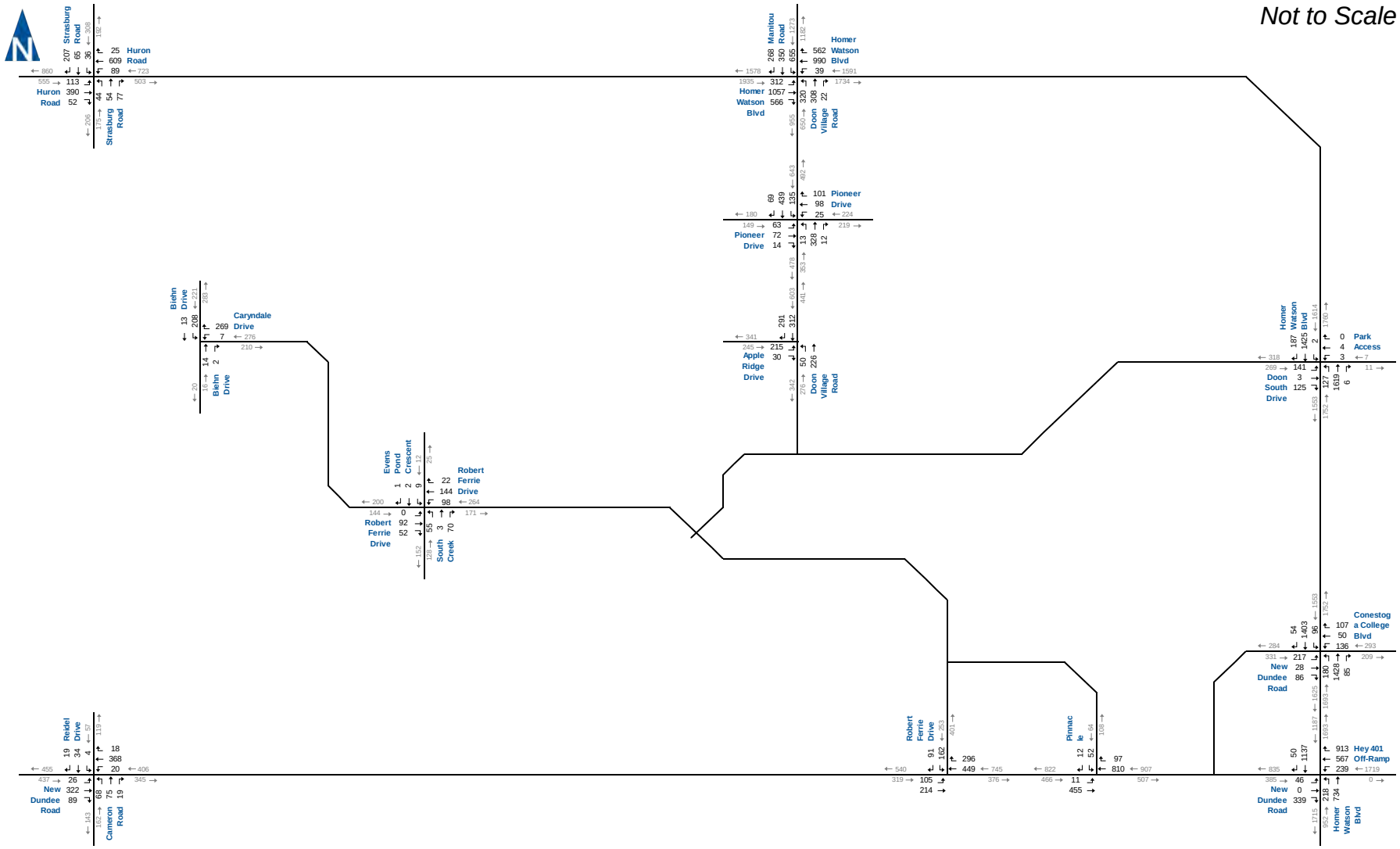
| Intersection | Count Date | Source |
|---|---|---|
| Huron Rd. and Strasburg Rd. | Wed. Apr. 20, 2022 | Paradigm |
| Doon Village Rd. and Homer Watson Blvd. | Wed. Oct. 11, 2023 | Paradigm |
| Doon South Dr. and Homer Watson Blvd. | Wed. Oct. 11, 2023 | Paradigm |
| Homer Watson Blvd. and Conestoga College Blvd. | Thurs. 4 Nov. 2021 | Region |
| Homer Watson Blvd. and New Dundee Rd./Hwy. 401 | Wed. Mar. 29, 2023 | Region |
| New Dundee Rd. and Pinnacle Dr. | Tues. Jun. 7, 2022 | Region |
| New Dundee Rd. and Robert Ferrie Dr. | Wed. Mar. 29, 2023 | Region |
| New Dundee Rd. and Reidel Dr./Cameron Rd. | Wed. May 31, 2023 | Paradigm |
| Robert Ferrie Dr. and South Creek Dr. | Wed. Oct. 11, 2023 | Paradigm |
| Doon Mills Rd. and Apple Ridge Dr. | Wed. Oct. 11, 2023 | Paradigm |
| Biehn Dr. and Caryndale Dr. | Wed. Oct. 11, 2023 | Paradigm |
| Doon Village Rd. and Pioneer Dr. | Tues. Oct. 18, 2022 | Region |

*Not to Scale*




# Existing Traffic Volumes
# AM Peak Hour

*Not to Scale*




# Existing Traffic Volumes
# PM Peak Hour

## 3.2 Daily Traffic Count Volumes

Alongside the TMC data described in **Section 3.1** Paradigm conducted 24-hour traffic volume counts and vehicle classification surveys across 25 road segments. Due to equipment malfunctions, the data collection equipment only recorded vehicle classification data from 7 AM to 6 PM. **Appendix B** contains the raw ATR data.

To estimate daily 24-hour volumes from the subset collected, Paradigm reviewed historical ATR data for four study roads provided by the City. The historical data were collected in Fall 2022 at four locations in the study area. The data review indicates 11-hour volumes from 7 AM to 6 PM represent, on average, 70% of the 24-hour volume across the four different ATR locations in the study area. Therefore, the 11-hour ATR data was factored to a 24-hour condition, by assuming the observed volumes represented 70% of the 24-hour volume. The subsequent value was then rounded to the nearest 100.

**Table 3.2** summarizes the 24-hour data collected as part of the 2016 TIS, the factored 11-hour data collected in 2023, and the net change in daily two-way traffic volumes. **Figure 3.3** illustrates the 2023 volume data presented in **Table 3.2**.

## TABLE 3.2: 24-HOUR TRAFFIC VOLUME REVIEW

| Road | Limits | Daily Volume | | Change |
|---|---|---|---|---|
| | | 2015 | 2023[1] | |
| Apple Ridge Dr. | Forest Creek Dr. to Doon Mills Rd. | 5,300 | 5,100 | -200 |
| Biehn Dr. | Caryndale Dr. to Black Walnut Dr. | 4,500 | 6,500 | 2,000 |
| Caryndale Dr. | Robert Ferrie Drive to Stauffer Dr. | 1,650 | 1,500 | -150 |
| Caryndale Dr. | Evenstone Avenue to Chapel Hill Dr. | 2,350 | 3,800 | 1,450 |
| Doon Mills Dr. | Pine Valley Dr. to Doon South Dr. | 4,700 | 6,000 | 1,300 |
| Doon Mills Dr. | Tilt Dr. to Apple Ridge Dr. | 8,200 | 10,400 | 2,200 |
| Doon Mills Dr. | Anvil Street to Tilt Dr. | - | 10,900 | 10,900 |
| Doon South Dr. | Homer Watson Blvd. to Doon Village Rd. | 6,450 | 7,300 | 850 |
| Doon South Dr. | Robert Ferrie Dr. to Thomas Slee Dr. | - | 3,200 | 3,200 |
| Doon South Dr. | Doon Mills Dr. to Forest Edge Tr. | - | 4,400 | 4,400 |
| Doon South Dr. | Doon South Dr. to Robert Ferrie Dr. | - | 6,400 | 6,400 |
| Doon Village Rd. | Pioneer Dr. to Bechtel Dr. | 8,150 | 10,100 | 1,950 |
| Doon Village Rd. | Pioneer Dr. to Homer Watson Blvd. | 12,400 | 14,500 | 2,100 |
| Forest Creek Dr. | Robert Ferrie Dr. to Apple Ridge Dr. | 2,100 | 2,600 | 500 |
| Forest Edge Tr. | Doon South Dr. to Windrush Tr. | - | 700 | 700 |
| Forest Edge Tr. | Windrush Tr. to Thomas Slee Dr. | - | 1,500 | 1,500 |
| Reidel Dr. | Stauffer Dr. to New Dundee Rd. | 1,300 | 1,600 | 300 |
| Robert Ferrie Dr. | Doon South Dr. to Thomas Slee Dr. | 2,400 | 3,500 | 1,100 |
| Robert Ferrie Dr. | Forest Creek Dr. to Doon South Dr. | 1,650 | 2,900 | 1,250 |
| Robert Ferrie Dr. | South Creek Dr. to Forest Creek Dr. | 1,550 | 3,700 | 2,150 |
| Robert Ferrie Dr. | Blair Creek Dr. to New Dundee Rd. | 3,550 | 7,000 | 3,450 |
| South Creek Dr. | Robert Ferrie Dr. to Doon South Dr. | 550 | 2,600 | 2,050 |
| Thomas Slee Dr. | Doon South Dr. to Robert Ferrie Dr. | - | 2,300 | 2,300 |
| Thomas Slee Dr. | South Creek Dr. to Doon South Dr. | - | 2,500 | 2,500 |
| Windrush Tr. | Doon South Dr. to Forest Edge Tr. | - | 1,500 | 1,500 |

Notes:

1. 2023 volumes represent an estimate of daily volumes based on consecutive 11-hour observations conducted from 7 AM to 6 PM, factored to a 24-hour condition. Based on a review of Fall 2022 ATR data at four locations in the study area it is assumed the 11-hour period from 7 AM to 6 PM captures 70% of the daily traffic volume.

Image Source: City of Kitchener Online Interactive Mapping Tool (https://maps.kitchener.ca/OnPointExternal/RMap/Default.aspx#)

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# 24-Hour Traffic Volume Observations

## 3.3 Traffic Operations

The quality of intersection operations at signalized and unsignalized intersections is evaluated in terms of level of service (LOS) and volume-to-capacity (v/c) as defined by the Highway Capacity Manual (HCM). LOS is evaluated based on the average control delay per vehicle and includes deceleration delay, queue move-up delay, stopped delay, and final acceleration delay. Volume-to-capacity is calculated as the ratio of the total vehicular demand for each movement as compared to the theoretical capacity for each movement.

For signalized intersections, LOS ranges from LOS A (less than 10 seconds of average delay) to LOS F (greater than 80 seconds of average delay). For unsignalized intersections, LOS ranges from LOS A (less than 10 seconds of average delay) to LOS F (greater than 50 seconds of average delay). Capacity is evaluated in terms of the ratio of demand flow to theoretical capacity, with an at capacity condition represented by a v/c ratio of 1.00 (that is, volume demand equals capacity).

The Region of Waterloo *Transportation Impact Study Guidelines*[5] define critical intersections as those where the average control delay per vehicle is greater than 55 seconds (for signalized intersections) or 35 seconds (for unsignalized intersections). Both delays correspond to LOS E. Critical movements, regardless of intersection control type, are defined as those where:

- The average control delay for individual movements is greater than 55 seconds;
- The estimated 95th percentile queue length for an exclusive movement exceeds the available lane storage;
- The estimated 95th percentile queue length for an individual movement blocks an existing access;
- Exclusive turning lanes are inaccessible because of queue lengths in adjacent through lanes; and
- Poor quality of service for non-auto modes.

The operations of the study intersections (except those operating as roundabouts) have been modelled and analyzed using Synchro 11, which implements the methodology of the Highway Capacity Manual (HCM), with the following parameters:

[5] Region of Waterloo, *Transportation Impact Study Guidelines,* (Kitchener, Region of Waterloo, 2014), 12.

- Existing lane geometry and traffic control;
- Saturation flow rates and peak hour factors as defined in the Region of Waterloo *Transportation Impact Study Requirements for Capacity Analysis, Roundabouts, and Signal Warrants*[6];
- Heavy vehicle percentages and pedestrian volumes as extracted from the turning movement counts; and
- Synchro default values for all other inputs.

For intersections operating as a roundabout, traffic operations have been analyzed using ARCADY. The analysis considers three separate measures of performance:

- The level of service (LOS) and average delay for each turning movement, measured in seconds (s);
- The volume to capacity (v/c) ratio for each movement; and
- The 95th percentile queue length, in metres (m).

**Table 3.3** and **Table 3.4** summarize the estimated base year conditions. The analyses indicate the study intersections are generally operating at acceptable levels of service and within capacity. The following critical movements are noted:

- **Homer Watson Boulevard and Manitou Drive/Doon Village Road**:
  - In the AM peak hour, the eastbound left-turn, southbound left-turn, and westbound through movements are operating with delays greater than 55 seconds. The northbound left-turn movement is also operating with queues that exceed available lane capacity; and
  - In the PM peak hour, the eastbound left-turn, westbound through, northbound left-turn and through, and southbound left-turn and through movements are operating with delays greater than 55 seconds. The northbound and southbound left-turn movements are also operating with queues that exceed available lane capacity.
- **Homer Watson Boulevard and Doon South Drive**: In the PM peak hour, the southbound through movement is operating with delays greater than 55 seconds.

[6] Region of Waterloo, *Transportation Impact Studies (TIS), Requirements for Capacity Analysis, Roundabouts, Signal Warrants*, (Kitchener: Region of Waterloo, n.d.).

- **Homer Watson Boulevard and Conestoga College Boulevard**: In the PM peak hour, the eastbound left-turn movement is operating with delays greater than 55 seconds.
- **Homer Watson Boulevard and New Dundee Road/Highway 401 Ramp**:
  - In the AM peak hour, the eastbound right-turn movement is operating with delays greater than 55 seconds; and
  - In the PM peak hour, the northbound left-turn movement is operating with delays greater than 55 seconds.

**Appendix C** contains the detailed Synchro 11 reports.

# TABLE 3.3: EXISTING TRAFFIC OPERATIONS – AM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 3 | > | 3 | < | 2 | > | 2 | 3 |
| | | | V/C | < | 0.36 | > | | < | 0.16 | > | | < | 0.12 | > | | < | 0.06 | > | | |
| | | | Q | < | 7 | > | | < | 2 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | D | C | E | D | F | E | F | E | F | > | E | F | F | E | F | D |
| | | | Delay | 86 | 31 | 24 | 41 | 35 | 80 | 47 | 68 | 40 | 51 | > | 45 | 64 | 53 | 47 | 58 | 54 |
| | | | V/C | 0.96 | 0.62 | 0.18 | | 0.08 | 1.00 | 0.63 | | 0.73 | 0.48 | > | | 0.67 | 0.40 | 0.08 | | 0.91 |
| | | | Q | 137 | 148 | 22 | | 6 | 220 | 93 | | 109 | 67 | > | | 55 | 59 | 17 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 138 | - | 58 | | 114 | - | 107 | | -84 | - | > | | 50 | - | 48 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | B | > | B | A | D | > | D | C |
| | | | Delay | < | 48 | 29 | 39 | < | 27 | > | 27 | 45 | 16 | > | 17 | 0 | 36 | > | 36 | 28 |
| | | | V/C | < | 0.80 | 0.15 | | < | 0.00 | > | | 0.51 | 0.77 | > | | 0.00 | 0.93 | > | | 0.90 |
| | | | Q | < | 76 | 17 | | < | 0 | > | | 31 | 174 | > | | 0 | 240 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 79 | - | > | | 55 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | D | D | > | D | D | D | D | D | C | B | B | B | D | C | B | C | C |
| | | | Delay | 39 | 39 | > | 39 | 37 | 41 | 40 | 39 | 26 | 16 | 12 | 16 | 40 | 35 | 13 | 35 | 26 |
| | | | V/C | 0.60 | 0.16 | > | | 0.47 | 0.19 | 0.06 | | 0.65 | 0.54 | 0.14 | | 0.33 | 0.93 | 0.02 | | 0.85 |
| | | | Q | 35 | 10 | > | | 24 | 12 | 2 | | 49 | 85 | 14 | | 14 | 194 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | 15 | - | > | | 26 | - | - | | 156 | - | > | | 161 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | C | | E | E | C | C | A | A | C | C | > | C | | C | C | C | C |
| | | | Delay | 33 | | 79 | 75 | 26 | 25 | 2 | 10 | 22 | 21 | > | 21 | | 31 | 22 | 31 | 29 |
| | | | V/C | 0.19 | | 0.97 | | 0.40 | 0.30 | 0.62 | | 0.41 | 0.51 | > | | | 0.69 | 0.02 | | 0.84 |
| | | | Q | 24 | | 181 | | 68 | 63 | 0 | | 16 | 84 | > | | | 107 | 0 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | 51 | | - | | - | - | - | | 164 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | C | | > | C | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 17 | | > | 17 | |
| | | | V/C | < | 0.00 | | | | 0.15 | > | | | | | | 0.20 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 6 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | B | B | > | B | < | C | B | C | | | | | < | B | > | B | B |
| | | | Delay | 13 | 15 | > | 15 | < | 22 | 18 | 21 | | | | | < | 19 | > | 19 | 18 |
| | | | V/C | 0.17 | 0.51 | > | | < | 0.55 | 0.07 | | | | | | < | 0.66 | > | | 0.64 |
| | | | Q | 10 | 49 | > | | < | 40 | 10 | | | | | | < | 99 | > | | |
| | | | Ex | 30 | - | > | | < | - | 25 | | | | | | < | - | > | | |
| | | | Avail. | 20 | - | > | | < | - | 15 | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | C | > | C | < | C | > | C | |
| | | | Delay | < | 0 | > | 0 | < | 1 | > | 1 | < | 17 | > | 17 | < | 15 | > | 15 | |
| | | | V/C | < | 0.01 | > | | < | 0.01 | > | | < | 0.23 | > | | < | 0.16 | > | | |
| | | | Q | < | 0 | > | | < | 0 | > | | < | 7 | > | | < | 4 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.11 | > | | < | 0.20 | > | | < | 0.14 | > | | < | 0.03 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | B | > | B | |
| | | | Delay | 13 | | > | 13 | | | | | < | 13 | | 13 | | 11 | > | 11 | |
| | | | V/C | 0.43 | | > | | | | | | < | 0.48 | | | | 0.41 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.29 | | > | | | 0.01 | > | | < | 0.10 | | | |
| | | | Q | | | | | 10 | | > | | | 0 | > | | < | 3 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | A | B | > | B | B |
| | | | Delay | 17 | 16 | > | 16 | < | 15 | 15 | 15 | 9 | 13 | > | 13 | 10 | 12 | > | 12 | 13 |
| | | | V/C | 0.23 | 0.17 | > | | < | 0.09 | 0.06 | | 0.10 | 0.49 | > | | 0.15 | 0.41 | > | | 0.39 |
| | | | Q | 18 | 16 | > | | < | 10 | 8 | | 8 | 51 | > | | 10 | 37 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 3 | - | > | | < | - | 22 | | 12 | - | > | | 21 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*
*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*
*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*
*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

# TABLE 3.4: EXISTING TRAFFIC OPERATIONS – PM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| PM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 2 | > | 2 | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.30 | > | | < | 0.39 | > | | < | 0.11 | > | | < | 0.21 | > | | |
| | | | Q | < | 7 | > | | < | 5 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | E | C | E | E | F | E | F | F | F | > | F | F | F | E | F | E |
| | | | Delay | 86 | 40 | 34 | 45 | 38 | 99 | 50 | 80 | 57 | 57 | > | 57 | 105 | 61 | 47 | 81 | 65 |
| | | | V/C | 0.96 | 0.74 | 0.51 | | 0.27 | 1.05 | 0.60 | | 0.85 | 0.51 | > | | 1.04 | 0.74 | 0.28 | | 0.98 |
| | | | Q | 141 | 176 | 70 | | 13 | 222 | 85 | | 94 | 65 | > | | 152 | 141 | 40 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 134 | - | 10 | | 107 | - | 115 | | -69 | - | > | | -47 | - | 25 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | B | > | B | B | E | > | E | D |
| | | | Delay | < | 45 | 32 | 39 | < | 31 | > | 31 | 40 | 12 | > | 14 | 13 | 57 | > | 57 | 35 |
| | | | V/C | < | 0.69 | 0.09 | | < | 0.03 | > | | 0.55 | 0.75 | > | | 0.02 | 1.04 | > | | 0.93 |
| | | | Q | < | 49 | 15 | | < | 5 | > | | 45 | 164 | > | | 2 | 277 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 65 | - | > | | 53 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | F | D | > | E | C | D | D | D | C | B | B | B | D | C | B | C | C |
| | | | Delay | 90 | 39 | > | 73 | 33 | 38 | 37 | 36 | 25 | 18 | 13 | 19 | 40 | 30 | 14 | 30 | 29 |
| | | | V/C | 0.97 | 0.17 | > | | 0.55 | 0.26 | 0.08 | | 0.66 | 0.60 | 0.06 | | 0.38 | 0.88 | 0.04 | | 0.86 |
| | | | Q | 75 | 11 | > | | 37 | 20 | 9 | | 42 | 99 | 0 | | 17 | 198 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | -25 | - | > | | 13 | - | - | | 163 | - | > | | 158 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | D | | D | D | C | C | A | B | E | C | > | C | | C | C | C | C |
| | | | Delay | 37 | | 36 | 36 | 24 | 35 | 2 | 16 | 64 | 20 | > | 30 | | 32 | 24 | 32 | 25 |
| | | | V/C | 0.31 | | 0.43 | | 0.36 | 0.75 | 0.66 | | 0.94 | 0.46 | > | | | 0.66 | 0.03 | | 0.92 |
| | | | Q | 22 | | 57 | | 65 | 188 | 0 | | 75 | 72 | > | | | 94 | 0 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | 53 | | - | | - | - | - | | 105 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | D | | > | D | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 34 | | > | 34 | |
| | | | V/C | < | 0.01 | | | | 0.53 | > | | | | | | 0.34 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 11 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | B | B | > | B | < | C | B | C | | | | | < | C | > | C | C |
| | | | Delay | 13 | 11 | > | 12 | < | 32 | 19 | 27 | | | | | < | 21 | > | 21 | 22 |
| | | | V/C | 0.31 | 0.24 | > | | < | 0.81 | 0.36 | | | | | | < | 0.42 | > | | 0.58 |
| | | | Q | 14 | 28 | > | | < | 97 | 31 | | | | | | < | 60 | > | | |
| | | | Ex | 30 | - | > | | < | - | 25 | | | | | | < | - | > | | |
| | | | Avail. | 16 | - | > | | < | - | -6 | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | D | > | D | < | C | > | C | |
| | | | Delay | < | 1 | > | 1 | < | 1 | > | 1 | < | 34 | > | 34 | < | 18 | > | 18 | |
| | | | V/C | < | 0.02 | > | | < | 0.02 | > | | < | 0.58 | > | | < | 0.17 | > | | |
| | | | Q | < | 1 | > | | < | 0 | > | | < | 27 | > | | < | 5 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.14 | > | | < | 0.25 | > | | < | 0.12 | > | | < | 0.01 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | D | > | D | |
| | | | Delay | 14 | | > | 14 | | | | | < | 13 | | 13 | | 26 | > | 26 | |
| | | | V/C | 0.42 | | > | | | | | | < | 0.43 | | | | 0.82 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.27 | | > | | | 0.01 | > | | < | 0.13 | | | |
| | | | Q | | | | | 9 | | > | | | 0 | > | | < | 4 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | B | B | > | B | B |
| | | | Delay | 16 | 16 | > | 16 | < | 17 | 15 | 16 | 9 | 12 | > | 12 | 12 | 17 | > | 15 | 15 |
| | | | V/C | 0.17 | 0.15 | > | | < | 0.25 | 0.07 | | 0.04 | 0.44 | > | | 0.31 | 0.66 | > | | 0.49 |
| | | | Q | 13 | 15 | > | | < | 22 | 9 | | 3 | 44 | > | | 20 | 73 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 7 | - | > | | < | - | 21 | | 17 | - | > | | 10 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

# 4 Community Development and Status of Build-out

The 2016 *Update to Doon South Community and Broader Study Area Traffic Impact Study* (the 2016 TIS) estimated a total yield of the planned, registered, and remaining units in the Doon South Phase 1, Doon South Phase 2, and Brigadoon areas. **Table 4.1** summarizes the estimated unit allocation in the 2016 study and the remaining units assumed in that report.

### TABLE 4.1: ESTIMATED UNIT ALLOCATION (2016)

| Location | Planned Units | Remaining Units |
|---|---|---|
| Doon South Phase 1 | 1,172 – 1,384 | 607-819 |
| Doon South Phase 2 | 2,471 – 2,952 | 2,278 – 2,759 |
| Brigadoon | 887-1,566 | 887 – 1,566 |
| **Total** | **4,530 – 5,902** | **3,772 – 5,144** |

**Table 4.2** summarizes the updated unit allocation estimates based on a field review of completed units as compared to those included in the 2016 TIS. The updated unit allocation indicates between 2,115 and 3,082 units remain outstanding in the study area.

### TABLE 4.2: UPDATED UNIT ALLOCATION ESTIMATES (2023)

| Location | Remaining Units |
|---|---|
| Doon South Phase 1 | 0 |
| Doon South Phase 2 | 1,228 – 1,516 |
| Brigadoon | 887 – 1,566 |
| **Total** | **2,115 – 3,082** |

To supplement the estimates above Paradigm reviewed the Growth Area Subplans included as Appendix A to the *Kitchener Growth Management Plan (Fall 2019 to Fall 2021)*[7] alongside information provided by the City of Kitchener Planning Department. **Table 4.3** summarizes the estimated remaining units based on known site plan approvals, with a total of 2,841 units outstanding.

[7] City of Kitchener Development Services Department – Planning Division, *Kitchener Growth Management Plan (KGMP)*, (City of Kitchener: Kitchener, 2019).

## TABLE 4.3: ESTIMATED REMAINING UNITS BY STUDY ZONE

| Location | Remaining Units |
|---|---|
| Doon South Phase 1 | 52 |
| Doon South Phase 2 | 1,600 |
| Brigadoon | 1,189 |
| **Total** | **2,841** |

# 5 Future Traffic Volumes

## 5.1 Horizon Years

Consistent with the Region of Waterloo *Transportation Impact Study Guidelines* and pre-study discussions with City of Kitchener staff, future traffic forecasts and analyses correspond to five- and ten-years from the date of study, representative of 2028 and 2033.

## 5.2 Planned Roadway Improvements

Given the ongoing development in the study area, several new road construction projects and intersection improvements are planned over the analysis periods assumed in this study. **Table 5.1** summarizes the assumed road and intersection improvements and their estimated completion. Except for future widenings of Homer Watson Boulevard and New Dundee Road, all improvements are scheduled to occur before the 2028 horizon year. Therefore, the analysis of 2028 and 2033 conditions assumes all improvements except the widenings of Homer Watson Boulevard and New Dundee Road.

The future traffic analyses do not assume a future extension of Biehn Drive, because the ultimate alignment and timing of this extension remains unknown

## 5.3 Forecast Background Traffic

The future background traffic volumes in the study area (that is, traffic growth unrelated to the remaining units to be development in the Doon South area) is expected to comprise general background traffic growth from development outside the study area.

Future traffic growth estimates are based on a general background growth rate of 1% compounded per annum, applied only to movements on Huron Road, Homer Watson Boulevard, and New Dundee Road. This growth rate was recommended by City staff during pre-study consultation and accounts for future development outside of the Doon South and Brigadoon neighbourhoods.

**Figure 5.1**, and **Figure 5.2** illustrate the future background traffic volumes at the 2028 horizon year. **Figure 5.3** and **Figure 5.4** illustrate the future background traffic volumes at the 2033 horizon year.

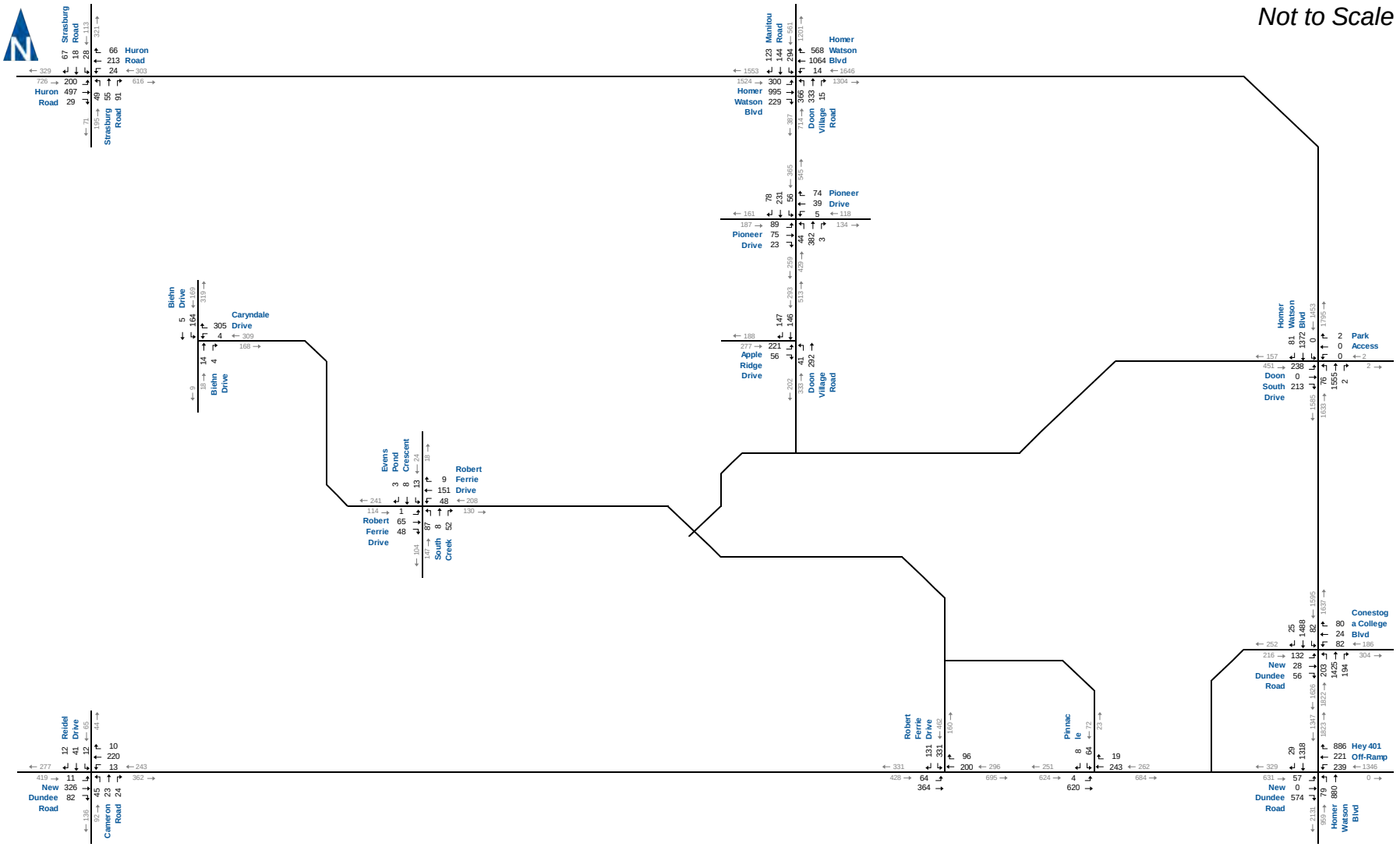
## TABLE 5.1: PLANNED ROADWAY AND INTERSECTION IMPROVEMENTS

| Roadway or Intersection | Limits | Description | Estimated Completion | Source |
|---|---|---|---|---|
| Robert Ferrie Drive | Caryndale Drive to Strasburg Road | Two-lane extension | 2023-2025 | [2] |
| Strasburg Road | Robert Ferrie Drive to New Dundee Road | Four-lane extension. | 2025 | [2] |
| Blair Creek Drive Extension | Reidel Drive to Strasburg Road | Two-lane extension | 2026 | [2] |
| Strasburg Road and Robert Ferrie Drive | | New Roundabout | 2025 | [3] |
| Strasburg Road and Blair Creek Drive Extension | | New Roundabout | 2025 | [3] |
| Strasburg Road and New Dundee Road | | New Roundabout | 2025 | [3] |
| New Dundee Road and Robert Ferrie Drive | | New Roundabout | 2024-2025 | [1] |
| Caryndale Drive and Robert Ferrie Drive | | New Traffic Control Signal | 2025 | [3] |
| Homer Watson Boulevard | Conestoga College Boulevard to Manitou Drive | Widening for new transit lanes | 2031-2041 | [4] |
| New Dundee Road | Fisher Hallman Road to Homer Watson Boulevard | Widening | Beyond 2041 | [4] |

Source:

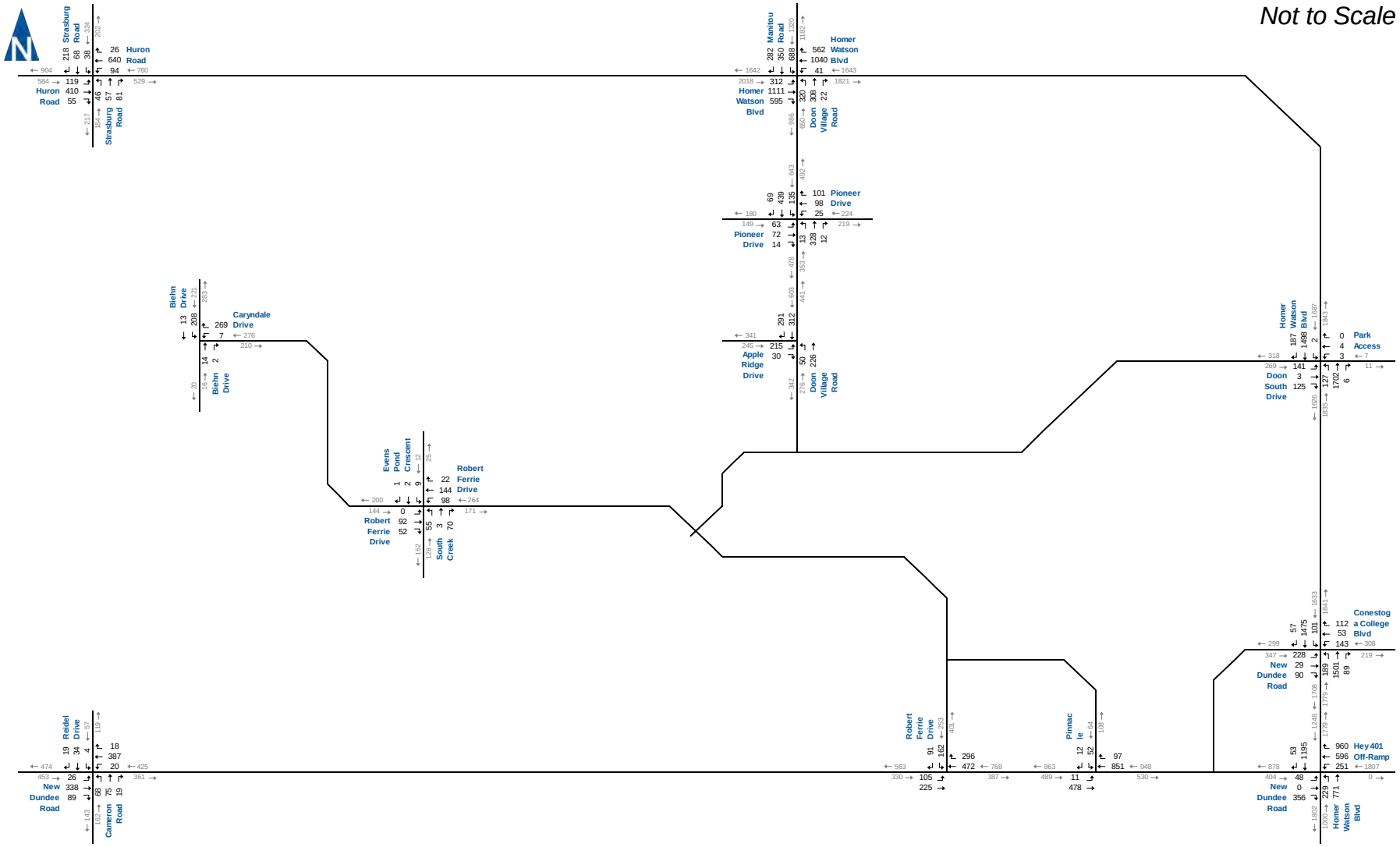

1. Region of Waterloo, *(RR12) New Dundee Road Roundabout at Robert Ferrie Drive*, Accessed 13 November 2023 from https://www.regionofwaterloo.ca/en/living-here/resources/Documents/Future-Construction/DC_07284_InfoSheet.pdf
2. City of Kitchener, *Approved Budget Summary 2023, Appendix B Capital Budget Details,* Accessed 13 November 2023 from https://www.kitchener.ca/en/resourcesGeneral/Documents/FIN_FP_2023_Budget_Appendix_B.pdf
3. BA Consulting Group Limited, *Update to Doon South Community and Broader Study Area Traffic Impact Study,* (Toronto: BA Group, 2016).
4. Region of Waterloo, *2018 Transportation Master Plan,* Accessed 13 November 2023 from https://www.regionofwaterloo.ca/en/living-here/resources/Transportation-Master-Plan/DOCS_ADMIN-3030800-v3-TMP_Report_Moving_Forward_Main_Report_FINAL_2019-06-12.pdf

*Not to Scale*



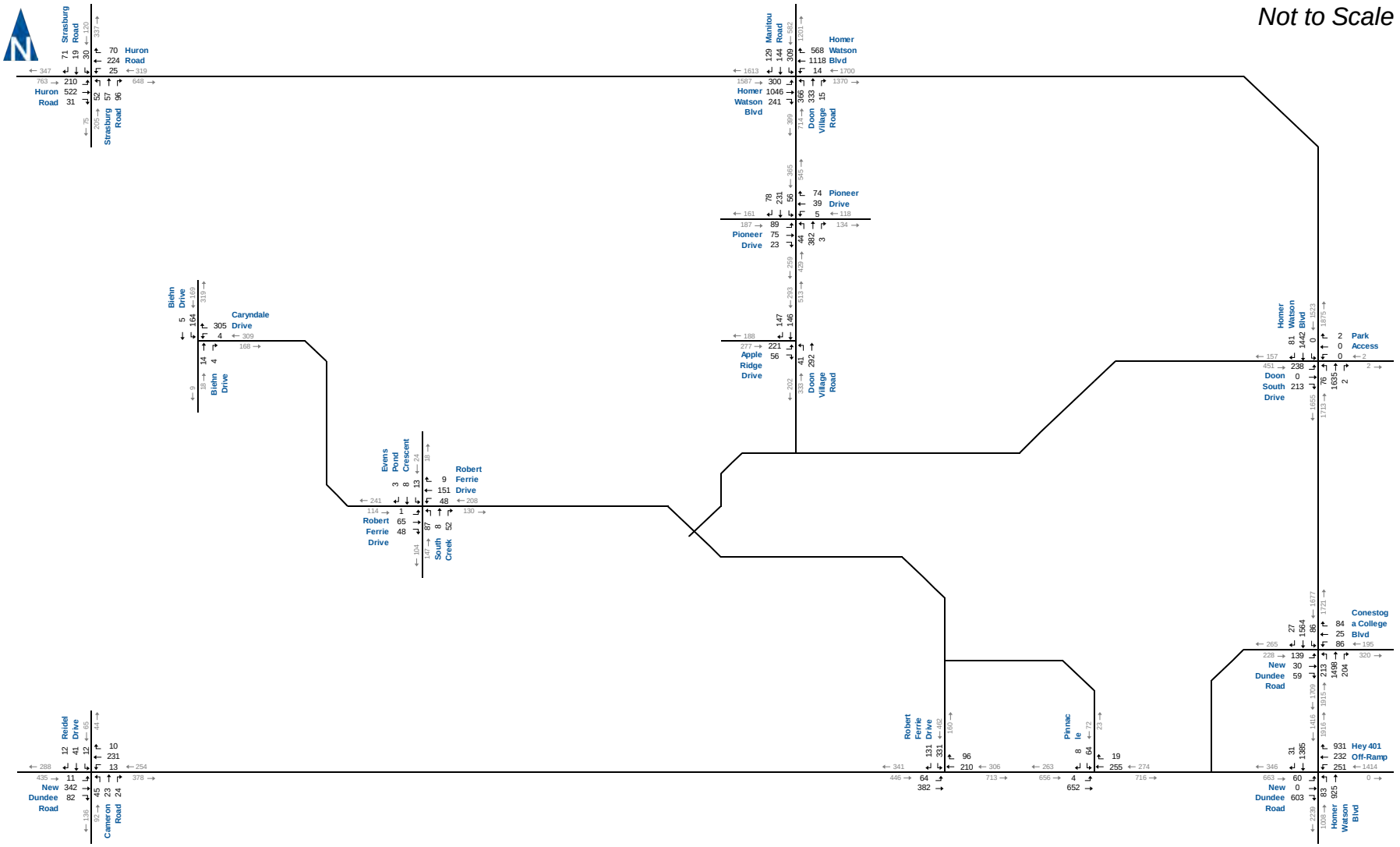

# 2028 Background Traffic Forecast
# AM Peak Hour

*Not to Scale*



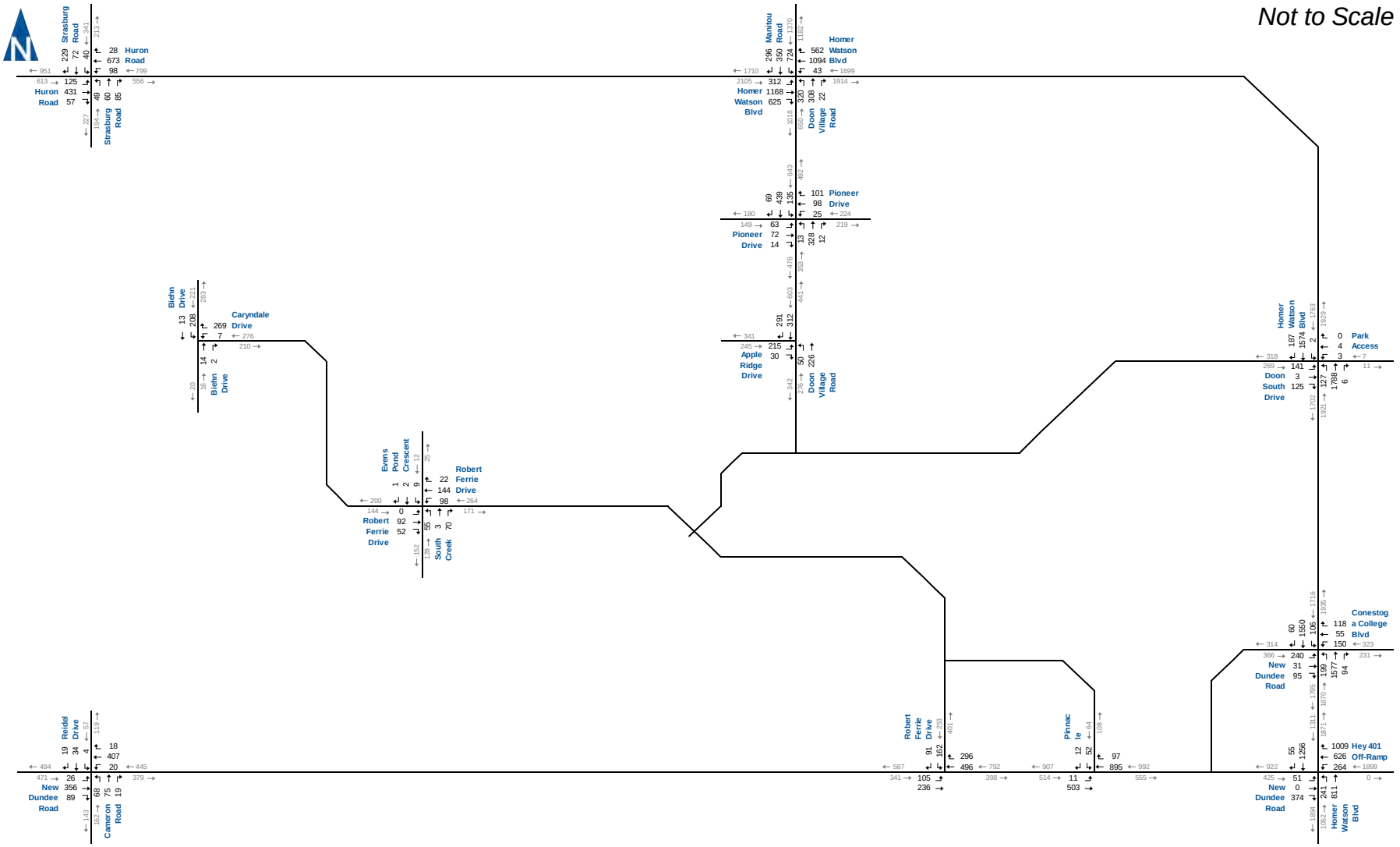

# 2028 Background Traffic Forecast
# PM Peak Hour

*Not to Scale*




# 2033 Background Traffic Forecast
# AM Peak Hour

*Not to Scale*




# 2033 Background Traffic Forecast
# PM Peak Hour

## 5.4 Forecast Site Traffic

### 5.4.1 Trip Generation

Traffic activity related to the undeveloped portions of the Doon South and Brigadoon neighbourhoods reflects trip generation information in the Institute of Transportation Engineers (ITE) *Trip Generation Manual*[8] for land use code (LUC) 210 (Multifamily Housing (Low-Rise)). LUC 210 is described as "any single family detached home on an individual lot; a typical site is a suburban subdivision." Although the specific unit type for each residential parcel remains unknown, this presents a conservative estimate of trip generation activity.

**Table 5.2** summarizes the estimated trip generation based on the number of remaining units estimated in each study area zone. The estimates are based on the regression equations published by ITE for LUC 210 and include a 5% modal split reduction to account for potential trips completed by public transit, walking, or cycling. This mode split reduction is consistent with that used in the 2016 TIS and was confirmed with City staff during pre-study consultation.

Development of the remaining units is estimated to generate 1,593 trips in the weekday AM peak hour and 2,297 trips in the weekday PM peak hour.

### 5.4.2 Trip Distribution and Assignment

The trip distribution developed for this study is based on existing travel patterns. Given the similar nature of the existing development pattern and future development land uses, it is assumed existing travel patterns provide a reasonable estimate of trip patterns to and from the study area. **Table 5.3** summarizes the estimated trip distribution.

For trips associated with Doon South Phase 2 and the Brigadoon areas, the trip assignment also reflects the variety of routes traffic could take to the arterial road network. This includes the planned extensions of Strasburg Road south to New Dundee Road, Robert Ferrie Drive west to Strasburg Road, and Blair Creek Drive west to Strasburg Road, all of which are assumed to be in place at the 2028 horizon year. The trip assignments do not assume a future extension of Biehn Drive, because the ultimate alignment and timing of this extension remains unknown. **Table 5.4** summarizes the assumed routing of vehicle trips for the Doon South Phase 2 and Brigadoon

[8] Institute of Transportation Engineers, *Trip Generation Manual*, 11th ed., (Washington, DC: ITE, 2021).

areas. **Figure 5.5** and **Figure 5.6** illustrate the site-generated traffic assignments.

## TABLE 5.2: ESTIMATED TRIP GENERATION

| Zone | LUC | Units | AM Peak Hour | | | | PM Peak Hour | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rate[1] | In | Out | Total | Rate[2] | In | Out | Total |
| Phase 1 | 220 | 52 | Eqn. | 10 | 31 | 41 | Eqn. | 34 | 20 | 54 |
| Phase 2 | 220 | 1,600 | Eqn. | 232 | 697 | 929 | Eqn. | 848 | 498 | 1,346 |
| Brigadoon | 220 | 1,189 | Eqn. | 177 | 532 | 709 | Eqn. | 641 | 377 | 1,018 |
| **Total Trip Generation** | | | | **419** | **1,260** | **1,679** | | **1,524** | **894** | **2,418** |
| Modal Split Reduction | | | *5%* | *-22* | *-64* | *-86* | *5%* | *-76* | *-45* | *-121* |
| **Net Trip Generation** | | | | **397** | **1,196** | **1,593** | | **1,447** | **850** | **2,297** |

*Source Institute of Transportation Engineers, Trip Generation Manual, 11th ed., (Washington, DC: ITE, 2021).*

Notes:

1. LUC 210 (AM): Ln(T) = 0.91Ln(X) + 0.12, 25% entering, 75% exiting
2. LUC 210 (PM): Ln(T) = 0.94Ln(X) + 0.27, 63% entering, 37% exiting

## TABLE 5.3: ESTIMATED TRIP DISTRIBUTION

| Origin/Destination | AM Peak Hour | | PM Peak Hour | |
|---|---|---|---|---|
| | In | Out | In | Out |
| North via Manitou Dr. | 10% | 20% | 20% | 20% |
| North via Homer Watson Blvd. | 20% | 25% | 20% | 15% |
| East via Highway 401 | 25% | (see note 1) | 25% | (see note 1) |
| South via Homer Watson Blvd. | 20%[2] | 40%[1] | 15%[2] | 30%[1] |
| West via Huron Rd. | 15% | 5% | 10% | 15% |
| West via Hew Dundee Rd. | 10% | 5% | 10% | 10% |
| West via Highway 401 | 0%[2] | 5%[3] | 0%[2] | 10%[3] |
| **Total** | **100%** | **100%** | **100%** | **100%** |

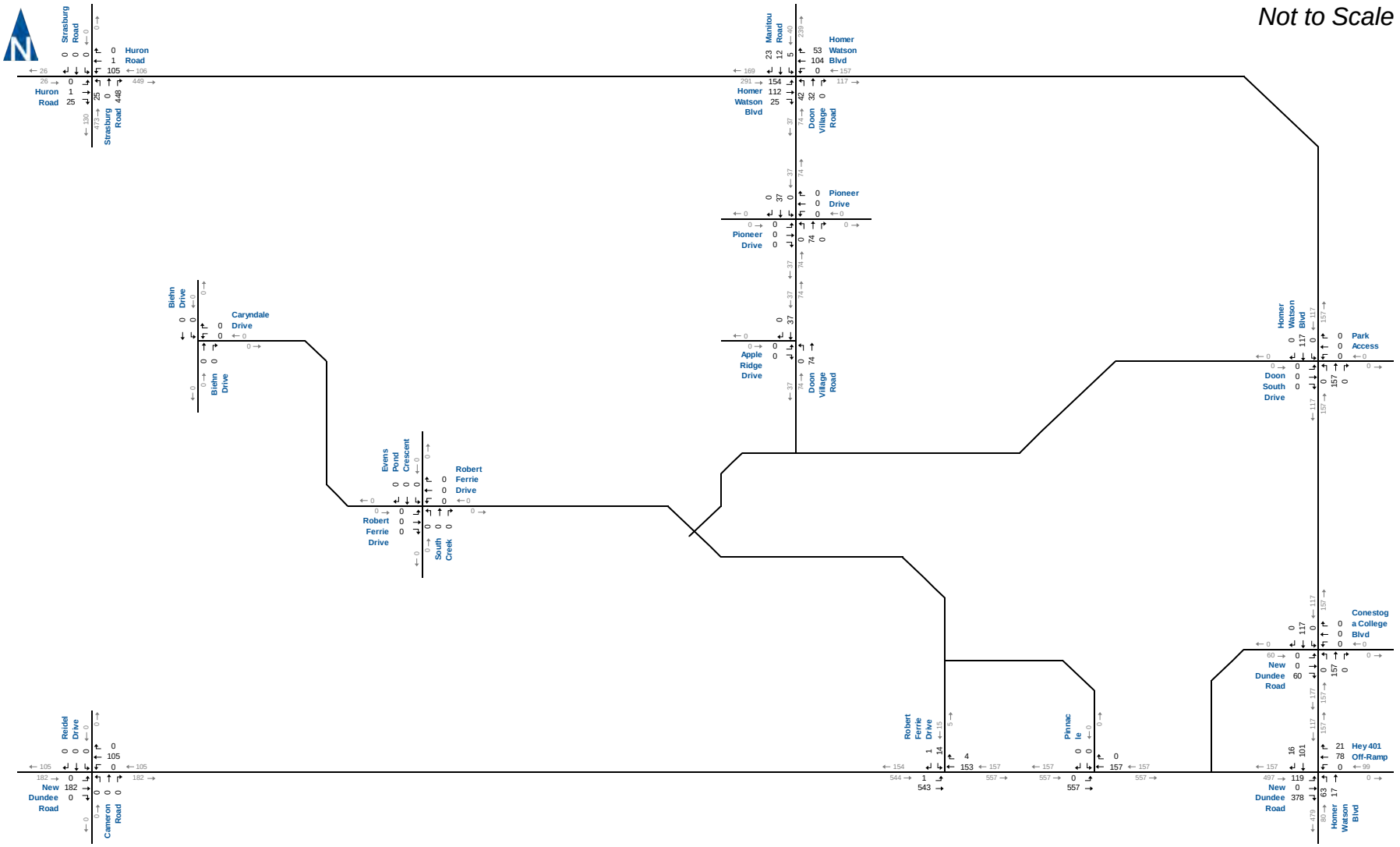
Notes:

1. Outbound trips to eastbound Highway 401 are included in the percentage for outbound trips to the south via Homer Watson Boulevard.
2. Inbound trips from the south via Homer Watson Boulevard include those trips entering from the west via eastbound Highway 401.
3. Outbound trips on New Dundee Road destined to the west via Highway 401 are assumed to travel east on New Dundee Road, north via Conestoga College Boulevard, and then south via Homer Watson Boulevard.

## TABLE 5.4: ESTIMATED TRIP ASSIGNMENT – DOON SOUTH PHASE 2 AND BRIGADOON

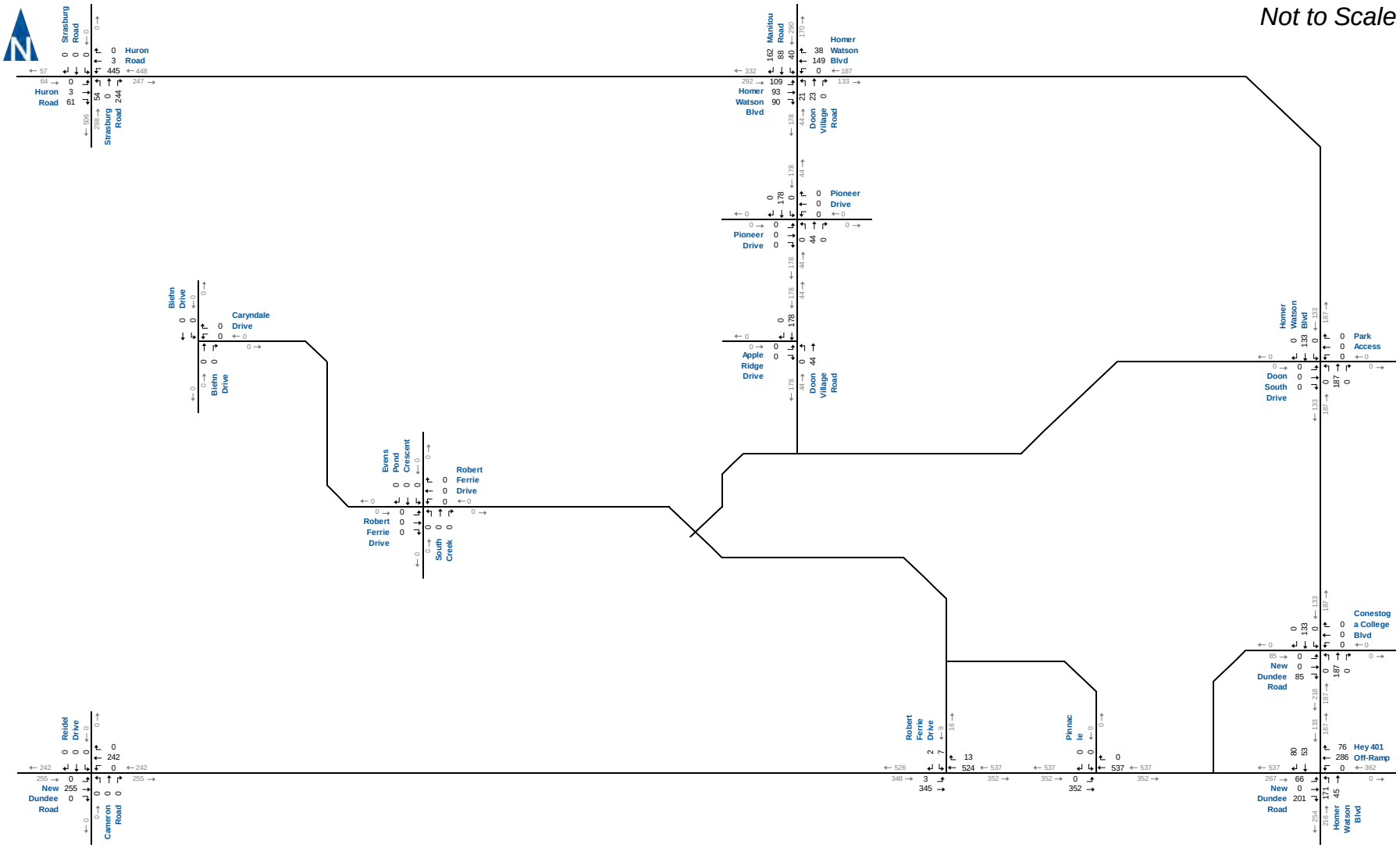
| Origin/Destination | Doon South Phase 2 | | Brigadoon | |
|---|---|---|---|---|
| | In | Out | In | Out |
| **North via Manitou Dr.** | | | | |
| via Doon Village Rd. | 50% | 20% | | |
| via Homer Watson Blvd. and Doon South Dr. | 0% | 0% | | |
| via New Dundee Rd. | 25% | 40% | | |
| via Strasburg Rd. extension | 25% | 40% | | |
| **North via Homer Watson Blvd.** | | | | |
| via Doon Village Rd. | 50% | 20% | | |
| via Homer Watson Blvd. and Doon South Dr. | 0% | 0% | | |
| via New Dundee Rd. | 25% | 40% | | |
| via Strasburg Rd. extension | 25% | 40% | | |
| **East via Highway 401** | | | | |
| via Huron Rd. and Homer Watson Blvd. | 0% | 0% | 50% | 50% |
| via Strasburg Rd. extension and New Dundee Road | 50% | 50% | 50% | 50% |
| via Blair Valley St./Staulter Woods St. | 50% | 50% | 0% | 0% |
| **South via Homer Watson Blvd.** | | | | |
| via Huron Rd. and Homer Watson Blvd. | 0% | 0% | 50% | 50% |
| via Strasburg Rd. extension and New Dundee Road | 50% | 50% | 50% | 50% |
| via Blair Valley St./Staulter Woods St. | 50% | 50% | 0% | 0% |

*Not to Scale*




# Estimated Site Generated Traffic
# AM Peak Hour

*Not to Scale*




# Estimated Site Generated Traffic
# PM Peak Hour

## 5.5 Future Total Traffic

The future total traffic volumes at each horizon year represent the summation of the site generated traffic volumes (see **Figure 5.5** and **Figure 5.6**) and the background traffic volumes from each respective horizon year.

**Figure 5.7** and **Figure 5.8** illustrate the future total traffic volumes at the 2028 horizon. **Figure 5.9** and **Figure 5.10** illustrate the future total traffic volumes at the 2033 horizon.

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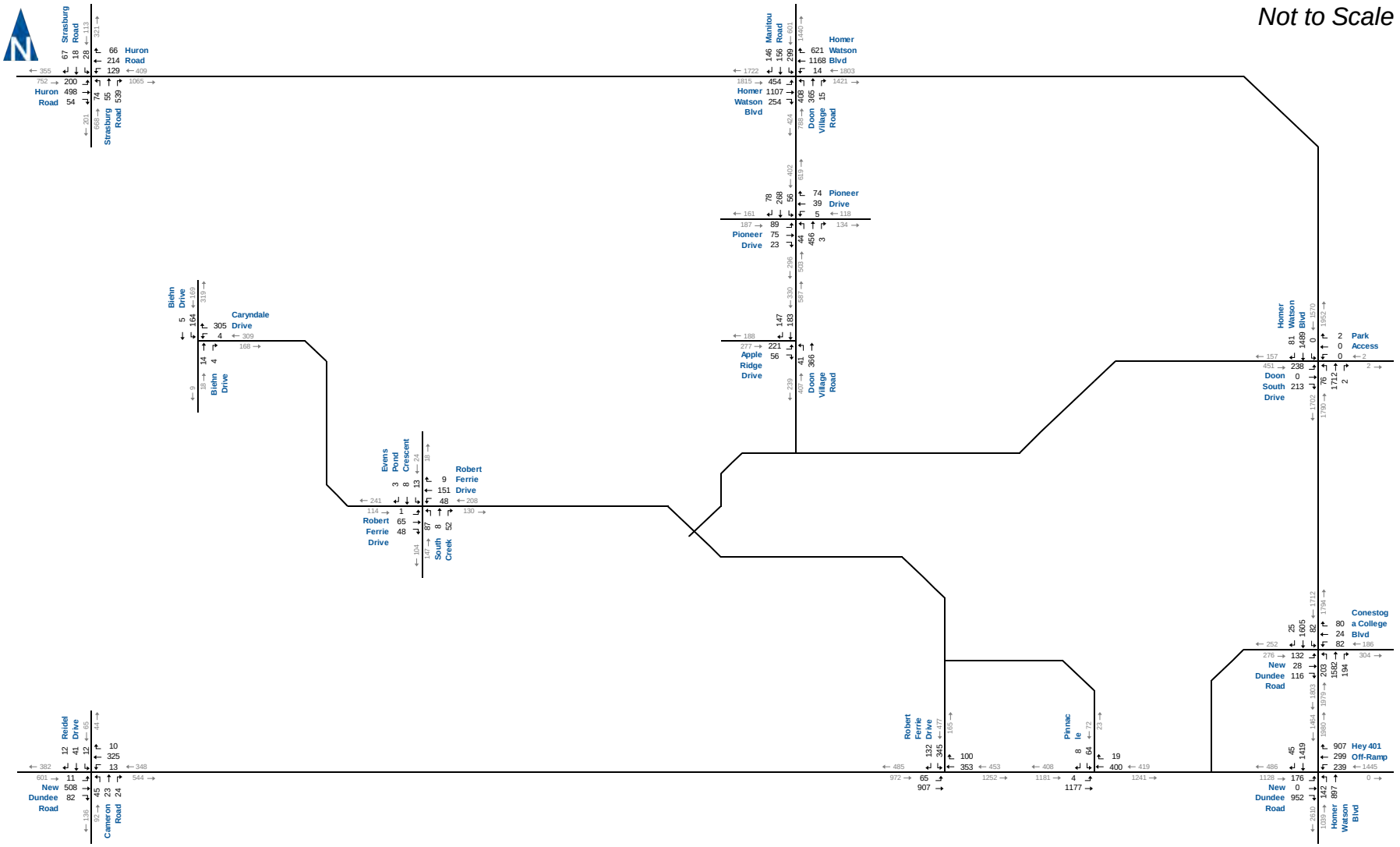


# 2028 Total Traffic Forecast
# AM Peak Hour

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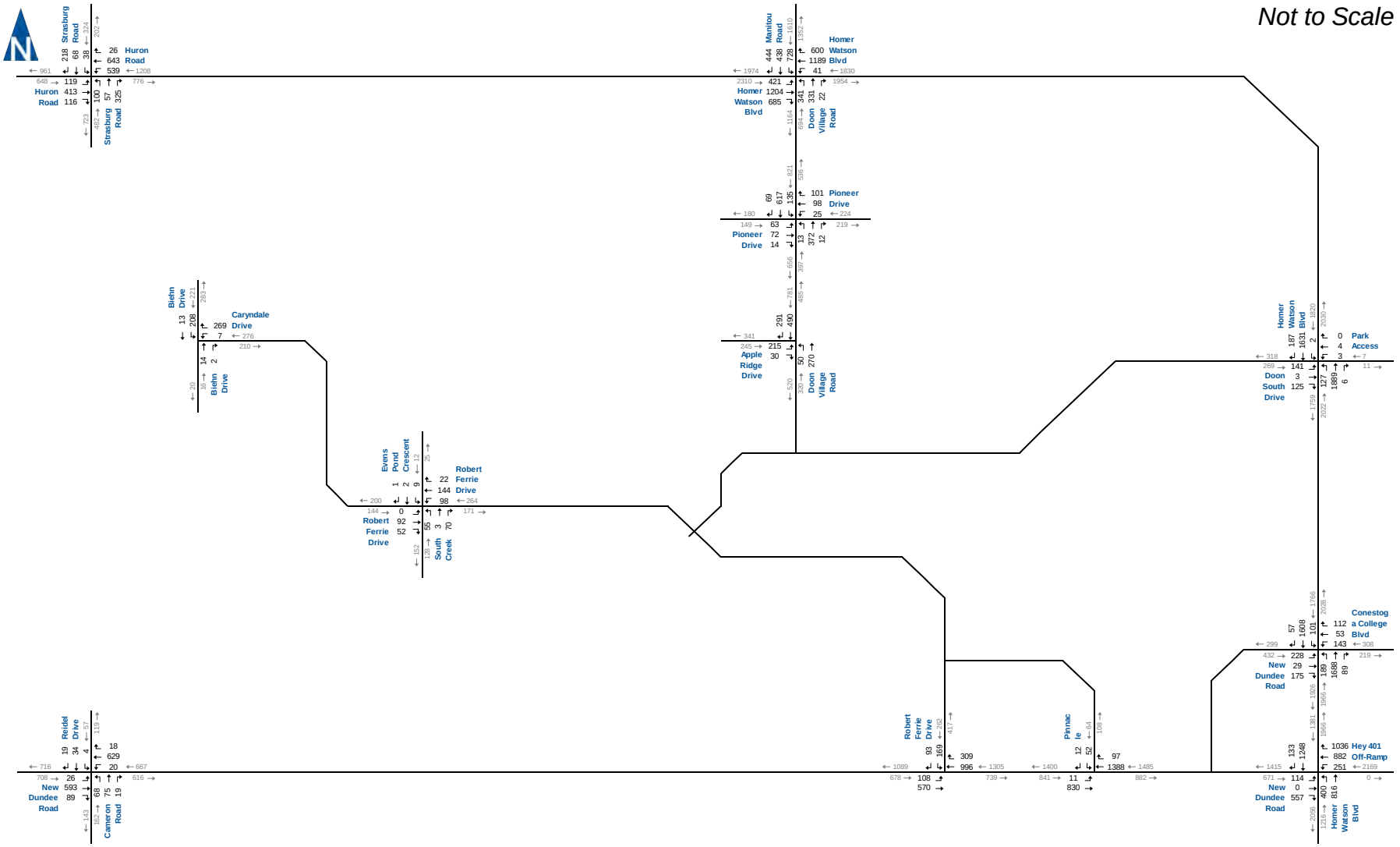
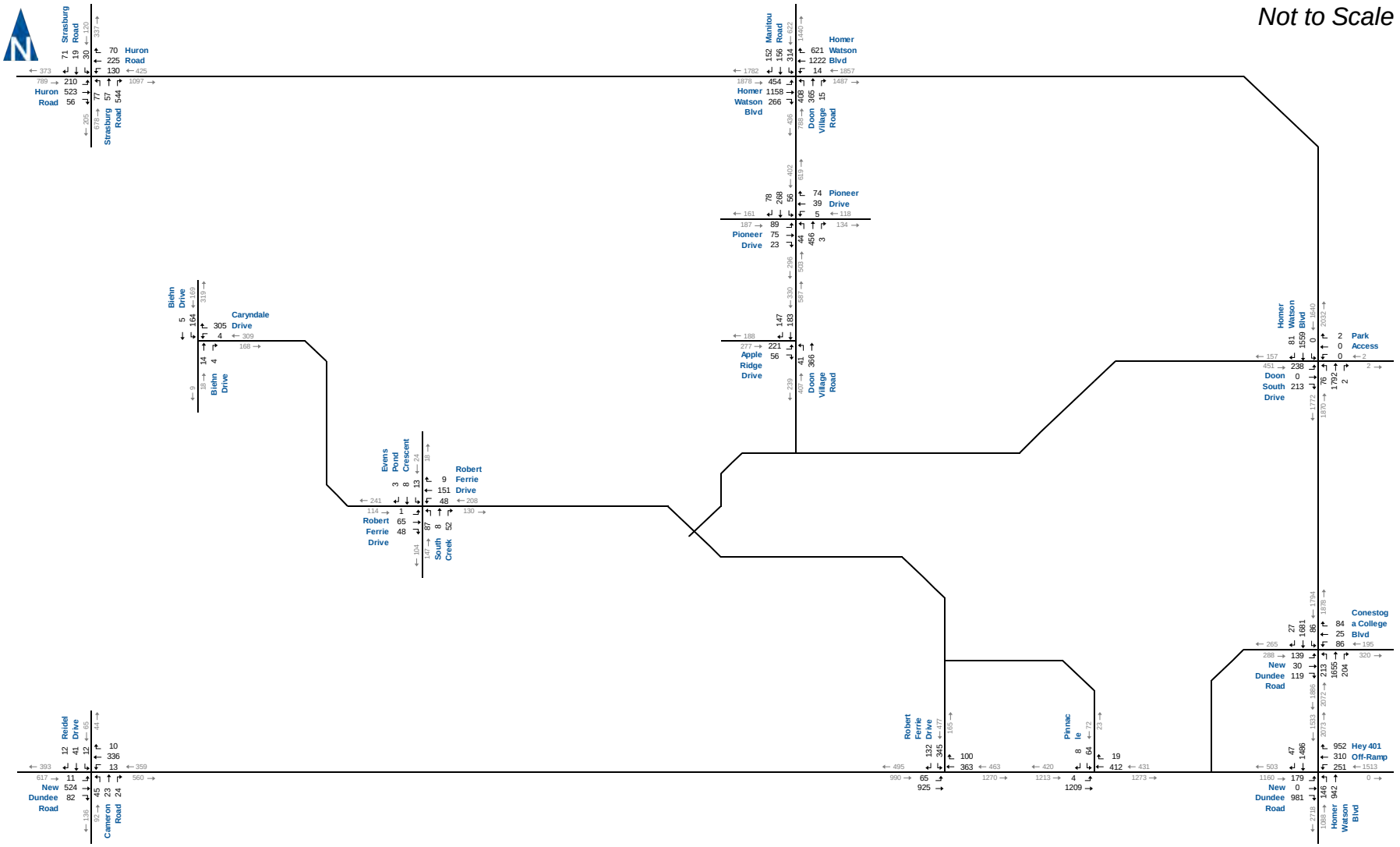



# 2028 Total Traffic Forecast
# PM Peak Hour

*Not to Scale*

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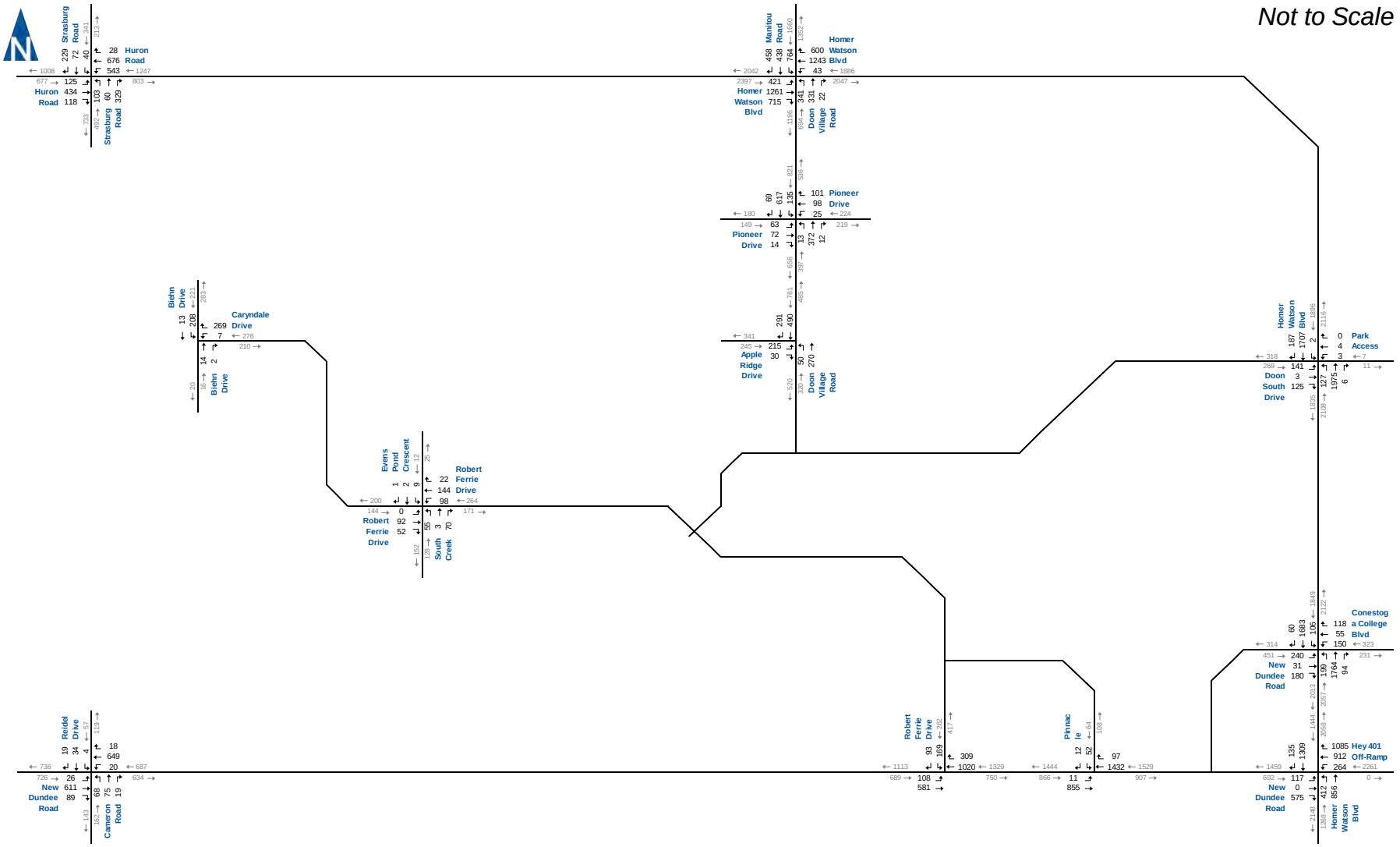
# 2033 Total Traffic Forecast
# AM Peak Hour

*Not to Scale*




# 2033 Total Traffic Forecast
# PM Peak Hour

City of Kitchener Doon South Community Area Transportation Study
230376

**Figure 5.10**

# 6 Traffic Operations Assessment

## 6.1 Background Traffic Operations

Analysis of background traffic conditions uses the same methodology as existing traffic conditions. Signal timing splits and cycle lengths have not been modified to determine the net impacts of traffic related to and not related the outstanding development activity. Lane configurations at the existing study intersections are unchanged, except for the new two-lane roundabout proposed at Robert Ferrie Drive and New Dundee Road.

### 6.1.1 2028 Background Traffic Operations

**Table 6.1** and **Table 6.2** summarize the background traffic level of service conditions at the 2028 horizon year. Critical movements are highlighted in yellow. The results indicate the study intersections are forecast to operate at similar levels of service as existing conditions. The following critical movements are noted:

- **Homer Watson Boulevard and Manitou Drive/Doon Village Road**:
  - In the AM peak hour, the eastbound left-turn, southbound left-turn, and westbound through movements are forecast to operate with delays greater than 55 seconds. The northbound left-turn movement is forecast to operate with queues exceeding available lane capacity; and
  - In the PM peak hour, the eastbound left-turn, westbound through, northbound left-turn and through, and southbound left-turn and through movement are forecast to operate with delays greater than 55 seconds. The northbound and southbound left-turn movements and eastbound right-turn movement are forecast to operate with queues exceeding available lane capacity.
- **Homer Watson Boulevard and Doon South Drive**: In the PM peak hour, the southbound through movement is forecast to operate with delays greater than 55 seconds.
- **Homer Watson Boulevard and Conestoga College Boulevard**: In the PM peak hour, the eastbound left-turn movement is forecast to operate with delays greater than 55 seconds.
- **Homer Watson Boulevard and New Dundee Road/Highway 401 Ramp**:

- In the AM peak hour, the eastbound right-turn movement is forecast to operate with delays greater than 55 seconds; and
- In the PM peak hour, the northbound left-turn movement is forecast to operate with delays greater than 55 seconds.

**Appendix D** contains the detailed Synchro reports.

# TABLE 6.1: 2028 BACKGROUND TRAFFIC OPERATIONS – AM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 3 | > | 3 | < | 2 | > | 2 | 3 |
| | | | V/C | < | 0.37 | > | | < | 0.17 | > | | < | 0.13 | > | | < | 0.06 | > | | |
| | | | Q | < | 7 | > | | < | 2 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | D | C | E | D | F | E | F | E | F | > | E | F | F | E | F | E |
| | | | Delay | 84 | 32 | 24 | 41 | 35 | 92 | 47 | 76 | 42 | 53 | > | 47 | 64 | 52 | 47 | 57 | 57 |
| | | | V/C | 0.96 | 0.65 | 0.20 | | 0.09 | 1.05 | 0.62 | | 0.74 | 0.50 | > | | 0.69 | 0.39 | 0.09 | | 0.91 |
| | | | Q | 138 | 159 | 26 | | 6 | 240 | 94 | | 109 | 67 | > | | 58 | 59 | 17 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 137 | - | 54 | | 114 | - | 106 | | -84 | - | > | | 47 | - | 48 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | B | > | B | A | D | > | D | C |
| | | | Delay | < | 49 | 29 | 39 | < | 28 | > | 28 | 45 | 17 | > | 18 | 0 | 43 | > | 43 | 31 |
| | | | V/C | < | 0.80 | 0.15 | | < | 0.00 | > | | 0.51 | 0.80 | > | | 0.00 | 0.98 | > | | 0.93 |
| | | | Q | < | 76 | 17 | | < | 0 | > | | 31 | 192 | > | | 0 | 257 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 79 | - | > | | 55 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | D | D | > | D | D | D | D | D | C | B | B | B | D | D | B | D | C |
| | | | Delay | 40 | 39 | > | 40 | 37 | 41 | 40 | 39 | 28 | 16 | 12 | 17 | 40 | 44 | 14 | 44 | 31 |
| | | | V/C | 0.63 | 0.17 | > | | 0.48 | 0.20 | 0.07 | | 0.67 | 0.57 | 0.16 | | 0.35 | 0.99 | 0.02 | | 0.89 |
| | | | Q | 37 | 10 | > | | 25 | 12 | 3 | | 55 | 92 | 15 | | 15 | 211 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | 13 | - | > | | 25 | - | - | | 150 | - | > | | 160 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | C | | F | F | C | C | A | B | C | C | > | C | | C | C | C | C |
| | | | Delay | 35 | | 107 | 101 | 27 | 26 | 2 | 11 | 23 | 21 | > | 21 | | 31 | 22 | 31 | 33 |
| | | | V/C | 0.21 | | 1.07 | | 0.43 | 0.32 | 0.65 | | 0.45 | 0.53 | > | | | 0.70 | 0.02 | | 0.89 |
| | | | Q | 25 | | 200 | | 72 | 66 | 0 | | 17 | 89 | > | | | 114 | 0 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | 50 | | - | | - | - | - | | 163 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | C | | > | C | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 18 | | > | 18 | |
| | | | V/C | < | 0.00 | | | | 0.15 | > | | | | | | 0.21 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 6 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 3 | | 3 | | 2 | > | 2 | | | | | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.26 | | | | 0.16 | > | | | | | | < | 0.32 | > | | |
| | | | Q | < | 7 | | | | 7 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | C | > | C | < | C | > | C | |
| | | | Delay | < | 0 | > | 0 | < | 1 | > | 1 | < | 17 | > | 17 | < | 16 | > | 16 | |
| | | | V/C | < | 0.01 | > | | < | 0.01 | > | | < | 0.24 | > | | < | 0.16 | > | | |
| | | | Q | < | 0 | > | | < | 0 | > | | < | 7 | > | | < | 5 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.11 | > | | < | 0.20 | > | | < | 0.14 | > | | < | 0.03 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | B | > | B | |
| | | | Delay | 13 | | > | 13 | | | | | < | 13 | | 13 | | 11 | > | 11 | |
| | | | V/C | 0.43 | | > | | | | | | < | 0.48 | | | | 0.41 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.29 | | > | | | 0.01 | > | | < | 0.10 | | | |
| | | | Q | | | | | 10 | | > | | | 0 | > | | < | 3 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | A | B | > | B | B |
| | | | Delay | 17 | 16 | > | 16 | < | 15 | 15 | 15 | 9 | 13 | > | 13 | 10 | 12 | > | 12 | 13 |
| | | | V/C | 0.23 | 0.17 | > | | < | 0.09 | 0.06 | | 0.10 | 0.49 | > | | 0.15 | 0.41 | > | | 0.39 |
| | | | Q | 18 | 16 | > | | < | 10 | 8 | | 8 | 51 | > | | 10 | 37 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 3 | - | > | | < | - | 22 | | 12 | - | > | | 21 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

# TABLE 6.2: 2028 BACKGROUND TRAFFIC OPERATIONS – PM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| PM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 2 | > | 2 | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.32 | > | | < | 0.42 | > | | < | 0.12 | > | | < | 0.23 | > | | |
| | | | Q | < | 7 | > | | < | 5 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | E | C | E | E | F | E | F | F | F | > | F | F | F | E | F | E |
| | | | Delay | 86 | 41 | 35 | 46 | 39 | 117 | 50 | 92 | 57 | 57 | > | 57 | 122 | 61 | 47 | 90 | 71 |
| | | | V/C | 0.96 | 0.78 | 0.56 | | 0.31 | 1.11 | 0.60 | | 0.85 | 0.51 | > | | 1.09 | 0.74 | 0.30 | | 1.01 |
| | | | Q | 141 | 189 | 84 | | 14 | 239 | 85 | | 94 | 65 | > | | 163 | 141 | 41 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 134 | - | -4 | | 106 | - | 115 | | -69 | - | > | | -58 | - | 24 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | B | > | B | B | E | > | E | D |
| | | | Delay | < | 45 | 32 | 39 | < | 31 | > | 31 | 40 | 13 | > | 15 | 13 | 74 | > | 74 | 43 |
| | | | V/C | < | 0.69 | 0.09 | | < | 0.03 | > | | 0.55 | 0.79 | > | | 0.02 | 1.09 | > | | 0.97 |
| | | | Q | < | 49 | 15 | | < | 5 | > | | 45 | 183 | > | | 2 | 295 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 65 | - | > | | 53 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | F | D | > | F | C | D | D | D | C | C | B | C | D | D | B | D | C |
| | | | Delay | 107 | 40 | > | 84 | 33 | 38 | 37 | 35 | 25 | 21 | 14 | 21 | 38 | 38 | 14 | 37 | 34 |
| | | | V/C | 1.03 | 0.18 | > | | 0.57 | 0.27 | 0.09 | | 0.66 | 0.67 | 0.07 | | 0.32 | 0.95 | 0.04 | | 0.91 |
| | | | Q | 81 | 12 | > | | 39 | 21 | 10 | | 44 | 108 | 0 | | 18 | 216 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | -31 | - | > | | 11 | - | - | | 161 | - | > | | 157 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | D | | D | D | C | D | A | B | F | B | > | D | | C | C | C | C |
| | | | Delay | 45 | | 39 | 40 | 25 | 40 | 3 | 18 | 86 | 20 | > | 35 | | 32 | 24 | 31 | 28 |
| | | | V/C | 0.41 | | 0.49 | | 0.39 | 0.81 | 0.69 | | 1.01 | 0.46 | > | | | 0.66 | 0.04 | | 0.99 |
| | | | Q | 25 | | 67 | | 72 | 215 | 0 | | 86 | 76 | > | | | 99 | 0 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | 50 | | - | | - | - | - | | 94 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | E | | > | E | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 38 | | > | 38 | |
| | | | V/C | < | 0.02 | | | | 0.56 | > | | | | | | 0.37 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 13 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 2 | | 2 | | 3 | > | 3 | | | | | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.19 | | | | 0.42 | > | | | | | | < | 0.20 | > | | |
| | | | Q | < | 7 | | | | 7 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | E | > | E | < | C | > | C | |
| | | | Delay | < | 1 | > | 1 | < | 1 | > | 1 | < | 38 | > | 38 | < | 19 | > | 19 | |
| | | | V/C | < | 0.02 | > | | < | 0.02 | > | | < | 0.61 | > | | < | 0.18 | > | | |
| | | | Q | < | 1 | > | | < | 0 | > | | < | 30 | > | | < | 5 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.14 | > | | < | 0.25 | > | | < | 0.12 | > | | < | 0.01 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | D | > | D | |
| | | | Delay | 14 | | > | 14 | | | | | < | 13 | | 13 | | 26 | > | 26 | |
| | | | V/C | 0.42 | | > | | | | | | < | 0.43 | | | | 0.82 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.27 | | > | | | 0.01 | > | | < | 0.13 | | | |
| | | | Q | | | | | 9 | | > | | | 0 | > | | < | 4 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | B | B | > | B | B |
| | | | Delay | 16 | 16 | > | 16 | < | 17 | 15 | 16 | 9 | 12 | > | 12 | 12 | 17 | > | 15 | 15 |
| | | | V/C | 0.17 | 0.15 | > | | < | 0.25 | 0.07 | | 0.04 | 0.44 | > | | 0.31 | 0.66 | > | | 0.49 |
| | | | Q | 13 | 15 | > | | < | 22 | 9 | | 3 | 44 | > | | 20 | 73 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 7 | - | > | | < | - | 21 | | 17 | - | > | | 10 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

### 6.1.2 2033 Background Traffic Operations

**Table 6.3** and **Table 6.4** summarize the background traffic level of service conditions at the 2033 horizon year. Critical movements are highlighted in yellow. The results indicate the study intersections are forecast to operate at similar levels of service as existing conditions. The following critical movements are noted:

- **Homer Watson Boulevard and Manitou Drive/Doon Village Road**:
  - In the AM peak hour, the eastbound left-turn, southbound left-turn, and westbound through movements are forecast to operate with delays greater than 55 seconds. The northbound left-turn movement is forecast to operate with queues exceeding available lane capacity; and
  - In the PM peak hour, the eastbound left-turn, westbound through, northbound left-turn and through, and southbound left-turn and through movement are forecast to operate with delays greater than 55 seconds. The northbound and southbound left-turn movements and eastbound right-turn movement are forecast to operate with queues exceeding available lane capacity.
- **Homer Watson Boulevard and Doon South Drive**: In the PM peak hour, the southbound through movement is forecast to operate with delays greater than 55 seconds.
- **Homer Watson Boulevard and Conestoga College Boulevard**:
  - In the AM peak hour, the southbound through movement is forecast to operate with delays greater than 55 seconds; and
  - In the PM peak hour, the eastbound left-turn movement is forecast to operate with delays greater than 55 seconds.
- **Homer Watson Boulevard and New Dundee Road/Highway 401 Ramp**:
  - In the AM peak hour, the eastbound right-turn movement is forecast to operate with a delay greater than 55 seconds; and
  - In the PM peak hour, the northbound and eastbound left-turn movements are forecast to operate with a delay greater than 55 seconds.

**Appendix E** contains the detailed Synchro reports.

# TABLE 6.3: 2033 BACKGROUND TRAFFIC OPERATIONS – AM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | Overall |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 3 | > | 3 | < | 2 | > | 2 | 3 |
| | | | V/C | < | 0.39 | > | | < | 0.18 | > | | < | 0.14 | > | | < | 0.07 | > | | |
| | | | Q | < | 7 | > | | < | 2 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | D | C | E | D | F | E | F | E | F | > | E | F | F | E | F | E |
| | | | Delay | 85 | 33 | 24 | 41 | 35 | 111 | 47 | 89 | 42 | 53 | > | 48 | 64 | 52 | 47 | 57 | 62 |
| | | | V/C | 0.96 | 0.69 | 0.22 | | 0.10 | 1.10 | 0.63 | | 0.74 | 0.51 | > | | 0.70 | 0.39 | 0.09 | | 0.93 |
| | | | Q | 140 | 173 | 30 | | 6 | 261 | 94 | | 108 | 68 | > | | 61 | 59 | 18 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 135 | - | 50 | | 114 | - | 106 | | -83 | - | > | | 44 | - | 47 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | B | > | C | A | D | > | D | D |
| | | | Delay | < | 49 | 29 | 39 | < | 28 | > | 28 | 45 | 19 | > | 20 | 0 | 55 | > | 55 | 37 |
| | | | V/C | < | 0.80 | 0.15 | | < | 0.00 | > | | 0.51 | 0.85 | > | | 0.00 | 1.03 | > | | 0.97 |
| | | | Q | < | 76 | 17 | | < | 0 | > | | 31 | 222 | > | | 0 | 275 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 79 | - | > | | 55 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | D | D | > | D | D | D | D | D | C | B | B | B | D | E | B | E | D |
| | | | Delay | 42 | 39 | > | 41 | 37 | 41 | 40 | 39 | 31 | 17 | 12 | 18 | 40 | 59 | 14 | 57 | 36 |
| | | | V/C | 0.66 | 0.18 | > | | 0.49 | 0.20 | 0.07 | | 0.71 | 0.60 | 0.17 | | 0.37 | 1.04 | 0.02 | | 0.93 |
| | | | Q | 38 | 11 | > | | 26 | 12 | 4 | | 61 | 100 | 17 | | 16 | 229 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | 12 | - | > | | 24 | - | - | | 144 | - | > | | 160 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | D | | F | F | C | C | A | B | C | C | > | C | | C | C | C | D |
| | | | Delay | 36 | | 146 | 136 | 29 | 27 | 3 | 11 | 24 | 21 | > | 21 | | 31 | 21 | 31 | 38 |
| | | | V/C | 0.23 | | 1.17 | | 0.46 | 0.34 | 0.68 | | 0.50 | 0.54 | > | | | 0.72 | 0.02 | | 0.94 |
| | | | Q | 26 | | 219 | | 76 | 69 | 0 | | 18 | 95 | > | | | 122 | 0 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | 49 | | - | | - | - | - | | 162 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | C | | > | C | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 19 | | > | 19 | |
| | | | V/C | < | 0.00 | | | | 0.16 | > | | | | | | 0.22 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 7 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 3 | | 3 | | 2 | > | 2 | | | | | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.27 | | | | 0.17 | > | | | | | | < | 0.32 | > | | |
| | | | Q | < | 7 | | | | 7 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | C | > | C | < | C | > | C | |
| | | | Delay | < | 0 | > | 0 | < | 1 | > | 1 | < | 18 | > | 18 | < | 16 | > | 16 | |
| | | | V/C | < | 0.01 | > | | < | 0.01 | > | | < | 0.25 | > | | < | 0.17 | > | | |
| | | | Q | < | 0 | > | | < | 0 | > | | < | 8 | > | | < | 5 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.11 | > | | < | 0.20 | > | | < | 0.14 | > | | < | 0.03 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | B | > | B | |
| | | | Delay | 13 | | > | 13 | | | | | < | 13 | | 13 | | 11 | > | 11 | |
| | | | V/C | 0.43 | | > | | | | | | < | 0.48 | | | | 0.41 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.29 | | > | | | 0.01 | > | | < | 0.10 | | | |
| | | | Q | | | | | 10 | | > | | | 0 | > | | < | 3 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | A | B | > | B | B |
| | | | Delay | 17 | 16 | > | 16 | < | 15 | 15 | 15 | 9 | 13 | > | 13 | 10 | 12 | > | 12 | 13 |
| | | | V/C | 0.23 | 0.17 | > | | < | 0.09 | 0.06 | | 0.10 | 0.49 | > | | 0.15 | 0.41 | > | | 0.39 |
| | | | Q | 18 | 16 | > | | < | 10 | 8 | | 8 | 51 | > | | 10 | 37 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 3 | - | > | | < | - | 22 | | 12 | - | > | | 21 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

# TABLE 6.4: 2033 BACKGROUND TRAFFIC OPERATIONS – PM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| PM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 2 | > | 2 | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.33 | > | | < | 0.44 | > | | < | 0.12 | > | | < | 0.24 | > | | |
| | | | Q | < | 7 | > | | < | 6 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | E | D | E | E | F | E | F | F | F | > | F | F | F | E | F | E |
| | | | Delay | 86 | 43 | 37 | 48 | 40 | 140 | 50 | 107 | 57 | 57 | > | 57 | 143 | 61 | 47 | 101 | 79 |
| | | | V/C | 0.96 | 0.82 | 0.61 | | 0.36 | 1.16 | 0.60 | | 0.85 | 0.51 | > | | 1.15 | 0.74 | 0.31 | | 1.05 |
| | | | Q | 141 | 203 | 100 | | 14 | 258 | 85 | | 94 | 65 | > | | 175 | 141 | 43 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 134 | - | -20 | | 106 | - | 115 | | -69 | - | > | | -70 | - | 22 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | B | > | B | B | F | > | F | D |
| | | | Delay | < | 45 | 32 | 39 | < | 31 | > | 31 | 40 | 15 | > | 17 | 13 | 93 | > | 93 | 52 |
| | | | V/C | < | 0.69 | 0.09 | | < | 0.03 | > | | 0.55 | 0.83 | > | | 0.02 | 1.13 | > | | 1.01 |
| | | | Q | < | 49 | 15 | | < | 5 | > | | 45 | 206 | > | | 2 | 314 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 65 | - | > | | 53 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | F | D | > | F | C | D | D | D | C | C | B | C | D | D | B | D | D |
| | | | Delay | 127 | 40 | > | 97 | 33 | 38 | 37 | 36 | 27 | 22 | 14 | 22 | 38 | 54 | 15 | 51 | 41 |
| | | | V/C | 1.10 | 0.19 | > | | 0.59 | 0.27 | 0.09 | | 0.66 | 0.70 | 0.07 | | 0.33 | 1.02 | 0.04 | | 0.96 |
| | | | Q | 88 | 12 | > | | 41 | 21 | 12 | | 48 | 118 | 0 | | 19 | 236 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | -38 | - | > | | 9 | - | - | | 157 | - | > | | 156 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | E | | D | D | C | D | A | C | F | B | > | D | | C | C | C | C |
| | | | Delay | 64 | | 42 | 45 | 27 | 46 | 3 | 21 | 114 | 20 | > | 41 | | 32 | 23 | 31 | 31 |
| | | | V/C | 0.59 | | 0.56 | | 0.42 | 0.87 | 0.73 | | 1.10 | 0.48 | > | | | 0.67 | 0.04 | | 1.07 |
| | | | Q | 35 | | 78 | | 77 | 238 | 0 | | 100 | 81 | > | | | 105 | 1 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | 40 | | - | | - | - | - | | 80 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | E | | > | E | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 43 | | > | 43 | |
| | | | V/C | < | 0.02 | | | | 0.58 | > | | | | | | 0.41 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 14 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 2 | | 2 | | 3 | > | 3 | | | | | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.19 | | | | 0.44 | > | | | | | | < | 0.20 | > | | |
| | | | Q | < | 7 | | | | 7 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | E | > | E | < | C | > | C | |
| | | | Delay | < | 1 | > | 1 | < | 1 | > | 1 | < | 43 | > | 43 | < | 20 | > | 20 | |
| | | | V/C | < | 0.02 | > | | < | 0.02 | > | | < | 0.65 | > | | < | 0.19 | > | | |
| | | | Q | < | 1 | > | | < | 1 | > | | < | 33 | > | | < | 6 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.14 | > | | < | 0.25 | > | | < | 0.12 | > | | < | 0.01 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | D | > | D | |
| | | | Delay | 14 | | > | 14 | | | | | < | 13 | | 13 | | 26 | > | 26 | |
| | | | V/C | 0.42 | | > | | | | | | < | 0.43 | | | | 0.82 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.27 | | > | | | 0.01 | > | | < | 0.13 | | | |
| | | | Q | | | | | 9 | | > | | | 0 | > | | < | 4 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | B | B | > | B | B |
| | | | Delay | 16 | 16 | > | 16 | < | 17 | 15 | 16 | 9 | 12 | > | 12 | 12 | 17 | > | 15 | 15 |
| | | | V/C | 0.17 | 0.15 | > | | < | 0.25 | 0.07 | | 0.04 | 0.44 | > | | 0.31 | 0.66 | > | | 0.49 |
| | | | Q | 13 | 15 | > | | < | 22 | 9 | | 3 | 44 | > | | 20 | 73 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 7 | - | > | | < | - | 21 | | 17 | - | > | | 10 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

## 6.2 Total Traffic Operations

Analysis of total traffic conditions uses the same methodology as existing and future background traffic conditions. Signal timing splits and cycle lengths have not been modified to determine the net impacts of traffic related to and not related the outstanding development activity. Lane configurations at the existing study intersections are unchanged, except for the new two-lane roundabout proposed at Robert Ferrie Drive and New Dundee Road.

### 6.2.1 2028 Total Traffic Operations

**Table 6.5** and **Table 6.6** summarize the total traffic level of service conditions at the 2028 horizon year. Critical movements are highlighted in yellow. The results indicate the study intersections are forecast to operate at similar levels of service as existing conditions. The following critical movements are noted:

- **Homer Watson Boulevard and Manitou Drive/Doon Village Road**:
  - In the AM peak hour, the eastbound left-turn, southbound left-turn, westbound right-turn and westbound through movements are forecast to operate with delays greater than 55 seconds. The northbound left-turn movement is forecast to operate with queues exceeding available lane capacity; and
  - In the PM peak hour, the eastbound left-turn, westbound through, westbound right-turn, northbound left-turn and through, and southbound left-turn, through and right-turn movements are forecast to operate with delays greater than 55 seconds. The northbound and southbound left-turn movements and eastbound and southbound right-turn movements are forecast to operate with queues exceeding available lane capacity.
- **Homer Watson Boulevard and Doon South Drive**: In the AM peak hour and PM peak hour, the southbound through movement is forecast to operate with delays greater than 55 seconds.
- **Homer Watson Boulevard and Conestoga College Boulevard**:
  - In the AM peak hour, the southbound through movement is forecast to operate with delays greater than 55 seconds; and

  - In the PM peak hour, the eastbound left-turn and southbound through movements are forecast to operate with delays greater than 55 seconds.

- **Homer Watson Boulevard and New Dundee Road/Highway 401 Ramp**:
  - In the AM peak hour, the eastbound left-turn and right-turn movements are forecast to operate with delays greater than 55 seconds. The eastbound left-turn movement is forecast to operate with queues exceeding available lane capacity; and
  - In the PM peak hour, the eastbound left-turn, eastbound right-turn, westbound through, and northbound left-turn movements are forecast to operate with delays greater than 55 seconds. The eastbound and northbound left-turn movements are forecast to operate with queues exceeding available lane capacity.
- **New Dundee Road and Pinnacle Drive**: In the PM peak hour, the southbound approach is forecast to operate with delays greater than 55 seconds.
- **New Dundee Road and Reidel Drive/Cameron Road**: In the PM peak hour, the northbound approach is forecast to operate with delays greater than 55 seconds.
- **Doons Mills Road and Apple Ridge Drive**: In the PM peak hour, the southbound approach is forecast to operate with delays greater than 55 seconds.

**Appendix F** contains the detailed Synchro 11 reports.

# TABLE 6.5: 2028 TOTAL TRAFFIC OPERATIONS – AM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 4 | > | 4 | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.40 | > | | < | 0.23 | > | | < | 0.46 | > | | < | 0.07 | > | | |
| | | | Q | < | 7 | > | | < | 2 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | D | C | F | E | F | F | F | E | F | > | F | F | F | E | F | F |
| | | | Delay | 269 | 34 | 25 | 92 | 35 | 132 | 60 | 107 | 49 | 54 | > | 51 | 64 | 53 | 47 | 57 | 87 |
| | | | V/C | 1.46 | 0.73 | 0.25 | | 0.11 | 1.16 | 0.82 | | 0.83 | 0.54 | > | | 0.69 | 0.43 | 0.11 | | 1.23 |
| | | | Q | 246 | 185 | 34 | | 6 | 275 | 158 | | 131 | 73 | > | | 59 | 63 | 19 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 29 | - | 47 | | 114 | - | 42 | | -106 | - | > | | 46 | - | 46 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | C | > | C | A | E | > | E | D |
| | | | Delay | < | 49 | 29 | 39 | < | 28 | > | 28 | 45 | 21 | > | 22 | 0 | 65 | > | 65 | 42 |
| | | | V/C | < | 0.80 | 0.15 | | < | 0.00 | > | | 0.51 | 0.89 | > | | 0.00 | 1.06 | > | | 0.99 |
| | | | Q | < | 76 | 17 | | < | 0 | > | | 31 | 253 | > | | 0 | 288 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 79 | - | > | | 55 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | D | D | > | D | D | D | D | D | C | B | B | B | D | E | B | E | D |
| | | | Delay | 40 | 39 | > | 39 | 37 | 41 | 40 | 39 | 29 | 17 | 12 | 18 | 40 | 68 | 14 | 66 | 40 |
| | | | V/C | 0.62 | 0.20 | > | | 0.48 | 0.19 | 0.07 | | 0.67 | 0.64 | 0.16 | | 0.35 | 1.07 | 0.02 | | 0.93 |
| | | | Q | 37 | 12 | > | | 25 | 12 | 3 | | 56 | 109 | 15 | | 15 | 241 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | 13 | - | > | | 25 | - | - | | 149 | - | > | | 160 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | E | | F | F | C | C | A | B | D | B | > | C | | C | C | C | F |
| | | | Delay | 61 | | 590 | 507 | 31 | 32 | 3 | 13 | 38 | 19 | > | 22 | | 32 | 22 | 32 | 130 |
| | | | V/C | 0.74 | | 2.19 | | 0.46 | 0.47 | 0.66 | | 0.74 | 0.50 | > | | | 0.73 | 0.04 | | 1.23 |
| | | | Q | 81 | | 421 | | 72 | 90 | 0 | | 48 | 92 | > | | | 126 | 0 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | -6 | | - | | - | - | - | | 133 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | F | | > | F | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 62 | | > | 62 | |
| | | | V/C | < | 0.00 | | | | 0.25 | > | | | | | | 0.55 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 22 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 5 | | 5 | | 3 | > | 3 | | | | | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.58 | | | | 0.25 | > | | | | | | < | 0.35 | > | | |
| | | | Q | < | 7 | | | | 7 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | D | > | D | < | C | > | C | |
| | | | Delay | < | 0 | > | 0 | < | 1 | > | 1 | < | 27 | > | 27 | < | 22 | > | 22 | |
| | | | V/C | < | 0.01 | > | | < | 0.01 | > | | < | 0.36 | > | | < | 0.24 | > | | |
| | | | Q | < | 0 | > | | < | 0 | > | | < | 13 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.11 | > | | < | 0.20 | > | | < | 0.14 | > | | < | 0.03 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | C | | C | | B | > | B | |
| | | | Delay | 14 | | > | 14 | | | | | < | 16 | | 16 | | 13 | > | 13 | |
| | | | V/C | 0.45 | | > | | | | | | < | 0.61 | | | | 0.48 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.29 | | > | | | 0.01 | > | | < | 0.10 | | | |
| | | | Q | | | | | 10 | | > | | | 0 | > | | < | 3 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | B | B | > | B | B |
| | | | Delay | 17 | 16 | > | 16 | < | 15 | 15 | 15 | 9 | 15 | > | 14 | 10 | 13 | > | 13 | 14 |
| | | | V/C | 0.23 | 0.17 | > | | < | 0.09 | 0.06 | | 0.11 | 0.59 | > | | 0.17 | 0.47 | > | | 0.44 |
| | | | Q | 18 | 16 | > | | < | 10 | 8 | | 8 | 64 | > | | 10 | 43 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 3 | - | > | | < | - | 22 | | 12 | - | > | | 20 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

# TABLE 6.6: 2028 TOTAL TRAFFIC OPERATIONS – PM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| PM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 4 | > | 4 | < | 6 | > | 6 | < | 3 | > | 3 | < | 5 | > | 5 | 5 |
| | | | V/C | < | 0.42 | > | | < | 0.67 | > | | < | 0.31 | > | | < | 0.30 | > | | |
| | | | Q | < | 7 | > | | < | 15 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | E | D | F | E | F | F | F | F | F | > | F | F | F | F | F | F |
| | | | Delay | 201 | 45 | 39 | 72 | 41 | 182 | 58 | 138 | 118 | 58 | > | 87 | 145 | 85 | 58 | 105 | 100 |
| | | | V/C | 1.29 | 0.85 | 0.68 | | 0.37 | 1.26 | 0.75 | | 1.08 | 0.54 | > | | 1.15 | 0.94 | 0.63 | | 1.23 |
| | | | Q | 218 | 212 | 123 | | 14 | 290 | 135 | | 158 | 69 | > | | 177 | 206 | 94 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 57 | - | -43 | | 106 | - | 65 | | -133 | - | > | | -72 | - | -29 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | B | > | B | B | F | > | F | E |
| | | | Delay | < | 45 | 32 | 39 | < | 31 | > | 31 | 40 | 17 | > | 19 | 13 | 108 | > | 108 | 59 |
| | | | V/C | < | 0.69 | 0.09 | | < | 0.03 | > | | 0.55 | 0.88 | > | | 0.03 | 1.17 | > | | 1.04 |
| | | | Q | < | 49 | 15 | | < | 5 | > | | 45 | 260 | > | | 2 | 328 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 65 | - | > | | 53 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | F | D | > | E | C | D | D | D | C | C | B | C | D | E | B | E | D |
| | | | Delay | 100 | 40 | > | 72 | 33 | 38 | 37 | 35 | 26 | 23 | 14 | 23 | 38 | 58 | 14 | 56 | 42 |
| | | | V/C | 1.01 | 0.21 | > | | 0.57 | 0.26 | 0.09 | | 0.66 | 0.76 | 0.07 | | 0.31 | 1.04 | 0.04 | | 0.96 |
| | | | Q | 78 | 14 | > | | 39 | 21 | 10 | | 45 | 131 | 0 | | 18 | 251 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | -28 | - | > | | 11 | - | - | | 161 | - | > | | 157 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | F | | F | F | C | F | A | E | F | B | > | F | | C | C | C | F |
| | | | Delay | 533 | | 99 | 173 | 27 | 151 | 4 | 67 | 403 | 20 | > | 146 | | 31 | 24 | 30 | 88 |
| | | | V/C | 1.97 | | 1.04 | | 0.40 | 1.23 | 0.75 | | 1.80 | 0.48 | > | | | 0.66 | 0.12 | | 1.85 |
| | | | Q | 87 | | 190 | | 74 | 385 | 0 | | 197 | 81 | > | | | 104 | 17 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | -12 | | - | | - | - | - | | -17 | - | > | | | - | 48 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | F | | > | F | |
| | | | Delay | < | 1 | | 1 | | 0 | > | 0 | | | | | 357 | | > | 357 | |
| | | | V/C | < | 0.02 | | | | 0.87 | > | | | | | | 1.29 | | > | | |
| | | | Q | < | 1 | | | | 0 | > | | | | | | 47 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 3 | | 3 | | 7 | > | 7 | | | | | < | 4 | > | 4 | 5 |
| | | | V/C | < | 0.38 | | | | 0.72 | > | | | | | | < | 0.26 | > | | |
| | | | Q | < | 7 | | | | 28 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | F | > | F | < | E | > | E | |
| | | | Delay | < | 1 | > | 1 | < | 1 | > | 1 | < | 278 | > | 278 | < | 41 | > | 41 | |
| | | | V/C | < | 0.03 | > | | < | 0.02 | > | | < | 1.37 | > | | < | 0.37 | > | | |
| | | | Q | < | 1 | > | | < | 1 | > | | < | 88 | > | | < | 12 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.14 | > | | < | 0.25 | > | | < | 0.12 | > | | < | 0.01 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | F | > | F | |
| | | | Delay | 15 | | > | 15 | | | | | < | 15 | | 15 | | 87 | > | 87 | |
| | | | V/C | 0.44 | | > | | | | | | < | 0.51 | | | | 1.11 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.27 | | > | | | 0.01 | > | | < | 0.13 | | | |
| | | | Q | | | | | 9 | | > | | | 0 | > | | < | 4 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | B | C | > | C | C |
| | | | Delay | 16 | 16 | > | 16 | < | 17 | 15 | 16 | 9 | 13 | > | 13 | 12 | 29 | > | 26 | 20 |
| | | | V/C | 0.17 | 0.15 | > | | < | 0.25 | 0.07 | | 0.07 | 0.50 | > | | 0.34 | 0.89 | > | | 0.63 |
| | | | Q | 13 | 15 | > | | < | 22 | 9 | | 4 | 51 | > | | 21 | 136 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 7 | - | > | | < | - | 21 | | 17 | - | > | | 9 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

### 6.2.2 2033 Total Traffic Operations

**Table 6.7** and **Table 6.8** summarize the total traffic level of service conditions at the 2033 horizon year. Critical movements are highlighted in yellow. The results indicate the study intersections are forecast to operate at similar levels of service as existing conditions. The following critical movements are noted:

- **Homer Watson Boulevard and Manitou Drive/Doon Village Road**:
  - In the AM peak hour, the eastbound left-turn, southbound left-turn, westbound right-turn and westbound through movements are forecast to operate with delays greater than 55 seconds. The northbound left-turn movement is forecast to operate with queues exceeding available lane capacity; and
  - In the PM peak hour, the eastbound left-turn, westbound through, westbound right-turn, northbound left-turn and through, and southbound left-turn, through and right-turn movements are forecast to operate with delays greater than 55 seconds. The northbound and southbound left-turn movements and eastbound and southbound right-turn movements are forecast to operate with queues exceeding available lane capacity.
- **Homer Watson Boulevard and Doon South Drive**: In the AM peak hour and PM peak hour, the southbound through movement is forecast to operate with delays greater than 55 seconds.
- **Homer Watson Boulevard and Conestoga College Boulevard**:
  - In the AM peak hour, the southbound through movement is forecast to operate with delays greater than 55 seconds; and
  - In the PM peak hour, the eastbound left-turn and southbound through movements are forecast to operate with delays greater than 55 seconds.
- **Homer Watson Boulevard and New Dundee Road/Highway 401 Ramp**:
  - In the AM peak hour, the eastbound left-turn and right-turn movements are forecast to operate with delays greater than 55 seconds. The eastbound left-turn movement is forecast to operate with queues exceeding available lane capacity; and

- In the PM peak hour, the eastbound left-turn, eastbound right-turn, westbound through, and northbound left-turn movements are forecast to operate with delays greater than 55 seconds. The eastbound and northbound left-turn movements are forecast to operate with queues exceeding available lane capacity.

- **New Dundee Road and Pinnacle Drive**: In the PM peak hour, the southbound approach is forecast to operate with delays greater than 55 seconds.
- **New Dundee Road and Reidel Drive/Cameron Road**: In the PM peak hour, the northbound approach is forecast to operate with delays greater than 55 seconds.
- **Doons Mills Road and Apple Ridge Drive**: In the PM peak hour, the southbound approach is forecast to operate with delays greater than 55 seconds.

**Appendix G** contains the detailed Synchro reports.

# TABLE 6.7: 2033 TOTAL TRAFFIC OPERATIONS – AM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| AM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 3 | > | 3 | < | 4 | > | 4 | < | 3 | > | 3 | 3 |
| | | | V/C | < | 0.42 | > | | < | 0.24 | > | | < | 0.47 | > | | < | 0.07 | > | | |
| | | | Q | < | 7 | > | | < | 3 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | E | C | F | E | F | F | F | E | F | > | F | F | F | E | F | F |
| | | | Delay | 269 | 36 | 25 | 91 | 36 | 156 | 60 | 123 | 49 | 54 | > | 52 | 64 | 53 | 47 | 57 | 92 |
| | | | V/C | 1.46 | 0.76 | 0.27 | | 0.12 | 1.21 | 0.82 | | 0.83 | 0.55 | > | | 0.70 | 0.42 | 0.11 | | 1.23 |
| | | | Q | 248 | 200 | 38 | | 6 | 296 | 159 | | 130 | 74 | > | | 62 | 63 | 19 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 27 | - | 42 | | 114 | - | 41 | | -105 | - | > | | 43 | - | 46 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | C | > | C | A | F | > | F | D |
| | | | Delay | < | 49 | 29 | 39 | < | 28 | > | 28 | 45 | 25 | > | 26 | 0 | 82 | > | 82 | 51 |
| | | | V/C | < | 0.80 | 0.15 | | < | 0.00 | > | | 0.51 | 0.93 | > | | 0.00 | 1.10 | > | | 1.02 |
| | | | Q | < | 76 | 17 | | < | 0 | > | | 31 | 273 | > | | 0 | 306 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 79 | - | > | | 55 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | D | D | > | D | D | D | D | D | C | B | B | B | D | F | B | F | D |
| | | | Delay | 41 | 39 | > | 40 | 37 | 40 | 40 | 39 | 31 | 18 | 13 | 19 | 41 | 88 | 14 | 85 | 48 |
| | | | V/C | 0.64 | 0.21 | > | | 0.50 | 0.19 | 0.07 | | 0.71 | 0.67 | 0.17 | | 0.37 | 1.12 | 0.02 | | 0.98 |
| | | | Q | 38 | 13 | > | | 25 | 12 | 4 | | 62 | 118 | 17 | | 16 | 259 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | 12 | - | > | | 25 | - | - | | 143 | - | > | | 159 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | E | | F | F | C | C | A | B | D | B | > | C | | C | C | C | F |
| | | | Delay | 65 | | 645 | 555 | 32 | 34 | 3 | 14 | 47 | 20 | > | 23 | | 33 | 22 | 32 | 140 |
| | | | V/C | 0.77 | | 2.31 | | 0.49 | 0.49 | 0.70 | | 0.79 | 0.52 | > | | | 0.75 | 0.04 | | 1.3 |
| | | | Q | 84 | | 439 | | 76 | 94 | 0 | | 56 | 98 | > | | | 134 | 0 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | -9 | | - | | - | - | - | | 125 | - | > | | | - | 65 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | F | | > | F | |
| | | | Delay | < | 0 | | 0 | | 0 | > | 0 | | | | | 70 | | > | 70 | |
| | | | V/C | < | 0.00 | | | | 0.25 | > | | | | | | 0.59 | | > | | |
| | | | Q | < | 0 | | | | 0 | > | | | | | | 23 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 5 | | 5 | | 3 | > | 3 | | | | | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.59 | | | | 0.25 | > | | | | | | < | 0.35 | > | | |
| | | | Q | < | 7 | | | | 7 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | D | > | D | < | C | > | C | |
| | | | Delay | < | 0 | > | 0 | < | 1 | > | 1 | < | 29 | > | 29 | < | 23 | > | 23 | |
| | | | V/C | < | 0.01 | > | | < | 0.01 | > | | < | 0.38 | > | | < | 0.25 | > | | |
| | | | Q | < | 0 | > | | < | 0 | > | | < | 13 | > | | < | 8 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 3 | > | 3 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.11 | > | | < | 0.20 | > | | < | 0.14 | > | | < | 0.03 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | C | | C | | B | > | B | |
| | | | Delay | 14 | | > | 14 | | | | | < | 16 | | 16 | | 13 | > | 13 | |
| | | | V/C | 0.45 | | > | | | | | | < | 0.61 | | | | 0.48 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.29 | | > | | | 0.01 | > | | < | 0.10 | | | |
| | | | Q | | | | | 10 | | > | | | 0 | > | | < | 3 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | B | B | > | B | B |
| | | | Delay | 17 | 16 | > | 16 | < | 15 | 15 | 15 | 9 | 15 | > | 14 | 10 | 13 | > | 13 | 14 |
| | | | V/C | 0.23 | 0.17 | > | | < | 0.09 | 0.06 | | 0.11 | 0.59 | > | | 0.17 | 0.47 | > | | 0.44 |
| | | | Q | 18 | 16 | > | | < | 10 | 8 | | 8 | 64 | > | | 10 | 43 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 3 | - | > | | < | - | 22 | | 12 | - | > | | 20 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*

*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*

*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*

*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

# TABLE 6.8: 2033 TOTAL TRAFFIC OPERATIONS – PM PEAK HOUR

| Analysis Period | Intersection | Control Type | MOE | Direction / Movement / Approach | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Eastbound | | | | Westbound | | | | Northbound | | | | Southbound | | | | Overall |
| | | | | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | Left | Through | Right | Approach | |
| PM Peak Hour | Strasburg Road and Huron Road | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 4 | > | 4 | < | 6 | > | 6 | < | 3 | > | 3 | < | 5 | > | 5 | 5 |
| | | | V/C | < | 0.45 | > | | < | 0.70 | > | | < | 0.32 | > | | < | 0.33 | > | | |
| | | | Q | < | 7 | > | | < | 16 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Homer Watson Boulevard and Manitou Drive/Doon Village Road | TCS | LOS | F | E | D | F | E | F | F | F | F | F | > | F | F | F | F | F | F |
| | | | Delay | 201 | 48 | 42 | 73 | 42 | 207 | 58 | 156 | 108 | 58 | > | 83 | 168 | 93 | 62 | 119 | 109 |
| | | | V/C | 1.29 | 0.89 | 0.73 | | 0.43 | 1.32 | 0.75 | | 1.05 | 0.54 | > | | 1.21 | 0.98 | 0.68 | | 1.24 |
| | | | Q | 218 | 231 | 145 | | 14 | 308 | 135 | | 160 | 69 | > | | 189 | 206 | 99 | | |
| | | | Ex | 275 | - | 80 | | 120 | - | 200 | | 25 | - | > | | 105 | - | 65 | | |
| | | | Avail. | 57 | - | -65 | | 106 | - | 65 | | -135 | - | > | | -84 | - | -34 | | |
| | Homer Watson Boulevard and Doon South Drive | TCS | LOS | < | D | C | D | < | C | > | C | D | C | > | C | B | F | > | F | E |
| | | | Delay | < | 45 | 32 | 39 | < | 31 | > | 31 | 40 | 20 | > | 21 | 13 | 129 | > | 128 | 70 |
| | | | V/C | < | 0.69 | 0.09 | | < | 0.03 | > | | 0.55 | 0.92 | > | | 0.03 | 1.22 | > | | 1.08 |
| | | | Q | < | 49 | 15 | | < | 5 | > | | 45 | 282 | > | | 2 | 347 | > | | |
| | | | Ex | < | - | - | | < | - | > | | 110 | - | > | | 55 | - | > | | |
| | | | Avail. | < | - | - | | < | - | > | | 65 | - | > | | 53 | - | > | | |
| | Homer Watson Boulevard and Conestoga College Boulevard | TCS | LOS | F | D | > | F | C | D | D | D | C | C | B | C | D | F | B | F | D |
| | | | Delay | 120 | 40 | > | 83 | 34 | 38 | 37 | 36 | 27 | 25 | 15 | 24 | 39 | 86 | 15 | 81 | 53 |
| | | | V/C | 1.08 | 0.22 | > | | 0.59 | 0.26 | 0.09 | | 0.67 | 0.79 | 0.07 | | 0.33 | 1.11 | 0.04 | | 1.01 |
| | | | Q | 85 | 15 | > | | 41 | 21 | 12 | | 52 | 142 | 0 | | 19 | 271 | 0 | | |
| | | | Ex | 50 | - | > | | 50 | - | - | | 205 | - | > | | 175 | - | 190 | | |
| | | | Avail. | -35 | - | > | | 10 | - | - | | 153 | - | > | | 156 | - | 190 | | |
| | Homer Watson Boulevard and WB 401 Ramp/New Dundee Road | TCS | LOS | F | | F | F | C | F | A | E | F | B | > | F | | C | C | C | F |
| | | | Delay | 573 | | 125 | 201 | 29 | 181 | 4 | 79 | 456 | 20 | > | 161 | | 31 | 23 | 30 | 100 |
| | | | V/C | 2.05 | | 1.11 | | 0.43 | 1.30 | 0.78 | | 1.92 | 0.49 | > | | | 0.67 | 0.13 | | 1.96 |
| | | | Q | 90 | | 203 | | 77 | 401 | 0 | | 209 | 86 | > | | | 111 | 17 | | |
| | | | Ex | 75 | | - | | - | - | - | | 180 | - | > | | | - | 65 | | |
| | | | Avail. | -15 | | - | | - | - | - | | -29 | - | > | | | - | 48 | | |
| | New Dundee Road and Pinnacle Drive | TWSC | LOS | < | A | | A | | A | > | A | | | | | F | | > | F | |
| | | | Delay | < | 1 | | 1 | | 0 | > | 0 | | | | | 425 | | > | 425 | |
| | | | V/C | < | 0.02 | | | | 0.90 | > | | | | | | 1.42 | | > | | |
| | | | Q | < | 1 | | | | 0 | > | | | | | | 50 | | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | - | | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | - | | > | | |
| | New Dundee Road and Robert Ferrie Drive | TCS | LOS | < | A | | A | | A | > | A | | | | | < | A | > | A | A |
| | | | Delay | < | 3 | | 3 | | 7 | > | 7 | | | | | < | 5 | > | 5 | 5 |
| | | | V/C | < | 0.39 | | | | 0.73 | > | | | | | | < | 0.26 | > | | |
| | | | Q | < | 7 | | | | 28 | > | | | | | | < | 7 | > | | |
| | | | Ex | < | - | | | | - | > | | | | | | < | - | > | | |
| | | | Avail. | < | - | | | | - | > | | | | | | < | - | > | | |
| | New Dundee Road and Reidel Drive | TWSC | LOS | < | A | > | A | < | A | > | A | < | F | > | F | < | E | > | E | |
| | | | Delay | < | 1 | > | 1 | < | 1 | > | 1 | < | 320 | > | 320 | < | 44 | > | 44 | |
| | | | V/C | < | 0.03 | > | | < | 0.02 | > | | < | 1.46 | > | | < | 0.39 | > | | |
| | | | Q | < | 1 | > | | < | 1 | > | | < | 93 | > | | < | 13 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Robert Ferrie Drive and South Creek Drive | RBT | LOS | < | A | > | A | < | A | > | A | < | A | > | A | < | A | > | A | A |
| | | | Delay | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | < | 4 | > | 4 | 4 |
| | | | V/C | < | 0.14 | > | | < | 0.25 | > | | < | 0.12 | > | | < | 0.01 | > | | |
| | | | Q | < | 7 | > | | < | 7 | > | | < | 7 | > | | < | 7 | > | | |
| | | | Ex | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | | | Avail. | < | - | > | | < | - | > | | < | - | > | | < | - | > | | |
| | Doon Mills Road and Apple Ridge Drive | AWSC | LOS | B | | > | B | | | | | < | B | | B | | F | > | F | |
| | | | Delay | 15 | | > | 15 | | | | | < | 15 | | 15 | | 87 | > | 87 | |
| | | | V/C | 0.44 | | > | | | | | | < | 0.51 | | | | 1.11 | > | | |
| | | | Q | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Ex | - | | > | | | | | | < | - | | | | - | > | | |
| | | | Avail. | - | | > | | | | | | < | - | | | | - | > | | |
| | Biehn Drive and Caryndale Drive | TWSC | LOS | | | | | A | | > | A | | A | > | A | < | A | | A | |
| | | | Delay | | | | | 10 | | > | 10 | | 0 | > | 0 | < | 7 | | 7 | |
| | | | V/C | | | | | 0.27 | | > | | | 0.01 | > | | < | 0.13 | | | |
| | | | Q | | | | | 9 | | > | | | 0 | > | | < | 4 | | | |
| | | | Ex | | | | | - | | > | | | - | > | | < | - | | | |
| | | | Avail. | | | | | - | | > | | | - | > | | < | - | | | |
| | Doon Village Road and Pioneer Drive | TCS | LOS | B | B | > | B | < | B | B | B | A | B | > | B | B | C | > | C | C |
| | | | Delay | 16 | 16 | > | 16 | < | 17 | 15 | 16 | 9 | 13 | > | 13 | 12 | 29 | > | 26 | 20 |
| | | | V/C | 0.17 | 0.15 | > | | < | 0.25 | 0.07 | | 0.07 | 0.50 | > | | 0.34 | 0.89 | > | | 0.63 |
| | | | Q | 13 | 15 | > | | < | 22 | 9 | | 4 | 51 | > | | 21 | 136 | > | | |
| | | | Ex | 20 | - | > | | < | - | 30 | | 20 | - | > | | 30 | - | > | | |
| | | | Avail. | 7 | - | > | | < | - | 21 | | 17 | - | > | | 9 | - | > | | |

*MOE - Measure of Effectiveness*
*LOS - Level of Service*
*Delay - Average Delay per Vehicle in Seconds*
*Q - 95th Percentile Queue Length (m)*
*Ex. - Existing Available Storage (m)*
*Avail. - Available Storage (m)*
*TCS - Traffic Control Signal*
*TWSC - Two-Way Stop Control*
*AWSC - All-Way Stop Control*
*<- Shared Left/Through Lane*
*>- Shared Right/Through Lane*
*UM - Unopposed Movement*

# 7 Remedial Measures

## 7.1 Intersection Control Improvements

The analyses presented in **Section 6.2** indicate two study intersections along New Dundee Road and the intersection of Doon Mills Road and Apple Ridge Drive are forecast to operate with critical movements after build-out of the outstanding units.

While the planned widening of New Dundee Road (see **Table 5.1**) may alleviate critical movements at New Dundee Road and Pinnacle Road, and New Dundee Road and Reidel Drive, these critical movements are confined to vehicles on the minor road which are not afforded opportunities, or gaps, to enter the traffic stream on the major road. The widening of New Dundee Road is also assumed outside of the 2028 and 2033 horizon years used in this study.

Intersection control improvements, such as traffic control signals (if warranted) may alleviate these critical movements by providing a gap in the major road traffic stream. The warrant analysis for each intersection is based on Justification 7 outlined in Ontario Traffic Manual (OTM) *Book 12 (Traffic Signals)*.[9] Justification 7 uses forecast traffic volumes to determine the need for traffic control signals at an intersection and comprises two warrants:

- Warrant 1: Minimum Vehicular Volume; and
- Warrant 2: Delay to Cross Traffic.

**Appendix H** contains the warrant analyses worksheets based on 2033 total traffic volumes. **Table 7.1** summarizes the findings of the warrant review indicating traffic control signals are not warranted at any of the three intersections.

[9] Ontario Ministry of Transportation, *Ontario Traffic Manual Book 12: Traffic Signals*, (Toronto: Queen's Printer of Ontario, 2012).

## TABLE 7.1: TRAFFIC CONTROL WARRANT SUMMARY

| Intersection | Warrant | | | | Warranted |
|---|---|---|---|---|---|
| | 1A | 1B | 2A | 2B | |
| New Dundee Road and Pinnacle Drive | 217% | 19% | 210% | 58% | No |
| New Dundee Road and Reidel Road | 144% | 78% | 124% | 114% | No |
| Doon Mills Road and Apple Ridge Drive | 82% | 51% | 64% | 145% | No |

Notes:

For existing intersections with forecast traffic volumes, either Warrant 1A and 1B, or 2A and 2B must both be satisfied to 120%. For new intersections with forecast traffic volumes, either Warrant 1A and 1B, or 2A and 2B must both be satisfied to 150%.

# 8 Biehn Drive Extension

The analyses contained in **Section 6** does not account for a potential extension of Biehn Drive to Robert Ferrie Drive because the ultimate alignment and timing of this extension remains unknown. The *Biehn Drive Municipal Class Environmental Assessment Study Design Report (Revision 1)*[10] did review four alignment alternatives of Biehn Drive and recommended "that the extension of Biehn Drive only consider connections to the extension of Robert Ferrie Drive, [rather than a connection to Strasburg Road]."[11]

At the request of City of Kitchener staff, Paradigm has reviewed the need and justification for the Biehn Drive extension within the context of the future traffic forecasts contained in this report and the existing road classification system in the study area.

## 8.1 Existing Road Classifications and Network Structure

The City of Kitchener Official Plan defines six road classifications: provincial highways, regional roads, city arterial streets, major community collector streets, minor neighbourhood collector streets, and local streets. Each road classification serves a specific transportation and mobility role in the City's transportation network.

Biehn Drive and Robert Ferrie Drive are both classified as major community collector streets. These roads are intended to "balance the provision of mobility in the city with land access, [and] do this by collecting and distributing people and goods […] from Local Streets and Minor Neighbourhood Collector Streets to City Arterial Streets and Regional Roads."[12]

Conversely, Caryndale Drive is classified as a minor neighbourhood collector street, whose function is "to move people and goods primarily within neighbourhoods. They connect lower volume local roads to higher volume major community collector streets."[13]

Although Caryndale Drive is classified as a minor neighbourhood community collector street, its location in the current road network means it functions as a major community collector, independent of

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[10] BT Engineering Inc., *Biehn Drive Municipal Class Environmental Assessment Study Design Report, Revision 1*, 2021.

[11] BT Engineering Inc., *Biehn Drive Municipal Class Environmental Assessment Study Design Report, Revision 1*, 2021, 21.

[12] City of Kitchener, "Integrated Transportation System," chap. 13 in *Official Plan, A Complete and Healthy Kitchener,* (Kitchener, 2014), 11.

[13] City of Kitchener, "Integrated Transportation System," chap. 13 in *Official Plan, A Complete and Healthy Kitchener,* (Kitchener, 2014), 12.

traffic volumes. This is because it provides the only connection between Biehn Drive and Robert Ferrie Drive, both of which connect to arterial streets (Biehn Drive connecting to Huron Road) or regional roads (Robert Ferrie Drive connecting to New Dundee Road).

Because Robert Ferrie Drive and Biehn Drive both terminate near Caryndale Drive, vehicles must use Caryndale Drive to continue their journey.

## 8.2 Future Road Network and Classification

The future extension of Strasburg Road south to New Dundee Road will provide a parallel north-south route between New Dundee Road and Huron Road. Map 11 in the Official Plan identifies this new connection as a City Arterial Street. This extension will replace the role currently being facilitated by Robert Ferrie Drive, Caryndale Drive, and Biehn Drive, assuming motorists seek New Dundee Road and Huron Road as east-west alternatives to Robert Ferrie Drive.

The planned extension of Robert Ferrie Drive to Strasburg Road will provide a continuous east-west corridor parallel to New Dundee Road. This extension in combination with that of Strasburg Road would be expected to redistribute a portion of existing trips using Caryndale Drive. This is because these new connections will permit motorists using Robert Ferrie Drive and Caryndale Drive to use Robert Ferrie Drive and Strasburg Road instead.

While this will accommodate motorists in the southern areas of the Doon South neighbourhood (that is, along and south of Robert Ferrie Drive) those residing in streets connecting to Biehn Drive or Caryndale Drive (such as Evenstone Avenue and Hearthway Street) will still need to use Caryndale Drive or Old Huron Road for local access to Robert Ferrie Drive or Huron Road, respectively.

Extending Biehn Drive to Robert Ferrie Drive would provide the necessary “bypass” of Caryndale Drive to ensure Caryndale Drive remains closer to its intended classification in the Official Plan, and design guidance published in *Complete Streets Kitchener* which indicates “minor collector streets will carry traffic primarily originating from within the neighbourhood it serves. Cut-through traffic is discouraged through traffic calming or diversion techniques.” [14]

[14] City of Kitchener, *Complete Streets Kitchener*, (Kitchener, 2019), 25.

## 8.3 Traffic Volume Considerations

The 24-hour ATR data illustrated in **Figure 3.3** indicate Caryndale Drive is serving approximately 3,800 daily vehicles between Chapel Hill Drive and Evenstone Avenue, and 1,500 vehicles between Robert Ferrie Drive and Stauffer Drive.[15] Biehn Drive is servicing approximately 6,500 daily vehicles between Caryndale Drive and Black Walnut Drive. Robert Ferrie Drive immediately east of South Creek Drive is also serving approximately 3,700 daily vehicles. All four segments are operating with daily traffic volumes less than 8,000 – the upper threshold for a minor collector street defined in the City of Kitchener *Development Manual*.[16]

In the absence of a detailed vehicle trace study, it is difficult to estimate the percentage of existing traffic on Caryndale Drive that represents local trips, rather than those cutting through the area to access other roads. It is also acknowledged that the split catchment area of Brigadoon Public School likely results in trips from outside the study area of this report (namely lands on the east side of Homer Watson Boulevard north of Highway 401) using Caryndale Drive to get to and from Brigadoon Public School. These trips would not be considered cut-through trips because the motorists' destination (Brigadoon Public School) is on Caryndale Drive and inaccessible via other routes.

In both the AM peak hour and PM peak hour, the existing volume data in **Figure 3.1** and **Figure 3.2** indicate a net loss of southbound vehicles and a net gain of northbound traffic on Caryndale Drive between Biehn Drive and Robert Ferrie Drive. This could indicate southbound traffic terminates or northbound traffic commences their trip south of Biehn Drive. The differing peak hours at both intersections may also explain these traffic volume trends.

The future total traffic volumes illustrated in **Figure 5.7** through **Figure 5.10** assume the future extensions of Robert Ferrie Drive and Strasburg Road are in place. Given the location of outstanding development is nearer New Dundee Road (for Doon South Phase 2) and Strasburg Road (for Brigadoon), it is assumed trips generated by outstanding development activity will seek routes primarily via the higher order arterial road network, rather than the internal collector road network. Therefore, the traffic assignments illustrated in **Figure 5.5** and **Figure 5.6** do not add additional traffic onto Robert Ferrie Drive at South Creek Drive, or at Biehn Drive and Caryndale Drive.

[15] The segment of Caryndale Road between Evenstone Avenue and Stauffer Drive represents part of the future alignment of Robert Ferrie Drive from to Strasburg Road.

[16] City of Kitchener, *Development Manual*, (Kitchener, 2021), 41.

An undetermined portion of existing traffic volumes on Caryndale Drive between Biehn Drive and Robert Ferrie Drive could be assumed to divert once Robert Ferrie Drive is extended to Strasburg Road. Without an extension of Biehn Drive, Caryndale Drive would be expected to continue functioning as a major community collector street. This is because Biehn Drive will not connect to another major community collector street or higher order road; it will only connect to Huron Road.

## 8.4 Operational Considerations

Under existing conditions, the intersection of Biehn Drive and Caryndale Drive is operating at acceptable levels of service (LOS A) and within capacity in both the AM peak hour and the PM peak hour. In the existing road network, the intersection is part of the shortest route to and from the west of the study area, via the intersection of Battler Road and Huron Road. A longer more circuitous route is provided by Fisher Hallman Road and New Dundee Road.

Under future total conditions the intersection is forecast to continue operating at an acceptable level of service (LOS A) and within capacity. This is because the analysis of future total conditions, assumes the extension of Robert Ferrie Drive westward to the extension of Strasburg Road. These new road segments provide an alternate route for those trips destined to and from the west of the study area. Because Caryndale Drive and Biehn Drive both feature traffic calming devices, it is assumed that Strasburg Road and Robert Ferrie Drive will absorb new trips generated by the outstanding development in Doon Phase 2 and Brigadoon.

An undetermined portion of existing cut-through traffic on Biehn Drive and Caryndale Drive would also be expected to use Robert Ferrie Drive and Strasburg Road instead. This would reduce overall traffic volumes at the intersection of Biehn Drive and Caryndale Drive, resulting in an improved level of service.

## 8.5 Need and Justification

Until Strasburg Road and Robert Ferrie Drive are extended, Caryndale Drive will continue to provide the only north-south connection in the west area of the study area. Despite being classified as a minor neighbourhood collector street, Caryndale Drive is functioning as a major neighborhood community collector because:

- It provides the only connection between Biehn Drive and Robert Ferrie Drive (which are both major community collectors); and

- In combination with Biehn Drive and Robert Ferrie Drive these roads provide the only continuous route through the western area of the Doon South neighbourhood.

Based on the existing cross-section, speed limit, and traffic calming devices on Caryndale Drive, the road – as designed – is consistent with that for a minor collector street defined in the City of Kitchener *Complete Streets Kitchener* and *Development Manual*. The former publication also states "minor collector streets will carry traffic primarily originating from within the neighbourhood it serves. Cut-through traffic is discouraged through traffic calming or diversion techniques."[17]

If Biehn Drive is not extended:

- residents living on Spencer Court, Kilkerran Crescent, Kilbirnie Court, McLeod Court, Mitton Place, Robertson Crescent, Macintosh Place, Sutherland Walk, Culloden Place, and a portion of Biehn Drive will still need to use Caryndale Drive as one of two ways to exit the subdivision – the other being Old Huron Road; and
- Caryndale Drive would be expected to continue functioning as a major community collector street because Biehn Drive would not connect to another major community collector street or higher order road; it would only connect to Huron Road at the north.

The findings of this study (see **Table 6.7** and **Table 6.8**) estimate the intersection to operate at an acceptable level of service (LOS A) after build-out of the remaining units. The need for the Biehn Drive extension is largely independent of traffic operations because existing cut-through traffic using Biehn Drive and Caryndale Drive would be able to use Robert Ferrie Drive and Strasburg Road instead. This would reduce overall traffic volumes at Biehn Drive and Caryndale Drive, resulting in an improved level of service.

Overall, an extension of Biehn Drive to Robert Ferrie Drive is justified to:

- Provide a diversion route around the Caryndale Drive corridor for residents living on and adjacent to Biehn Drive; and
- Ensure Carnydale Drive better serves its function as a minor neighbourhood collector street, as detailed in the City of Kitchener Official Plan, and based on existing design details (such as traffic calming and the presence of schools) in the corridor.

[17] City of Kitchener, *Complete Streets Kitchener*, (Kitchener, 2019), 25.

# 9 Conclusions and Recommendations

## 9.1 Findings and Conclusions

Based on the analyses contained herein, the findings of this report are as follows:

**Transportation Impact Assessment**

- Under existing (2023) conditions, most study intersections are operating at acceptable levels of service and within capacity. In both the AM peak hour and PM peak hour, there are critical movements at Homer Watson Boulevard and Manitou Drive/Doon Village Road, and Homer Watson Boulevard and New Dundee Road/Highway 401 Off-Ramp;
- Under future background traffic conditions (2028 and 2033), most study intersections are forecast to continue to operate at acceptable levels of service and within capacity. In both the AM peak hour and PM peak hour, critical movements are forecast at:
  - Homer Watson Boulevard and Manitou Drive/Doon Village Road;
  - Homer Watson Boulevard and Conestoga College Boulevard; and
  - Homer Watson Boulevard and New Dundee Road/Highway 401 Off-Ramp.
- Approximately 2,841 units remain outstanding in the Doon South and Brigadoon areas of the City. This comprises 1,652 units in Doon South and 1,189 units in Brigadoon.
- Build-out of these remaining units is estimated to generate 1,593 trips in the weekday AM peak hour and 2,297 trips in the weekday PM peak hour.
- Under future total traffic conditions (2028 and 2033), including several planned roadway and intersection improvements, traffic operations throughout the Homer Watson Boulevard corridor are forecast to further deteriorate.

  Several critical movements are forecast at Homer Watson Boulevard and its intersections with Manitou Drive/Doon Village Road, Doon South Drive, Conestoga College Boulevard, and New Dundee Road/Highway 401 Off-Ramp. Critical movements are also forecast at New Dundee Road and its intersections with Pinnacle Drive, and Reidel Drive.

- Traffic control signals are not warranted at New Dundee Road and Reidel Drive, New Dundee Road and Pinnacle Drive, or Doon Mills Road and Apple Ridge Drive.

**Biehn Drive Extension Need and Justification**

- Within the existing road network (and without the extension of Robert Ferrie Drive) Caryndale Drive is functioning as a major neighborhood community collector (despite being classified as a minor neighbourhood collector street). It provides the only westerly connection between Biehn Drive and Robert Ferrie Drive;
- Caryndale Drive in combination with Biehn Drive and Robert Ferrie Drive provides the only continuous route through the western area of the Doon South neighbourhood between New Dundee Road and Huron Road;
- The future extension of Robert Ferrie Drive west to Strasburg Road, and the extension of Strasburg Road south to New Dundee Road is likely to redistribute traffic volumes on Caryndale Drive by providing a parallel north-south route to Caryndale Drive; and
- Without the Biehn Drive extension to Robert Ferrie Drive, Caryndale Drive is expected to continue functioning as a major community collector street because Biehn Drive (which itself is classified as a major community collector street) will not connect to another major community collector street or higher order road; it will only connect to Huron Road.

Based on the findings of this report it is concluded that:

- The Homer Waston Boulevard and New Dundee Road corridors offer insufficient capacity to accommodate future traffic volumes associated with the remaining units in Doon South and Brigadoon; and
- Overall, an extension of Biehn Drive to Robert Ferrie Drive is justified to:
  - Provide a diversion route around the Caryndale Drive corridor for residents living on and adjacent to Biehn Drive; and
  - Ensure Carnydale Drive better serves its function as a minor neighbourhood collector street, as detailed in the City of Kitchener Official Plan, and based on existing design details (such as traffic calming and the presence of schools) in the corridor.

## 9.2 Recommendations

Based on the findings and conclusions of this study, it is recommended:

- The City of Kitchener coordinate with the Region of Waterloo to identify remedial measures in the Homer Watson Boulevard and New Dundee corridors; and
- The City of Kitchener proceed with an extension of Biehn Drive from Robert Ferrie Drive to its current terminus west of Caryndale Drive.

# Appendix A

## Turning Movement Count Data and Signal Timing Plans

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022


# Turning Movement Data

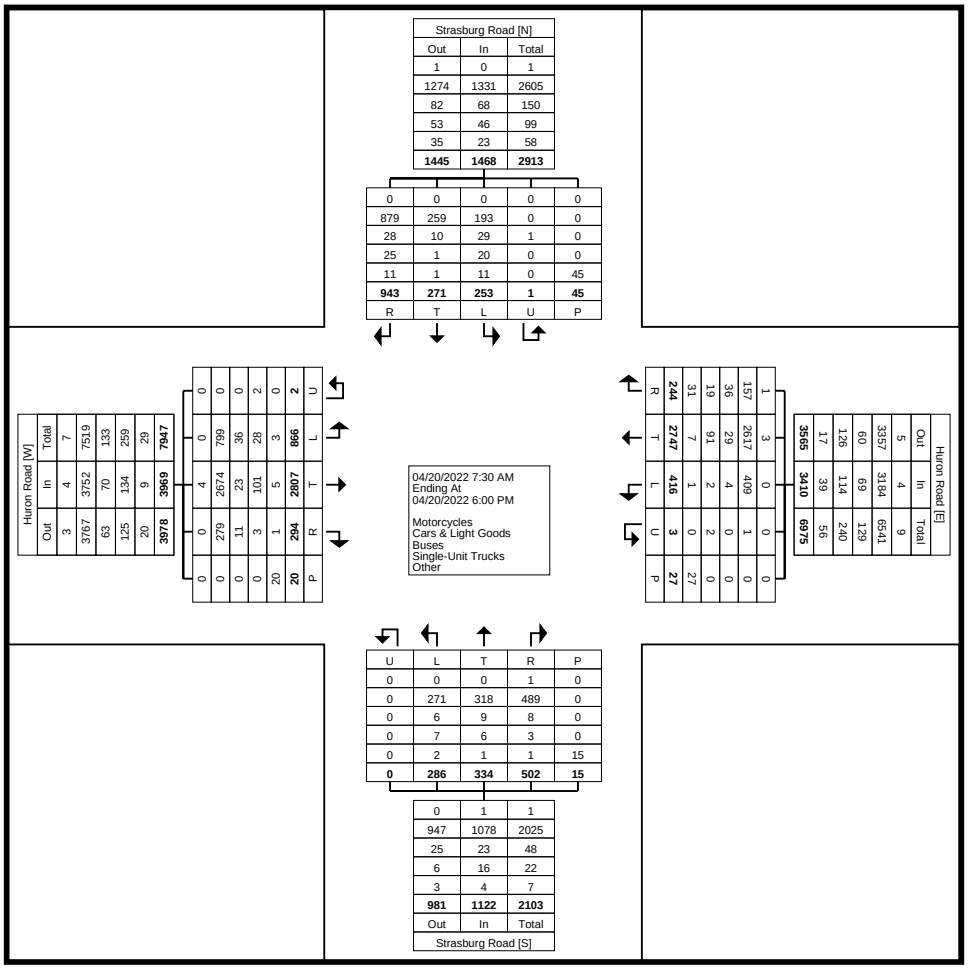
| Start Time | Huron Road Eastbound | | | | | | Huron Road Westbound | | | | | | Strasburg Road Northbound | | | | | | Strasburg Road Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 7:30 AM | 51 | 119 | 8 | 0 | 0 | 178 | 5 | 40 | 26 | 0 | 1 | 71 | 11 | 11 | 26 | 0 | 0 | 48 | 3 | 1 | 13 | 0 | 0 | 17 | 314 |
| 7:45 AM | 65 | 121 | 5 | 0 | 0 | 191 | 7 | 45 | 22 | 1 | 1 | 75 | 9 | 17 | 20 | 0 | 0 | 46 | 13 | 5 | 13 | 0 | 1 | 31 | 343 |
| Hourly Total | 116 | 240 | 13 | 0 | 0 | 369 | 12 | 85 | 48 | 1 | 2 | 146 | 20 | 28 | 46 | 0 | 0 | 94 | 16 | 6 | 26 | 0 | 1 | 48 | 657 |
| 8:00 AM | 42 | 97 | 5 | 1 | 0 | 145 | 4 | 58 | 9 | 0 | 0 | 71 | 14 | 11 | 24 | 0 | 0 | 49 | 6 | 6 | 16 | 0 | 3 | 28 | 293 |
| 8:15 AM | 32 | 136 | 10 | 0 | 0 | 178 | 7 | 60 | 6 | 0 | 1 | 73 | 13 | 13 | 17 | 0 | 0 | 43 | 5 | 5 | 22 | 0 | 0 | 32 | 326 |
| 8:30 AM | 27 | 136 | 8 | 0 | 1 | 171 | 6 | 59 | 5 | 0 | 1 | 70 | 7 | 17 | 20 | 0 | 0 | 44 | 5 | 3 | 17 | 0 | 1 | 25 | 310 |
| 8:45 AM | 35 | 121 | 12 | 0 | 2 | 168 | 11 | 44 | 7 | 0 | 1 | 62 | 6 | 16 | 7 | 0 | 0 | 29 | 3 | 5 | 17 | 0 | 2 | 25 | 284 |
| Hourly Total | 136 | 490 | 35 | 1 | 3 | 662 | 28 | 221 | 27 | 0 | 3 | 276 | 40 | 57 | 68 | 0 | 0 | 165 | 19 | 19 | 72 | 0 | 6 | 110 | 1213 |
| 9:00 AM | 24 | 73 | 5 | 0 | 0 | 102 | 7 | 54 | 2 | 1 | 1 | 64 | 9 | 7 | 14 | 0 | 1 | 30 | 11 | 7 | 13 | 0 | 1 | 31 | 227 |
| 9:15 AM | 14 | 76 | 6 | 0 | 0 | 96 | 8 | 52 | 5 | 0 | 0 | 65 | 14 | 7 | 10 | 0 | 2 | 31 | 3 | 6 | 31 | 0 | 0 | 40 | 232 |
| 9:30 AM | 14 | 69 | 4 | 0 | 0 | 87 | 7 | 48 | 4 | 0 | 0 | 59 | 6 | 16 | 12 | 0 | 1 | 34 | 5 | 5 | 17 | 0 | 0 | 27 | 207 |
| 9:45 AM | 20 | 66 | 6 | 0 | 0 | 92 | 10 | 34 | 8 | 1 | 0 | 53 | 5 | 7 | 9 | 0 | 1 | 21 | 5 | 8 | 11 | 0 | 0 | 24 | 190 |
| Hourly Total | 72 | 284 | 21 | 0 | 0 | 377 | 32 | 188 | 19 | 2 | 1 | 241 | 34 | 37 | 45 | 0 | 5 | 116 | 24 | 26 | 72 | 0 | 1 | 122 | 856 |
| 10:00 AM | 12 | 63 | 6 | 0 | 0 | 81 | 10 | 55 | 5 | 0 | 0 | 70 | 6 | 6 | 8 | 0 | 1 | 20 | 7 | 3 | 17 | 0 | 1 | 27 | 198 |
| 10:15 AM | 23 | 48 | 7 | 0 | 0 | 78 | 5 | 55 | 8 | 0 | 0 | 68 | 7 | 13 | 15 | 0 | 0 | 35 | 6 | 8 | 10 | 0 | 0 | 24 | 205 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 35 | 111 | 13 | 0 | 0 | 159 | 15 | 110 | 13 | 0 | 0 | 138 | 13 | 19 | 23 | 0 | 1 | 55 | 13 | 11 | 27 | 0 | 1 | 51 | 403 |
| 12:00 PM | 17 | 58 | 8 | 0 | 0 | 83 | 9 | 78 | 1 | 0 | 0 | 88 | 5 | 7 | 15 | 0 | 0 | 27 | 11 | 7 | 26 | 0 | 0 | 44 | 242 |
| 12:15 PM | 19 | 65 | 6 | 0 | 0 | 90 | 12 | 56 | 10 | 0 | 1 | 78 | 5 | 8 | 14 | 0 | 1 | 27 | 5 | 6 | 28 | 0 | 4 | 39 | 234 |
| 12:30 PM | 16 | 81 | 6 | 0 | 3 | 103 | 8 | 64 | 4 | 0 | 1 | 76 | 1 | 7 | 12 | 0 | 1 | 20 | 5 | 5 | 36 | 0 | 3 | 46 | 245 |
| 12:45 PM | 23 | 80 | 6 | 1 | 4 | 110 | 15 | 67 | 13 | 0 | 1 | 95 | 10 | 16 | 26 | 0 | 0 | 52 | 9 | 12 | 20 | 0 | 0 | 41 | 298 |
| Hourly Total | 75 | 284 | 26 | 1 | 7 | 386 | 44 | 265 | 28 | 0 | 3 | 337 | 21 | 38 | 67 | 0 | 2 | 126 | 30 | 30 | 110 | 0 | 7 | 170 | 1019 |
| 1:00 PM | 22 | 67 | 6 | 0 | 0 | 95 | 12 | 72 | 3 | 0 | 1 | 87 | 5 | 9 | 18 | 0 | 0 | 32 | 4 | 7 | 22 | 0 | 0 | 33 | 247 |
| 1:15 PM | 21 | 64 | 6 | 0 | 0 | 91 | 11 | 53 | 5 | 0 | 0 | 69 | 6 | 5 | 11 | 0 | 0 | 22 | 8 | 4 | 26 | 0 | 2 | 38 | 220 |
| 1:30 PM | 23 | 74 | 6 | 0 | 0 | 103 | 11 | 72 | 12 | 0 | 1 | 95 | 8 | 5 | 12 | 0 | 0 | 25 | 5 | 8 | 20 | 0 | 2 | 33 | 256 |
| 1:45 PM | 24 | 67 | 6 | 0 | 2 | 97 | 11 | 63 | 10 | 0 | 2 | 84 | 2 | 7 | 14 | 0 | 1 | 23 | 18 | 5 | 30 | 0 | 3 | 53 | 257 |
| Hourly Total | 90 | 272 | 24 | 0 | 2 | 386 | 45 | 260 | 30 | 0 | 4 | 335 | 21 | 26 | 55 | 0 | 1 | 102 | 35 | 24 | 98 | 0 | 7 | 157 | 980 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 19 | 72 | 9 | 0 | 1 | 100 | 8 | 95 | 12 | 0 | 0 | 115 | 12 | 10 | 14 | 0 | 4 | 36 | 10 | 12 | 33 | 0 | 0 | 55 | 306 |
| 3:15 PM | 32 | 88 | 9 | 0 | 0 | 129 | 15 | 113 | 9 | 0 | 0 | 137 | 14 | 8 | 7 | 0 | 1 | 29 | 12 | 8 | 47 | 0 | 2 | 67 | 362 |
| 3:30 PM | 27 | 85 | 14 | 0 | 0 | 126 | 18 | 118 | 4 | 0 | 2 | 140 | 8 | 13 | 10 | 0 | 1 | 31 | 23 | 9 | 39 | 0 | 4 | 71 | 368 |
| 3:45 PM | 39 | 92 | 17 | 0 | 0 | 148 | 19 | 130 | 5 | 0 | 0 | 154 | 23 | 7 | 11 | 0 | 0 | 41 | 4 | 6 | 46 | 0 | 2 | 56 | 399 |
| Hourly Total | 117 | 337 | 49 | 0 | 1 | 503 | 60 | 456 | 30 | 0 | 2 | 546 | 57 | 38 | 42 | 0 | 6 | 137 | 49 | 35 | 165 | 0 | 8 | 249 | 1435 |
| 4:00 PM | 22 | 87 | 18 | 0 | 0 | 127 | 15 | 150 | 5 | 0 | 3 | 170 | 6 | 8 | 12 | 0 | 0 | 26 | 8 | 13 | 61 | 0 | 3 | 82 | 405 |
| 4:15 PM | 40 | 111 | 12 | 0 | 1 | 163 | 29 | 137 | 5 | 0 | 4 | 171 | 11 | 7 | 25 | 0 | 0 | 43 | 7 | 13 | 34 | 0 | 3 | 54 | 431 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 PM | 30 | 100 | 16 | 0 | 2 | 146 | 20 | 136 | 8 | 0 | 0 | 164 | 9 | 18 | 11 | 0 | 0 | 38 | 14 | 17 | 72 | 0 | 4 | 103 | 451 |
| 4:45 PM | 28 | 102 | 13 | 0 | 0 | 143 | 23 | 127 | 7 | 0 | 1 | 157 | 11 | 13 | 18 | 0 | 0 | 42 | 6 | 13 | 42 | 0 | 1 | 61 | 403 |
| Hourly Total | 120 | 400 | 59 | 0 | 3 | 579 | 87 | 550 | 25 | 0 | 8 | 662 | 37 | 46 | 66 | 0 | 0 | 149 | 35 | 56 | 209 | 0 | 11 | 300 | 1690 |
| 5:00 PM | 22 | 98 | 14 | 0 | 0 | 134 | 22 | 168 | 8 | 0 | 2 | 198 | 9 | 8 | 24 | 0 | 0 | 41 | 10 | 17 | 56 | 0 | 1 | 83 | 456 |
| 5:15 PM | 33 | 90 | 9 | 0 | 3 | 132 | 24 | 178 | 2 | 0 | 1 | 204 | 15 | 15 | 24 | 0 | 0 | 54 | 6 | 18 | 37 | 0 | 1 | 61 | 451 |
| 5:30 PM | 27 | 98 | 18 | 0 | 1 | 143 | 25 | 134 | 6 | 0 | 1 | 165 | 8 | 12 | 24 | 0 | 0 | 44 | 6 | 13 | 40 | 0 | 0 | 59 | 411 |
| 5:45 PM | 23 | 103 | 13 | 0 | 0 | 139 | 22 | 132 | 8 | 0 | 0 | 162 | 11 | 10 | 18 | 0 | 0 | 39 | 10 | 16 | 31 | 1 | 1 | 58 | 398 |
| Hourly Total | 105 | 389 | 54 | 0 | 4 | 548 | 93 | 612 | 24 | 0 | 4 | 729 | 43 | 45 | 90 | 0 | 0 | 178 | 32 | 64 | 164 | 1 | 3 | 261 | 1716 |
| Grand Total | 866 | 2807 | 294 | 2 | 20 | 3969 | 416 | 2747 | 244 | 3 | 27 | 3410 | 286 | 334 | 502 | 0 | 15 | 1122 | 253 | 271 | 943 | 1 | 45 | 1468 | 9969 |
| Approach % | 21.8 | 70.7 | 7.4 | 0.1 | - | - | 12.2 | 80.6 | 7.2 | 0.1 | - | - | 25.5 | 29.8 | 44.7 | 0.0 | - | - | 17.2 | 18.5 | 64.2 | 0.1 | - | - | - |
| Total % | 8.7 | 28.2 | 2.9 | 0.0 | - | 39.8 | 4.2 | 27.6 | 2.4 | 0.0 | - | 34.2 | 2.9 | 3.4 | 5.0 | 0.0 | - | 11.3 | 2.5 | 2.7 | 9.5 | 0.0 | - | 14.7 | - |
| Motorcycles | 0 | 4 | 0 | 0 | - | 4 | 0 | 3 | 1 | 0 | - | 4 | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 9 |
| % Motorcycles | 0.0 | 0.1 | 0.0 | 0.0 | - | 0.1 | 0.0 | 0.1 | 0.4 | 0.0 | - | 0.1 | 0.0 | 0.0 | 0.2 | - | - | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.1 |
| Cars & Light Goods | 799 | 2674 | 279 | 0 | - | 3752 | 409 | 2617 | 157 | 1 | - | 3184 | 271 | 318 | 489 | 0 | - | 1078 | 193 | 259 | 879 | 0 | - | 1331 | 9345 |
| % Cars & Light Goods | 92.3 | 95.3 | 94.9 | 0.0 | - | 94.5 | 98.3 | 95.3 | 64.3 | 33.3 | - | 93.4 | 94.8 | 95.2 | 97.4 | - | - | 96.1 | 76.3 | 95.6 | 93.2 | 0.0 | - | 90.7 | 93.7 |
| Buses | 36 | 23 | 11 | 0 | - | 70 | 4 | 29 | 36 | 0 | - | 69 | 6 | 9 | 8 | 0 | - | 23 | 29 | 10 | 28 | 1 | - | 68 | 230 |
| % Buses | 4.2 | 0.8 | 3.7 | 0.0 | - | 1.8 | 1.0 | 1.1 | 14.8 | 0.0 | - | 2.0 | 2.1 | 2.7 | 1.6 | - | - | 2.0 | 11.5 | 3.7 | 3.0 | 100.0 | - | 4.6 | 2.3 |
| Single-Unit Trucks | 28 | 101 | 3 | 2 | - | 134 | 2 | 91 | 19 | 2 | - | 114 | 7 | 6 | 3 | 0 | - | 16 | 20 | 1 | 25 | 0 | - | 46 | 310 |
| % Single-Unit Trucks | 3.2 | 3.6 | 1.0 | 100.0 | - | 3.4 | 0.5 | 3.3 | 7.8 | 66.7 | - | 3.3 | 2.4 | 1.8 | 0.6 | - | - | 1.4 | 7.9 | 0.4 | 2.7 | 0.0 | - | 3.1 | 3.1 |
| Articulated Trucks | 3 | 5 | 1 | 0 | - | 9 | 1 | 7 | 31 | 0 | - | 39 | 2 | 1 | 1 | 0 | - | 4 | 11 | 1 | 9 | 0 | - | 21 | 73 |
| % Articulated Trucks | 0.3 | 0.2 | 0.3 | 0.0 | - | 0.2 | 0.2 | 0.3 | 12.7 | 0.0 | - | 1.1 | 0.7 | 0.3 | 0.2 | - | - | 0.4 | 4.3 | 0.4 | 1.0 | 0.0 | - | 1.4 | 0.7 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 2 | 0 | - | 2 | 2 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | - | 0.1 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 6 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 3 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 30.0 | - | - | - | - | - | 3.7 | - | - | - | - | - | 6.7 | - | - | - | - | - | 6.7 | - | - |
| Pedestrians | - | - | - | - | 14 | - | - | - | - | - | 26 | - | - | - | - | - | 14 | - | - | - | - | - | 42 | - | - |
| % Pedestrians | - | - | - | - | 70.0 | - | - | - | - | - | 96.3 | - | - | - | - | - | 93.3 | - | - | - | - | - | 93.3 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022


Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022


# Approach Data

| Start Time | Eb Street Eastbound | | | | | | Wb Street Westbound | | | | | | Nb Street Northbound | | | | | | Sb Street Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Peds CCW | Peds CW | Circulating | Out | In | Next | Peds CCW | Peds CW | Circulating | Out | In | Next | Peds CCW | Peds CW | Circulating | Out | In | Next | Peds CCW | Peds CW | Circulating | Out | In | Next |
| 7:30 AM | 0 | 0 | 9 | 65 | 179 | 119 | 0 | 1 | 72 | 150 | 71 | 26 | 0 | 0 | 174 | 15 | 47 | 11 | 0 | 0 | 57 | 90 | 17 | 1 |
| 7:45 AM | 0 | 0 | 25 | 67 | 190 | 121 | 0 | 1 | 90 | 155 | 76 | 22 | 0 | 0 | 199 | 17 | 45 | 9 | 0 | 1 | 63 | 104 | 30 | 5 |
| Hourly Total | 0 | 0 | 34 | 132 | 369 | 240 | 0 | 2 | 162 | 305 | 147 | 48 | 0 | 0 | 373 | 32 | 92 | 20 | 0 | 1 | 120 | 194 | 47 | 6 |
| 8:00 AM | 0 | 0 | 18 | 89 | 145 | 97 | 0 | 0 | 65 | 127 | 71 | 9 | 0 | 0 | 147 | 15 | 48 | 14 | 2 | 1 | 78 | 62 | 30 | 6 |
| 8:15 AM | 0 | 0 | 15 | 96 | 177 | 136 | 0 | 1 | 60 | 158 | 73 | 6 | 0 | 0 | 172 | 22 | 44 | 13 | 0 | 0 | 80 | 52 | 31 | 5 |
| 8:30 AM | 0 | 1 | 12 | 83 | 171 | 136 | 0 | 1 | 52 | 161 | 69 | 5 | 0 | 0 | 169 | 17 | 45 | 7 | 0 | 1 | 71 | 50 | 24 | 3 |
| 8:45 AM | 0 | 2 | 19 | 67 | 167 | 121 | 0 | 1 | 57 | 131 | 62 | 7 | 0 | 0 | 158 | 29 | 29 | 6 | 1 | 1 | 61 | 57 | 25 | 5 |
| Hourly Total | 0 | 3 | 64 | 335 | 660 | 490 | 0 | 3 | 234 | 577 | 275 | 27 | 0 | 0 | 646 | 83 | 166 | 40 | 3 | 3 | 290 | 221 | 110 | 19 |
| 9:00 AM | 0 | 0 | 26 | 76 | 102 | 73 | 0 | 1 | 40 | 98 | 63 | 2 | 1 | 0 | 108 | 19 | 30 | 9 | 0 | 1 | 70 | 33 | 32 | 7 |
| 9:15 AM | 0 | 0 | 15 | 97 | 95 | 76 | 0 | 0 | 35 | 89 | 65 | 5 | 1 | 1 | 92 | 21 | 31 | 14 | 0 | 0 | 74 | 26 | 38 | 6 |
| 9:30 AM | 0 | 0 | 16 | 72 | 87 | 69 | 0 | 0 | 35 | 86 | 59 | 4 | 0 | 1 | 88 | 17 | 33 | 6 | 0 | 0 | 61 | 35 | 26 | 5 |
| 9:45 AM | 0 | 0 | 23 | 51 | 92 | 66 | 0 | 0 | 33 | 81 | 55 | 8 | 1 | 0 | 93 | 24 | 22 | 5 | 0 | 0 | 53 | 35 | 24 | 8 |
| Hourly Total | 0 | 0 | 80 | 296 | 376 | 284 | 0 | 1 | 143 | 354 | 242 | 19 | 3 | 2 | 381 | 81 | 116 | 34 | 0 | 1 | 258 | 129 | 120 | 26 |
| 10:00 AM | 0 | 0 | 19 | 78 | 81 | 63 | 0 | 0 | 25 | 78 | 71 | 5 | 0 | 1 | 83 | 19 | 21 | 6 | 0 | 1 | 73 | 23 | 27 | 3 |
| 10:15 AM | 0 | 0 | 18 | 72 | 78 | 48 | 0 | 0 | 42 | 69 | 69 | 8 | 0 | 0 | 78 | 20 | 34 | 7 | 0 | 0 | 68 | 43 | 24 | 8 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 0 | 0 | 37 | 150 | 159 | 111 | 0 | 0 | 67 | 147 | 140 | 13 | 0 | 1 | 161 | 39 | 55 | 13 | 0 | 1 | 141 | 66 | 51 | 11 |
| 12:00 PM | 0 | 0 | 26 | 109 | 83 | 58 | 0 | 0 | 28 | 84 | 88 | 1 | 0 | 0 | 86 | 24 | 26 | 5 | 0 | 0 | 92 | 25 | 43 | 7 |
| 12:15 PM | 0 | 0 | 22 | 89 | 90 | 65 | 0 | 1 | 31 | 85 | 77 | 10 | 1 | 0 | 90 | 25 | 26 | 5 | 3 | 1 | 72 | 38 | 39 | 6 |
| 12:30 PM | 0 | 3 | 16 | 102 | 103 | 81 | 1 | 0 | 23 | 99 | 76 | 4 | 0 | 1 | 103 | 20 | 19 | 1 | 3 | 0 | 74 | 28 | 45 | 5 |
| 12:45 PM | 2 | 2 | 37 | 98 | 109 | 80 | 0 | 1 | 45 | 116 | 94 | 13 | 0 | 0 | 112 | 34 | 49 | 10 | 0 | 0 | 93 | 54 | 41 | 12 |
| Hourly Total | 2 | 5 | 101 | 398 | 385 | 284 | 1 | 2 | 127 | 384 | 335 | 28 | 1 | 1 | 391 | 103 | 120 | 21 | 6 | 1 | 331 | 145 | 168 | 30 |
| 1:00 PM | 0 | 0 | 21 | 100 | 94 | 67 | 1 | 0 | 33 | 90 | 87 | 3 | 0 | 0 | 93 | 26 | 30 | 5 | 0 | 0 | 90 | 36 | 32 | 7 |
| 1:15 PM | 0 | 0 | 23 | 87 | 90 | 64 | 0 | 0 | 27 | 84 | 68 | 5 | 0 | 0 | 93 | 23 | 19 | 6 | 0 | 2 | 69 | 33 | 37 | 4 |
| 1:30 PM | 0 | 0 | 23 | 101 | 103 | 74 | 0 | 1 | 36 | 92 | 94 | 12 | 0 | 0 | 102 | 26 | 24 | 8 | 0 | 2 | 90 | 42 | 32 | 8 |
| 1:45 PM | 1 | 1 | 32 | 95 | 96 | 67 | 1 | 1 | 30 | 99 | 83 | 10 | 1 | 0 | 108 | 23 | 21 | 2 | 1 | 2 | 76 | 42 | 52 | 5 |
| Hourly Total | 1 | 1 | 99 | 383 | 383 | 272 | 2 | 2 | 126 | 365 | 332 | 30 | 1 | 0 | 396 | 98 | 94 | 21 | 1 | 6 | 325 | 153 | 153 | 24 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 0 | 1 | 30 | 141 | 100 | 72 | 0 | 0 | 39 | 96 | 114 | 12 | 4 | 0 | 103 | 30 | 35 | 12 | 0 | 0 | 114 | 41 | 55 | 12 |
| 3:15 PM | 0 | 0 | 33 | 175 | 128 | 88 | 0 | 0 | 55 | 108 | 138 | 9 | 0 | 1 | 132 | 34 | 29 | 14 | 2 | 0 | 143 | 50 | 66 | 8 |
| 3:30 PM | 0 | 0 | 49 | 166 | 125 | 85 | 1 | 1 | 47 | 117 | 139 | 4 | 1 | 0 | 134 | 43 | 31 | 8 | 1 | 3 | 143 | 45 | 70 | 9 |
| 3:45 PM | 0 | 0 | 29 | 200 | 147 | 92 | 0 | 0 | 68 | 107 | 153 | 5 | 0 | 0 | 135 | 43 | 40 | 23 | 2 | 0 | 170 | 51 | 56 | 6 |
| Hourly Total | 0 | 1 | 141 | 682 | 500 | 337 | 1 | 1 | 209 | 428 | 544 | 30 | 5 | 1 | 504 | 150 | 135 | 57 | 5 | 3 | 570 | 187 | 247 | 35 |
| 4:00 PM | 0 | 0 | 35 | 218 | 127 | 87 | 0 | 3 | 35 | 108 | 169 | 5 | 0 | 0 | 118 | 48 | 25 | 6 | 0 | 3 | 170 | 36 | 81 | 13 |
| 4:15 PM | 1 | 0 | 48 | 184 | 162 | 111 | 1 | 3 | 56 | 143 | 171 | 5 | 0 | 0 | 157 | 54 | 42 | 11 | 3 | 0 | 179 | 52 | 53 | 13 |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 PM | 1 | 1 | 49 | 216 | 146 | 100 | 0 | 0 | 56 | 125 | 165 | 8 | 0 | 0 | 144 | 54 | 37 | 9 | 1 | 3 | 167 | 57 | 102 | 17 |
| 4:45 PM | 0 | 0 | 41 | 181 | 142 | 102 | 0 | 1 | 50 | 127 | 156 | 7 | 0 | 0 | 136 | 51 | 41 | 11 | 1 | 0 | 161 | 50 | 60 | 13 |
| Hourly Total | 2 | 1 | 173 | 799 | 577 | 400 | 1 | 7 | 197 | 503 | 661 | 25 | 0 | 0 | 555 | 207 | 145 | 37 | 5 | 6 | 677 | 195 | 296 | 56 |
| 5:00 PM | 0 | 0 | 47 | 233 | 134 | 98 | 1 | 1 | 37 | 133 | 197 | 8 | 0 | 0 | 131 | 54 | 40 | 9 | 0 | 1 | 199 | 40 | 82 | 17 |
| 5:15 PM | 2 | 1 | 46 | 230 | 132 | 90 | 1 | 0 | 60 | 121 | 204 | 2 | 0 | 0 | 129 | 52 | 52 | 15 | 1 | 0 | 220 | 53 | 60 | 18 |
| 5:30 PM | 0 | 1 | 42 | 183 | 142 | 98 | 1 | 0 | 47 | 128 | 165 | 6 | 0 | 0 | 130 | 56 | 44 | 8 | 0 | 0 | 168 | 46 | 58 | 13 |
| 5:45 PM | 0 | 0 | 47 | 174 | 139 | 103 | 0 | 0 | 44 | 133 | 162 | 8 | 0 | 0 | 137 | 52 | 38 | 11 | 1 | 0 | 166 | 44 | 57 | 16 |
| Hourly Total | 2 | 2 | 182 | 820 | 547 | 389 | 3 | 1 | 188 | 515 | 728 | 24 | 0 | 0 | 527 | 214 | 174 | 43 | 2 | 1 | 753 | 183 | 257 | 64 |
| Grand Total | 7 | 13 | 911 | 3995 | 3956 | 2807 | 8 | 19 | 1453 | 3578 | 3404 | 244 | 10 | 5 | 3934 | 1007 | 1097 | 286 | 22 | 23 | 3465 | 1473 | 1449 | 271 |
| Approach % | - | - | 7.8 | 34.2 | 33.9 | 24.1 | - | - | 16.7 | 41.2 | 39.2 | 2.8 | - | - | 62.2 | 15.9 | 17.3 | 4.5 | - | - | 52.0 | 22.1 | 21.8 | 4.1 |
| Total % | - | - | 2.7 | 12.0 | 11.9 | 8.4 | - | - | 4.4 | 10.7 | 10.2 | 0.7 | - | - | 11.8 | 3.0 | 3.3 | 0.9 | - | - | 10.4 | 4.4 | 4.3 | 0.8 |
| Motorcycles | - | - | 0 | 4 | 5 | 4 | - | - | 1 | 6 | 4 | 1 | - | - | 5 | 0 | 1 | 0 | - | - | 3 | 1 | 0 | 0 |
| % Motorcycles | - | - | 0.0 | 0.1 | 0.1 | 0.1 | - | - | 0.1 | 0.2 | 0.1 | 0.4 | - | - | 0.1 | 0.0 | 0.1 | 0.0 | - | - | 0.1 | 0.1 | 0.0 | 0.0 |
| Cars & Light Goods | - | - | 829 | 3775 | 3738 | 2674 | - | - | 1352 | 3368 | 3175 | 157 | - | - | 3666 | 971 | 1054 | 271 | - | - | 3306 | 1298 | 1311 | 259 |
| % Cars & Light Goods | - | - | 91.0 | 94.5 | 94.5 | 95.3 | - | - | 93.0 | 94.1 | 93.3 | 64.3 | - | - | 93.2 | 96.4 | 96.1 | 94.8 | - | - | 95.4 | 88.1 | 90.5 | 95.6 |
| Buses | - | - | 45 | 64 | 68 | 23 | - | - | 52 | 60 | 70 | 36 | - | - | 88 | 25 | 23 | 6 | - | - | 41 | 82 | 69 | 10 |
| % Buses | - | - | 4.9 | 1.6 | 1.7 | 0.8 | - | - | 3.6 | 1.7 | 2.1 | 14.8 | - | - | 2.2 | 2.5 | 2.1 | 2.1 | - | - | 1.2 | 5.6 | 4.8 | 3.7 |
| Single-Unit Trucks | - | - | 23 | 129 | 135 | 101 | - | - | 41 | 126 | 116 | 19 | - | - | 155 | 7 | 15 | 7 | - | - | 105 | 55 | 45 | 1 |
| % Single-Unit Trucks | - | - | 2.5 | 3.2 | 3.4 | 3.6 | - | - | 2.8 | 3.5 | 3.4 | 7.8 | - | - | 3.9 | 0.7 | 1.4 | 2.4 | - | - | 3.0 | 3.7 | 3.1 | 0.4 |
| Articulated Trucks | - | - | 14 | 21 | 10 | 5 | - | - | 7 | 18 | 39 | 31 | - | - | 20 | 3 | 4 | 2 | - | - | 10 | 36 | 22 | 1 |
| % Articulated Trucks | - | - | 1.5 | 0.5 | 0.3 | 0.2 | - | - | 0.5 | 0.5 | 1.1 | 12.7 | - | - | 0.5 | 0.3 | 0.4 | 0.7 | - | - | 0.3 | 2.4 | 1.5 | 0.4 |
| Bicycles on Road | - | - | 0 | 2 | 0 | 0 | - | - | 0 | 0 | 0 | 0 | - | - | 0 | 1 | 0 | 0 | - | - | 0 | 1 | 2 | 0 |
| % Bicycles on Road | - | - | 0.0 | 0.1 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.1 | 0.0 | 0.0 | - | - | 0.0 | 0.1 | 0.1 | 0.0 |
| Bicycles on Crosswalk | 3 | 3 | - | - | - | - | 0 | 1 | - | - | - | - | 0 | 1 | - | - | - | - | 2 | 1 | - | - | - | - |
| % Bicycles on Crosswalk | 42.9 | 23.1 | - | - | - | - | 0.0 | 5.3 | - | - | - | - | 0.0 | 20.0 | - | - | - | - | 9.1 | 4.3 | - | - | - | - |
| Pedestrians | 4 | 10 | - | - | - | - | 8 | 18 | - | - | - | - | 10 | 4 | - | - | - | - | 20 | 22 | - | - | - | - |
| % Pedestrians | 57.1 | 76.9 | - | - | - | - | 100.0 | 94.7 | - | - | - | - | 100.0 | 80.0 | - | - | - | - | 90.9 | 95.7 | - | - | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022

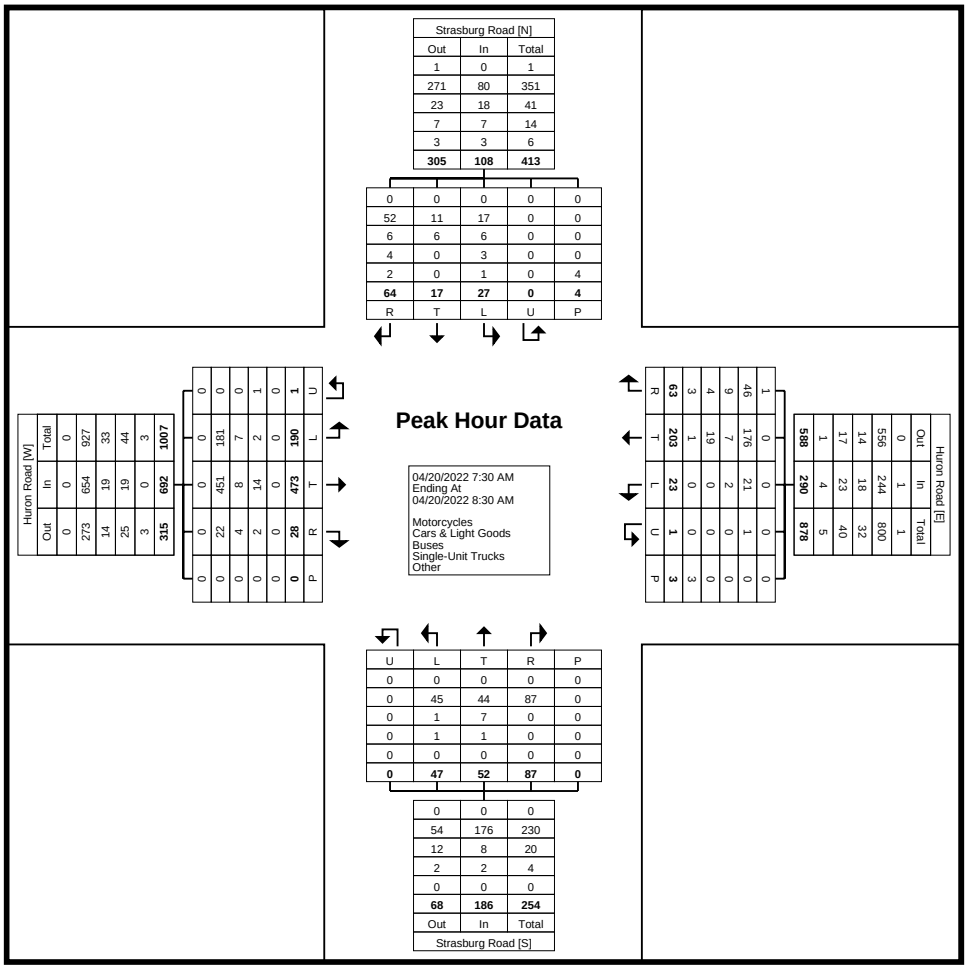

# Turning Movement Peak Hour Data (7:30 AM)

| Start Time | Huron Road Eastbound | | | | | | Huron Road Westbound | | | | | | Strasburg Road Northbound | | | | | | Strasburg Road Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 7:30 AM | 51 | 119 | 8 | 0 | 0 | 178 | 5 | 40 | 26 | 0 | 1 | 71 | 11 | 11 | 26 | 0 | 0 | 48 | 3 | 1 | 13 | 0 | 0 | 17 | 314 |
| 7:45 AM | 65 | 121 | 5 | 0 | 0 | 191 | 7 | 45 | 22 | 1 | 1 | 75 | 9 | 17 | 20 | 0 | 0 | 46 | 13 | 5 | 13 | 0 | 1 | 31 | 343 |
| 8:00 AM | 42 | 97 | 5 | 1 | 0 | 145 | 4 | 58 | 9 | 0 | 0 | 71 | 14 | 11 | 24 | 0 | 0 | 49 | 6 | 6 | 16 | 0 | 3 | 28 | 293 |
| 8:15 AM | 32 | 136 | 10 | 0 | 0 | 178 | 7 | 60 | 6 | 0 | 1 | 73 | 13 | 13 | 17 | 0 | 0 | 43 | 5 | 5 | 22 | 0 | 0 | 32 | 326 |
| Total | 190 | 473 | 28 | 1 | 0 | 692 | 23 | 203 | 63 | 1 | 3 | 290 | 47 | 52 | 87 | 0 | 0 | 186 | 27 | 17 | 64 | 0 | 4 | 108 | 1276 |
| Approach % | 27.5 | 68.4 | 4.0 | 0.1 | - | - | 7.9 | 70.0 | 21.7 | 0.3 | - | - | 25.3 | 28.0 | 46.8 | 0.0 | - | - | 25.0 | 15.7 | 59.3 | 0.0 | - | - | - |
| Total % | 14.9 | 37.1 | 2.2 | 0.1 | - | 54.2 | 1.8 | 15.9 | 4.9 | 0.1 | - | 22.7 | 3.7 | 4.1 | 6.8 | 0.0 | - | 14.6 | 2.1 | 1.3 | 5.0 | 0.0 | - | 8.5 | - |
| PHF | 0.731 | 0.869 | 0.700 | 0.250 | - | 0.906 | 0.821 | 0.846 | 0.606 | 0.250 | - | 0.967 | 0.839 | 0.765 | 0.837 | 0.000 | - | 0.949 | 0.519 | 0.708 | 0.727 | 0.000 | - | 0.844 | 0.930 |
| Motorcycles | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Motorcycles | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 1.6 | 0.0 | - | 0.3 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.1 |
| Cars & Light Goods | 181 | 451 | 22 | 0 | - | 654 | 21 | 176 | 46 | 1 | - | 244 | 45 | 44 | 87 | 0 | - | 176 | 17 | 11 | 52 | 0 | - | 80 | 1154 |
| % Cars & Light Goods | 95.3 | 95.3 | 78.6 | 0.0 | - | 94.5 | 91.3 | 86.7 | 73.0 | 100.0 | - | 84.1 | 95.7 | 84.6 | 100.0 | - | - | 94.6 | 63.0 | 64.7 | 81.3 | - | - | 74.1 | 90.4 |
| Buses | 7 | 8 | 4 | 0 | - | 19 | 2 | 7 | 9 | 0 | - | 18 | 1 | 7 | 0 | 0 | - | 8 | 6 | 6 | 6 | 0 | - | 18 | 63 |
| % Buses | 3.7 | 1.7 | 14.3 | 0.0 | - | 2.7 | 8.7 | 3.4 | 14.3 | 0.0 | - | 6.2 | 2.1 | 13.5 | 0.0 | - | - | 4.3 | 22.2 | 35.3 | 9.4 | - | - | 16.7 | 4.9 |
| Single-Unit Trucks | 2 | 14 | 2 | 1 | - | 19 | 0 | 19 | 4 | 0 | - | 23 | 1 | 1 | 0 | 0 | - | 2 | 3 | 0 | 4 | 0 | - | 7 | 51 |
| % Single-Unit Trucks | 1.1 | 3.0 | 7.1 | 100.0 | - | 2.7 | 0.0 | 9.4 | 6.3 | 0.0 | - | 7.9 | 2.1 | 1.9 | 0.0 | - | - | 1.1 | 11.1 | 0.0 | 6.3 | - | - | 6.5 | 4.0 |
| Articulated Trucks | 0 | 0 | 0 | 0 | - | 0 | 0 | 1 | 3 | 0 | - | 4 | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 2 | 0 | - | 3 | 7 |
| % Articulated Trucks | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.5 | 4.8 | 0.0 | - | 1.4 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 3.7 | 0.0 | 3.1 | - | - | 2.8 | 0.5 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | 33.3 | - | - | - | - | - | - | - | - | - | - | - | 25.0 | - | - |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 2 | - | - | - | - | - | 0 | - | - | - | - | - | 3 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | 66.7 | - | - | - | - | - | - | - | - | - | - | - | 75.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022


Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022

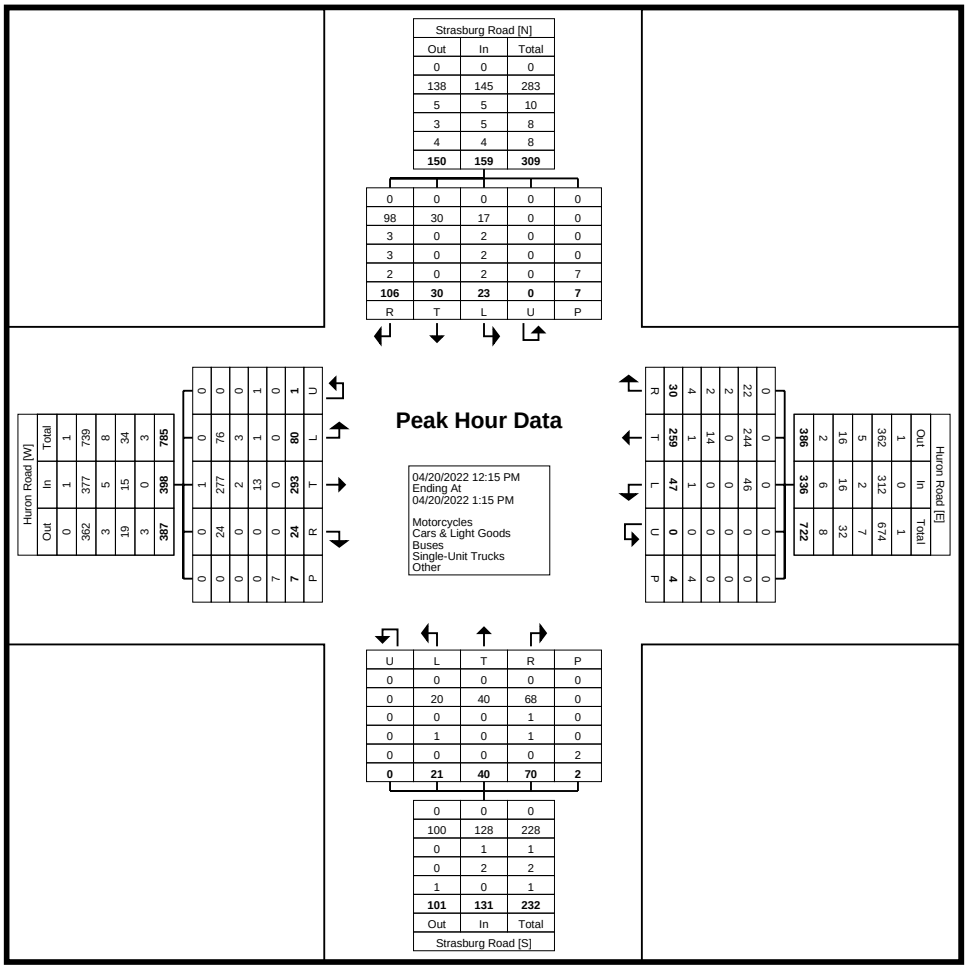

# Turning Movement Peak Hour Data (12:15 PM)

| Start Time | Huron Road Eastbound | | | | | | Huron Road Westbound | | | | | | Strasburg Road Northbound | | | | | | Strasburg Road Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 12:15 PM | 19 | 65 | 6 | 0 | 0 | 90 | 12 | 56 | 10 | 0 | 1 | 78 | 5 | 8 | 14 | 0 | 1 | 27 | 5 | 6 | 28 | 0 | 4 | 39 | 234 |
| 12:30 PM | 16 | 81 | 6 | 0 | 3 | 103 | 8 | 64 | 4 | 0 | 1 | 76 | 1 | 7 | 12 | 0 | 1 | 20 | 5 | 5 | 36 | 0 | 3 | 46 | 245 |
| 12:45 PM | 23 | 80 | 6 | 1 | 4 | 110 | 15 | 67 | 13 | 0 | 1 | 95 | 10 | 16 | 26 | 0 | 0 | 52 | 9 | 12 | 20 | 0 | 0 | 41 | 298 |
| 1:00 PM | 22 | 67 | 6 | 0 | 0 | 95 | 12 | 72 | 3 | 0 | 1 | 87 | 5 | 9 | 18 | 0 | 0 | 32 | 4 | 7 | 22 | 0 | 0 | 33 | 247 |
| Total | 80 | 293 | 24 | 1 | 7 | 398 | 47 | 259 | 30 | 0 | 4 | 336 | 21 | 40 | 70 | 0 | 2 | 131 | 23 | 30 | 106 | 0 | 7 | 159 | 1024 |
| Approach % | 20.1 | 73.6 | 6.0 | 0.3 | - | - | 14.0 | 77.1 | 8.9 | 0.0 | - | - | 16.0 | 30.5 | 53.4 | 0.0 | - | - | 14.5 | 18.9 | 66.7 | 0.0 | - | - | - |
| Total % | 7.8 | 28.6 | 2.3 | 0.1 | - | 38.9 | 4.6 | 25.3 | 2.9 | 0.0 | - | 32.8 | 2.1 | 3.9 | 6.8 | 0.0 | - | 12.8 | 2.2 | 2.9 | 10.4 | 0.0 | - | 15.5 | - |
| PHF | 0.870 | 0.904 | 1.000 | 0.250 | - | 0.905 | 0.783 | 0.899 | 0.577 | 0.000 | - | 0.884 | 0.525 | 0.625 | 0.673 | 0.000 | - | 0.630 | 0.639 | 0.625 | 0.736 | 0.000 | - | 0.864 | 0.859 |
| Motorcycles | 0 | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Motorcycles | 0.0 | 0.3 | 0.0 | 0.0 | - | 0.3 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.1 |
| Cars & Light Goods | 76 | 277 | 24 | 0 | - | 377 | 46 | 244 | 22 | 0 | - | 312 | 20 | 40 | 68 | 0 | - | 128 | 17 | 30 | 98 | 0 | - | 145 | 962 |
| % Cars & Light Goods | 95.0 | 94.5 | 100.0 | 0.0 | - | 94.7 | 97.9 | 94.2 | 73.3 | - | - | 92.9 | 95.2 | 100.0 | 97.1 | - | - | 97.7 | 73.9 | 100.0 | 92.5 | - | - | 91.2 | 93.9 |
| Buses | 3 | 2 | 0 | 0 | - | 5 | 0 | 0 | 2 | 0 | - | 2 | 0 | 0 | 1 | 0 | - | 1 | 2 | 0 | 3 | 0 | - | 5 | 13 |
| % Buses | 3.8 | 0.7 | 0.0 | 0.0 | - | 1.3 | 0.0 | 0.0 | 6.7 | - | - | 0.6 | 0.0 | 0.0 | 1.4 | - | - | 0.8 | 8.7 | 0.0 | 2.8 | - | - | 3.1 | 1.3 |
| Single-Unit Trucks | 1 | 13 | 0 | 1 | - | 15 | 0 | 14 | 2 | 0 | - | 16 | 1 | 0 | 1 | 0 | - | 2 | 2 | 0 | 3 | 0 | - | 5 | 38 |
| % Single-Unit Trucks | 1.3 | 4.4 | 0.0 | 100.0 | - | 3.8 | 0.0 | 5.4 | 6.7 | - | - | 4.8 | 4.8 | 0.0 | 1.4 | - | - | 1.5 | 8.7 | 0.0 | 2.8 | - | - | 3.1 | 3.7 |
| Articulated Trucks | 0 | 0 | 0 | 0 | - | 0 | 1 | 1 | 4 | 0 | - | 6 | 0 | 0 | 0 | 0 | - | 0 | 2 | 0 | 2 | 0 | - | 4 | 10 |
| % Articulated Trucks | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 2.1 | 0.4 | 13.3 | - | - | 1.8 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 8.7 | 0.0 | 1.9 | - | - | 2.5 | 1.0 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 2 | - | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 28.6 | - | - | - | - | - | 0.0 | - | - | - | - | - | 50.0 | - | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | - | 5 | - | - | - | - | - | 4 | - | - | - | - | - | 1 | - | - | - | - | - | 7 | - | - |
| % Pedestrians | - | - | - | - | 71.4 | - | - | - | - | - | 100.0 | - | - | - | - | - | 50.0 | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022


Turning Movement Peak Hour Data Plot (12:15 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022

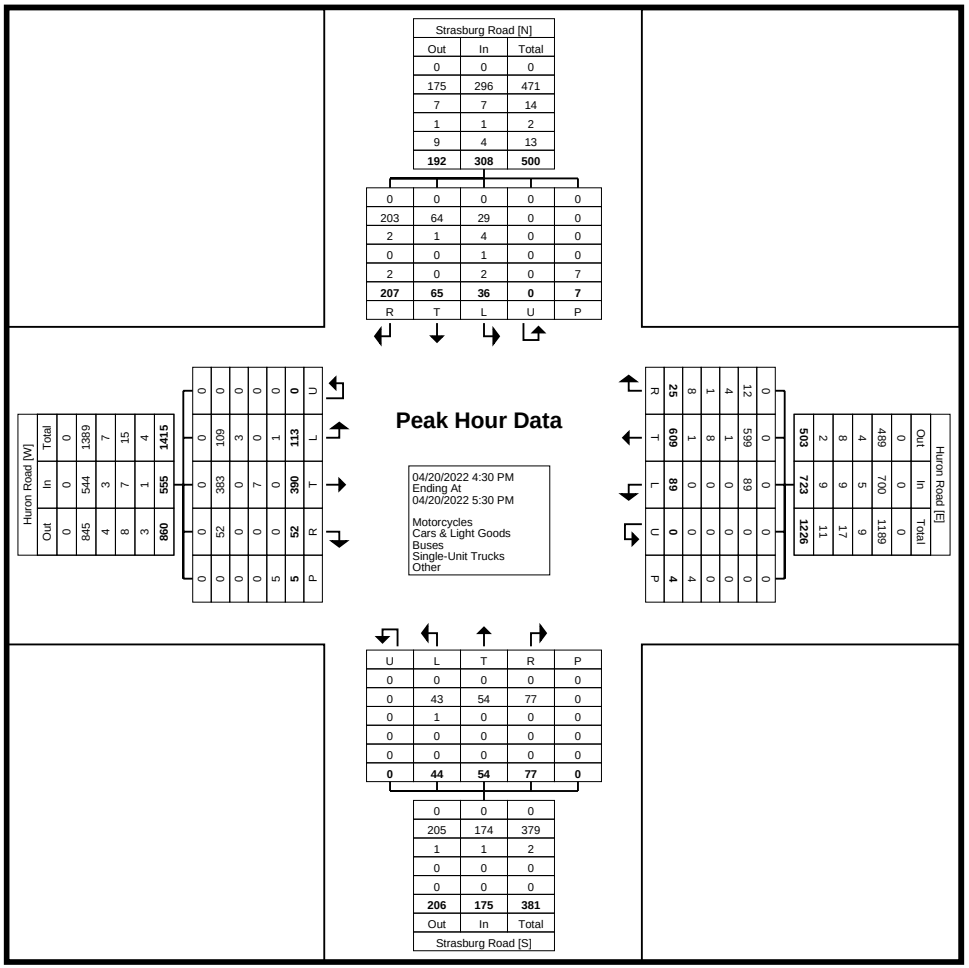

# Turning Movement Peak Hour Data (4:30 PM)

| Start Time | Huron Road Eastbound | | | | | | Huron Road Westbound | | | | | | Strasburg Road Northbound | | | | | | Strasburg Road Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 4:30 PM | 30 | 100 | 16 | 0 | 2 | 146 | 20 | 136 | 8 | 0 | 0 | 164 | 9 | 18 | 11 | 0 | 0 | 38 | 14 | 17 | 72 | 0 | 4 | 103 | 451 |
| 4:45 PM | 28 | 102 | 13 | 0 | 0 | 143 | 23 | 127 | 7 | 0 | 1 | 157 | 11 | 13 | 18 | 0 | 0 | 42 | 6 | 13 | 42 | 0 | 1 | 61 | 403 |
| 5:00 PM | 22 | 98 | 14 | 0 | 0 | 134 | 22 | 168 | 8 | 0 | 2 | 198 | 9 | 8 | 24 | 0 | 0 | 41 | 10 | 17 | 56 | 0 | 1 | 83 | 456 |
| 5:15 PM | 33 | 90 | 9 | 0 | 3 | 132 | 24 | 178 | 2 | 0 | 1 | 204 | 15 | 15 | 24 | 0 | 0 | 54 | 6 | 18 | 37 | 0 | 1 | 61 | 451 |
| Total | 113 | 390 | 52 | 0 | 5 | 555 | 89 | 609 | 25 | 0 | 4 | 723 | 44 | 54 | 77 | 0 | 0 | 175 | 36 | 65 | 207 | 0 | 7 | 308 | 1761 |
| Approach % | 20.4 | 70.3 | 9.4 | 0.0 | - | - | 12.3 | 84.2 | 3.5 | 0.0 | - | - | 25.1 | 30.9 | 44.0 | 0.0 | - | - | 11.7 | 21.1 | 67.2 | 0.0 | - | - | - |
| Total % | 6.4 | 22.1 | 3.0 | 0.0 | - | 31.5 | 5.1 | 34.6 | 1.4 | 0.0 | - | 41.1 | 2.5 | 3.1 | 4.4 | 0.0 | - | 9.9 | 2.0 | 3.7 | 11.8 | 0.0 | - | 17.5 | - |
| PHF | 0.856 | 0.956 | 0.813 | 0.000 | - | 0.950 | 0.927 | 0.855 | 0.781 | 0.000 | - | 0.886 | 0.733 | 0.750 | 0.802 | 0.000 | - | 0.810 | 0.643 | 0.903 | 0.719 | 0.000 | - | 0.748 | 0.965 |
| Motorcycles | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 109 | 383 | 52 | 0 | - | 544 | 89 | 599 | 12 | 0 | - | 700 | 43 | 54 | 77 | 0 | - | 174 | 29 | 64 | 203 | 0 | - | 296 | 1714 |
| % Cars & Light Goods | 96.5 | 98.2 | 100.0 | - | - | 98.0 | 100.0 | 98.4 | 48.0 | - | - | 96.8 | 97.7 | 100.0 | 100.0 | - | - | 99.4 | 80.6 | 98.5 | 98.1 | - | - | 96.1 | 97.3 |
| Buses | 3 | 0 | 0 | 0 | - | 3 | 0 | 1 | 4 | 0 | - | 5 | 1 | 0 | 0 | 0 | - | 1 | 4 | 1 | 2 | 0 | - | 7 | 16 |
| % Buses | 2.7 | 0.0 | 0.0 | - | - | 0.5 | 0.0 | 0.2 | 16.0 | - | - | 0.7 | 2.3 | 0.0 | 0.0 | - | - | 0.6 | 11.1 | 1.5 | 1.0 | - | - | 2.3 | 0.9 |
| Single-Unit Trucks | 0 | 7 | 0 | 0 | - | 7 | 0 | 8 | 1 | 0 | - | 9 | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | 0 | - | 1 | 17 |
| % Single-Unit Trucks | 0.0 | 1.8 | 0.0 | - | - | 1.3 | 0.0 | 1.3 | 4.0 | - | - | 1.2 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 2.8 | 0.0 | 0.0 | - | - | 0.3 | 1.0 |
| Articulated Trucks | 1 | 0 | 0 | 0 | - | 1 | 0 | 1 | 8 | 0 | - | 9 | 0 | 0 | 0 | 0 | - | 0 | 2 | 0 | 1 | 0 | - | 3 | 13 |
| % Articulated Trucks | 0.9 | 0.0 | 0.0 | - | - | 0.2 | 0.0 | 0.2 | 32.0 | - | - | 1.2 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 5.6 | 0.0 | 0.5 | - | - | 1.0 | 0.7 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 1 | 0 | - | 1 | 1 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.5 | - | - | 0.3 | 0.1 |
| Bicycles on Crosswalk | - | - | - | - | 1 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 2 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 20.0 | - | - | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | - | - | 28.6 | - | - |
| Pedestrians | - | - | - | - | 4 | - | - | - | - | - | 4 | - | - | - | - | - | 0 | - | - | - | - | - | 5 | - | - |
| % Pedestrians | - | - | - | - | 80.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | - | - | - | - | - | - | 71.4 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 asteinsky@ptsl.com

Count Name: Strasburg Road & Huron Road
Site Code: 220160
Start Date: 04/20/2022


Turning Movement Peak Hour Data Plot (4:30 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Data

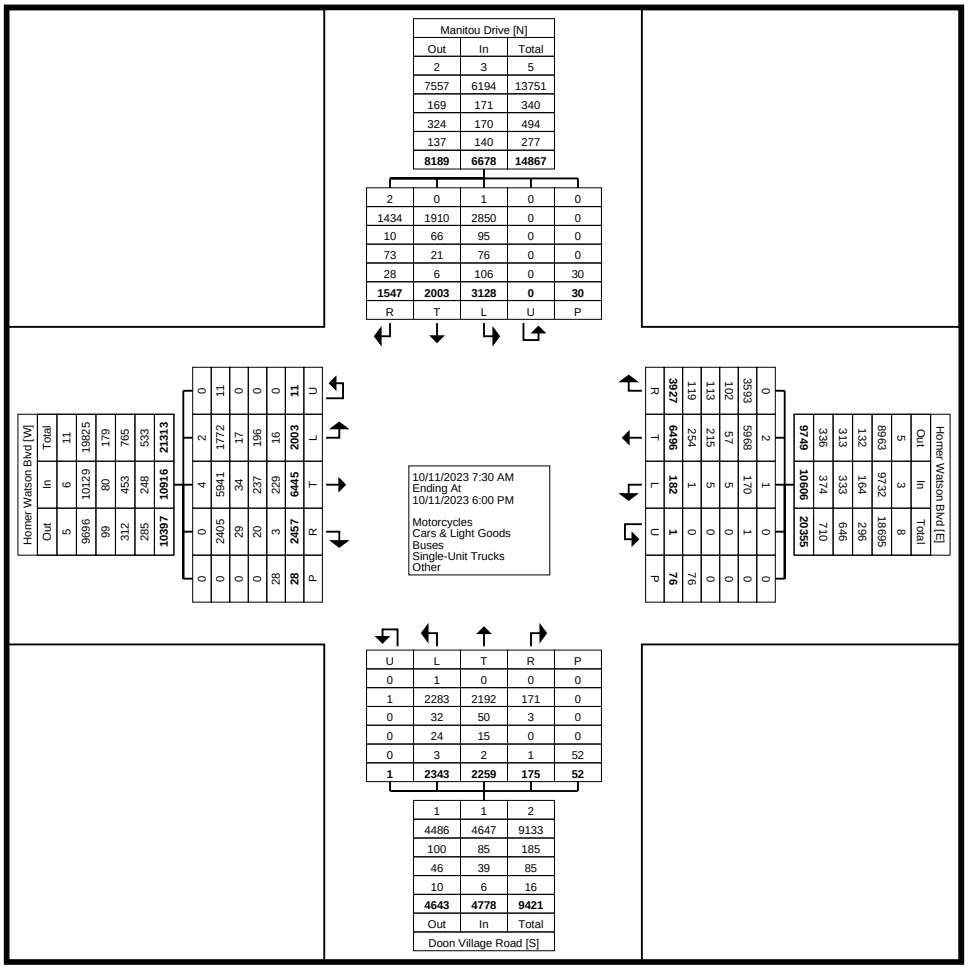
| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon Village Road Northbound | | | | | | Manitou Drive Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 7:30 AM | 60 | 259 | 29 | 0 | 2 | 348 | 2 | 231 | 130 | 0 | 4 | 363 | 106 | 85 | 7 | 0 | 6 | 198 | 80 | 30 | 36 | 0 | 3 | 146 | 1055 |
| 7:45 AM | 91 | 252 | 55 | 1 | 0 | 399 | 1 | 256 | 167 | 0 | 8 | 424 | 98 | 94 | 5 | 0 | 3 | 197 | 70 | 38 | 26 | 0 | 1 | 134 | 1154 |
| Hourly Total | 151 | 511 | 84 | 1 | 2 | 747 | 3 | 487 | 297 | 0 | 12 | 787 | 204 | 179 | 12 | 0 | 9 | 395 | 150 | 68 | 62 | 0 | 4 | 280 | 2209 |
| 8:00 AM | 68 | 205 | 61 | 0 | 3 | 334 | 3 | 278 | 157 | 0 | 0 | 438 | 87 | 67 | 2 | 0 | 1 | 156 | 68 | 35 | 30 | 0 | 1 | 133 | 1061 |
| 8:15 AM | 81 | 231 | 73 | 0 | 0 | 385 | 7 | 247 | 114 | 0 | 1 | 368 | 75 | 87 | 1 | 0 | 0 | 163 | 62 | 41 | 25 | 0 | 3 | 128 | 1044 |
| 8:30 AM | 64 | 210 | 53 | 0 | 0 | 327 | 2 | 144 | 94 | 0 | 3 | 240 | 114 | 94 | 3 | 0 | 2 | 211 | 67 | 44 | 32 | 0 | 1 | 143 | 921 |
| 8:45 AM | 75 | 172 | 56 | 0 | 0 | 303 | 4 | 157 | 109 | 0 | 3 | 270 | 97 | 105 | 5 | 1 | 1 | 208 | 74 | 34 | 21 | 0 | 1 | 129 | 910 |
| Hourly Total | 288 | 818 | 243 | 0 | 3 | 1349 | 16 | 826 | 474 | 0 | 7 | 1316 | 373 | 353 | 11 | 1 | 4 | 738 | 271 | 154 | 108 | 0 | 6 | 533 | 3936 |
| 9:00 AM | 46 | 171 | 55 | 0 | 0 | 272 | 5 | 189 | 118 | 1 | 1 | 313 | 96 | 93 | 4 | 0 | 0 | 193 | 58 | 42 | 34 | 0 | 0 | 134 | 912 |
| 9:15 AM | 77 | 173 | 48 | 0 | 0 | 298 | 1 | 169 | 93 | 0 | 3 | 263 | 79 | 70 | 3 | 0 | 0 | 152 | 57 | 44 | 28 | 0 | 0 | 129 | 842 |
| 9:30 AM | 59 | 179 | 45 | 1 | 0 | 284 | 2 | 161 | 115 | 0 | 1 | 278 | 64 | 61 | 3 | 0 | 1 | 128 | 63 | 45 | 36 | 0 | 0 | 144 | 834 |
| 9:45 AM | 61 | 168 | 47 | 0 | 0 | 276 | 9 | 156 | 101 | 0 | 1 | 266 | 63 | 49 | 8 | 0 | 0 | 120 | 73 | 28 | 26 | 0 | 0 | 127 | 789 |
| Hourly Total | 243 | 691 | 195 | 1 | 0 | 1130 | 17 | 675 | 427 | 1 | 6 | 1120 | 302 | 273 | 18 | 0 | 1 | 593 | 251 | 159 | 124 | 0 | 0 | 534 | 3377 |
| 10:00 AM | 50 | 148 | 31 | 0 | 1 | 229 | 3 | 160 | 97 | 0 | 1 | 260 | 51 | 74 | 8 | 0 | 2 | 133 | 60 | 32 | 26 | 0 | 0 | 118 | 740 |
| 10:15 AM | 54 | 153 | 44 | 1 | 1 | 252 | 3 | 163 | 85 | 0 | 2 | 251 | 52 | 48 | 4 | 0 | 2 | 104 | 66 | 36 | 25 | 0 | 0 | 127 | 734 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 104 | 301 | 75 | 1 | 2 | 481 | 6 | 323 | 182 | 0 | 3 | 511 | 103 | 122 | 12 | 0 | 4 | 237 | 126 | 68 | 51 | 0 | 0 | 245 | 1474 |
| 12:00 PM | 61 | 171 | 67 | 1 | 2 | 300 | 0 | 157 | 99 | 0 | 1 | 256 | 50 | 55 | 5 | 0 | 1 | 110 | 83 | 65 | 38 | 0 | 0 | 186 | 852 |
| 12:15 PM | 53 | 158 | 55 | 0 | 1 | 266 | 8 | 174 | 127 | 0 | 4 | 309 | 64 | 69 | 8 | 0 | 2 | 141 | 82 | 59 | 35 | 0 | 1 | 176 | 892 |
| 12:30 PM | 56 | 180 | 72 | 0 | 1 | 308 | 12 | 172 | 105 | 0 | 6 | 289 | 59 | 57 | 10 | 0 | 2 | 126 | 68 | 65 | 44 | 0 | 2 | 177 | 900 |
| 12:45 PM | 49 | 156 | 43 | 0 | 1 | 248 | 4 | 150 | 123 | 0 | 2 | 277 | 61 | 65 | 7 | 0 | 0 | 133 | 83 | 66 | 55 | 0 | 2 | 204 | 862 |
| Hourly Total | 219 | 665 | 237 | 1 | 5 | 1122 | 24 | 653 | 454 | 0 | 13 | 1131 | 234 | 246 | 30 | 0 | 5 | 510 | 316 | 255 | 172 | 0 | 5 | 743 | 3506 |
| 1:00 PM | 40 | 137 | 52 | 0 | 0 | 229 | 1 | 175 | 117 | 0 | 1 | 293 | 46 | 51 | 8 | 0 | 1 | 105 | 86 | 78 | 42 | 0 | 0 | 206 | 833 |
| 1:15 PM | 33 | 180 | 46 | 0 | 0 | 259 | 9 | 166 | 135 | 0 | 1 | 310 | 65 | 71 | 7 | 0 | 1 | 143 | 78 | 47 | 37 | 0 | 0 | 162 | 874 |
| 1:30 PM | 50 | 140 | 55 | 0 | 0 | 245 | 0 | 146 | 102 | 0 | 2 | 248 | 73 | 65 | 11 | 0 | 1 | 149 | 95 | 73 | 33 | 0 | 0 | 201 | 843 |
| 1:45 PM | 60 | 191 | 59 | 1 | 0 | 311 | 5 | 136 | 123 | 0 | 6 | 264 | 68 | 51 | 5 | 0 | 6 | 124 | 87 | 56 | 34 | 0 | 0 | 177 | 876 |
| Hourly Total | 183 | 648 | 212 | 1 | 0 | 1044 | 15 | 623 | 477 | 0 | 10 | 1115 | 252 | 238 | 31 | 0 | 9 | 521 | 346 | 254 | 146 | 0 | 0 | 746 | 3426 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 75 | 164 | 96 | 0 | 0 | 335 | 10 | 223 | 110 | 0 | 3 | 343 | 55 | 48 | 7 | 0 | 3 | 110 | 124 | 91 | 68 | 0 | 1 | 283 | 1071 |
| 3:15 PM | 60 | 197 | 108 | 0 | 0 | 365 | 8 | 222 | 146 | 0 | 0 | 376 | 59 | 53 | 5 | 0 | 1 | 117 | 144 | 76 | 88 | 0 | 0 | 308 | 1166 |
| 3:30 PM | 55 | 227 | 90 | 0 | 0 | 372 | 5 | 225 | 108 | 0 | 1 | 338 | 76 | 62 | 4 | 0 | 1 | 142 | 108 | 91 | 91 | 0 | 1 | 290 | 1142 |
| 3:45 PM | 55 | 214 | 96 | 2 | 0 | 367 | 9 | 256 | 162 | 0 | 2 | 427 | 87 | 60 | 4 | 0 | 1 | 151 | 125 | 68 | 69 | 0 | 3 | 262 | 1207 |
| Hourly Total | 245 | 802 | 390 | 2 | 0 | 1439 | 32 | 926 | 526 | 0 | 6 | 1484 | 277 | 223 | 20 | 0 | 6 | 520 | 501 | 326 | 316 | 0 | 5 | 1143 | 4586 |
| 4:00 PM | 66 | 233 | 112 | 0 | 0 | 411 | 5 | 237 | 125 | 0 | 2 | 367 | 72 | 82 | 6 | 0 | 3 | 160 | 120 | 93 | 75 | 0 | 0 | 288 | 1226 |
| 4:15 PM | 54 | 226 | 109 | 0 | 0 | 389 | 9 | 284 | 137 | 0 | 1 | 430 | 76 | 55 | 6 | 0 | 1 | 137 | 139 | 86 | 76 | 0 | 0 | 301 | 1257 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 PM | 73 | 286 | 128 | 0 | 1 | 487 | 4 | 212 | 144 | 0 | 2 | 360 | 66 | 88 | 2 | 0 | 6 | 156 | 145 | 96 | 77 | 0 | 2 | 318 | 1321 |
| 4:45 PM | 93 | 256 | 145 | 0 | 4 | 494 | 5 | 252 | 155 | 0 | 0 | 412 | 79 | 83 | 2 | 0 | 4 | 164 | 151 | 72 | 58 | 0 | 4 | 281 | 1351 |
| Hourly Total | 286 | 1001 | 494 | 0 | 5 | 1781 | 23 | 985 | 561 | 0 | 5 | 1569 | 293 | 308 | 16 | 0 | 14 | 617 | 555 | 347 | 286 | 0 | 6 | 1188 | 5155 |
| 5:00 PM | 76 | 274 | 138 | 0 | 3 | 488 | 9 | 218 | 121 | 0 | 1 | 348 | 90 | 92 | 9 | 0 | 0 | 191 | 174 | 96 | 71 | 0 | 1 | 341 | 1368 |
| 5:15 PM | 82 | 282 | 143 | 1 | 3 | 508 | 11 | 286 | 146 | 0 | 0 | 443 | 68 | 60 | 5 | 0 | 0 | 133 | 165 | 89 | 63 | 0 | 3 | 317 | 1401 |
| 5:30 PM | 61 | 245 | 140 | 1 | 4 | 447 | 14 | 234 | 140 | 0 | 2 | 388 | 83 | 73 | 6 | 0 | 0 | 162 | 165 | 93 | 77 | 0 | 0 | 335 | 1332 |
| 5:45 PM | 65 | 207 | 106 | 2 | 1 | 380 | 12 | 260 | 122 | 0 | 11 | 394 | 64 | 92 | 5 | 0 | 0 | 161 | 108 | 94 | 71 | 0 | 0 | 273 | 1208 |
| Hourly Total | 284 | 1008 | 527 | 4 | 11 | 1823 | 46 | 998 | 529 | 0 | 14 | 1573 | 305 | 317 | 25 | 0 | 0 | 647 | 612 | 372 | 282 | 0 | 4 | 1266 | 5309 |
| Grand Total | 2003 | 6445 | 2457 | 11 | 28 | 10916 | 182 | 6496 | 3927 | 1 | 76 | 10606 | 2343 | 2259 | 175 | 1 | 52 | 4778 | 3128 | 2003 | 1547 | 0 | 30 | 6678 | 32978 |
| Approach % | 18.3 | 59.0 | 22.5 | 0.1 | - | - | 1.7 | 61.2 | 37.0 | 0.0 | - | - | 49.0 | 47.3 | 3.7 | 0.0 | - | - | 46.8 | 30.0 | 23.2 | 0.0 | - | - | - |
| Total % | 6.1 | 19.5 | 7.5 | 0.0 | - | 33.1 | 0.6 | 19.7 | 11.9 | 0.0 | - | 32.2 | 7.1 | 6.9 | 0.5 | 0.0 | - | 14.5 | 9.5 | 6.1 | 4.7 | 0.0 | - | 20.2 | - |
| Motorcycles | 2 | 4 | 0 | 0 | - | 6 | 1 | 2 | 0 | 0 | - | 3 | 1 | 0 | 0 | 0 | - | 1 | 1 | 0 | 2 | 0 | - | 3 | 13 |
| % Motorcycles | 0.1 | 0.1 | 0.0 | 0.0 | - | 0.1 | 0.5 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.1 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 1772 | 5941 | 2405 | 11 | - | 10129 | 170 | 5968 | 3593 | 1 | - | 9732 | 2283 | 2192 | 171 | 1 | - | 4647 | 2850 | 1910 | 1434 | 0 | - | 6194 | 30702 |
| % Cars & Light Goods | 88.5 | 92.2 | 97.9 | 100.0 | - | 92.8 | 93.4 | 91.9 | 91.5 | 100.0 | - | 91.8 | 97.4 | 97.0 | 97.7 | 100.0 | - | 97.3 | 91.1 | 95.4 | 92.7 | - | - | 92.8 | 93.1 |
| Buses | 17 | 34 | 29 | 0 | - | 80 | 5 | 57 | 102 | 0 | - | 164 | 32 | 50 | 3 | 0 | - | 85 | 95 | 66 | 10 | 0 | - | 171 | 500 |
| % Buses | 0.8 | 0.5 | 1.2 | 0.0 | - | 0.7 | 2.7 | 0.9 | 2.6 | 0.0 | - | 1.5 | 1.4 | 2.2 | 1.7 | 0.0 | - | 1.8 | 3.0 | 3.3 | 0.6 | - | - | 2.6 | 1.5 |
| Single-Unit Trucks | 196 | 237 | 20 | 0 | - | 453 | 5 | 215 | 113 | 0 | - | 333 | 24 | 15 | 0 | 0 | - | 39 | 76 | 21 | 73 | 0 | - | 170 | 995 |
| % Single-Unit Trucks | 9.8 | 3.7 | 0.8 | 0.0 | - | 4.1 | 2.7 | 3.3 | 2.9 | 0.0 | - | 3.1 | 1.0 | 0.7 | 0.0 | 0.0 | - | 0.8 | 2.4 | 1.0 | 4.7 | - | - | 2.5 | 3.0 |
| Articulated Trucks | 16 | 226 | 3 | 0 | - | 245 | 1 | 254 | 119 | 0 | - | 374 | 3 | 2 | 1 | 0 | - | 6 | 106 | 5 | 28 | 0 | - | 139 | 764 |
| % Articulated Trucks | 0.8 | 3.5 | 0.1 | 0.0 | - | 2.2 | 0.5 | 3.9 | 3.0 | 0.0 | - | 3.5 | 0.1 | 0.1 | 0.6 | 0.0 | - | 0.1 | 3.4 | 0.2 | 1.8 | - | - | 2.1 | 2.3 |
| Bicycles on Road | 0 | 3 | 0 | 0 | - | 3 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 1 | 0 | 0 | - | 1 | 4 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 12 | - | - | - | - | - | 6 | - | - | - | - | - | 10 | - | - | - | - | - | 6 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 42.9 | - | - | - | - | - | 7.9 | - | - | - | - | - | 19.2 | - | - | - | - | - | 20.0 | - | - |
| Pedestrians | - | - | - | - | 16 | - | - | - | - | - | 70 | - | - | - | - | - | 42 | - | - | - | - | - | 24 | - | - |
| % Pedestrians | - | - | - | - | 57.1 | - | - | - | - | - | 92.1 | - | - | - | - | - | 80.8 | - | - | - | - | - | 80.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023

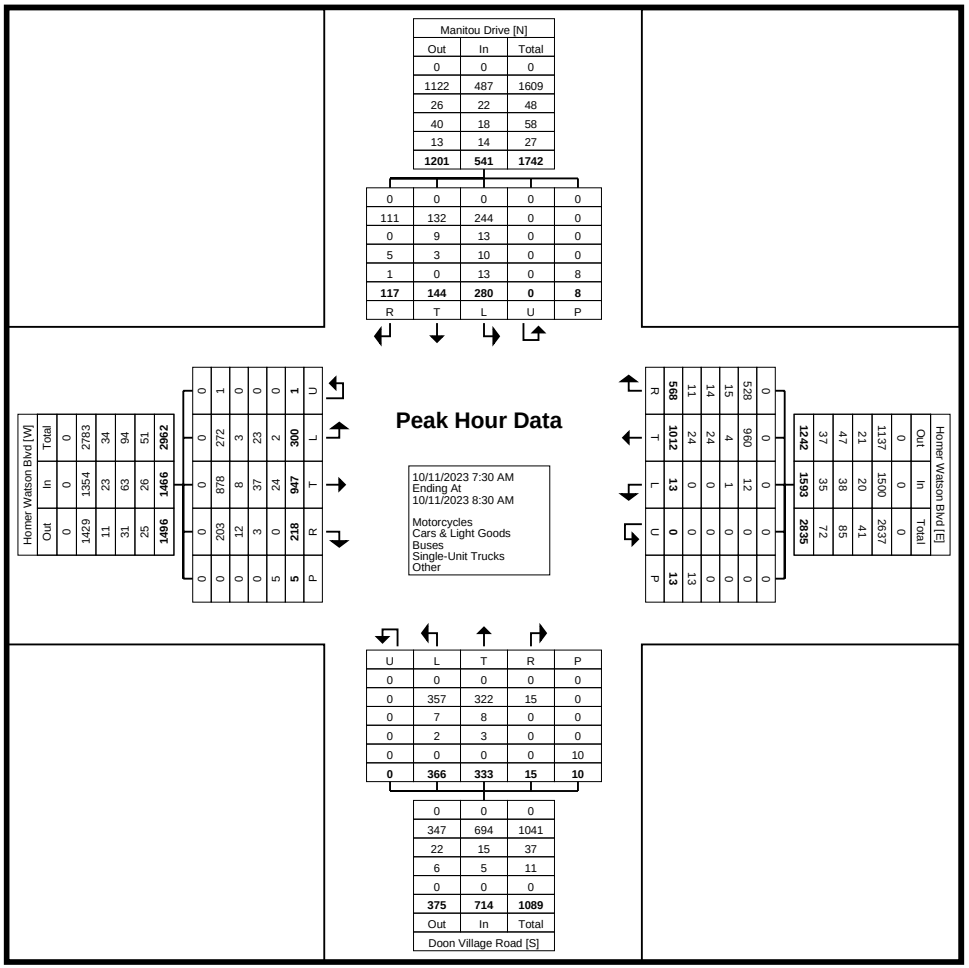

# Turning Movement Peak Hour Data (7:30 AM)

| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon Village Road Northbound | | | | | | Manitou Drive Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 7:30 AM | 60 | 259 | 29 | 0 | 2 | 348 | 2 | 231 | 130 | 0 | 4 | 363 | 106 | 85 | 7 | 0 | 6 | 198 | 80 | 30 | 36 | 0 | 3 | 146 | 1055 |
| 7:45 AM | 91 | 252 | 55 | 1 | 0 | 399 | 1 | 256 | 167 | 0 | 8 | 424 | 98 | 94 | 5 | 0 | 3 | 197 | 70 | 38 | 26 | 0 | 1 | 134 | 1154 |
| 8:00 AM | 68 | 205 | 61 | 0 | 3 | 334 | 3 | 278 | 157 | 0 | 0 | 438 | 87 | 67 | 2 | 0 | 1 | 156 | 68 | 35 | 30 | 0 | 1 | 133 | 1061 |
| 8:15 AM | 81 | 231 | 73 | 0 | 0 | 385 | 7 | 247 | 114 | 0 | 1 | 368 | 75 | 87 | 1 | 0 | 0 | 163 | 62 | 41 | 25 | 0 | 3 | 128 | 1044 |
| Total | 300 | 947 | 218 | 1 | 5 | 1466 | 13 | 1012 | 568 | 0 | 13 | 1593 | 366 | 333 | 15 | 0 | 10 | 714 | 280 | 144 | 117 | 0 | 8 | 541 | 4314 |
| Approach % | 20.5 | 64.6 | 14.9 | 0.1 | - | - | 0.8 | 63.5 | 35.7 | 0.0 | - | - | 51.3 | 46.6 | 2.1 | 0.0 | - | - | 51.8 | 26.6 | 21.6 | 0.0 | - | - | - |
| Total % | 7.0 | 22.0 | 5.1 | 0.0 | - | 34.0 | 0.3 | 23.5 | 13.2 | 0.0 | - | 36.9 | 8.5 | 7.7 | 0.3 | 0.0 | - | 16.6 | 6.5 | 3.3 | 2.7 | 0.0 | - | 12.5 | - |
| PHF | 0.824 | 0.914 | 0.747 | 0.250 | - | 0.919 | 0.464 | 0.910 | 0.850 | 0.000 | - | 0.909 | 0.863 | 0.886 | 0.536 | 0.000 | - | 0.902 | 0.875 | 0.878 | 0.813 | 0.000 | - | 0.926 | 0.935 |
| Motorcycles | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 272 | 878 | 203 | 1 | - | 1354 | 12 | 960 | 528 | 0 | - | 1500 | 357 | 322 | 15 | 0 | - | 694 | 244 | 132 | 111 | 0 | - | 487 | 4035 |
| % Cars & Light Goods | 90.7 | 92.7 | 93.1 | 100.0 | - | 92.4 | 92.3 | 94.9 | 93.0 | - | - | 94.2 | 97.5 | 96.7 | 100.0 | - | - | 97.2 | 87.1 | 91.7 | 94.9 | - | - | 90.0 | 93.5 |
| Buses | 3 | 8 | 12 | 0 | - | 23 | 1 | 4 | 15 | 0 | - | 20 | 7 | 8 | 0 | 0 | - | 15 | 13 | 9 | 0 | 0 | - | 22 | 80 |
| % Buses | 1.0 | 0.8 | 5.5 | 0.0 | - | 1.6 | 7.7 | 0.4 | 2.6 | - | - | 1.3 | 1.9 | 2.4 | 0.0 | - | - | 2.1 | 4.6 | 6.3 | 0.0 | - | - | 4.1 | 1.9 |
| Single-Unit Trucks | 23 | 37 | 3 | 0 | - | 63 | 0 | 24 | 14 | 0 | - | 38 | 2 | 3 | 0 | 0 | - | 5 | 10 | 3 | 5 | 0 | - | 18 | 124 |
| % Single-Unit Trucks | 7.7 | 3.9 | 1.4 | 0.0 | - | 4.3 | 0.0 | 2.4 | 2.5 | - | - | 2.4 | 0.5 | 0.9 | 0.0 | - | - | 0.7 | 3.6 | 2.1 | 4.3 | - | - | 3.3 | 2.9 |
| Articulated Trucks | 2 | 24 | 0 | 0 | - | 26 | 0 | 24 | 11 | 0 | - | 35 | 0 | 0 | 0 | 0 | - | 0 | 13 | 0 | 1 | 0 | - | 14 | 75 |
| % Articulated Trucks | 0.7 | 2.5 | 0.0 | 0.0 | - | 1.8 | 0.0 | 2.4 | 1.9 | - | - | 2.2 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 4.6 | 0.0 | 0.9 | - | - | 2.6 | 1.7 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 4 | - | - | - | - | - | 2 | - | - | - | - | - | 5 | - | - | - | - | - | 1 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 80.0 | - | - | - | - | - | 15.4 | - | - | - | - | - | 50.0 | - | - | - | - | - | 12.5 | - | - |
| Pedestrians | - | - | - | - | 1 | - | - | - | - | - | 11 | - | - | - | - | - | 5 | - | - | - | - | - | 7 | - | - |
| % Pedestrians | - | - | - | - | 20.0 | - | - | - | - | - | 84.6 | - | - | - | - | - | 50.0 | - | - | - | - | - | 87.5 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023

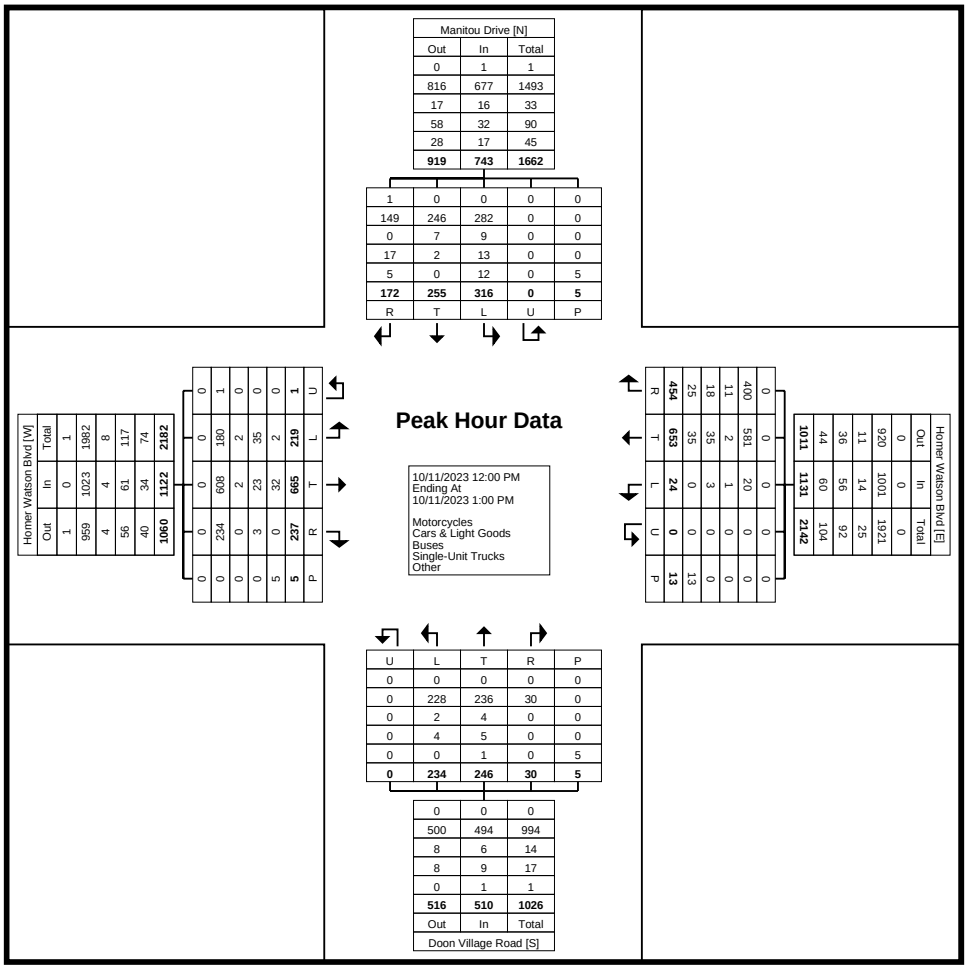

# Turning Movement Peak Hour Data (12:00 PM)

| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon Village Road Northbound | | | | | | Manitou Drive Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 12:00 PM | 61 | 171 | 67 | 1 | 2 | 300 | 0 | 157 | 99 | 0 | 1 | 256 | 50 | 55 | 5 | 0 | 1 | 110 | 83 | 65 | 38 | 0 | 0 | 186 | 852 |
| 12:15 PM | 53 | 158 | 55 | 0 | 1 | 266 | 8 | 174 | 127 | 0 | 4 | 309 | 64 | 69 | 8 | 0 | 2 | 141 | 82 | 59 | 35 | 0 | 1 | 176 | 892 |
| 12:30 PM | 56 | 180 | 72 | 0 | 1 | 308 | 12 | 172 | 105 | 0 | 6 | 289 | 59 | 57 | 10 | 0 | 2 | 126 | 68 | 65 | 44 | 0 | 2 | 177 | 900 |
| 12:45 PM | 49 | 156 | 43 | 0 | 1 | 248 | 4 | 150 | 123 | 0 | 2 | 277 | 61 | 65 | 7 | 0 | 0 | 133 | 83 | 66 | 55 | 0 | 2 | 204 | 862 |
| Total | 219 | 665 | 237 | 1 | 5 | 1122 | 24 | 653 | 454 | 0 | 13 | 1131 | 234 | 246 | 30 | 0 | 5 | 510 | 316 | 255 | 172 | 0 | 5 | 743 | 3506 |
| Approach % | 19.5 | 59.3 | 21.1 | 0.1 | - | - | 2.1 | 57.7 | 40.1 | 0.0 | - | - | 45.9 | 48.2 | 5.9 | 0.0 | - | - | 42.5 | 34.3 | 23.1 | 0.0 | - | - | - |
| Total % | 6.2 | 19.0 | 6.8 | 0.0 | - | 32.0 | 0.7 | 18.6 | 12.9 | 0.0 | - | 32.3 | 6.7 | 7.0 | 0.9 | 0.0 | - | 14.5 | 9.0 | 7.3 | 4.9 | 0.0 | - | 21.2 | - |
| PHF | 0.898 | 0.924 | 0.823 | 0.250 | - | 0.911 | 0.500 | 0.938 | 0.894 | 0.000 | - | 0.915 | 0.914 | 0.891 | 0.750 | 0.000 | - | 0.904 | 0.952 | 0.966 | 0.782 | 0.000 | - | 0.911 | 0.974 |
| Motorcycles | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 1 | 0 | - | 1 | 1 |
| % Motorcycles | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.6 | - | - | 0.1 | 0.0 |
| Cars & Light Goods | 180 | 608 | 234 | 1 | - | 1023 | 20 | 581 | 400 | 0 | - | 1001 | 228 | 236 | 30 | 0 | - | 494 | 282 | 246 | 149 | 0 | - | 677 | 3195 |
| % Cars & Light Goods | 82.2 | 91.4 | 98.7 | 100.0 | - | 91.2 | 83.3 | 89.0 | 88.1 | - | - | 88.5 | 97.4 | 95.9 | 100.0 | - | - | 96.9 | 89.2 | 96.5 | 86.6 | - | - | 91.1 | 91.1 |
| Buses | 2 | 2 | 0 | 0 | - | 4 | 1 | 2 | 11 | 0 | - | 14 | 2 | 4 | 0 | 0 | - | 6 | 9 | 7 | 0 | 0 | - | 16 | 40 |
| % Buses | 0.9 | 0.3 | 0.0 | 0.0 | - | 0.4 | 4.2 | 0.3 | 2.4 | - | - | 1.2 | 0.9 | 1.6 | 0.0 | - | - | 1.2 | 2.8 | 2.7 | 0.0 | - | - | 2.2 | 1.1 |
| Single-Unit Trucks | 35 | 23 | 3 | 0 | - | 61 | 3 | 35 | 18 | 0 | - | 56 | 4 | 5 | 0 | 0 | - | 9 | 13 | 2 | 17 | 0 | - | 32 | 158 |
| % Single-Unit Trucks | 16.0 | 3.5 | 1.3 | 0.0 | - | 5.4 | 12.5 | 5.4 | 4.0 | - | - | 5.0 | 1.7 | 2.0 | 0.0 | - | - | 1.8 | 4.1 | 0.8 | 9.9 | - | - | 4.3 | 4.5 |
| Articulated Trucks | 2 | 32 | 0 | 0 | - | 34 | 0 | 35 | 25 | 0 | - | 60 | 0 | 1 | 0 | 0 | - | 1 | 12 | 0 | 5 | 0 | - | 17 | 112 |
| % Articulated Trucks | 0.9 | 4.8 | 0.0 | 0.0 | - | 3.0 | 0.0 | 5.4 | 5.5 | - | - | 5.3 | 0.0 | 0.4 | 0.0 | - | - | 0.2 | 3.8 | 0.0 | 2.9 | - | - | 2.3 | 3.2 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 3 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 2 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 60.0 | - | - | - | - | - | 0.0 | - | - | - | - | - | 0.0 | - | - | - | - | - | 40.0 | - | - |
| Pedestrians | - | - | - | - | 2 | - | - | - | - | - | 13 | - | - | - | - | - | 5 | - | - | - | - | - | 3 | - | - |
| % Pedestrians | - | - | - | - | 40.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | 60.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023
Page No: 7




Turning Movement Peak Hour Data Plot (12:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023

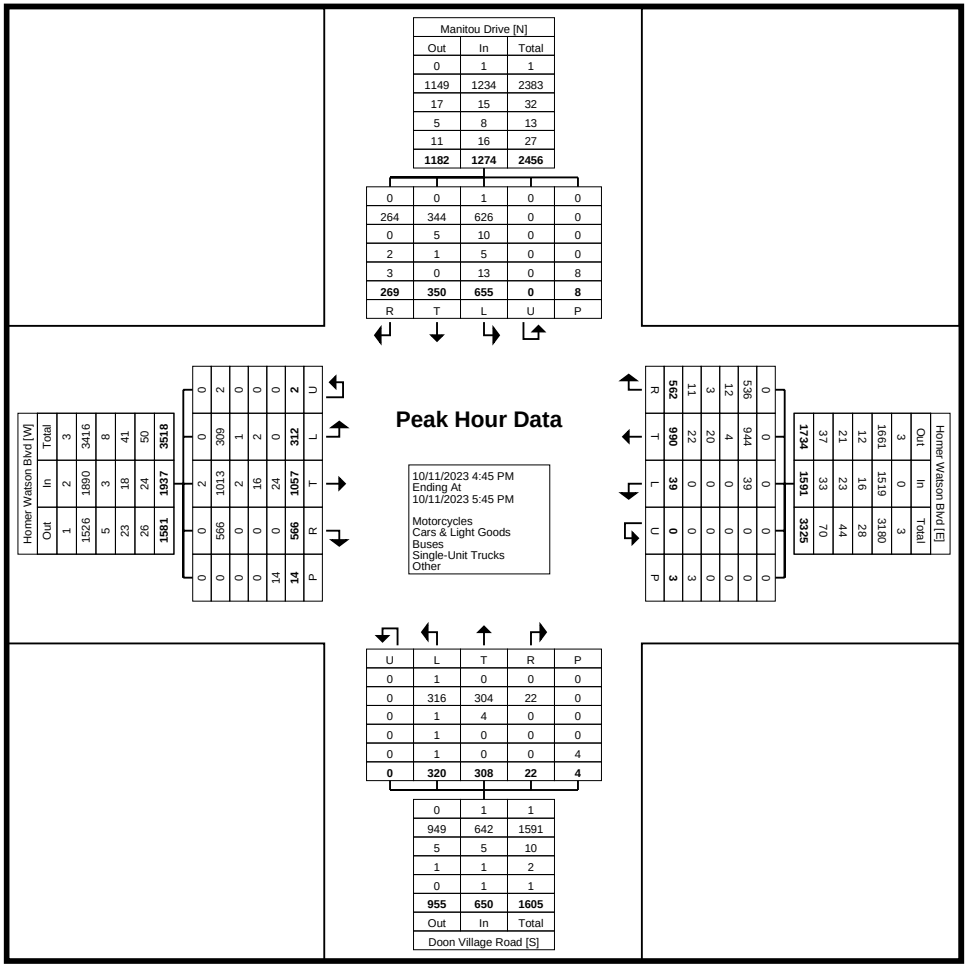

# Turning Movement Peak Hour Data (4:45 PM)

| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon Village Road Northbound | | | | | | Manitou Drive Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 4:45 PM | 93 | 256 | 145 | 0 | 4 | 494 | 5 | 252 | 155 | 0 | 0 | 412 | 79 | 83 | 2 | 0 | 4 | 164 | 151 | 72 | 58 | 0 | 4 | 281 | 1351 |
| 5:00 PM | 76 | 274 | 138 | 0 | 3 | 488 | 9 | 218 | 121 | 0 | 1 | 348 | 90 | 92 | 9 | 0 | 0 | 191 | 174 | 96 | 71 | 0 | 1 | 341 | 1368 |
| 5:15 PM | 82 | 282 | 143 | 1 | 3 | 508 | 11 | 286 | 146 | 0 | 0 | 443 | 68 | 60 | 5 | 0 | 0 | 133 | 165 | 89 | 63 | 0 | 3 | 317 | 1401 |
| 5:30 PM | 61 | 245 | 140 | 1 | 4 | 447 | 14 | 234 | 140 | 0 | 2 | 388 | 83 | 73 | 6 | 0 | 0 | 162 | 165 | 93 | 77 | 0 | 0 | 335 | 1332 |
| Total | 312 | 1057 | 566 | 2 | 14 | 1937 | 39 | 990 | 562 | 0 | 3 | 1591 | 320 | 308 | 22 | 0 | 4 | 650 | 655 | 350 | 269 | 0 | 8 | 1274 | 5452 |
| Approach % | 16.1 | 54.6 | 29.2 | 0.1 | - | - | 2.5 | 62.2 | 35.3 | 0.0 | - | - | 49.2 | 47.4 | 3.4 | 0.0 | - | - | 51.4 | 27.5 | 21.1 | 0.0 | - | - | - |
| Total % | 5.7 | 19.4 | 10.4 | 0.0 | - | 35.5 | 0.7 | 18.2 | 10.3 | 0.0 | - | 29.2 | 5.9 | 5.6 | 0.4 | 0.0 | - | 11.9 | 12.0 | 6.4 | 4.9 | 0.0 | - | 23.4 | - |
| PHF | 0.839 | 0.937 | 0.976 | 0.500 | - | 0.953 | 0.696 | 0.865 | 0.906 | 0.000 | - | 0.898 | 0.889 | 0.837 | 0.611 | 0.000 | - | 0.851 | 0.941 | 0.911 | 0.873 | 0.000 | - | 0.934 | 0.973 |
| Motorcycles | 0 | 2 | 0 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | 0 | - | 1 | 1 | 0 | 0 | 0 | - | 1 | 4 |
| % Motorcycles | 0.0 | 0.2 | 0.0 | 0.0 | - | 0.1 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.3 | 0.0 | 0.0 | - | - | 0.2 | 0.2 | 0.0 | 0.0 | - | - | 0.1 | 0.1 |
| Cars & Light Goods | 309 | 1013 | 566 | 2 | - | 1890 | 39 | 944 | 536 | 0 | - | 1519 | 316 | 304 | 22 | 0 | - | 642 | 626 | 344 | 264 | 0 | - | 1234 | 5285 |
| % Cars & Light Goods | 99.0 | 95.8 | 100.0 | 100.0 | - | 97.6 | 100.0 | 95.4 | 95.4 | - | - | 95.5 | 98.8 | 98.7 | 100.0 | - | - | 98.8 | 95.6 | 98.3 | 98.1 | - | - | 96.9 | 96.9 |
| Buses | 1 | 2 | 0 | 0 | - | 3 | 0 | 4 | 12 | 0 | - | 16 | 1 | 4 | 0 | 0 | - | 5 | 10 | 5 | 0 | 0 | - | 15 | 39 |
| % Buses | 0.3 | 0.2 | 0.0 | 0.0 | - | 0.2 | 0.0 | 0.4 | 2.1 | - | - | 1.0 | 0.3 | 1.3 | 0.0 | - | - | 0.8 | 1.5 | 1.4 | 0.0 | - | - | 1.2 | 0.7 |
| Single-Unit Trucks | 2 | 16 | 0 | 0 | - | 18 | 0 | 20 | 3 | 0 | - | 23 | 1 | 0 | 0 | 0 | - | 1 | 5 | 1 | 2 | 0 | - | 8 | 50 |
| % Single-Unit Trucks | 0.6 | 1.5 | 0.0 | 0.0 | - | 0.9 | 0.0 | 2.0 | 0.5 | - | - | 1.4 | 0.3 | 0.0 | 0.0 | - | - | 0.2 | 0.8 | 0.3 | 0.7 | - | - | 0.6 | 0.9 |
| Articulated Trucks | 0 | 23 | 0 | 0 | - | 23 | 0 | 22 | 11 | 0 | - | 33 | 1 | 0 | 0 | 0 | - | 1 | 13 | 0 | 3 | 0 | - | 16 | 73 |
| % Articulated Trucks | 0.0 | 2.2 | 0.0 | 0.0 | - | 1.2 | 0.0 | 2.2 | 2.0 | - | - | 2.1 | 0.3 | 0.0 | 0.0 | - | - | 0.2 | 2.0 | 0.0 | 1.1 | - | - | 1.3 | 1.3 |
| Bicycles on Road | 0 | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Bicycles on Road | 0.0 | 0.1 | 0.0 | 0.0 | - | 0.1 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 5 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 35.7 | - | - | - | - | - | 0.0 | - | - | - | - | - | 0.0 | - | - | - | - | - | 12.5 | - | - |
| Pedestrians | - | - | - | - | 9 | - | - | - | - | - | 3 | - | - | - | - | - | 4 | - | - | - | - | - | 7 | - | - |
| % Pedestrians | - | - | - | - | 64.3 | - | - | - | - | - | 100.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | 87.5 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (4:45 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Data

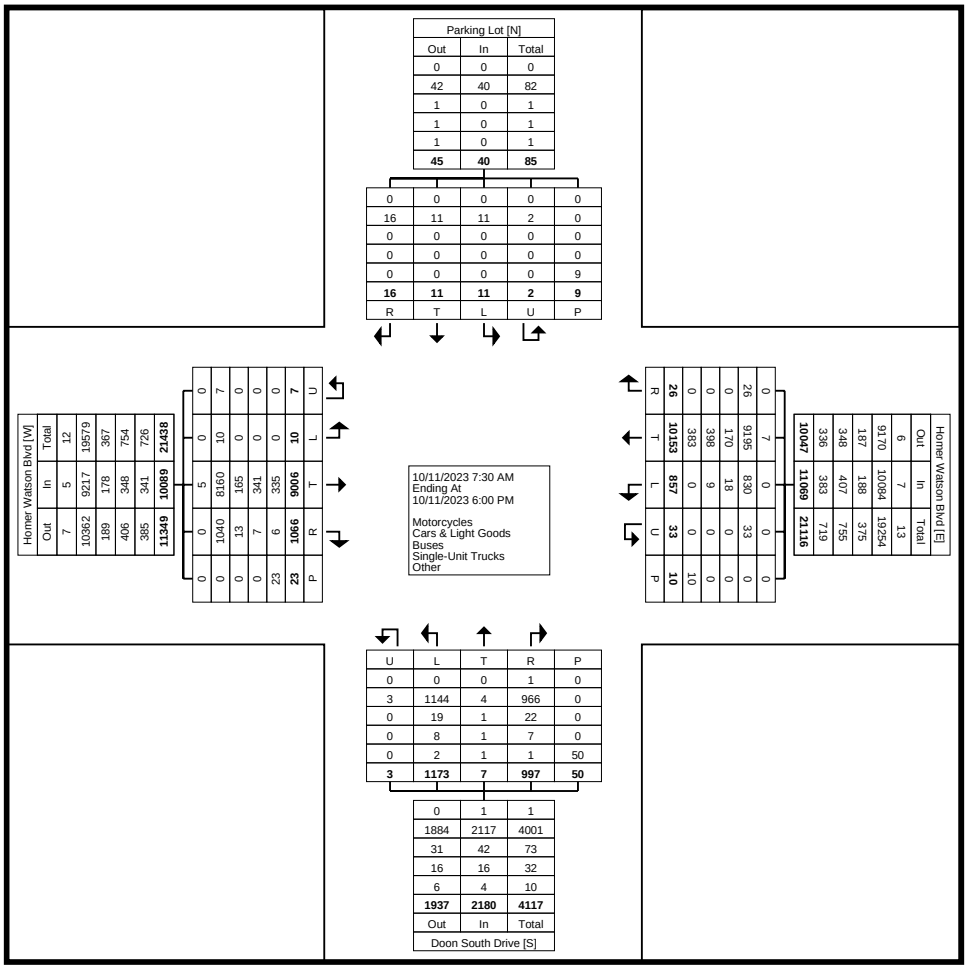
| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon South Drive Northbound | | | | | | Parking Lot Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 7:30 AM | 0 | 366 | 9 | 0 | 0 | 375 | 8 | 305 | 0 | 1 | 0 | 314 | 59 | 0 | 48 | 0 | 1 | 107 | 0 | 0 | 1 | 0 | 0 | 1 | 797 |
| 7:45 AM | 0 | 348 | 14 | 0 | 0 | 362 | 15 | 340 | 0 | 0 | 0 | 355 | 69 | 0 | 68 | 0 | 1 | 137 | 0 | 0 | 0 | 0 | 0 | 0 | 854 |
| Hourly Total | 0 | 714 | 23 | 0 | 0 | 737 | 23 | 645 | 0 | 1 | 0 | 669 | 128 | 0 | 116 | 0 | 2 | 244 | 0 | 0 | 1 | 0 | 0 | 1 | 1651 |
| 8:00 AM | 0 | 300 | 22 | 0 | 0 | 322 | 16 | 309 | 1 | 1 | 0 | 327 | 50 | 0 | 48 | 0 | 1 | 98 | 0 | 0 | 1 | 0 | 0 | 1 | 748 |
| 8:15 AM | 0 | 291 | 36 | 0 | 1 | 327 | 25 | 293 | 1 | 0 | 1 | 319 | 60 | 0 | 49 | 0 | 4 | 109 | 0 | 0 | 0 | 0 | 0 | 0 | 755 |
| 8:30 AM | 0 | 280 | 28 | 0 | 0 | 308 | 26 | 223 | 1 | 0 | 0 | 250 | 62 | 0 | 45 | 0 | 2 | 107 | 0 | 0 | 0 | 0 | 0 | 0 | 665 |
| 8:45 AM | 1 | 265 | 20 | 0 | 0 | 286 | 64 | 178 | 1 | 3 | 0 | 246 | 39 | 1 | 50 | 3 | 1 | 93 | 0 | 2 | 0 | 0 | 1 | 2 | 627 |
| Hourly Total | 1 | 1136 | 106 | 0 | 1 | 1243 | 131 | 1003 | 4 | 4 | 1 | 1142 | 211 | 1 | 192 | 3 | 8 | 407 | 0 | 2 | 1 | 0 | 1 | 3 | 2795 |
| 9:00 AM | 0 | 265 | 22 | 0 | 0 | 287 | 23 | 180 | 1 | 2 | 0 | 206 | 21 | 1 | 43 | 0 | 0 | 65 | 0 | 2 | 0 | 0 | 0 | 2 | 560 |
| 9:15 AM | 0 | 246 | 14 | 0 | 1 | 260 | 9 | 180 | 1 | 0 | 1 | 190 | 43 | 0 | 37 | 0 | 1 | 80 | 0 | 0 | 2 | 0 | 1 | 2 | 532 |
| 9:30 AM | 0 | 251 | 13 | 0 | 0 | 264 | 12 | 246 | 0 | 2 | 0 | 260 | 36 | 0 | 32 | 0 | 1 | 68 | 1 | 0 | 0 | 0 | 0 | 1 | 593 |
| 9:45 AM | 1 | 243 | 21 | 0 | 0 | 265 | 10 | 243 | 1 | 1 | 0 | 255 | 27 | 0 | 25 | 0 | 0 | 52 | 0 | 1 | 0 | 0 | 0 | 1 | 573 |
| Hourly Total | 1 | 1005 | 70 | 0 | 1 | 1076 | 54 | 849 | 3 | 5 | 1 | 911 | 127 | 1 | 137 | 0 | 2 | 265 | 1 | 3 | 2 | 0 | 1 | 6 | 2258 |
| 10:00 AM | 0 | 220 | 19 | 0 | 2 | 239 | 14 | 279 | 0 | 0 | 0 | 293 | 20 | 0 | 32 | 0 | 2 | 52 | 0 | 1 | 0 | 0 | 0 | 1 | 585 |
| 10:15 AM | 1 | 206 | 18 | 0 | 0 | 225 | 17 | 249 | 0 | 1 | 0 | 267 | 25 | 0 | 25 | 0 | 3 | 50 | 0 | 0 | 1 | 0 | 0 | 1 | 543 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 1 | 426 | 37 | 0 | 2 | 464 | 31 | 528 | 0 | 1 | 0 | 560 | 45 | 0 | 57 | 0 | 5 | 102 | 0 | 1 | 1 | 0 | 0 | 2 | 1128 |
| 12:00 PM | 1 | 185 | 24 | 0 | 0 | 210 | 22 | 281 | 1 | 3 | 2 | 307 | 27 | 0 | 22 | 0 | 3 | 49 | 0 | 0 | 1 | 0 | 0 | 1 | 567 |
| 12:15 PM | 0 | 186 | 30 | 0 | 1 | 216 | 8 | 282 | 0 | 3 | 2 | 293 | 30 | 0 | 21 | 0 | 1 | 51 | 0 | 0 | 0 | 0 | 0 | 0 | 560 |
| 12:30 PM | 0 | 246 | 38 | 0 | 1 | 284 | 14 | 284 | 0 | 0 | 0 | 298 | 30 | 0 | 17 | 0 | 3 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 629 |
| 12:45 PM | 0 | 238 | 26 | 0 | 1 | 264 | 17 | 241 | 0 | 0 | 0 | 258 | 29 | 1 | 21 | 0 | 0 | 51 | 0 | 0 | 0 | 0 | 1 | 0 | 573 |
| Hourly Total | 1 | 855 | 118 | 0 | 3 | 974 | 61 | 1088 | 1 | 6 | 4 | 1156 | 116 | 1 | 81 | 0 | 7 | 198 | 0 | 0 | 1 | 0 | 1 | 1 | 2329 |
| 1:00 PM | 0 | 197 | 25 | 0 | 0 | 222 | 23 | 261 | 2 | 1 | 0 | 287 | 22 | 0 | 20 | 0 | 2 | 42 | 0 | 0 | 0 | 0 | 2 | 0 | 551 |
| 1:15 PM | 0 | 244 | 29 | 0 | 0 | 273 | 18 | 273 | 1 | 1 | 1 | 293 | 37 | 0 | 27 | 0 | 3 | 64 | 1 | 0 | 1 | 0 | 0 | 2 | 632 |
| 1:30 PM | 0 | 237 | 34 | 0 | 0 | 271 | 22 | 260 | 0 | 0 | 0 | 282 | 31 | 0 | 14 | 0 | 4 | 45 | 2 | 0 | 0 | 0 | 0 | 2 | 600 |
| 1:45 PM | 1 | 270 | 28 | 0 | 0 | 299 | 12 | 252 | 1 | 0 | 0 | 265 | 22 | 0 | 31 | 0 | 4 | 53 | 1 | 0 | 1 | 0 | 0 | 2 | 619 |
| Hourly Total | 1 | 948 | 116 | 0 | 0 | 1065 | 75 | 1046 | 4 | 2 | 1 | 1127 | 112 | 0 | 92 | 0 | 13 | 204 | 4 | 0 | 2 | 0 | 2 | 6 | 2402 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 0 | 279 | 48 | 0 | 2 | 327 | 41 | 351 | 2 | 0 | 1 | 394 | 46 | 0 | 28 | 0 | 2 | 74 | 1 | 0 | 0 | 0 | 0 | 1 | 796 |
| 3:15 PM | 0 | 290 | 28 | 0 | 0 | 318 | 28 | 350 | 0 | 1 | 1 | 379 | 32 | 0 | 16 | 0 | 3 | 48 | 0 | 0 | 0 | 0 | 0 | 0 | 745 |
| 3:30 PM | 0 | 301 | 53 | 1 | 2 | 355 | 32 | 362 | 2 | 3 | 1 | 399 | 42 | 0 | 33 | 0 | 4 | 75 | 2 | 0 | 0 | 1 | 0 | 3 | 832 |
| 3:45 PM | 1 | 293 | 39 | 0 | 3 | 333 | 31 | 406 | 1 | 0 | 0 | 438 | 30 | 0 | 15 | 0 | 1 | 45 | 0 | 0 | 2 | 0 | 0 | 2 | 818 |
| Hourly Total | 1 | 1163 | 168 | 1 | 7 | 1333 | 132 | 1469 | 5 | 4 | 3 | 1610 | 150 | 0 | 92 | 0 | 10 | 242 | 3 | 0 | 2 | 1 | 0 | 6 | 3191 |
| 4:00 PM | 0 | 328 | 44 | 1 | 2 | 373 | 29 | 477 | 1 | 2 | 0 | 509 | 31 | 0 | 23 | 0 | 0 | 54 | 0 | 1 | 0 | 0 | 0 | 1 | 937 |
| 4:15 PM | 0 | 330 | 51 | 3 | 1 | 384 | 28 | 519 | 1 | 2 | 0 | 550 | 38 | 2 | 34 | 0 | 0 | 74 | 1 | 1 | 0 | 0 | 0 | 2 | 1010 |

| | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 PM | 0 | 337 | 46 | 0 | 0 | 383 | 49 | 465 | 1 | 0 | 0 | 515 | 35 | 0 | 38 | 0 | 0 | 73 | 1 | 0 | 0 | 1 | 0 | 2 | 973 |
| 4:45 PM | 2 | 328 | 46 | 0 | 3 | 376 | 44 | 456 | 4 | 0 | 0 | 504 | 37 | 1 | 21 | 0 | 0 | 59 | 1 | 2 | 0 | 0 | 0 | 3 | 942 |
| Hourly Total | 2 | 1323 | 187 | 4 | 6 | 1516 | 150 | 1917 | 7 | 4 | 0 | 2078 | 141 | 3 | 116 | 0 | 0 | 260 | 3 | 4 | 0 | 1 | 0 | 8 | 3862 |
| 5:00 PM | 0 | 318 | 54 | 0 | 0 | 372 | 49 | 406 | 0 | 0 | 0 | 455 | 37 | 0 | 16 | 0 | 1 | 53 | 0 | 0 | 3 | 0 | 1 | 3 | 883 |
| 5:15 PM | 1 | 358 | 58 | 1 | 0 | 418 | 53 | 444 | 1 | 1 | 0 | 499 | 38 | 1 | 31 | 0 | 0 | 70 | 0 | 1 | 1 | 0 | 0 | 2 | 989 |
| 5:30 PM | 0 | 392 | 66 | 0 | 1 | 458 | 49 | 412 | 0 | 2 | 0 | 463 | 24 | 0 | 34 | 0 | 1 | 58 | 0 | 0 | 2 | 0 | 2 | 2 | 981 |
| 5:45 PM | 1 | 368 | 63 | 1 | 2 | 433 | 49 | 346 | 1 | 3 | 0 | 399 | 44 | 0 | 33 | 0 | 1 | 77 | 0 | 0 | 0 | 0 | 1 | 0 | 909 |
| Hourly Total | 2 | 1436 | 241 | 2 | 3 | 1681 | 200 | 1608 | 2 | 6 | 0 | 1816 | 143 | 1 | 114 | 0 | 3 | 258 | 0 | 1 | 6 | 0 | 4 | 7 | 3762 |
| Grand Total | 10 | 9006 | 1066 | 7 | 23 | 10089 | 857 | 10153 | 26 | 33 | 10 | 11069 | 1173 | 7 | 997 | 3 | 50 | 2180 | 11 | 11 | 16 | 2 | 9 | 40 | 23378 |
| Approach % | 0.1 | 89.3 | 10.6 | 0.1 | - | - | 7.7 | 91.7 | 0.2 | 0.3 | - | - | 53.8 | 0.3 | 45.7 | 0.1 | - | - | 27.5 | 27.5 | 40.0 | 5.0 | - | - | - |
| Total % | 0.0 | 38.5 | 4.6 | 0.0 | - | 43.2 | 3.7 | 43.4 | 0.1 | 0.1 | - | 47.3 | 5.0 | 0.0 | 4.3 | 0.0 | - | 9.3 | 0.0 | 0.0 | 0.1 | 0.0 | - | 0.2 | - |
| Motorcycles | 0 | 5 | 0 | 0 | - | 5 | 0 | 7 | 0 | 0 | - | 7 | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 13 |
| % Motorcycles | 0.0 | 0.1 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | - | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.1 |
| Cars & Light Goods | 10 | 8160 | 1040 | 7 | - | 9217 | 830 | 9195 | 26 | 33 | - | 10084 | 1144 | 4 | 966 | 3 | - | 2117 | 11 | 11 | 16 | 2 | - | 40 | 21458 |
| % Cars & Light Goods | 100.0 | 90.6 | 97.6 | 100.0 | - | 91.4 | 96.8 | 90.6 | 100.0 | 100.0 | - | 91.1 | 97.5 | 57.1 | 96.9 | 100.0 | - | 97.1 | 100.0 | 100.0 | 100.0 | 100.0 | - | 100.0 | 91.8 |
| Buses | 0 | 165 | 13 | 0 | - | 178 | 18 | 170 | 0 | 0 | - | 188 | 19 | 1 | 22 | 0 | - | 42 | 0 | 0 | 0 | 0 | - | 0 | 408 |
| % Buses | 0.0 | 1.8 | 1.2 | 0.0 | - | 1.8 | 2.1 | 1.7 | 0.0 | 0.0 | - | 1.7 | 1.6 | 14.3 | 2.2 | 0.0 | - | 1.9 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 1.7 |
| Single-Unit Trucks | 0 | 341 | 7 | 0 | - | 348 | 9 | 398 | 0 | 0 | - | 407 | 8 | 1 | 7 | 0 | - | 16 | 0 | 0 | 0 | 0 | - | 0 | 771 |
| % Single-Unit Trucks | 0.0 | 3.8 | 0.7 | 0.0 | - | 3.4 | 1.1 | 3.9 | 0.0 | 0.0 | - | 3.7 | 0.7 | 14.3 | 0.7 | 0.0 | - | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 3.3 |
| Articulated Trucks | 0 | 334 | 5 | 0 | - | 339 | 0 | 382 | 0 | 0 | - | 382 | 1 | 0 | 1 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 723 |
| % Articulated Trucks | 0.0 | 3.7 | 0.5 | 0.0 | - | 3.4 | 0.0 | 3.8 | 0.0 | 0.0 | - | 3.5 | 0.1 | 0.0 | 0.1 | 0.0 | - | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 3.1 |
| Bicycles on Road | 0 | 1 | 1 | 0 | - | 2 | 0 | 1 | 0 | 0 | - | 1 | 1 | 1 | 0 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 5 |
| % Bicycles on Road | 0.0 | 0.0 | 0.1 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.1 | 14.3 | 0.0 | 0.0 | - | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 4 | - | - | - | - | - | 2 | - | - | - | - | - | 13 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 17.4 | - | - | - | - | - | 20.0 | - | - | - | - | - | 26.0 | - | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | - | 19 | - | - | - | - | - | 8 | - | - | - | - | - | 37 | - | - | - | - | - | 9 | - | - |
| % Pedestrians | - | - | - | - | 82.6 | - | - | - | - | - | 80.0 | - | - | - | - | - | 74.0 | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023

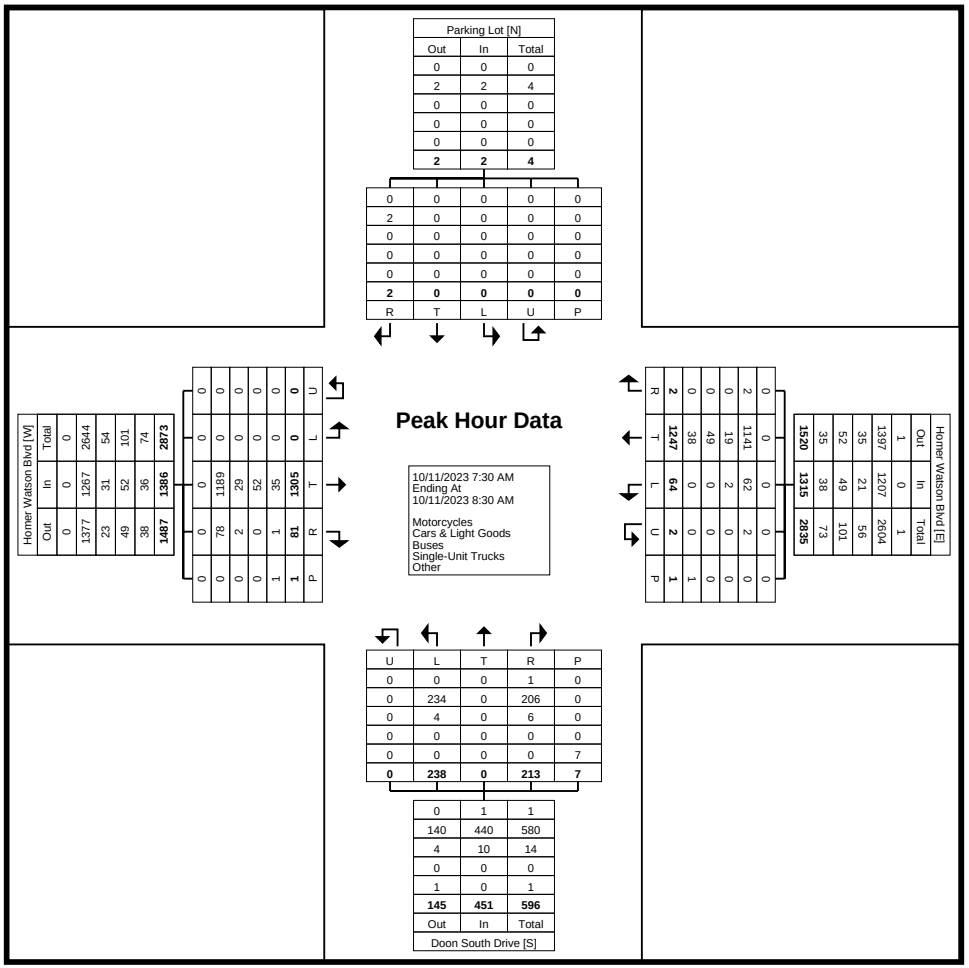

# Turning Movement Peak Hour Data (7:30 AM)

| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon South Drive Northbound | | | | | | Parking Lot Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 7:30 AM | 0 | 366 | 9 | 0 | 0 | 375 | 8 | 305 | 0 | 1 | 0 | 314 | 59 | 0 | 48 | 0 | 1 | 107 | 0 | 0 | 1 | 0 | 0 | 1 | 797 |
| 7:45 AM | 0 | 348 | 14 | 0 | 0 | 362 | 15 | 340 | 0 | 0 | 0 | 355 | 69 | 0 | 68 | 0 | 1 | 137 | 0 | 0 | 0 | 0 | 0 | 0 | 854 |
| 8:00 AM | 0 | 300 | 22 | 0 | 0 | 322 | 16 | 309 | 1 | 1 | 0 | 327 | 50 | 0 | 48 | 0 | 1 | 98 | 0 | 0 | 1 | 0 | 0 | 1 | 748 |
| 8:15 AM | 0 | 291 | 36 | 0 | 1 | 327 | 25 | 293 | 1 | 0 | 1 | 319 | 60 | 0 | 49 | 0 | 4 | 109 | 0 | 0 | 0 | 0 | 0 | 0 | 755 |
| Total | 0 | 1305 | 81 | 0 | 1 | 1386 | 64 | 1247 | 2 | 2 | 1 | 1315 | 238 | 0 | 213 | 0 | 7 | 451 | 0 | 0 | 2 | 0 | 0 | 2 | 3154 |
| Approach % | 0.0 | 94.2 | 5.8 | 0.0 | - | - | 4.9 | 94.8 | 0.2 | 0.2 | - | - | 52.8 | 0.0 | 47.2 | 0.0 | - | - | 0.0 | 0.0 | 100.0 | 0.0 | - | - | - |
| Total % | 0.0 | 41.4 | 2.6 | 0.0 | - | 43.9 | 2.0 | 39.5 | 0.1 | 0.1 | - | 41.7 | 7.5 | 0.0 | 6.8 | 0.0 | - | 14.3 | 0.0 | 0.0 | 0.1 | 0.0 | - | 0.1 | - |
| PHF | 0.000 | 0.891 | 0.563 | 0.000 | - | 0.924 | 0.640 | 0.917 | 0.500 | 0.500 | - | 0.926 | 0.862 | 0.000 | 0.783 | 0.000 | - | 0.823 | 0.000 | 0.000 | 0.500 | 0.000 | - | 0.500 | 0.923 |
| Motorcycles | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Motorcycles | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | - | 0.5 | - | - | 0.2 | - | - | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 0 | 1189 | 78 | 0 | - | 1267 | 62 | 1141 | 2 | 2 | - | 1207 | 234 | 0 | 206 | 0 | - | 440 | 0 | 0 | 2 | 0 | - | 2 | 2916 |
| % Cars & Light Goods | - | 91.1 | 96.3 | - | - | 91.4 | 96.9 | 91.5 | 100.0 | 100.0 | - | 91.8 | 98.3 | - | 96.7 | - | - | 97.6 | - | - | 100.0 | - | - | 100.0 | 92.5 |
| Buses | 0 | 29 | 2 | 0 | - | 31 | 2 | 19 | 0 | 0 | - | 21 | 4 | 0 | 6 | 0 | - | 10 | 0 | 0 | 0 | 0 | - | 0 | 62 |
| % Buses | - | 2.2 | 2.5 | - | - | 2.2 | 3.1 | 1.5 | 0.0 | 0.0 | - | 1.6 | 1.7 | - | 2.8 | - | - | 2.2 | - | - | 0.0 | - | - | 0.0 | 2.0 |
| Single-Unit Trucks | 0 | 52 | 0 | 0 | - | 52 | 0 | 49 | 0 | 0 | - | 49 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 101 |
| % Single-Unit Trucks | - | 4.0 | 0.0 | - | - | 3.8 | 0.0 | 3.9 | 0.0 | 0.0 | - | 3.7 | 0.0 | - | 0.0 | - | - | 0.0 | - | - | 0.0 | - | - | 0.0 | 3.2 |
| Articulated Trucks | 0 | 35 | 1 | 0 | - | 36 | 0 | 38 | 0 | 0 | - | 38 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 74 |
| % Articulated Trucks | - | 2.7 | 1.2 | - | - | 2.6 | 0.0 | 3.0 | 0.0 | 0.0 | - | 2.9 | 0.0 | - | 0.0 | - | - | 0.0 | - | - | 0.0 | - | - | 0.0 | 2.3 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Bicycles on Road | - | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | - | 0.0 | - | - | 0.0 | - | - | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - | - | - | - | 1 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 0.0 | - | - | - | - | - | 100.0 | - | - | - | - | - | 14.3 | - | - | - | - | - | - | - | - |
| Pedestrians | - | - | - | - | 1 | - | - | - | - | - | 0 | - | - | - | - | - | 6 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | 100.0 | - | - | - | - | - | 0.0 | - | - | - | - | - | 85.7 | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Peak Hour Data (1:00 PM)

| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon South Drive Northbound | | | | | | Parking Lot Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 1:00 PM | 0 | 197 | 25 | 0 | 0 | 222 | 23 | 261 | 2 | 1 | 0 | 287 | 22 | 0 | 20 | 0 | 2 | 42 | 0 | 0 | 0 | 0 | 2 | 0 | 551 |
| 1:15 PM | 0 | 244 | 29 | 0 | 0 | 273 | 18 | 273 | 1 | 1 | 1 | 293 | 37 | 0 | 27 | 0 | 3 | 64 | 1 | 0 | 1 | 0 | 0 | 2 | 632 |
| 1:30 PM | 0 | 237 | 34 | 0 | 0 | 271 | 22 | 260 | 0 | 0 | 0 | 282 | 31 | 0 | 14 | 0 | 4 | 45 | 2 | 0 | 0 | 0 | 0 | 2 | 600 |
| 1:45 PM | 1 | 270 | 28 | 0 | 0 | 299 | 12 | 252 | 1 | 0 | 0 | 265 | 22 | 0 | 31 | 0 | 4 | 53 | 1 | 0 | 1 | 0 | 0 | 2 | 619 |
| Total | 1 | 948 | 116 | 0 | 0 | 1065 | 75 | 1046 | 4 | 2 | 1 | 1127 | 112 | 0 | 92 | 0 | 13 | 204 | 4 | 0 | 2 | 0 | 2 | 6 | 2402 |
| Approach % | 0.1 | 89.0 | 10.9 | 0.0 | - | - | 6.7 | 92.8 | 0.4 | 0.2 | - | - | 54.9 | 0.0 | 45.1 | 0.0 | - | - | 66.7 | 0.0 | 33.3 | 0.0 | - | - | - |
| Total % | 0.0 | 39.5 | 4.8 | 0.0 | - | 44.3 | 3.1 | 43.5 | 0.2 | 0.1 | - | 46.9 | 4.7 | 0.0 | 3.8 | 0.0 | - | 8.5 | 0.2 | 0.0 | 0.1 | 0.0 | - | 0.2 | - |
| PHF | 0.250 | 0.878 | 0.853 | 0.000 | - | 0.890 | 0.815 | 0.958 | 0.500 | 0.500 | - | 0.962 | 0.757 | 0.000 | 0.742 | 0.000 | - | 0.797 | 0.500 | 0.000 | 0.500 | 0.000 | - | 0.750 | 0.950 |
| Motorcycles | 0 | 0 | 0 | 0 | - | 0 | 0 | 2 | 0 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 2 |
| % Motorcycles | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | - | 0.2 | 0.0 | - | 0.0 | - | - | 0.0 | 0.0 | - | 0.0 | - | - | 0.0 | 0.1 |
| Cars & Light Goods | 1 | 820 | 111 | 0 | - | 932 | 73 | 907 | 4 | 2 | - | 986 | 107 | 0 | 90 | 0 | - | 197 | 4 | 0 | 2 | 0 | - | 6 | 2121 |
| % Cars & Light Goods | 100.0 | 86.5 | 95.7 | - | - | 87.5 | 97.3 | 86.7 | 100.0 | 100.0 | - | 87.5 | 95.5 | - | 97.8 | - | - | 96.6 | 100.0 | - | 100.0 | - | - | 100.0 | 88.3 |
| Buses | 0 | 16 | 0 | 0 | - | 16 | 0 | 19 | 0 | 0 | - | 19 | 1 | 0 | 1 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 37 |
| % Buses | 0.0 | 1.7 | 0.0 | - | - | 1.5 | 0.0 | 1.8 | 0.0 | 0.0 | - | 1.7 | 0.9 | - | 1.1 | - | - | 1.0 | 0.0 | - | 0.0 | - | - | 0.0 | 1.5 |
| Single-Unit Trucks | 0 | 61 | 4 | 0 | - | 65 | 2 | 66 | 0 | 0 | - | 68 | 4 | 0 | 1 | 0 | - | 5 | 0 | 0 | 0 | 0 | - | 0 | 138 |
| % Single-Unit Trucks | 0.0 | 6.4 | 3.4 | - | - | 6.1 | 2.7 | 6.3 | 0.0 | 0.0 | - | 6.0 | 3.6 | - | 1.1 | - | - | 2.5 | 0.0 | - | 0.0 | - | - | 0.0 | 5.7 |
| Articulated Trucks | 0 | 51 | 0 | 0 | - | 51 | 0 | 52 | 0 | 0 | - | 52 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 103 |
| % Articulated Trucks | 0.0 | 5.4 | 0.0 | - | - | 4.8 | 0.0 | 5.0 | 0.0 | 0.0 | - | 4.6 | 0.0 | - | 0.0 | - | - | 0.0 | 0.0 | - | 0.0 | - | - | 0.0 | 4.3 |
| Bicycles on Road | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Bicycles on Road | 0.0 | 0.0 | 0.9 | - | - | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | - | 0.0 | - | - | 0.0 | 0.0 | - | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 6 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | 0.0 | - | - | - | - | - | 46.2 | - | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - | - | - | - | 7 | - | - | - | - | - | 2 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - | - | - | - | 53.8 | - | - | - | - | - | 100.0 | - | - |

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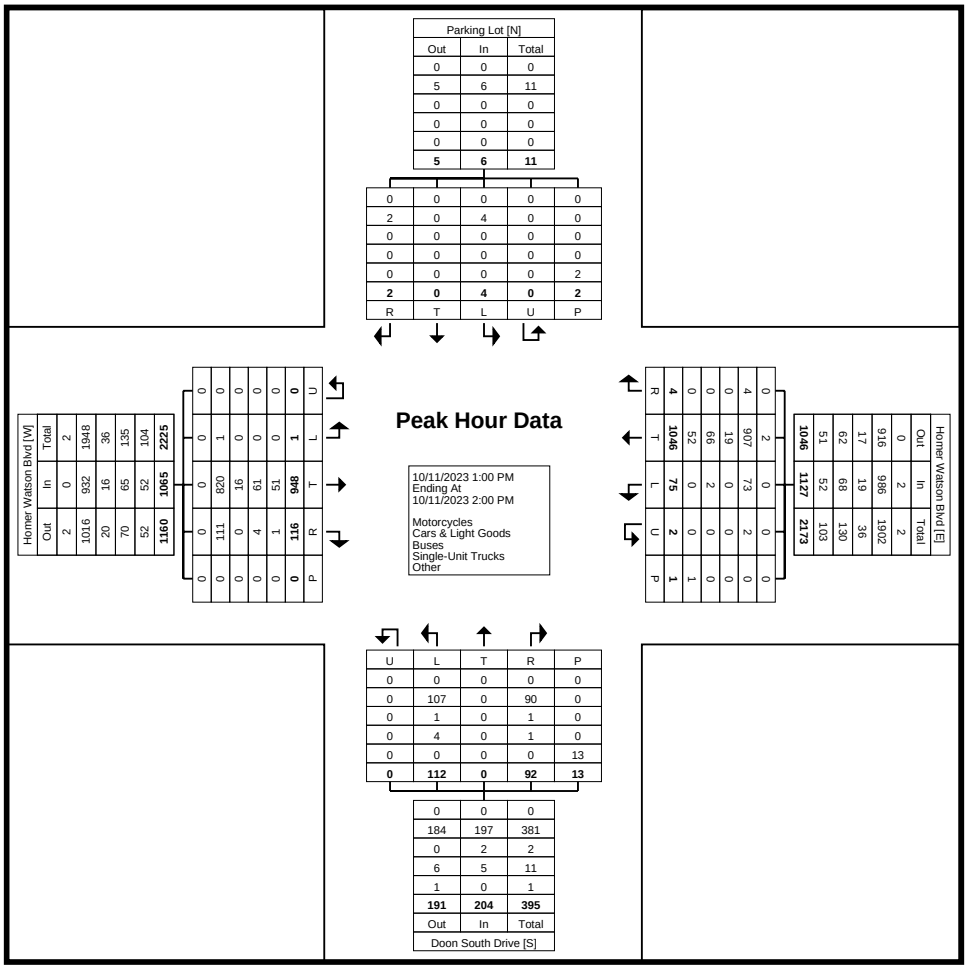
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (1:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive & Homer Watson Blvd
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Peak Hour Data (4:00 PM)

| Start Time | Homer Watson Blvd Eastbound | | | | | | Homer Watson Blvd Westbound | | | | | | Doon South Drive Northbound | | | | | | Parking Lot Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 4:00 PM | 0 | 328 | 44 | 1 | 2 | 373 | 29 | 477 | 1 | 2 | 0 | 509 | 31 | 0 | 23 | 0 | 0 | 54 | 0 | 1 | 0 | 0 | 0 | 1 | 937 |
| 4:15 PM | 0 | 330 | 51 | 3 | 1 | 384 | 28 | 519 | 1 | 2 | 0 | 550 | 38 | 2 | 34 | 0 | 0 | 74 | 1 | 1 | 0 | 0 | 0 | 2 | 1010 |
| 4:30 PM | 0 | 337 | 46 | 0 | 0 | 383 | 49 | 465 | 1 | 0 | 0 | 515 | 35 | 0 | 38 | 0 | 0 | 73 | 1 | 0 | 0 | 1 | 0 | 2 | 973 |
| 4:45 PM | 2 | 328 | 46 | 0 | 3 | 376 | 44 | 456 | 4 | 0 | 0 | 504 | 37 | 1 | 21 | 0 | 0 | 59 | 1 | 2 | 0 | 0 | 0 | 3 | 942 |
| Total | 2 | 1323 | 187 | 4 | 6 | 1516 | 150 | 1917 | 7 | 4 | 0 | 2078 | 141 | 3 | 116 | 0 | 0 | 260 | 3 | 4 | 0 | 1 | 0 | 8 | 3862 |
| Approach % | 0.1 | 87.3 | 12.3 | 0.3 | - | - | 7.2 | 92.3 | 0.3 | 0.2 | - | - | 54.2 | 1.2 | 44.6 | 0.0 | - | - | 37.5 | 50.0 | 0.0 | 12.5 | - | - | - |
| Total % | 0.1 | 34.3 | 4.8 | 0.1 | - | 39.3 | 3.9 | 49.6 | 0.2 | 0.1 | - | 53.8 | 3.7 | 0.1 | 3.0 | 0.0 | - | 6.7 | 0.1 | 0.1 | 0.0 | 0.0 | - | 0.2 | - |
| PHF | 0.250 | 0.981 | 0.917 | 0.333 | - | 0.987 | 0.765 | 0.923 | 0.438 | 0.500 | - | 0.945 | 0.928 | 0.375 | 0.763 | 0.000 | - | 0.878 | 0.750 | 0.500 | 0.000 | 0.250 | - | 0.667 | 0.956 |
| Motorcycles | 0 | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Motorcycles | 0.0 | 0.1 | 0.0 | 0.0 | - | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | 0.0 | - | 0.0 | 0.0 |
| Cars & Light Goods | 2 | 1253 | 184 | 4 | - | 1443 | 148 | 1804 | 7 | 4 | - | 1963 | 136 | 1 | 110 | 0 | - | 247 | 3 | 4 | 0 | 1 | - | 8 | 3661 |
| % Cars & Light Goods | 100.0 | 94.7 | 98.4 | 100.0 | - | 95.2 | 98.7 | 94.1 | 100.0 | 100.0 | - | 94.5 | 96.5 | 33.3 | 94.8 | - | - | 95.0 | 100.0 | 100.0 | - | 100.0 | - | 100.0 | 94.8 |
| Buses | 0 | 18 | 2 | 0 | - | 20 | 2 | 28 | 0 | 0 | - | 30 | 3 | 1 | 4 | 0 | - | 8 | 0 | 0 | 0 | 0 | - | 0 | 58 |
| % Buses | 0.0 | 1.4 | 1.1 | 0.0 | - | 1.3 | 1.3 | 1.5 | 0.0 | 0.0 | - | 1.4 | 2.1 | 33.3 | 3.4 | - | - | 3.1 | 0.0 | 0.0 | - | 0.0 | - | 0.0 | 1.5 |
| Single-Unit Trucks | 0 | 25 | 1 | 0 | - | 26 | 0 | 44 | 0 | 0 | - | 44 | 2 | 1 | 2 | 0 | - | 5 | 0 | 0 | 0 | 0 | - | 0 | 75 |
| % Single-Unit Trucks | 0.0 | 1.9 | 0.5 | 0.0 | - | 1.7 | 0.0 | 2.3 | 0.0 | 0.0 | - | 2.1 | 1.4 | 33.3 | 1.7 | - | - | 1.9 | 0.0 | 0.0 | - | 0.0 | - | 0.0 | 1.9 |
| Articulated Trucks | 0 | 26 | 0 | 0 | - | 26 | 0 | 40 | 0 | 0 | - | 40 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 66 |
| % Articulated Trucks | 0.0 | 2.0 | 0.0 | 0.0 | - | 1.7 | 0.0 | 2.1 | 0.0 | 0.0 | - | 1.9 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | 0.0 | - | 0.0 | 1.7 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | 0.0 | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 1 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | 16.7 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pedestrians | - | - | - | - | 5 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | 83.3 | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

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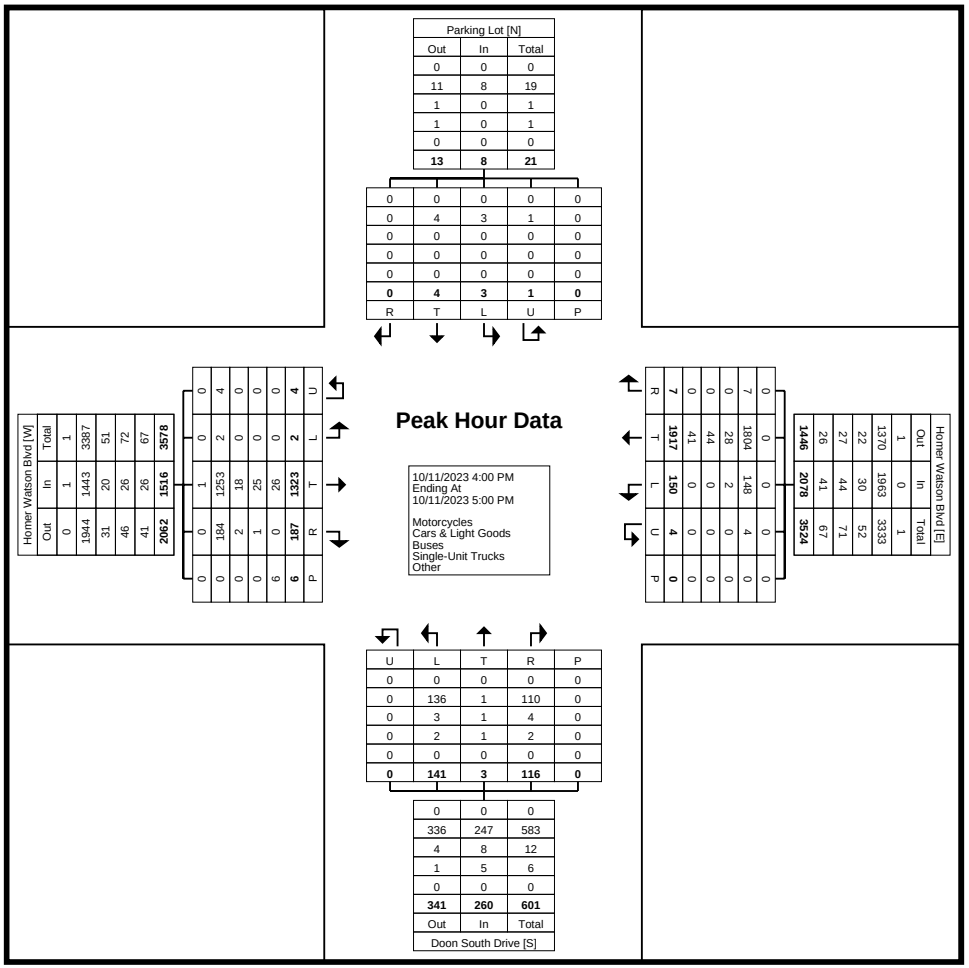
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (4:00 PM)

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Morning Peak Diagram

**Count Period**
**From:** 7:30 AM
**To:** 10:30 AM

**Peak Hour**
**From:** 7:30 AM
**To:** 8:30 AM

**Municipality:** Kitchener
**Intersection:** Homer Watson Blvd & Conestoga College Blvd
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Cloudy

**Person(s) who counted:** AT22-AB

**GeoID:** 16119
**Count Date:** Thursday, 04-Nov-21

**North Leg Total:** 2,235
**North Entering:** 1,116
**North Peds:** 6
**Peds Cross:** ⋈

| | | | | |
|---|---|---|---|---|
| % Trks | 21% | 9% | 19% | |
| Heavys | 2 | 57 | 15 | 74 |
| Trucks | 3 | 35 | 0 | 38 |
| Cars | 19 | 922 | 63 | 1,004 |
| Total | 24 | 1,014 | 78 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 25 | 6 | 151 | 182 |

**Conestoga College Blvd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 7% | 6 | 2 | 99 | 107 |
| 11% | 3 | 0 | 24 | 27 |
| 40% | 19 | 2 | 32 | 53 |
| | 28 | 4 | 155 | |

**Homer Watson Blvd**

| | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| Total | 63 | 25 | 1,031 | 1,119 |

**East Leg Total:** 400
**East Entering:** 166
**East Peds:** 3
**Peds Cross:** ⋈

**Homer Watson Blvd**

| | Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|---|
| | 65 | 51 | 1 | 13 | 22% |
| | 23 | 21 | 0 | 2 | 9% |
| | 78 | 68 | 1 | 9 | 13% |
| | | 140 | 2 | 24 | |

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**Conestoga College Blvd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 209 | 0 | 25 | 234 |

**Homer Watson Blvd**

| | | | |
|---|---|---|---|
| Total | 135 | 947 | 129 |
| Cars | 111 | 881 | 122 |
| Trucks | 3 | 22 | 0 |
| Heavys | 21 | 44 | 7 |
| % Trks | 18% | 7% | 5% |

**Peds Cross:** ⋈
**South Peds:** 8
**South Entering:** 1,211
**South leg Total:** 2,356

**Peds Cross:** ⋈
**West Peds:** 1
**West Entering:** 187
**West leg Total:** 369

| | |
|---|---|
| Heavys | 85 |
| Trucks | 38 |
| Cars | 1,022 |
| Total | 1,145 |

### Comments

To determine total vehicles entering the intersection during morning peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **2,680**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **187**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Mid-day Peak Diagram

**Count Period**
**From:** 12:00 PM
**To:** 2:00 PM

**Peak Hour**
**From:** 12:00 PM
**To:** 1:00 PM

**Municipality:** Kitchener
**Intersection:** Homer Watson Blvd & Conestoga College Blvd
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Cloudy

**Person(s) who counted:** AT22-AB

**GeoID:** 16119
**Count Date:** Thursday, 04-Nov-21

**North Leg Total:** 1,798
**North Entering:** 930
**North Peds:** 11
**Peds Cross:** ⋈

| | % Trks | 10% | 9% | 8% | |
|---|---|---|---|---|---|
| Heavys | | 5 | 49 | 9 | 63 |
| Trucks | | 2 | 20 | 0 | 22 |
| Cars | | 65 | 680 | 100 | 845 |
| Total | | 72 | 749 | 109 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 32 | 8 | 219 | 259 |

**East Leg Total:** 451
**East Entering:** 208
**East Peds:** 1
**Peds Cross:** ⧖

| | |
|---|---|
| Heavys | 79 |
| Trucks | 21 |
| Cars | 768 |
| Total | 868 |

**Homer Watson Blvd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 82 | 74 | 0 | 8 | 10% |
| 39 | 37 | 0 | 2 | 5% |
| 87 | 81 | 0 | 6 | 7% |
| 192 | 0 | 16 | | |

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**Conestoga College Blvd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 7% | 5 | 4 | 120 | 129 |
| 6% | 2 | 0 | 31 | 33 |
| 31% | 16 | 3 | 42 | 61 |
| | 23 | 7 | 193 | |

**Conestoga College Blvd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 225 | 2 | 16 | 243 |

**Homer Watson Blvd**

**Peds Cross:** ⧖
**West Peds:** 17
**West Entering:** 223
**West leg Total:** 482

| | |
|---|---|
| Heavys | 71 |
| Trucks | 23 |
| Cars | 803 |
| Total | 897 |

| | | | | |
|---|---|---|---|---|
| Total | 148 | 657 | 101 | |
| Cars | 117 | 574 | 94 | 785 |
| Trucks | 6 | 17 | 2 | 25 |
| Heavys | 25 | 66 | 5 | 96 |
| % Trks | 21% | 13% | 7% | |

**Peds Cross:** ⋈
**South Peds:** 12
**South Entering:** 906
**South leg Total:** 1,803

### Comments

To determine total vehicles entering the intersection during mid-day peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **2,267**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **223**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Afternoon Peak Diagram

**Count Period**
**From:** 3:00 PM
**To:** 6:00 PM

**Peak Hour**
**From:** 4:30 PM
**To:** 5:30 PM

**Municipality:** Kitchener
**Intersection:** Homer Watson Blvd & Conestoga College Blvd
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Cloudy

**Person(s) who counted:** AT22-AB

**GeoID:** 16119
**Count Date:** Thursday, 04-Nov-21

**North Leg Total:** 3,489
**North Entering:** 1,553
**North Peds:** 11
**Peds Cross:** ⋈

| | 2% | 4% | 14% | |
|---|---|---|---|---|
| % Trks | | | | |
| Heavys | 1 | 44 | 13 | 58 |
| Trucks | 0 | 15 | 0 | 15 |
| Cars | 53 | 1,344 | 83 | 1,480 |
| Total | 54 | 1,403 | 96 | |

**East Leg Total:** 514
**East Entering:** 293
**East Peds:** 1
**Peds Cross:** ⧖

| | |
|---|---|
| Heavys | 75 |
| Trucks | 33 |
| Cars | 1,828 |
| Total | 1,936 |

### Homer Watson Blvd

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 18 | 3 | 287 | 308 |

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 107 | 95 | 0 | 12 | 11% |
| 50 | 48 | 0 | 2 | 4% |
| 136 | 126 | 2 | 8 | 7% |
| | 269 | 2 | 22 | |

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### Conestoga College Blvd

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 4% | 4 | 4 | 200 | 208 |
| 7% | 2 | 0 | 26 | 28 |
| 16% | 13 | 1 | 72 | 86 |
| | 19 | 5 | 298 | |

### Conestoga College Blvd

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 198 | 1 | 22 | 221 |

### Homer Watson Blvd

**Peds Cross:** ⧖
**West Peds:** 7
**West Entering:** 322
**West leg Total:** 630

| | |
|---|---|
| Heavys | 65 |
| Trucks | 18 |
| Cars | 1,542 |
| Total | 1,625 |

| | | | | |
|---|---|---|---|---|
| Total | 204 | 1,621 | 97 | |
| Cars | 186 | 1,533 | 89 | 1,808 |
| Trucks | 3 | 29 | 1 | 33 |
| Heavys | 15 | 59 | 7 | 81 |
| % Trks | 9% | 5% | 8% | |

**Peds Cross:** ⋈
**South Peds:** 13
**South Entering:** 1,922
**South leg Total:** 3,547

### Comments

To determine total vehicles entering the intersection during afternoon peak hour, add all leg totals entering.

Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering

Example 1: Therefore, total vehicles entering intersection = **4,090**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn

Therefore, vehicles entering from the west = **322**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Total Count Diagram

**Municipality:** Kitchener
**Intersection:** Homer Watson Blvd & Conestoga College Blvd
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Cloudy

**Person(s) who counted:** AT22-AB

**GeoID:** 16119
**Count Date:** Thursday, 04-Nov-21

| | |
|---|---|
| **North Leg Total:** | 18,378 |
| **North Entering:** | 8,862 |
| **North Peds:** | 50 |
| **Peds Cross:** | ⋈ |
| **Bicycles Entering:** | 0 |
| **Buggies Entering:** | 0 |

| | | | | |
|---|---|---|---|---|
| % Trks | 11% | 8% | 15% | |
| Heavys | 31 | 404 | 99 | 534 |
| Trucks | 17 | 188 | 3 | 208 |
| Cars | 384 | 7,177 | 559 | 8,120 |
| Total | 432 | 7,769 | 661 | |

| | |
|---|---|
| Heavys | 617 |
| Trucks | 222 |
| Cars | 8,677 |
| Total | 9,516 |

| | |
|---|---|
| **East Leg Total:** | 3,249 |
| **East Entering:** | 1,733 |
| **East Peds:** | 15 |
| **Peds Cross:** | ⧖ |
| **Bicycles Entering:** | 0 |
| **Buggies Entering:** | 0 |

**Homer Watson Blvd**

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 223 | 43 | 1,736 | 2,002 |

**Conestoga College Blvd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 649 | 555 | 3 | 91 | 14% |
| 339 | 320 | 1 | 18 | 6% |
| 745 | 676 | 7 | 62 | 9% |
| | 1,551 | 11 | 171 | |

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| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 5% | 34 | 18 | 1,010 | 1,062 |
| 9% | 19 | 1 | 203 | 223 |
| 35% | 172 | 20 | 350 | 542 |
| | 225 | 39 | 1,563 | |

**Conestoga College Blvd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 1,343 | 9 | 164 | 1,516 |

**Homer Watson Blvd**

| | | | | |
|---|---|---|---|---|
| Total | 1,231 | 7,805 | 632 | |
| Cars | 1,032 | 7,112 | 581 | 8,725 |
| Trucks | 25 | 201 | 5 | 231 |
| Heavys | 174 | 492 | 46 | 712 |
| % Trks | 16% | 9% | 8% | |

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 46 |
| **West Entering:** | 1,827 |
| **West leg Total:** | 3,829 |
| **Bicycles Entering:** | 1 |
| **Buggies Entering:** | 0 |

| | |
|---|---|
| Heavys | 638 |
| Trucks | 215 |
| Cars | 8,203 |
| Total | 9,056 |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 73 |
| **South Entering:** | 9,668 |
| **South leg Total:** | 18,724 |
| **Bicycles Entering:** | 0 |
| **Buggies Entering:** | 0 |

### Comments

To determine total vehicles entering the intersection, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **22,090**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **1,827**

Notes: None

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Estimated Daily Traffic

Total Factor = Monthly Factor 1 x Daily Factor 1 x 24 Hour Factor 1.74 = 1.740000

**Municipality:** Kitchener
**Intersection:** Homer Watson Blvd & Conestoga College Blvd
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Cloudy

**Person(s) who counted:** AT22-AB

**GeoID:** 16119
**Count Date:** Thursday, 04-Nov-21

**North Leg Total:** 31,978
**North Entering:** 15,420
**North Peds:** N/A
**Peds Cross:** ⋈

| | | | | |
|---|---|---|---|---|
| % Trks | 11% | 8% | 15% | |
| Heavys | 54 | 703 | 172 | 929 |
| Trucks | 30 | 327 | 5 | 362 |
| Cars | 668 | 12,488 | 973 | 14,129 |
| Total | 752 | 13,518 | 1,150 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 388 | 75 | 3,021 | 3,483 |

**Conestoga College Blvd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 5% | 59 | 31 | 1,757 | 1,848 |
| 9% | 33 | 2 | 353 | 388 |
| 35% | 299 | 35 | 609 | 943 |
| | 392 | 68 | 2,720 | |

**Homer Watson Blvd**

| | | | | |
|---|---|---|---|---|
| Total | 2,142 | 13,581 | 1,100 | |
| Cars | 1,796 | 12,375 | 1,011 | 15,182 |
| Trucks | 44 | 350 | 9 | 402 |
| Heavys | 303 | 856 | 80 | 1,239 |
| % Trks | 16% | 9% | 8% | |

**Peds Cross:** ⧖
**West Peds:** N/A
**West Entering:** 3,179
**West leg Total:** 6,662

| | |
|---|---|
| Heavys | 1,110 |
| Trucks | 374 |
| Cars | 14,273 |
| Total | 15,757 |

**East Leg Total:** 5,653
**East Entering:** 3,015
**East Peds:** N/A
**Peds Cross:** ⧖

| | |
|---|---|
| Heavys | 1,074 |
| Trucks | 386 |
| Cars | 15,098 |
| Total | 16558 |

**Homer Watson Blvd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 1,129 | 966 | 5 | 158 | 14% |
| 590 | 557 | 2 | 31 | 6% |
| 1,296 | 1,176 | 12 | 108 | 9% |
| | 2,699 | 19 | 298 | |

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**Conestoga College Blvd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 2,337 | 16 | 285 | 2,638 |

**Peds Cross:** ⋈
**South Peds:** N/A
**South Entering:** 16,822
**South leg Total:** 32,580

### Comments

To determine the EDT (Estimated Daily Traffic), add all four leg totals and divide by two.
This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example: $\frac{\text{(West leg total + South leg total + East leg total + North leg total)}}{2}$ ***EDT =*** ***38,437***

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Peak Hour Factor By Movement

**Municipality:** Kitchener
**Intersection:** Homer Watson Blvd & Conestoga College Blvd
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Cloudy

**Person(s) who counted:** AT22-AB

**GeoID:** 16119
**Count Date:** Thursday, 04-Nov-21

**North Approach PHF**

| | |
|---|---|
| AM Peak: | 0.88 |
| Mid-day Peak: | 0.99 |
| PM Peak: | 0.93 |

| | Movement | | |
|---|---|---|---|
| PM | 0.59 | 0.96 | 0.77 |
| MID | 0.78 | 0.96 | 0.91 |
| AM | 0.60 | 0.89 | 0.67 |

**Homer Watson Blvd**

**East Approach PHF**

| | |
|---|---|
| AM Peak: | 0.83 |
| Mid-day Peak: | 0.90 |
| PM Peak: | 0.68 |

AM AM Peak Hour
MID Mid-day Peak Hour
PM PM Peak Hour

**Conestoga College Blvd**

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| AM | MID | PM |
|---|---|---|
| 0.71 | 0.85 | 0.76 |
| 0.72 | 0.81 | 0.63 |
| 0.85 | 0.91 | 0.65 |

Movement

**Conestoga College Blvd**

| Movement | PM | MID | AM |
|---|---|---|---|
| | 0.81 | 0.83 | 0.86 |
| | 0.64 | 0.75 | 0.52 |
| | 0.90 | 0.80 | 0.78 |

**Homer Watson Blvd**

**West Approach PHF**

| | |
|---|---|
| AM Peak: | 0.79 |
| Mid-day Peak: | 0.91 |
| PM Peak: | 0.85 |

| | | | | |
|---|---|---|---|---|
| 0.91 | 0.88 | 0.77 | AM |
| 0.95 | 0.91 | 0.77 | MID |
| 0.78 | 0.88 | 0.78 | PM |

Movement

**South Approach PHF**

| | |
|---|---|
| AM Peak: | 0.89 |
| Mid-day Peak: | 0.94 |
| PM Peak: | 0.92 |

**Comments**

**Intersection:** Homer Watson Blvd & Conestoga C
**GeoID:** 16119
**Municipality:** Kitchener
**Major Road:** Homer Watson Blvd

**Intersection Control:** Signalized
**Date:** Thursday, 04-Nov-21
**Name:** AT22-AB
**Weather:** Cloudy

| | | | EASTBOUND | | | WESTBOUND | | | NORTHBOUND | | | SOUTHBOUND | | | TOTAL | TOTAL HOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Approach Control* | | | ***Signalized*** | | | ***Signalized*** | | | ***Signalized*** | | | ***Signalized*** | | | | |
| 7:30 | to | 7:45 | 23 | 4 | 16 | 18 | 3 | 19 | 27 | 229 | 42 | 29 | 284 | 4 | 698 | |
| 7:45 | to | 8:00 | 24 | 6 | 14 | 23 | 4 | 15 | 34 | 269 | 37 | 11 | 275 | 2 | 714 | |
| 8:00 | to | 8:15 | 31 | 4 | 6 | 18 | 8 | 8 | 37 | 220 | 25 | 16 | 235 | 10 | 618 | |
| 8:15 | to | 8:30 | 29 | 13 | 17 | 19 | 8 | 23 | 37 | 229 | 25 | 22 | 220 | 8 | 650 | 2,680 |
| 8:30 | to | 8:45 | 25 | 8 | 17 | 14 | 10 | 15 | 38 | 210 | 18 | 25 | 262 | 15 | 657 | 2,639 |
| 8:45 | to | 9:00 | 25 | 6 | 23 | 19 | 14 | 13 | 39 | 188 | 23 | 30 | 205 | 9 | 594 | 2,519 |
| 9:00 | to | 9:15 | 17 | 5 | 21 | 26 | 13 | 27 | 34 | 164 | 18 | 14 | 206 | 9 | 554 | 2,455 |
| 9:15 | to | 9:30 | 15 | 8 | 14 | 28 | 7 | 16 | 31 | 165 | 12 | 15 | 180 | 8 | 499 | 2,304 |
| 9:30 | to | 9:45 | 20 | 6 | 11 | 19 | 14 | 15 | 32 | 154 | 8 | 23 | 210 | 15 | 527 | 2,174 |
| 9:45 | to | 10:00 | 13 | 5 | 20 | 15 | 5 | 20 | 34 | 141 | 7 | 11 | 177 | 7 | 455 | 2,035 |
| 10:00 | to | 10:15 | 28 | 3 | 21 | 30 | 14 | 22 | 30 | 134 | 5 | 13 | 169 | 8 | 477 | 1,958 |
| 10:15 | to | 10:30 | 22 | 6 | 10 | 14 | 6 | 6 | 32 | 155 | 8 | 16 | 156 | 11 | 442 | 1,901 |
| **AM Peak Hour** | | | | | | | | | | | | | | | | |
| **7:30** | **to** | **8:30** | **107** | **27** | **53** | **78** | **23** | **65** | **135** | **947** | **129** | **78** | **1,014** | **24** | **2,680** | |
| **# of trucks in peak** | | | 2 | 0 | 2 | 1 | 0 | 1 | 3 | 22 | 0 | 0 | 35 | 3 | 69 | |
| **# of heavies in peak** | | | 6 | 3 | 19 | 9 | 2 | 13 | 21 | 44 | 7 | 15 | 57 | 2 | 198 | |
| **% heavies (Total)** | | | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% | 10% | |
| 12:00 | to | 12:15 | 39 | 8 | 11 | 21 | 7 | 21 | 39 | 162 | 33 | 24 | 195 | 16 | 576 | |
| 12:15 | to | 12:30 | 33 | 4 | 13 | 24 | 10 | 24 | 39 | 170 | 22 | 30 | 186 | 18 | 573 | |
| 12:30 | to | 12:45 | 31 | 11 | 19 | 24 | 12 | 15 | 36 | 145 | 19 | 25 | 186 | 15 | 538 | |
| 12:45 | to | 13:00 | 26 | 10 | 18 | 18 | 10 | 22 | 34 | 180 | 27 | 30 | 182 | 23 | 580 | 2,267 |
| 13:00 | to | 13:15 | 27 | 8 | 20 | 15 | 14 | 15 | 50 | 159 | 13 | 16 | 163 | 18 | 518 | 2,209 |
| 13:15 | to | 13:30 | 23 | 10 | 15 | 17 | 8 | 18 | 42 | 196 | 6 | 8 | 202 | 14 | 559 | 2,195 |
| 13:30 | to | 13:45 | 35 | 6 | 22 | 29 | 17 | 17 | 49 | 149 | 21 | 14 | 205 | 21 | 585 | 2,242 |
| 13:45 | to | 14:00 | 35 | 7 | 16 | 15 | 9 | 12 | 19 | 197 | 24 | 17 | 184 | 11 | 546 | 2,208 |
| **Midday Peak Hour** | | | | | | | | | | | | | | | | |
| **12:00** | **to** | **13:00** | **129** | **33** | **61** | **87** | **39** | **82** | **148** | **657** | **101** | **109** | **749** | **72** | **2,267** | |
| **# of trucks in peak** | | | 4 | 0 | 3 | 0 | 0 | 0 | 6 | 17 | 2 | 0 | 20 | 2 | 54 | |
| **# of heavies in peak** | | | 5 | 2 | 16 | 6 | 2 | 8 | 25 | 66 | 5 | 9 | 49 | 5 | 198 | |
| **% heavies (Total)** | | | 7% | 6% | 31% | 7% | 5% | 10% | 21% | 13% | 7% | 8% | 9% | 10% | 11% | |
| 15:00 | to | 15:15 | 36 | 3 | 25 | 20 | 9 | 28 | 27 | 290 | 28 | 25 | 280 | 14 | 785 | |
| 15:15 | to | 15:30 | 26 | 6 | 12 | 30 | 12 | 30 | 44 | 269 | 22 | 14 | 275 | 17 | 757 | |
| 15:30 | to | 15:45 | 44 | 3 | 17 | 18 | 11 | 18 | 38 | 340 | 7 | 14 | 283 | 16 | 809 | |
| 15:45 | to | 16:00 | 39 | 15 | 12 | 35 | 15 | 16 | 30 | 318 | 11 | 28 | 297 | 18 | 834 | 3,185 |
| 16:00 | to | 16:15 | 44 | 5 | 19 | 44 | 16 | 32 | 34 | 334 | 14 | 19 | 313 | 17 | 891 | 3,291 |
| 16:15 | to | 16:30 | 42 | 7 | 18 | 21 | 16 | 29 | 35 | 378 | 15 | 30 | 326 | 23 | 940 | 3,474 |
| 16:30 | to | 16:45 | 49 | 11 | 22 | 52 | 20 | 35 | 48 | 370 | 23 | 25 | 338 | 11 | 1,004 | 3,669 |
| 16:45 | to | 17:00 | 53 | 6 | 21 | 36 | 10 | 32 | 65 | 408 | 25 | 31 | 365 | 23 | 1,075 | 3,910 |
| 17:00 | to | 17:15 | 64 | 7 | 24 | 30 | 11 | 15 | 49 | 380 | 31 | 18 | 343 | 10 | 982 | 4,001 |
| 17:15 | to | 17:30 | 42 | 4 | 19 | 18 | 9 | 25 | 42 | 463 | 18 | 22 | 357 | 10 | 1,029 | 4,090 |
| 17:30 | to | 17:45 | 55 | 10 | 14 | 19 | 9 | 24 | 55 | 348 | 27 | 26 | 259 | 20 | 866 | 3,952 |
| 17:45 | to | 18:00 | 47 | 8 | 15 | 16 | 8 | 22 | 51 | 291 | 18 | 20 | 251 | 11 | 758 | 3,635 |
| **PM Peak Hour** | | | | | | | | | | | | | | | | |
| **16:30** | **to** | **17:30** | **208** | **28** | **86** | **136** | **50** | **107** | **204** | **1,621** | **97** | **96** | **1,403** | **54** | **4,090** | |
| **# of trucks in peak** | | | 4 | 0 | 1 | 2 | 0 | 0 | 3 | 29 | 1 | 0 | 15 | 0 | 55 | |
| **# of heavies in peak** | | | 4 | 2 | 13 | 8 | 2 | 12 | 15 | 59 | 7 | 13 | 44 | 1 | 180 | |
| **% heavies (Total)** | | | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% | 6% | |

**Intersection:** Homer Watson Blvd & Conestoga Col
**GeoID:** 16119
**Municipality:** Kitchener
**Major Road:** Homer Watson Blvd

**Intersection Control:** Signalized
**Date:** Thursday, 04-Nov-21
**Name:** AT22-AB
**Weather:** Cloudy

| PEDESTRIAN CROSSING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Time | | | Crossing Approach | | | | | |
| | | | East App. | West App. | North App. | South App. | TOTAL | TOTAL HOUR |
| 7:30 | to | 7:45 | 0 | 0 | 1 | 1 | 2 | |
| 7:45 | to | 8:00 | 0 | 0 | 1 | 1 | 2 | |
| 8:00 | to | 8:15 | 1 | 0 | 2 | 2 | 5 | |
| 8:15 | to | 8:30 | 2 | 1 | 2 | 4 | 9 | 18 |
| 8:30 | to | 8:45 | 0 | 0 | 0 | 1 | 1 | 17 |
| 8:45 | to | 9:00 | 0 | 1 | 0 | 4 | 5 | 20 |
| 9:00 | to | 9:15 | 0 | 0 | 0 | 3 | 3 | 18 |
| 9:15 | to | 9:30 | 0 | 1 | 0 | 1 | 2 | 11 |
| 9:30 | to | 9:45 | 0 | 1 | 0 | 1 | 2 | 12 |
| 9:45 | to | 10:00 | 1 | 0 | 0 | 2 | 3 | 10 |
| 10:00 | to | 10:15 | 1 | 1 | 1 | 2 | 5 | 12 |
| 10:15 | to | 10:30 | 0 | 0 | 1 | 1 | 2 | 12 |
| **AM Peak Hour** | | | | | | | **41** | |
| **7:30** | **to** | **8:30** | **3** | **1** | **6** | **8** | **18** | |
| 12:00 | to | 12:15 | 0 | 1 | 0 | 1 | 2 | |
| 12:15 | to | 12:30 | 0 | 9 | 4 | 6 | 19 | |
| 12:30 | to | 12:45 | 0 | 7 | 2 | 5 | 14 | |
| 12:45 | to | 13:00 | 1 | 0 | 5 | 0 | 6 | 41 |
| 13:00 | to | 13:15 | 1 | 0 | 1 | 1 | 3 | 42 |
| 13:15 | to | 13:30 | 0 | 0 | 2 | 1 | 3 | 26 |
| 13:30 | to | 13:45 | 2 | 0 | 0 | 1 | 3 | 15 |
| 13:45 | to | 14:00 | 0 | 1 | 1 | 2 | 4 | 13 |
| **Midday Peak Hour** | | | | | | | **54** | |
| **12:00** | **to** | **13:00** | 1 | 17 | 11 | 12 | **41** | |
| 15:00 | to | 15:15 | 0 | 5 | 5 | 1 | 11 | |
| 15:15 | to | 15:30 | 0 | 2 | 0 | 2 | 4 | |
| 15:30 | to | 15:45 | 2 | 1 | 3 | 1 | 7 | |
| 15:45 | to | 16:00 | 0 | 0 | 0 | 5 | 5 | 27 |
| 16:00 | to | 16:15 | 0 | 3 | 3 | 6 | 12 | 28 |
| 16:15 | to | 16:30 | 0 | 2 | 1 | 1 | 4 | 28 |
| 16:30 | to | 16:45 | 0 | 0 | 3 | 2 | 5 | 26 |
| 16:45 | to | 17:00 | 0 | 1 | 2 | 4 | 7 | 28 |
| 17:00 | to | 17:15 | 1 | 3 | 3 | 4 | 11 | 27 |
| 17:15 | to | 17:30 | 0 | 3 | 3 | 3 | 9 | 32 |
| 17:30 | to | 17:45 | 1 | 0 | 1 | 1 | 3 | 30 |
| 17:45 | to | 18:00 | 2 | 3 | 3 | 3 | 11 | 34 |
| **PM Peak Hour** | | | | | | | **89** | |
| **16:30** | **to** | **17:30** | 1 | 7 | 11 | 13 | **32** | |

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Morning Peak Diagram

**Count Period**
**From:** 7:30 AM
**To:** 10:30 AM

**Peak Hour**
**From:** 7:30 AM
**To:** 8:30 AM

**Municipality:** Kitchener
**Intersection:** Homer Watston Blvd @ New Dundee Rd/Hwy 4
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 30764
**Count Date:** Wednesday, 29-Mar-23

**North Leg Total:** 3,016
**North Entering:** 1,282
**North Peds:** 0
**Peds Cross:** ⋈

| | | | | |
|---|---|---|---|---|
| % Trks | 18% | 8% | 0% | |
| Heavys | 3 | 71 | 0 | 74 |
| Trucks | 2 | 30 | 0 | 32 |
| Cars | 23 | 1,153 | 0 | 1,176 |
| Total | 28 | 1,254 | 0 | |

| | |
|---|---|
| Heavys | 87 |
| Trucks | 39 |
| Cars | 1,608 |
| Total | 1,734 |

**East Leg Total:** 1,280
**East Entering:** 1,280
**East Peds:** 2
**Peds Cross:** ⧖

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 17 | 8 | 288 | 313 |

**Homer Watson Blvd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 843 | 768 | 25 | 50 | 9% |
| 210 | 196 | 5 | 9 | 7% |
| 227 | 188 | 6 | 33 | 17% |
| 1,152 | 36 | 92 | | |

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**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 6% | 0 | 3 | 51 | 54 |
| 0% | 0 | 0 | 0 | 0 |
| 2% | 4 | 5 | 537 | 546 |
| | 4 | 8 | 588 | |

**Hwy 401 WB Ramp**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

**Homer Watson Blvd**

| | | | | |
|---|---|---|---|---|
| Total | 75 | 837 | 0 | |
| Cars | 69 | 789 | 0 | 858 |
| Trucks | 1 | 11 | 0 | 12 |
| Heavys | 5 | 37 | 0 | 42 |
| % Trks | 8% | 6% | 0% | |

**Peds Cross:** ⧖
**West Peds:** 0
**West Entering:** 600
**West leg Total:** 913

| | |
|---|---|
| Heavys | 108 |
| Trucks | 41 |
| Cars | 1,878 |
| Total | 2,027 |

**Peds Cross:** ⋈
**South Peds:** 0
**South Entering:** 912
**South leg Total:** 2,939

### Comments

To determine total vehicles entering the intersection during morning peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **4,074**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **600**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Mid-day Peak Diagram

**Count Period**
**From:** 12:00 PM
**To:** 2:00 PM

**Peak Hour**
**From:** 12:00 PM
**To:** 1:00 PM

**Municipality:** Kitchener
**Intersection:** Homer Watston Blvd @ New Dundee Rd/Hwy 4
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 30764
**Count Date:** Wednesday, 29-Mar-23

| | |
|---|---|
| **North Leg Total:** | 1,976 |
| **North Entering:** | 879 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |

| % Trks | 7% | 10% | 0% | |
|---|---|---|---|---|
| Heavys | 3 | 52 | 0 | 55 |
| Trucks | 0 | 31 | 0 | 31 |
| Cars | 41 | 752 | 0 | 793 |
| Total | 44 | 835 | 0 | |

| | |
|---|---|
| Heavys | 79 |
| Trucks | 30 |
| Cars | 988 |
| Total | 1,097 |

| | |
|---|---|
| **East Leg Total:** | 911 |
| **East Entering:** | 911 |
| **East Peds:** | 4 |
| **Peds Cross:** | ⧖ |

**Homer Watson Blvd**

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 18 | 7 | 360 | 385 |

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 516 | 442 | 19 | 55 | 14% |
| 229 | 213 | 5 | 11 | 7% |
| 166 | 129 | 3 | 34 | 22% |
| 784 | 27 | 100 | | |

**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 9% | 1 | 3 | 40 | 44 |
| 0% | 0 | 0 | 0 | 0 |
| 4% | 6 | 2 | 218 | 226 |
| | 7 | 5 | 258 | |

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**Hwy 401 WB Ramp**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

**Homer Watson Blvd**

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 270 |
| **West leg Total:** | 655 |

| | |
|---|---|
| Heavys | 92 |
| Trucks | 36 |
| Cars | 1,099 |
| Total | 1,227 |

| | | | | |
|---|---|---|---|---|
| Total | 112 | 537 | 0 | |
| Cars | 106 | 506 | 0 | 612 |
| Trucks | 2 | 8 | 0 | 10 |
| Heavys | 4 | 23 | 0 | 27 |
| % Trks | 5% | 6% | 0% | |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 0 |
| **South Entering:** | 649 |
| **South leg Total:** | 1,876 |

### Comments

To determine total vehicles entering the intersection during mid-day peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **2,709**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **270**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Afternoon Peak Diagram

**Count Period**
**From:** 3:00 PM
**To:** 6:00 PM

**Peak Hour**
**From:** 4:30 PM
**To:** 5:30 PM

**Municipality:** Kitchener
**Intersection:** Homer Watston Blvd @ New Dundee Rd/Hwy 4
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 30764
**Count Date:** Wednesday, 29-Mar-23

### North Leg

| | |
|---|---|
| **North Leg Total:** | 2,880 |
| **North Entering:** | 1,187 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |

| % Trks | 2% | 3% | 0% | |
|---|---|---|---|---|
| Heavys | 0 | 29 | 0 | 29 |
| Trucks | 1 | 6 | 0 | 7 |
| Cars | 49 | 1,102 | 0 | 1,151 |
| Total | 50 | 1,137 | 0 | |

### East Leg

| | |
|---|---|
| Heavys | 74 |
| Trucks | 24 |
| Cars | 1,595 |
| Total | 1,693 |

| | |
|---|---|
| **East Leg Total:** | 1,719 |
| **East Entering:** | 1,719 |
| **East Peds:** | 2 |
| **Peds Cross:** | ⧖ |

### Homer Watson Blvd

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 4 | 6 | 825 | 835 |

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 913 | 853 | 16 | 44 | 7% |
| 567 | 564 | 2 | 1 | 1% |
| 239 | 232 | 0 | 7 | 3% |
| | 1,649 | 18 | 52 | |

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### New Dundee Rd

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 4% | 2 | 0 | 44 | 46 |
| 0% | 0 | 0 | 0 | 0 |
| 2% | 2 | 5 | 332 | 339 |
| | 4 | 5 | 376 | |

### Hwy 401 WB Ramp

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

### Homer Watson Blvd

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 385 |
| **West leg Total:** | 1,220 |

| | |
|---|---|
| Heavys | 38 |
| Trucks | 11 |
| Cars | 1,666 |
| Total | 1,715 |

| | | | | |
|---|---|---|---|---|
| Total | 218 | 734 | 0 | |
| Cars | 212 | 698 | 0 | 910 |
| Trucks | 3 | 8 | 0 | 11 |
| Heavys | 3 | 28 | 0 | 31 |
| % Trks | 3% | 5% | 0% | |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 0 |
| **South Entering:** | 952 |
| **South leg Total:** | 2,667 |

### Comments

To determine total vehicles entering the intersection during afternoon peak hour, add all leg totals entering.

Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering

Example 1: Therefore, total vehicles entering intersection = **4,243**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn

Therefore, vehicles entering from the west = **385**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Total Count Diagram

**Municipality:** Kitchener
**Intersection:** Homer Watston Blvd @ New Dundee Rd/Hwy 4
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 30764
**Count Date:** Wednesday, 29-Mar-23

| | |
|---|---|
| **North Leg Total:** | 18,861 |
| **North Entering:** | 8,126 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |
| **Bicycles Entering:** | 0 |
| **Buggies Entering:** | 0 |

| % Trks | 4% | 8% | 0% | |
|---|---|---|---|---|
| Heavys | 7 | 460 | 0 | 467 |
| Trucks | 4 | 179 | 0 | 183 |
| Cars | 278 | 7,198 | 0 | 7,476 |
| Total | 289 | 7,837 | 0 | |

| | |
|---|---|
| Heavys | 678 |
| Trucks | 253 |
| Cars | 9,804 |
| Total | 10,735 |

| | |
|---|---|
| **East Leg Total:** | 9,507 |
| **East Entering:** | 9,507 |
| **East Peds:** | 15 |
| **Peds Cross:** | ⧖ |
| **Bicycles Entering:** | 0 |
| **Buggies Entering:** | 0 |

**Homer Watson Blvd**

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 93 | 48 | 3,622 | 3,763 |

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 5,432 | 4,852 | 151 | 429 | 11% |
| 2,457 | 2,364 | 34 | 59 | 4% |
| 1,618 | 1,384 | 20 | 214 | 14% |
| | 8,600 | 205 | 702 | |

**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 4% | 6 | 7 | 314 | 327 |
| 0% | 0 | 0 | 0 | 0 |
| 3% | 32 | 36 | 2,477 | 2,545 |
| | 38 | 43 | 2,791 | |

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**Hwy 401 WB Ramp**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

**Homer Watson Blvd**

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 2,872 |
| **West leg Total:** | 6,635 |
| **Bicycles Entering:** | 0 |
| **Buggies Entering:** | 0 |

| | | | | |
|---|---|---|---|---|
| Heavys | 706 | | | |
| Trucks | 235 | | | |
| Cars | 11,059 | | | |
| Total | 12,000 | | | |

| | | | | |
|---|---|---|---|---|
| Total | 1,017 | 4,976 | 0 | |
| Cars | 980 | 4,638 | 0 | 5,618 |
| Trucks | 10 | 95 | 0 | 105 |
| Heavys | 27 | 243 | 0 | 270 |
| % Trks | 4% | 7% | 0% | |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 1 |
| **South Entering:** | 5,993 |
| **South leg Total:** | 17,993 |
| **Bicycles Entering:** | 3 |
| **Buggies Entering:** | 0 |

### Comments

To determine total vehicles entering the intersection, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **26,498**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **2,872**

Notes: None

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Estimated Daily Traffic

Total Factor = Monthly Factor 1 x Daily Factor 1 x 24 Hour Factor 1.74 = 1.740000

**Municipality:** Kitchener
**Intersection:** Homer Watston Blvd @ New Dundee Rd/Hwy 4
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 30764
**Count Date:** Wednesday, 29-Mar-23

### Homer Watson Blvd

| | | | | | |
|---|---|---|---|---|---|
| **North Leg Total:** | 32,818 | % Trks | 4% | 8% | 0% |
| **North Entering:** | 14,139 | Heavys | 12 | 800 | 0 |
| **North Peds:** | N/A | Trucks | 7 | 311 | 0 |
| **Peds Cross:** | ⋈ | Cars | 484 | 12,525 | 0 |
| | | Total | 503 | 13,636 | 0 |

| | | | |
|---|---|---|---|
| | | | 813 |
| | | | 318 |
| | | | 13,008 |

| | | | |
|---|---|---|---|
| Heavys | 1,180 | **East Leg Total:** | 16,542 |
| Trucks | 440 | **East Entering:** | 16,542 |
| Cars | 17,059 | **East Peds:** | N/A |
| Total | 18679 | **Peds Cross:** | ⧖ |

### New Dundee Rd

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 162 | 84 | 6,302 | 6,548 |

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 9,452 | 8,442 | 263 | 746 | 11% |
| 4,275 | 4,113 | 59 | 103 | 4% |
| 2,815 | 2,408 | 35 | 372 | 14% |
| | 14,964 | 357 | 1,221 | |

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### Hwy 401 WB Ramp

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 4% | 10 | 12 | 546 | 569 |
| 0% | 0 | 0 | 0 | 0 |
| 3% | 56 | 63 | 4,310 | 4,428 |
| | 66 | 75 | 4,856 | |

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 0 | 0 | 0 | 0 |

### Homer Watson Blvd

| | | | | |
|---|---|---|---|---|
| **Peds Cross:** | ⧖ | Total | 1,770 | 8,658 | 0 |
| **West Peds:** | N/A | Cars | 1,705 | 8,070 | 0 |
| **West Entering:** | 4,997 | Trucks | 17 | 165 | 0 |
| **West leg Total:** | 11,545 | Heavys | 47 | 423 | 0 |
| | | % Trks | 4% | 7% | 0% |

| | | | |
|---|---|---|---|
| Heavys | 1,228 | | |
| Trucks | 409 | | |
| Cars | 19,243 | | 9,775 |
| Total | 20,880 | | 183 |
| | | | 470 |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | N/A |
| **South Entering:** | 10,428 |
| **South leg Total:** | 31,308 |

### Comments

To determine the EDT (Estimated Daily Traffic), add all four leg totals and divide by two.
This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example: (West leg total + South leg total + East leg total + North leg total) / 2 ***EDT =*** ***46,107***

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Peak Hour Factor By Movement

**Municipality:** Kitchener
**Intersection:** Homer Watston Blvd @ New Dundee Rd/Hwy 4
**Control:** Signalized
**Major Road:** Homer Watson Blvd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 30764
**Count Date:** Wednesday, 29-Mar-23

**North Approach PHF**

| | |
|---|---|
| AM Peak: | 0.95 |
| Mid-day Peak: | 0.88 |
| PM Peak: | 0.93 |

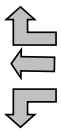
**East Approach PHF**

| | |
|---|---|
| AM Peak: | 0.86 |
| Mid-day Peak: | 0.92 |
| PM Peak: | 0.94 |

AM AM Peak Hour
MID Mid-day Peak Hour
PM PM Peak Hour

| | Movement | | |
|---|---|---|---|
| PM | 0.83 | 0.94 | 0.00 |
| MID | 0.61 | 0.90 | 0.00 |
| AM | 0.64 | 0.95 | 0.00 |

**Homer Watson Blvd**

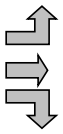


| AM | MID | PM | |
|---|---|---|---|
| 0.83 | 0.90 | 0.94 | |
| 0.91 | 0.92 | 0.96 | |
| 0.92 | 0.77 | 0.84 | Movement |

**New Dundee Rd**

**Hwy 401 WB Ramp**

| Movement | PM | MID | AM |
|---|---|---|---|
| | 0.58 | 0.92 | 0.90 |
| | 0.00 | 0.00 | 0.00 |
| | 0.78 | 0.87 | 0.86 |



**Homer Watson Blvd**

| | | | | |
|---|---|---|---|---|
| 0.78 | 0.89 | 0.00 | AM | |
| 0.85 | 0.87 | 0.00 | MID | |
| 0.96 | 0.88 | 0.00 | PM | |
| Movement | | | | |

**West Approach PHF**

| | |
|---|---|
| AM Peak: | 0.87 |
| Mid-day Peak: | 0.90 |
| PM Peak: | 0.83 |

**South Approach PHF**

| | |
|---|---|
| AM Peak: | 0.88 |
| Mid-day Peak: | 0.86 |
| PM Peak: | 0.90 |

**Comments**

**Intersection:** Homer Watston Blvd @ New Dunde
**GeoID:** 30764
**Municipality:** Kitchener
**Major Road:** Homer Watson Blvd

**Intersection Control:** Signalized
**Date:** Wednesday, 29-Mar-23
**Name:** Cam
**Weather:** Clear/Dry

| | | | EASTBOUND | | | WESTBOUND | | | NORTHBOUND | | | SOUTHBOUND | | | TOTAL | TOTAL HOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Approach Control* | | | ***Signalized*** | | | ***Signalized*** | | | ***Signalized*** | | | ***Signalized*** | | | | |
| 7:30 | to | 7:45 | 15 | 0 | 158 | 53 | 48 | 224 | 14 | 193 | 0 | 0 | 314 | 5 | 1,024 | |
| 7:45 | to | 8:00 | 13 | 0 | 144 | 62 | 56 | 255 | 24 | 234 | 0 | 0 | 329 | 7 | 1,124 | |
| 8:00 | to | 8:15 | 14 | 0 | 118 | 60 | 48 | 199 | 19 | 220 | 0 | 0 | 326 | 11 | 1,015 | |
| 8:15 | to | 8:30 | 12 | 0 | 126 | 52 | 58 | 165 | 18 | 190 | 0 | 0 | 285 | 5 | 911 | 4,074 |
| 8:30 | to | 8:45 | 10 | 0 | 124 | 66 | 65 | 159 | 26 | 172 | 0 | 0 | 224 | 5 | 851 | 3,901 |
| 8:45 | to | 9:00 | 9 | 0 | 104 | 58 | 55 | 164 | 30 | 150 | 0 | 0 | 250 | 7 | 827 | 3,604 |
| 9:00 | to | 9:15 | 7 | 0 | 79 | 39 | 46 | 127 | 20 | 136 | 0 | 0 | 228 | 10 | 692 | 3,281 |
| 9:15 | to | 9:30 | 6 | 0 | 89 | 36 | 43 | 120 | 29 | 123 | 0 | 0 | 195 | 10 | 651 | 3,021 |
| 9:30 | to | 9:45 | 11 | 0 | 82 | 52 | 48 | 129 | 8 | 119 | 0 | 0 | 182 | 5 | 636 | 2,806 |
| 9:45 | to | 10:00 | 8 | 0 | 76 | 54 | 38 | 157 | 14 | 107 | 0 | 0 | 219 | 5 | 678 | 2,657 |
| 10:00 | to | 10:15 | 17 | 0 | 39 | 41 | 40 | 112 | 8 | 114 | 0 | 0 | 222 | 6 | 599 | 2,564 |
| 10:15 | to | 10:30 | 6 | 0 | 55 | 34 | 35 | 125 | 12 | 122 | 0 | 0 | 191 | 0 | 580 | 2,493 |
| **AM Peak Hour** | | | | | | | | | | | | | | | | |
| **7:30** | **to** | **8:30** | **54** | **0** | **546** | **227** | **210** | **843** | **75** | **837** | **0** | **0** | **1,254** | **28** | **4,074** | |
| **# of trucks in peak** | | | 3 | 0 | 5 | 6 | 5 | 25 | 1 | 11 | 0 | 0 | 30 | 2 | 88 | |
| **# of heavies in peak** | | | 0 | 0 | 4 | 33 | 9 | 50 | 5 | 37 | 0 | 0 | 71 | 3 | 212 | |
| **% heavies (Total)** | | | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% | 7% | |
| 12:00 | to | 12:15 | 11 | 0 | 56 | 54 | 55 | 111 | 24 | 139 | 0 | 0 | 231 | 18 | 699 | |
| 12:15 | to | 12:30 | 11 | 0 | 51 | 25 | 52 | 132 | 33 | 155 | 0 | 0 | 201 | 5 | 665 | |
| 12:30 | to | 12:45 | 10 | 0 | 65 | 43 | 62 | 143 | 25 | 111 | 0 | 0 | 213 | 10 | 682 | |
| 12:45 | to | 13:00 | 12 | 0 | 54 | 44 | 60 | 130 | 30 | 132 | 0 | 0 | 190 | 11 | 663 | 2,709 |
| 13:00 | to | 13:15 | 12 | 0 | 47 | 41 | 46 | 147 | 23 | 143 | 0 | 0 | 210 | 8 | 677 | 2,687 |
| 13:15 | to | 13:30 | 5 | 0 | 67 | 46 | 62 | 127 | 18 | 115 | 0 | 0 | 205 | 13 | 658 | 2,680 |
| 13:30 | to | 13:45 | 12 | 0 | 62 | 45 | 50 | 112 | 18 | 104 | 0 | 0 | 213 | 8 | 624 | 2,622 |
| 13:45 | to | 14:00 | 16 | 0 | 57 | 42 | 49 | 154 | 28 | 123 | 0 | 0 | 185 | 8 | 662 | 2,621 |
| **Midday Peak Hour** | | | | | | | | | | | | | | | | |
| **12:00** | **to** | **13:00** | **44** | **0** | **226** | **166** | **229** | **516** | **112** | **537** | **0** | **0** | **835** | **44** | **2,709** | |
| **# of trucks in peak** | | | 3 | 0 | 2 | 3 | 5 | 19 | 2 | 8 | 0 | 0 | 31 | 0 | 73 | |
| **# of heavies in peak** | | | 1 | 0 | 6 | 34 | 11 | 55 | 4 | 23 | 0 | 0 | 52 | 3 | 189 | |
| **% heavies (Total)** | | | 9% | 0% | 4% | 22% | 7% | 14% | 5% | 6% | 0% | 0% | 10% | 7% | 10% | |
| 15:00 | to | 15:15 | 11 | 0 | 77 | 36 | 83 | 163 | 44 | 140 | 0 | 0 | 257 | 6 | 817 | |
| 15:15 | to | 15:30 | 8 | 0 | 58 | 50 | 90 | 172 | 32 | 155 | 0 | 0 | 292 | 7 | 864 | |
| 15:30 | to | 15:45 | 7 | 0 | 59 | 64 | 114 | 166 | 69 | 156 | 0 | 0 | 269 | 15 | 919 | |
| 15:45 | to | 16:00 | 13 | 0 | 83 | 55 | 118 | 187 | 59 | 174 | 0 | 0 | 287 | 6 | 982 | 3,582 |
| 16:00 | to | 16:15 | 6 | 0 | 83 | 65 | 138 | 210 | 60 | 186 | 0 | 0 | 259 | 9 | 1,016 | 3,781 |
| 16:15 | to | 16:30 | 8 | 0 | 60 | 59 | 126 | 220 | 63 | 200 | 0 | 0 | 267 | 10 | 1,013 | 3,930 |
| 16:30 | to | 16:45 | 8 | 0 | 83 | 44 | 135 | 214 | 51 | 184 | 0 | 0 | 304 | 15 | 1,038 | 4,049 |
| 16:45 | to | 17:00 | 10 | 0 | 80 | 56 | 147 | 230 | 57 | 208 | 0 | 0 | 281 | 9 | 1,078 | 4,145 |
| 17:00 | to | 17:15 | 8 | 0 | 108 | 68 | 142 | 227 | 55 | 161 | 0 | 0 | 263 | 13 | 1,045 | 4,174 |
| 17:15 | to | 17:30 | 20 | 0 | 68 | 71 | 143 | 242 | 55 | 181 | 0 | 0 | 289 | 13 | 1,082 | 4,243 |
| 17:30 | to | 17:45 | 4 | 0 | 82 | 69 | 147 | 190 | 31 | 161 | 0 | 0 | 234 | 17 | 935 | 4,140 |
| 17:45 | to | 18:00 | 7 | 0 | 51 | 34 | 58 | 219 | 20 | 168 | 0 | 0 | 222 | 12 | 791 | 3,853 |
| **PM Peak Hour** | | | | | | | | | | | | | | | | |
| **16:30** | **to** | **17:30** | **46** | **0** | **339** | **239** | **567** | **913** | **218** | **734** | **0** | **0** | **1,137** | **50** | **4,243** | |
| **# of trucks in peak** | | | 0 | 0 | 5 | 0 | 2 | 16 | 3 | 8 | 0 | 0 | 6 | 1 | 41 | |
| **# of heavies in peak** | | | 2 | 0 | 2 | 7 | 1 | 44 | 3 | 28 | 0 | 0 | 29 | 0 | 116 | |
| **% heavies (Total)** | | | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% | 4% | |

**Intersection:** Homer Watston Blvd @ New Dundee
**GeoID:** 30764
**Municipality:** Kitchener
**Major Road:** Homer Watson Blvd

**Intersection Control:** Signalized
**Date:** Wednesday, 29-Mar-23
**Name:** Cam
**Weather:** Clear/Dry

| PEDESTRIAN CROSSING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Time | | | Crossing Approach | | | | | |
| | | | East App. | West App. | North App. | South App. | TOTAL | TOTAL HOUR |
| 7:30 | to | 7:45 | 0 | 0 | 0 | 0 | 0 | |
| 7:45 | to | 8:00 | 1 | 0 | 0 | 0 | 1 | |
| 8:00 | to | 8:15 | 0 | 0 | 0 | 0 | 0 | |
| 8:15 | to | 8:30 | 1 | 0 | 0 | 0 | 1 | 2 |
| 8:30 | to | 8:45 | 0 | 0 | 0 | 0 | 0 | 2 |
| 8:45 | to | 9:00 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9:00 | to | 9:15 | 0 | 0 | 0 | 0 | 0 | 1 |
| 9:15 | to | 9:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | to | 9:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | to | 10:00 | 1 | 0 | 0 | 0 | 1 | 1 |
| 10:00 | to | 10:15 | 0 | 0 | 0 | 0 | 0 | 1 |
| 10:15 | to | 10:30 | 0 | 0 | 0 | 0 | 0 | 1 |
| **AM Peak Hour** | | | | | | | **3** | |
| **7:30** | **to** | **8:30** | **2** | **0** | **0** | **0** | **2** | |
| 12:00 | to | 12:15 | 2 | 0 | 0 | 0 | 2 | |
| 12:15 | to | 12:30 | 0 | 0 | 0 | 0 | 0 | |
| 12:30 | to | 12:45 | 1 | 0 | 0 | 0 | 1 | |
| 12:45 | to | 13:00 | 1 | 0 | 0 | 0 | 1 | 4 |
| 13:00 | to | 13:15 | 1 | 0 | 0 | 0 | 1 | 3 |
| 13:15 | to | 13:30 | 0 | 0 | 0 | 0 | 0 | 3 |
| 13:30 | to | 13:45 | 2 | 0 | 0 | 0 | 2 | 4 |
| 13:45 | to | 14:00 | 0 | 0 | 0 | 0 | 0 | 3 |
| **Midday Peak Hour** | | | | | | | **7** | |
| **12:00** | **to** | **13:00** | 4 | 0 | 0 | 0 | **4** | |
| 15:00 | to | 15:15 | 0 | 0 | 0 | 0 | 0 | |
| 15:15 | to | 15:30 | 0 | 0 | 0 | 0 | 0 | |
| 15:30 | to | 15:45 | 1 | 0 | 0 | 0 | 1 | |
| 15:45 | to | 16:00 | 0 | 0 | 0 | 0 | 0 | 1 |
| 16:00 | to | 16:15 | 1 | 0 | 0 | 0 | 1 | 2 |
| 16:15 | to | 16:30 | 0 | 0 | 0 | 0 | 0 | 2 |
| 16:30 | to | 16:45 | 0 | 0 | 0 | 0 | 0 | 1 |
| 16:45 | to | 17:00 | 1 | 0 | 0 | 0 | 1 | 2 |
| 17:00 | to | 17:15 | 1 | 0 | 0 | 0 | 1 | 2 |
| 17:15 | to | 17:30 | 0 | 0 | 0 | 0 | 0 | 2 |
| 17:30 | to | 17:45 | 1 | 0 | 0 | 0 | 1 | 3 |
| 17:45 | to | 18:00 | 0 | 0 | 0 | 1 | 1 | 3 |
| **PM Peak Hour** | | | | | | | **6** | |
| **16:30** | **to** | **17:30** | 2 | 0 | 0 | 0 | **2** | |

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Morning Peak Diagram

**Count Period**
**From:** 7:30 AM
**To:** 10:30 AM

**Peak Hour**
**From:** 7:30 AM
**To:** 8:30 AM

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Pinnacle Dr
**Control:** Non Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Overcast/Wet

**Person(s) who counted:** Cam

**GeoID:** 16097
**Count Date:** Tuesday, 07-Jun-22

**North Leg Total:** 95
**North Entering:** 72
**North Peds:** 0
**Peds Cross:** ⋈

| | | | | |
|---|---|---|---|---|
| % Trks | 0% | 0% | 0% | |
| Heavys | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Cars | 8 | 0 | 64 | 72 |
| Total | 8 | 0 | 64 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 10 | 6 | 223 | 239 |

**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 25% | 1 | 0 | 3 | 4 |
| 2% | 10 | 3 | 577 | 590 |
| 0% | 0 | 0 | 0 | 0 |
| | 11 | 3 | 580 | |

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**Pinnacle Dr**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 19 | 17 | 1 | 1 | 11% |
| 231 | 215 | 6 | 10 | 7% |
| 0 | 0 | 0 | 0 | 0% |
| | 232 | 7 | 11 | |

| Heavys | 2 |
|---|---|
| Trucks | 1 |
| Cars | 20 |
| Total | 23 |

**East Leg Total:** 904
**East Entering:** 250
**East Peds:** 0
**Peds Cross:** ⧖

**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 641 | 3 | 10 | 654 |

**na**

| | | | |
|---|---|---|---|
| Total | 0 | 0 | 0 |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

**Peds Cross:** ⧖
**West Peds:** 0
**West Entering:** 594
**West leg Total:** 833

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

**Peds Cross:** ⋈
**South Peds:** 0
**South Entering:** 0
**South leg Total:** 0

### Comments

To determine total vehicles entering the intersection during morning peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **916**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **594**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Mid-day Peak Diagram

**Count Period**
**From:** 12:00 PM
**To:** 2:00 PM

**Peak Hour**
**From:** 12:15 PM
**To:** 1:15 PM

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Pinnacle Dr
**Control:** Non Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Overcast/Wet

**Person(s) who counted:** Cam

**GeoID:** 16097
**Count Date:** Tuesday, 07-Jun-22

| | |
|---|---|
| **North Leg Total:** | 95 |
| **North Entering:** | 41 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |

| | | | | |
|---|---|---|---|---|
| % Trks | 11% | 0% | 0% | |
| Heavys | 0 | 0 | 0 | 0 |
| Trucks | 1 | 0 | 0 | 1 |
| Cars | 8 | 0 | 32 | 40 |
| Total | 9 | 0 | 32 | |

| | |
|---|---|
| Heavys | 0 |
| Trucks | 1 |
| Cars | 53 |
| Total | 54 |

| | |
|---|---|
| **East Leg Total:** | 686 |
| **East Entering:** | 364 |
| **East Peds:** | 0 |
| **Peds Cross:** | ⧖ |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 7 | 5 | 316 | 328 |

**Pinnacle Dr**

| | Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|---|
| | 45 | 44 | 1 | 0 | 2% |
| | 319 | 308 | 4 | 7 | 3% |
| | 0 | 0 | 0 | 0 | 0% |
| | | 352 | 5 | 7 | |

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**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 0% | 0 | 0 | 9 | 9 |
| 4% | 10 | 3 | 277 | 290 |
| 0% | 0 | 0 | 0 | 0 |
| | 10 | 3 | 286 | |

**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 309 | 3 | 10 | 322 |

na

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 299 |
| **West leg Total:** | 627 |

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 0 |
| **South Entering:** | 0 |
| **South leg Total:** | 0 |

### Comments

To determine total vehicles entering the intersection during mid-day peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **704**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **299**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Afternoon Peak Diagram

**Count Period**
**From:** 3:00 PM
**To:** 6:00 PM

**Peak Hour**
**From:** 4:30 PM
**To:** 5:30 PM

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Pinnacle Dr
**Control:** Non Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Overcast/Wet

**Person(s) who counted:** Cam

**GeoID:** 16097
**Count Date:** Tuesday, 07-Jun-22

### North Leg

| | |
|---|---|
| **North Leg Total:** | 172 |
| **North Entering:** | 64 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |

| | | | | |
|---|---|---|---|---|
| % Trks | 0% | 0% | 0% | |
| Heavys | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Cars | 12 | 0 | 52 | 64 |
| Total | 12 | 0 | 52 | |

### East Leg

| | |
|---|---|
| Heavys | 0 |
| Trucks | 1 |
| Cars | 107 |
| Total | 108 |

| | |
|---|---|
| **East Leg Total:** | 1,414 |
| **East Entering:** | 907 |
| **East Peds:** | 0 |
| **Peds Cross:** | ⧖ |

### Pinnacle Dr

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 7 | 7 | 808 | 822 |

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 97 | 96 | 1 | 0 | 1% |
| 810 | 796 | 7 | 7 | 2% |
| 0 | 0 | 0 | 0 | 0% |
| | 892 | 8 | 7 | |

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### New Dundee Rd

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 0% | 0 | 0 | 11 | 11 |
| 3% | 8 | 5 | 442 | 455 |
| 0% | 0 | 0 | 0 | 0 |
| | 8 | 5 | 453 | |

### New Dundee Rd

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 494 | 5 | 8 | 507 |

na

### West Leg

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 466 |
| **West leg Total:** | 1,288 |

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

### South Leg

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 0 |
| **South Entering:** | 0 |
| **South leg Total:** | 0 |

### Comments

To determine total vehicles entering the intersection during afternoon peak hour, add all leg totals entering.

Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering

Example 1: Therefore, total vehicles entering intersection = **1,437**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn

Therefore, vehicles entering from the west = **466**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Total Count Diagram

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Pinnacle Dr
**Control:** Non Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Overcast/Wet

**Person(s) who counted:** Cam

**GeoID:** 16097
**Count Date:** Tuesday, 07-Jun-22

| | |
|---|---|
| **North Leg Total:** | 847 |
| **North Entering:** | 399 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |
| **Bicycles Entering:** | 1 |
| **Buggies Entering:** | 0 |

| % Trks | 5% | 0% | 1% | |
|---|---|---|---|---|
| Heavys | 2 | 0 | 1 | 3 |
| Trucks | 1 | 0 | 2 | 3 |
| Cars | 61 | 0 | 332 | 393 |
| Total | 64 | 0 | 335 | |

| | |
|---|---|
| Heavys | 5 |
| Trucks | 6 |
| Cars | 437 |
| Total | 448 |

| | |
|---|---|
| **East Leg Total:** | 7,666 |
| **East Entering:** | 4,199 |
| **East Peds:** | 0 |
| **Peds Cross:** | ⧖ |
| **Bicycles Entering:** | 2 |
| **Buggies Entering:** | 0 |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 87 | 46 | 3,740 | 3,873 |

**Pinnacle Dr**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 390 | 380 | 6 | 4 | 3% |
| 3,809 | 3,679 | 45 | 85 | 3% |
| 0 | 0 | 0 | 0 | 0% |
| | 4,059 | 51 | 89 | |

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**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 2% | 1 | 0 | 57 | 58 |
| 3% | 70 | 32 | 3,030 | 3,132 |
| 0% | 0 | 0 | 0 | 0 |
| | 71 | 32 | 3,087 | |

**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 3,362 | 34 | 71 | 3,467 |

**na**

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 3,190 |
| **West leg Total:** | 7,063 |
| **Bicycles Entering:** | 3 |
| **Buggies Entering:** | 0 |

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 0 |
| **South Entering:** | 0 |
| **South leg Total:** | 0 |
| **Bicycles Entering:** | 0 |
| **Buggies Entering:** | 0 |

### Comments

To determine total vehicles entering the intersection, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **7,788**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **3,190**

Notes: None

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Estimated Daily Traffic

Total Factor = Monthly Factor 1 x Daily Factor 1 x 24 Hour Factor 1.74 = 1.740000

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Pinnacle Dr
**Control:** Non Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Overcast/Wet

**Person(s) who counted:** Cam

**GeoID:** 16097
**Count Date:** Tuesday, 07-Jun-22

**North Leg Total:** 1,474
**North Entering:** 694
**North Peds:** N/A
**Peds Cross:** ⋈

| | 5% | 0% | 1% | |
|---|---|---|---|---|
| % Trks | | | | |
| Heavys | 3 | 0 | 2 | 5 |
| Trucks | 2 | 0 | 3 | 5 |
| Cars | 106 | 0 | 578 | 684 |
| Total | 111 | 0 | 583 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 151 | 80 | 6,508 | 6,739 |

**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 2% | 2 | 0 | 99 | 101 |
| 3% | 122 | 56 | 5,272 | 5,450 |
| 0% | 0 | 0 | 0 | 0 |
| | 124 | 56 | 5,371 | |

**Peds Cross:** ⧖
**West Peds:** N/A
**West Entering:** 5,551
**West leg Total:** 12,290

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

**Pinnacle Dr**

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 9 | 10 | 760 | 780 |

**East Leg Total:** 13,339
**East Entering:** 7,306
**East Peds:** N/A
**Peds Cross:** ⧖

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 679 | 661 | 10 | 7 | 3% |
| 6,628 | 6,401 | 78 | 148 | 3% |
| 0 | 0 | 0 | 0 | 0% |
| | 7,063 | 89 | 155 | |

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**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 5,850 | 59 | 124 | 6,033 |

na

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

**Peds Cross:** ⋈
**South Peds:** N/A
**South Entering:** 0
**South leg Total:** 0

### Comments

To determine the EDT (Estimated Daily Traffic), add all four leg totals and divide by two.
This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example: $\frac{\text{(West leg total + South leg total + East leg total + North leg total)}}{2}$ ***EDT =*** ***13,551***

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Peak Hour Factor By Movement

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Pinnacle Dr
**Control:** Non Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Overcast/Wet

**Person(s) who counted:** Cam

**GeoID:** 16097
**Count Date:** Tuesday, 07-Jun-22

**North Approach PHF**

| | |
|---|---|
| AM Peak: | 0.78 |
| Mid-day Peak: | 0.73 |
| PM Peak: | 0.80 |

| | Movement | | |
|---|---|---|---|
| PM | 0.60 | 0.00 | 0.72 |
| MID | 0.75 | 0.00 | 0.73 |
| AM | 0.50 | 0.00 | 0.84 |

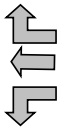
**East Approach PHF**

| | |
|---|---|
| AM Peak: | 0.87 |
| Mid-day Peak: | 0.89 |
| PM Peak: | 0.95 |

AM AM Peak Hour
MID Mid-day Peak Hour
PM PM Peak Hour

**Pinnacle Dr**

| AM | MID | PM | |
|---|---|---|---|
| 0.68 | 0.70 | 0.69 | |
| 0.89 | 0.88 | 0.96 | Movement |
| 0.00 | 0.00 | 0.00 | |



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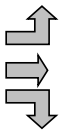
**New Dundee Rd**

| Movement | PM | MID | AM |
|---|---|---|---|
| | 0.69 | 0.75 | 0.50 |
| | 0.90 | 0.87 | 0.88 |
| | 0.00 | 0.00 | 0.00 |



**New Dundee Rd**

| | | | | |
|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | AM | |
| 0.00 | 0.00 | 0.00 | MID | |
| 0.00 | 0.00 | 0.00 | PM | |
| | Movement | | | |

**West Approach PHF**

| | |
|---|---|
| AM Peak: | 0.87 |
| Mid-day Peak: | 0.87 |
| PM Peak: | 0.90 |

**South Approach PHF**

| | |
|---|---|
| AM Peak: | 0.00 |
| Mid-day Peak: | 0.00 |
| PM Peak: | 0.00 |

**Comments**

**Intersection:** New Dundee Rd @ Pinnacle Dr
**GeoID:** 16097
**Municipality:** Kitchener
**Major Road:** New Dundee Rd

**Intersection Control:** Non Signalized
**Date:** Tuesday, 07-Jun-22
**Name:** Cam
**Weather:** Overcast/Wet

| | EASTBOUND | | | WESTBOUND | | | NORTHBOUND | | | SOUTHBOUND | | | TOTAL | TOTAL HOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Approach Control* | ***Free Flow*** | | | ***Free Flow*** | | | ***N/A*** | | | ***Stop Control*** | | | | |
| 7:30 to 7:45 | 2 | 168 | 0 | 0 | 64 | 5 | 0 | 0 | 0 | 19 | 0 | 4 | 262 | |
| 7:45 to 8:00 | 2 | 159 | 0 | 0 | 58 | 2 | 0 | 0 | 0 | 18 | 0 | 2 | 241 | |
| 8:00 to 8:15 | 0 | 121 | 0 | 0 | 65 | 7 | 0 | 0 | 0 | 16 | 0 | 2 | 211 | |
| 8:15 to 8:30 | 0 | 142 | 0 | 0 | 44 | 5 | 0 | 0 | 0 | 11 | 0 | 0 | 202 | 916 |
| 8:30 to 8:45 | 2 | 145 | 0 | 0 | 82 | 7 | 0 | 0 | 0 | 14 | 0 | 3 | 253 | 907 |
| 8:45 to 9:00 | 3 | 121 | 0 | 0 | 64 | 3 | 0 | 0 | 0 | 10 | 0 | 0 | 201 | 867 |
| 9:00 to 9:15 | 3 | 87 | 0 | 0 | 60 | 4 | 0 | 0 | 0 | 14 | 0 | 3 | 171 | 827 |
| 9:15 to 9:30 | 0 | 114 | 0 | 0 | 75 | 9 | 0 | 0 | 0 | 9 | 0 | 0 | 207 | 832 |
| 9:30 to 9:45 | 0 | 83 | 0 | 0 | 61 | 3 | 0 | 0 | 0 | 10 | 0 | 1 | 158 | 737 |
| 9:45 to 10:00 | 2 | 90 | 0 | 0 | 71 | 8 | 0 | 0 | 0 | 8 | 0 | 0 | 179 | 715 |
| 10:00 to 10:15 | 1 | 72 | 0 | 0 | 64 | 6 | 0 | 0 | 0 | 15 | 0 | 4 | 162 | 706 |
| 10:15 to 10:30 | 1 | 59 | 0 | 0 | 58 | 7 | 0 | 0 | 0 | 5 | 0 | 1 | 131 | 630 |
| **AM Peak Hour** | | | | | | | | | | | | | | |
| **7:30 to 8:30** | **4** | **590** | **0** | **0** | **231** | **19** | **0** | **0** | **0** | **64** | **0** | **8** | **916** | |
| **# of trucks in peak** | 0 | 3 | 0 | 0 | 6 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | |
| **# of heavies in peak** | 1 | 10 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | |
| **% heavies (Total)** | 25% | 2% | 0% | 0% | 7% | 11% | 0% | 0% | 0% | 0% | 0% | 0% | 3% | |
| 12:00 to 12:15 | 1 | 67 | 0 | 0 | 78 | 7 | 0 | 0 | 0 | 5 | 0 | 3 | 161 | |
| 12:15 to 12:30 | 0 | 67 | 0 | 0 | 85 | 11 | 0 | 0 | 0 | 8 | 0 | 1 | 172 | |
| 12:30 to 12:45 | 3 | 83 | 0 | 0 | 91 | 11 | 0 | 0 | 0 | 6 | 0 | 2 | 196 | |
| 12:45 to 13:00 | 3 | 58 | 0 | 0 | 85 | 16 | 0 | 0 | 0 | 7 | 0 | 3 | 172 | 701 |
| 13:00 to 13:15 | 3 | 82 | 0 | 0 | 58 | 7 | 0 | 0 | 0 | 11 | 0 | 3 | 164 | 704 |
| 13:15 to 13:30 | 2 | 54 | 0 | 0 | 63 | 7 | 0 | 0 | 0 | 9 | 0 | 1 | 136 | 668 |
| 13:30 to 13:45 | 1 | 95 | 0 | 0 | 68 | 9 | 0 | 0 | 0 | 10 | 0 | 1 | 184 | 656 |
| 13:45 to 14:00 | 0 | 76 | 0 | 0 | 84 | 10 | 0 | 0 | 0 | 10 | 0 | 2 | 182 | 666 |
| **Midday Peak Hour** | | | | | | | | | | | | | | |
| **12:15 to 13:15** | **9** | **290** | **0** | **0** | **319** | **45** | **0** | **0** | **0** | **32** | **0** | **9** | **704** | |
| **# of trucks in peak** | 0 | 3 | 0 | 0 | 4 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 9 | |
| **# of heavies in peak** | 0 | 10 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 | |
| **% heavies (Total)** | 0% | 4% | 0% | 0% | 3% | 2% | 0% | 0% | 0% | 0% | 0% | 11% | 4% | |
| 15:00 to 15:15 | 1 | 68 | 0 | 0 | 215 | 12 | 0 | 0 | 0 | 11 | 0 | 2 | 309 | |
| 15:15 to 15:30 | 6 | 87 | 0 | 0 | 201 | 20 | 0 | 0 | 0 | 11 | 0 | 2 | 327 | |
| 15:30 to 15:45 | 1 | 88 | 0 | 0 | 210 | 22 | 0 | 0 | 0 | 8 | 0 | 2 | 331 | |
| 15:45 to 16:00 | 4 | 103 | 0 | 0 | 204 | 21 | 0 | 0 | 0 | 6 | 0 | 4 | 342 | 1,309 |
| 16:00 to 16:15 | 1 | 91 | 0 | 0 | 217 | 13 | 0 | 0 | 0 | 9 | 0 | 2 | 333 | 1,333 |
| 16:15 to 16:30 | 3 | 98 | 0 | 0 | 202 | 17 | 0 | 0 | 0 | 7 | 0 | 1 | 328 | 1,334 |
| 16:30 to 16:45 | 0 | 127 | 0 | 0 | 211 | 23 | 0 | 0 | 0 | 10 | 0 | 3 | 374 | 1,377 |
| 16:45 to 17:00 | 4 | 97 | 0 | 0 | 204 | 21 | 0 | 0 | 0 | 12 | 0 | 2 | 340 | 1,375 |
| 17:00 to 17:15 | 3 | 126 | 0 | 0 | 192 | 18 | 0 | 0 | 0 | 12 | 0 | 5 | 356 | 1,398 |
| 17:15 to 17:30 | 4 | 105 | 0 | 0 | 203 | 35 | 0 | 0 | 0 | 18 | 0 | 2 | 367 | 1,437 |
| 17:30 to 17:45 | 1 | 117 | 0 | 0 | 194 | 20 | 0 | 0 | 0 | 7 | 0 | 2 | 341 | 1,404 |
| 17:45 to 18:00 | 1 | 82 | 0 | 0 | 178 | 24 | 0 | 0 | 0 | 9 | 0 | 1 | 295 | 1,359 |
| **PM Peak Hour** | | | | | | | | | | | | | | |
| **16:30 to 17:30** | **11** | **455** | **0** | **0** | **810** | **97** | **0** | **0** | **0** | **52** | **0** | **12** | **1,437** | |
| **# of trucks in peak** | 0 | 5 | 0 | 0 | 7 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | |
| **# of heavies in peak** | 0 | 8 | 0 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | |
| **% heavies (Total)** | 0% | 3% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 2% | |

**Intersection:** New Dundee Rd @ Pinnacle Dr
**GeoID:** 16097
**Municipality:** Kitchener
**Major Road:** New Dundee Rd

**Intersection Control:** Non Signalized
**Date:** Tuesday, 07-Jun-22
**Name:** Cam
**Weather:** Overcast/Wet

| PEDESTRIAN CROSSING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Time | | | Crossing Approach | | | | | |
| | | | East App. | West App. | North App. | South App. | TOTAL | TOTAL HOUR |
| 7:30 | to | 7:45 | 0 | 0 | 0 | 0 | 0 | |
| 7:45 | to | 8:00 | 0 | 0 | 0 | 0 | 0 | |
| 8:00 | to | 8:15 | 0 | 0 | 0 | 0 | 0 | |
| 8:15 | to | 8:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:30 | to | 8:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:45 | to | 9:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:00 | to | 9:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:15 | to | 9:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:30 | to | 9:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:45 | to | 10:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:00 | to | 10:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | to | 10:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| **AM Peak Hour** | | | | | | | **0** | |
| **7:30** | **to** | **8:30** | **0** | **0** | **0** | **0** | **0** | |
| 12:00 | to | 12:15 | 0 | 0 | 0 | 0 | 0 | |
| 12:15 | to | 12:30 | 0 | 0 | 0 | 0 | 0 | |
| 12:30 | to | 12:45 | 0 | 0 | 0 | 0 | 0 | |
| 12:45 | to | 13:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:00 | to | 13:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:15 | to | 13:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:30 | to | 13:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:45 | to | 14:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Midday Peak Hour** | | | | | | | **0** | |
| **12:15** | **to** | **13:15** | 0 | 0 | 0 | 0 | **0** | |
| 15:00 | to | 15:15 | 0 | 0 | 0 | 0 | 0 | |
| 15:15 | to | 15:30 | 0 | 0 | 0 | 0 | 0 | |
| 15:30 | to | 15:45 | 0 | 0 | 0 | 0 | 0 | |
| 15:45 | to | 16:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:00 | to | 16:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:15 | to | 16:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:30 | to | 16:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:45 | to | 17:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:00 | to | 17:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:15 | to | 17:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:30 | to | 17:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:45 | to | 18:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PM Peak Hour** | | | | | | | **0** | |
| **16:30** | **to** | **17:30** | 0 | 0 | 0 | 0 | **0** | |

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Morning Peak Diagram

**Count Period**
**From:** 7:30 AM
**To:** 10:30 AM

**Peak Hour**
**From:** 7:30 AM
**To:** 8:30 AM

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**Control:** Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 32185
**Count Date:** Wednesday, 29-Mar-23

**North Leg Total:** 622
**North Entering:** 462
**North Peds:** 0
**Peds Cross:** ⋈

| | 3% | 0% | 1% | |
|---|---|---|---|---|
| % Trks | | | | |
| Heavys | 3 | 0 | 3 | 6 |
| Trucks | 1 | 0 | 1 | 2 |
| Cars | 127 | 0 | 327 | 454 |
| Total | 131 | 0 | 331 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 10 | 9 | 302 | 321 |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 9 | 0 | 151 | 160 |

**East Leg Total:** 963
**East Entering:** 286
**East Peds:** 0
**Peds Cross:** ⧖

**Robert Ferrie Dr**

| | Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|---|
| | 96 | 89 | 0 | 7 | 7% |
| | 190 | 175 | 8 | 7 | 8% |
| | 0 | 0 | 0 | 0 | 0% |
| | | 264 | 8 | 14 | |

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**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 3% | 2 | 0 | 62 | 64 |
| 3% | 3 | 9 | 334 | 346 |
| 0% | 0 | 0 | 0 | 0 |
| | 5 | 9 | 396 | |

**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 661 | 10 | 6 | 677 |

**na**

| | | | |
|---|---|---|---|
| Total | 0 | 0 | 0 |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

**Peds Cross:** ⧖
**West Peds:** 0
**West Entering:** 410
**West leg Total:** 731

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

**Peds Cross:** ⋈
**South Peds:** 0
**South Entering:** 0
**South leg Total:** 0

### Comments

To determine total vehicles entering the intersection during morning peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **1,158**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **410**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Mid-day Peak Diagram

**Count Period**
**From:** 12:00 PM
**To:** 2:00 PM

**Peak Hour**
**From:** 12:30 PM
**To:** 1:30 PM

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**Control:** Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 32185
**Count Date:** Wednesday, 29-Mar-23

| | |
|---|---|
| **North Leg Total:** | 371 |
| **North Entering:** | 182 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |

| | | | | |
|---|---|---|---|---|
| % Trks | 6% | 0% | 3% | |
| Heavys | 0 | 0 | 4 | 4 |
| Trucks | 3 | 0 | 0 | 3 |
| Cars | 49 | 0 | 126 | 175 |
| Total | 52 | 0 | 130 | |

| | |
|---|---|
| Heavys | 3 |
| Trucks | 1 |
| Cars | 185 |
| Total | 189 |

| | |
|---|---|
| **East Leg Total:** | 631 |
| **East Entering:** | 351 |
| **East Peds:** | 0 |
| **Peds Cross:** | ⧖ |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 11 | 8 | 243 | 262 |

**Robert Ferrie Dr**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 141 | 138 | 0 | 3 | 2% |
| 210 | 194 | 5 | 11 | 8% |
| 0 | 0 | 0 | 0 | 0% |
| | 332 | 5 | 14 | |

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**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 2% | 0 | 1 | 47 | 48 |
| 3% | 3 | 2 | 145 | 150 |
| 0% | 0 | 0 | 0 | 0 |
| | 3 | 3 | 192 | |

**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 271 | 2 | 7 | 280 |

na

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 198 |
| **West leg Total:** | 460 |

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 0 |
| **South Entering:** | 0 |
| **South leg Total:** | 0 |

### Comments

To determine total vehicles entering the intersection during mid-day peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **731**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **198**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Afternoon Peak Diagram

**Count Period**
**From:** 3:00 PM
**To:** 6:00 PM

**Peak Hour**
**From:** 4:15 PM
**To:** 5:15 PM

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**Control:** Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 32185
**Count Date:** Wednesday, 29-Mar-23

| | |
|---|---|
| **North Leg Total:** | 654 |
| **North Entering:** | 253 |
| **North Peds:** | 0 |
| **Peds Cross:** | ⋈ |

| | | | | | |
|---|---|---|---|---|---|
| % Trks | 2% | 0% | 2% | | |
| Heavys | 0 | 0 | 3 | 3 | |
| Trucks | 2 | 0 | 0 | 2 | |
| Cars | 89 | 0 | 159 | 248 | |
| Total | 91 | 0 | 162 | | |

| | |
|---|---|
| Heavys | 3 |
| Trucks | 0 |
| Cars | 398 |
| Total | 401 |

| | |
|---|---|
| **East Leg Total:** | 1,121 |
| **East Entering:** | 745 |
| **East Peds:** | 0 |
| **Peds Cross:** | ⧖ |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 3 | 6 | 531 | 540 |

**Robert Ferrie Dr**

| | Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|---|
| | 296 | 294 | 0 | 2 | 1% |
| | 449 | 442 | 4 | 3 | 2% |
| | 0 | 0 | 0 | 0 | 0% |
| | | 736 | 4 | 5 | |

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**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 1% | 1 | 0 | 104 | 105 |
| 3% | 4 | 2 | 208 | 214 |
| 0% | 0 | 0 | 0 | 0 |
| | 5 | 2 | 312 | |

**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 367 | 2 | 7 | 376 |

na

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 0 |
| **West Entering:** | 319 |
| **West leg Total:** | 859 |

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 0 |
| **South Entering:** | 0 |
| **South leg Total:** | 0 |

### Comments

To determine total vehicles entering the intersection during afternoon peak hour, add all leg totals entering.

Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering

Example 1: Therefore, total vehicles entering intersection = **1,317**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn

Therefore, vehicles entering from the west = **319**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Total Count Diagram

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**Control:** Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 32185
**Count Date:** Wednesday, 29-Mar-23

| | |
|---|---|
| North Leg Total: | 3,890 |
| North Entering: | 1,988 |
| North Peds: | 1 |
| Peds Cross: | ⋈ |
| Bicycles Entering: | 0 |
| Buggies Entering: | 0 |

| % Trks | 5% | 0% | 2% | |
|---|---|---|---|---|
| Heavys | 13 | 0 | 26 | 39 |
| Trucks | 16 | 0 | 4 | 20 |
| Cars | 610 | 0 | 1,319 | 1,929 |
| Total | 639 | 0 | 1,349 | |

| | |
|---|---|
| Heavys | 38 |
| Trucks | 15 |
| Cars | 1,849 |
| Total | 1,902 |

| | |
|---|---|
| East Leg Total: | 6,482 |
| East Entering: | 3,455 |
| East Peds: | 5 |
| Peds Cross: | ⧖ |
| Bicycles Entering: | 2 |
| Buggies Entering: | 0 |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 65 | 61 | 2,611 | 2,737 |

**Robert Ferrie Dr**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 1,357 | 1,320 | 7 | 30 | 3% |
| 2,098 | 2,001 | 45 | 52 | 5% |
| 0 | 0 | 0 | 0 | 0% |
| | 3,321 | 52 | 82 | |

**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 3% | 8 | 8 | 529 | 545 |
| 4% | 28 | 39 | 1,611 | 1,678 |
| 0% | 0 | 0 | 0 | 0 |
| | 36 | 47 | 2,140 | |

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**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 2,930 | 43 | 54 | 3,027 |

**na**

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

| | |
|---|---|
| Peds Cross: | ⧖ |
| West Peds: | 1 |
| West Entering: | 2,223 |
| West leg Total: | 4,960 |
| Bicycles Entering: | 0 |
| Buggies Entering: | 0 |

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

| | |
|---|---|
| Peds Cross: | ⋈ |
| South Peds: | 0 |
| South Entering: | 0 |
| South leg Total: | 0 |
| Bicycles Entering: | 0 |
| Buggies Entering: | 0 |

### Comments

To determine total vehicles entering the intersection, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **7,666**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **2,223**

Notes: None

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Estimated Daily Traffic

Total Factor = Monthly Factor 1 x Daily Factor 1 x 24 Hour Factor 1.74 = 1.740000

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**Control:** Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 32185
**Count Date:** Wednesday, 29-Mar-23

**North Leg Total:** 6,769
**North Entering:** 3,459
**North Peds:** N/A
**Peds Cross:** ⋈

| | % Trks | 5% | 0% | 2% | |
|---|---|---|---|---|---|
| Heavys | | 23 | 0 | 45 | 68 |
| Trucks | | 28 | 0 | 7 | 35 |
| Cars | | 1,061 | 0 | 2,295 | 3,356 |
| Total | | 1,112 | 0 | 2,347 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 113 | 106 | 4,543 | 4,762 |

| Heavys | 66 |
|---|---|
| Trucks | 26 |
| Cars | 3,217 |
| Total | 3309 |

**East Leg Total:** 11,279
**East Entering:** 6,012
**East Peds:** N/A
**Peds Cross:** ⧖

**Robert Ferrie Dr**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 2,361 | 2,297 | 12 | 52 | 3% |
| 3,651 | 3,482 | 78 | 90 | 5% |
| 0 | 0 | 0 | 0 | 0% |
| | 5,779 | 90 | 143 | |

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**New Dundee Rd**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 3% | 14 | 14 | 920 | 948 |
| 4% | 49 | 68 | 2,803 | 2,920 |
| 0% | 0 | 0 | 0 | 0 |
| | 63 | 82 | 3,724 | |

**New Dundee Rd**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 5,098 | 75 | 94 | 5,267 |

**na**

**Peds Cross:** ⧖
**West Peds:** N/A
**West Entering:** 3,868
**West leg Total:** 8,630

| | |
|---|---|
| Heavys | 0 |
| Trucks | 0 |
| Cars | 0 |
| Total | 0 |

| | | | | |
|---|---|---|---|---|
| Total | 0 | 0 | 0 | |
| Cars | 0 | 0 | 0 | 0 |
| Trucks | 0 | 0 | 0 | 0 |
| Heavys | 0 | 0 | 0 | 0 |
| % Trks | 0% | 0% | 0% | |

**Peds Cross:** ⋈
**South Peds:** N/A
**South Entering:** 0
**South leg Total:** 0

### Comments

To determine the EDT (Estimated Daily Traffic), add all four leg totals and divide by two.
This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example: (West leg total + South leg total + East leg total + North leg total) / 2 ***EDT =*** ***13,339***

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Peak Hour Factor By Movement

**Municipality:** Kitchener
**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**Control:** Signalized
**Major Road:** New Dundee Rd

**Weather conditions:** Clear/Dry

**Person(s) who counted:** Cam

**GeoID:** 32185
**Count Date:** Wednesday, 29-Mar-23

**North Approach PHF**

| | |
|---|---|
| AM Peak: | 0.81 |
| Mid-day Peak: | 0.91 |
| PM Peak: | 0.94 |

| | Movement | | |
|---|---|---|---|
| PM | 0.84 | 0.00 | 0.86 |
| MID | 0.81 | 0.00 | 0.81 |
| AM | 0.80 | 0.00 | 0.78 |

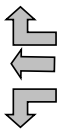
**East Approach PHF**

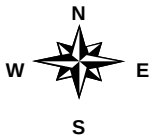
| | |
|---|---|
| AM Peak: | 0.89 |
| Mid-day Peak: | 0.93 |
| PM Peak: | 0.92 |

AM AM Peak Hour
MID Mid-day Peak Hour
PM PM Peak Hour

**Robert Ferrie Dr**

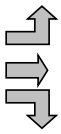
| AM | MID | PM | |
|---|---|---|---|
| 0.77 | 0.86 | 0.91 | |
| 0.93 | 0.86 | 0.91 | Movement |
| 0.00 | 0.00 | 0.00 | |






**New Dundee Rd**

| Movement | PM | MID | AM |
|---|---|---|---|
| | 0.63 | 0.92 | 0.73 |
| | 0.85 | 0.85 | 0.88 |
| | 0.00 | 0.00 | 0.00 |



**New Dundee Rd**

| | | | | |
|---|---|---|---|---|
| 0.00 | 0.00 | 0.00 | AM | |
| 0.00 | 0.00 | 0.00 | MID | |
| 0.00 | 0.00 | 0.00 | PM | |
| | Movement | | | |

**West Approach PHF**

| | |
|---|---|
| AM Peak: | 0.88 |
| Mid-day Peak: | 0.88 |
| PM Peak: | 0.79 |

**na**

**South Approach PHF**

| | |
|---|---|
| AM Peak: | 0.00 |
| Mid-day Peak: | 0.00 |
| PM Peak: | 0.00 |

**Comments**

**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**GeoID:** 32185
**Municipality:** Kitchener
**Major Road:** New Dundee Rd

**Intersection Control:** Signalized
**Date:** Wednesday, 29-Mar-23
**Name:** Cam
**Weather:** Clear/Dry

| | | | EASTBOUND | | | WESTBOUND | | | NORTHBOUND | | | SOUTHBOUND | | | TOTAL | TOTAL HOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Approach Control* | | | ***Signalized*** | | | ***Signalized*** | | | ***N/A*** | | | ***Signalized*** | | | | |
| 7:30 | to | 7:45 | 8 | 97 | 0 | 0 | 48 | 13 | 0 | 0 | 0 | 106 | 0 | 37 | 309 | |
| 7:45 | to | 8:00 | 19 | 98 | 0 | 0 | 50 | 23 | 0 | 0 | 0 | 82 | 0 | 41 | 313 | |
| 8:00 | to | 8:15 | 15 | 66 | 0 | 0 | 51 | 29 | 0 | 0 | 0 | 81 | 0 | 28 | 270 | |
| 8:15 | to | 8:30 | 22 | 85 | 0 | 0 | 41 | 31 | 0 | 0 | 0 | 62 | 0 | 25 | 266 | 1,158 |
| 8:30 | to | 8:45 | 10 | 84 | 0 | 0 | 53 | 25 | 0 | 0 | 0 | 68 | 0 | 30 | 270 | 1,119 |
| 8:45 | to | 9:00 | 14 | 44 | 0 | 0 | 63 | 26 | 0 | 0 | 0 | 56 | 0 | 19 | 222 | 1,028 |
| 9:00 | to | 9:15 | 20 | 52 | 0 | 0 | 35 | 25 | 0 | 0 | 0 | 44 | 0 | 19 | 195 | 953 |
| 9:15 | to | 9:30 | 6 | 56 | 0 | 0 | 44 | 27 | 0 | 0 | 0 | 44 | 0 | 21 | 198 | 885 |
| 9:30 | to | 9:45 | 5 | 55 | 0 | 0 | 29 | 16 | 0 | 0 | 0 | 39 | 0 | 15 | 159 | 774 |
| 9:45 | to | 10:00 | 7 | 50 | 0 | 0 | 40 | 22 | 0 | 0 | 0 | 45 | 0 | 13 | 177 | 729 |
| 10:00 | to | 10:15 | 9 | 41 | 0 | 0 | 40 | 12 | 0 | 0 | 0 | 25 | 0 | 12 | 139 | 673 |
| 10:15 | to | 10:30 | 14 | 26 | 0 | 0 | 42 | 19 | 0 | 0 | 0 | 43 | 0 | 18 | 162 | 637 |
| **AM Peak Hour** | | | | | | | | | | | | | | | | |
| **7:30** | **to** | **8:30** | **64** | **346** | **0** | **0** | **190** | **96** | **0** | **0** | **0** | **331** | **0** | **131** | **1,158** | |
| **# of trucks in peak** | | | 0 | 9 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 19 | |
| **# of heavies in peak** | | | 2 | 3 | 0 | 0 | 7 | 7 | 0 | 0 | 0 | 3 | 0 | 3 | 25 | |
| **% heavies (Total)** | | | 3% | 3% | 0% | 0% | 8% | 7% | 0% | 0% | 0% | 1% | 0% | 3% | 4% | |
| 12:00 | to | 12:15 | 16 | 44 | 0 | 0 | 45 | 35 | 0 | 0 | 0 | 25 | 0 | 19 | 184 | |
| 12:15 | to | 12:30 | 11 | 35 | 0 | 0 | 47 | 33 | 0 | 0 | 0 | 26 | 0 | 6 | 158 | |
| 12:30 | to | 12:45 | 11 | 36 | 0 | 0 | 53 | 41 | 0 | 0 | 0 | 34 | 0 | 16 | 191 | |
| 12:45 | to | 13:00 | 12 | 29 | 0 | 0 | 61 | 33 | 0 | 0 | 0 | 25 | 0 | 13 | 173 | 706 |
| 13:00 | to | 13:15 | 12 | 44 | 0 | 0 | 42 | 36 | 0 | 0 | 0 | 40 | 0 | 9 | 183 | 705 |
| 13:15 | to | 13:30 | 13 | 41 | 0 | 0 | 54 | 31 | 0 | 0 | 0 | 31 | 0 | 14 | 184 | 731 |
| 13:30 | to | 13:45 | 10 | 43 | 0 | 0 | 55 | 24 | 0 | 0 | 0 | 20 | 0 | 19 | 171 | 711 |
| 13:45 | to | 14:00 | 7 | 47 | 0 | 0 | 39 | 34 | 0 | 0 | 0 | 24 | 0 | 9 | 160 | 698 |
| **Midday Peak Hour** | | | | | | | | | | | | | | | | |
| **12:30** | **to** | **13:30** | **48** | **150** | **0** | **0** | **210** | **141** | **0** | **0** | **0** | **130** | **0** | **52** | **731** | |
| **# of trucks in peak** | | | 1 | 2 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 11 | |
| **# of heavies in peak** | | | 0 | 3 | 0 | 0 | 11 | 3 | 0 | 0 | 0 | 4 | 0 | 0 | 21 | |
| **% heavies (Total)** | | | 2% | 3% | 0% | 0% | 8% | 2% | 0% | 0% | 0% | 3% | 0% | 6% | 4% | |
| 15:00 | to | 15:15 | 28 | 52 | 0 | 0 | 98 | 54 | 0 | 0 | 0 | 33 | 0 | 18 | 283 | |
| 15:15 | to | 15:30 | 19 | 39 | 0 | 0 | 68 | 54 | 0 | 0 | 0 | 29 | 0 | 14 | 223 | |
| 15:30 | to | 15:45 | 22 | 46 | 0 | 0 | 95 | 71 | 0 | 0 | 0 | 28 | 0 | 20 | 282 | |
| 15:45 | to | 16:00 | 24 | 57 | 0 | 0 | 110 | 63 | 0 | 0 | 0 | 41 | 0 | 33 | 328 | 1,116 |
| 16:00 | to | 16:15 | 32 | 45 | 0 | 0 | 109 | 64 | 0 | 0 | 0 | 34 | 0 | 18 | 302 | 1,135 |
| 16:15 | to | 16:30 | 15 | 39 | 0 | 0 | 122 | 81 | 0 | 0 | 0 | 41 | 0 | 26 | 324 | 1,236 |
| 16:30 | to | 16:45 | 42 | 59 | 0 | 0 | 123 | 68 | 0 | 0 | 0 | 36 | 0 | 27 | 355 | 1,309 |
| 16:45 | to | 17:00 | 27 | 63 | 0 | 0 | 105 | 70 | 0 | 0 | 0 | 38 | 0 | 19 | 322 | 1,303 |
| 17:00 | to | 17:15 | 21 | 53 | 0 | 0 | 99 | 77 | 0 | 0 | 0 | 47 | 0 | 19 | 316 | 1,317 |
| 17:15 | to | 17:30 | 25 | 51 | 0 | 0 | 95 | 76 | 0 | 0 | 0 | 27 | 0 | 18 | 292 | 1,285 |
| 17:30 | to | 17:45 | 25 | 44 | 0 | 0 | 89 | 90 | 0 | 0 | 0 | 35 | 0 | 27 | 310 | 1,240 |
| 17:45 | to | 18:00 | 24 | 57 | 0 | 0 | 53 | 54 | 0 | 0 | 0 | 40 | 0 | 17 | 245 | 1,163 |
| **PM Peak Hour** | | | | | | | | | | | | | | | | |
| **16:15** | **to** | **17:15** | **105** | **214** | **0** | **0** | **449** | **296** | **0** | **0** | **0** | **162** | **0** | **91** | **1,317** | |
| **# of trucks in peak** | | | 0 | 2 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 8 | |
| **# of heavies in peak** | | | 1 | 4 | 0 | 0 | 3 | 2 | 0 | 0 | 0 | 3 | 0 | 0 | 13 | |
| **% heavies (Total)** | | | 1% | 3% | 0% | 0% | 2% | 1% | 0% | 0% | 0% | 2% | 0% | 2% | 2% | |

**Intersection:** New Dundee Rd @ Robert Ferrie Dr
**GeoID:** 32185
**Municipality:** Kitchener
**Major Road:** New Dundee Rd

**Intersection Control:** Signalized
**Date:** Wednesday, 29-Mar-23
**Name:** Cam
**Weather:** Clear/Dry

**PEDESTRIAN CROSSING**

| Time | | | Crossing Approach | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | East App. | West App. | North App. | South App. | TOTAL | TOTAL HOUR |
| 7:30 | to | 7:45 | 0 | 0 | 0 | 0 | 0 | |
| 7:45 | to | 8:00 | 0 | 0 | 0 | 0 | 0 | |
| 8:00 | to | 8:15 | 0 | 0 | 0 | 0 | 0 | |
| 8:15 | to | 8:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:30 | to | 8:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 8:45 | to | 9:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 9:00 | to | 9:15 | 2 | 0 | 0 | 0 | 2 | 2 |
| 9:15 | to | 9:30 | 0 | 0 | 0 | 0 | 0 | 2 |
| 9:30 | to | 9:45 | 0 | 0 | 0 | 0 | 0 | 2 |
| 9:45 | to | 10:00 | 0 | 0 | 0 | 0 | 0 | 2 |
| 10:00 | to | 10:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:15 | to | 10:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| **AM Peak Hour** | | | | | | | **2** | |
| **7:30** | **to** | **8:30** | **0** | **0** | **0** | **0** | **0** | |
| 12:00 | to | 12:15 | 1 | 0 | 1 | 0 | 2 | |
| 12:15 | to | 12:30 | 0 | 0 | 0 | 0 | 0 | |
| 12:30 | to | 12:45 | 0 | 0 | 0 | 0 | 0 | |
| 12:45 | to | 13:00 | 0 | 0 | 0 | 0 | 0 | 2 |
| 13:00 | to | 13:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:15 | to | 13:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:30 | to | 13:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13:45 | to | 14:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Midday Peak Hour** | | | | | | | **2** | |
| **12:30** | **to** | **13:30** | 0 | 0 | 0 | 0 | **0** | |
| 15:00 | to | 15:15 | 2 | 1 | 0 | 0 | 3 | |
| 15:15 | to | 15:30 | 0 | 0 | 0 | 0 | 0 | |
| 15:30 | to | 15:45 | 0 | 0 | 0 | 0 | 0 | |
| 15:45 | to | 16:00 | 0 | 0 | 0 | 0 | 0 | 3 |
| 16:00 | to | 16:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:15 | to | 16:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:30 | to | 16:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 16:45 | to | 17:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:00 | to | 17:15 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:15 | to | 17:30 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:30 | to | 17:45 | 0 | 0 | 0 | 0 | 0 | 0 |
| 17:45 | to | 18:00 | 0 | 0 | 0 | 0 | 0 | 0 |
| **PM Peak Hour** | | | | | | | **3** | |
| **16:15** | **to** | **17:15** | 0 | 0 | 0 | 0 | **0** | |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023


# Turning Movement Data

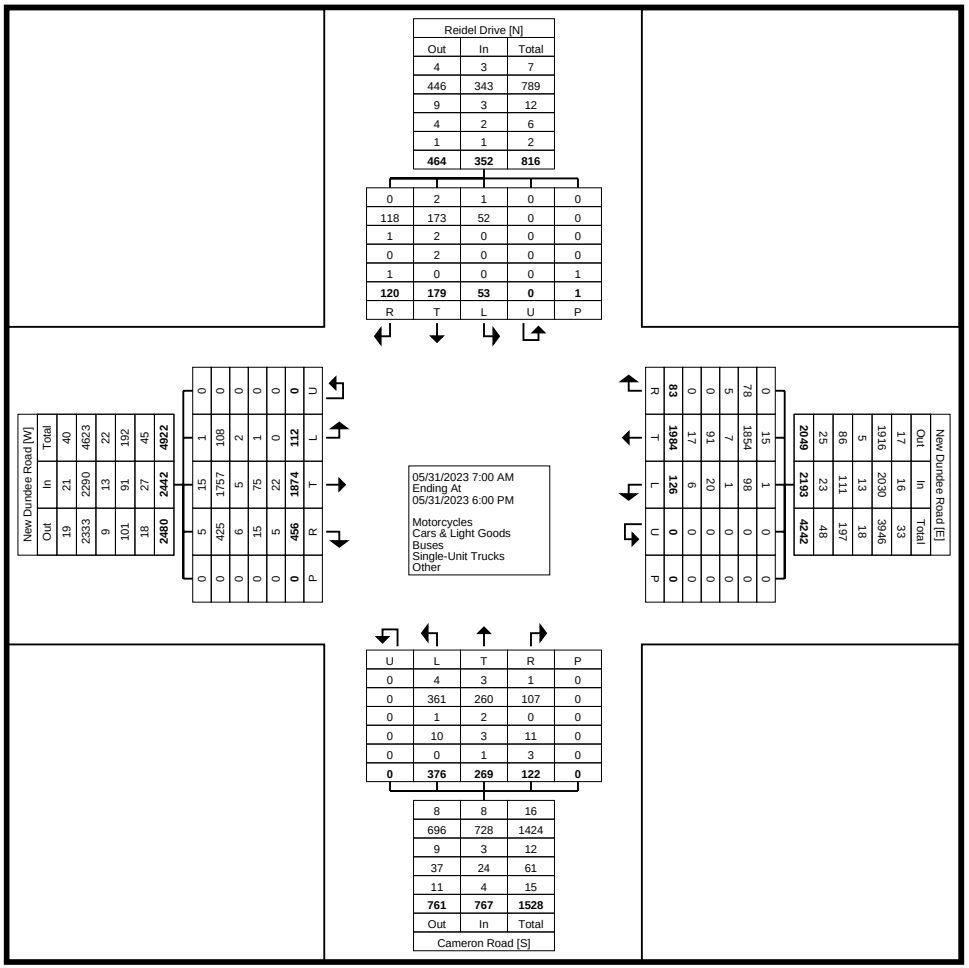
| Start Time | New Dundee Road Eastbound | | | | | | New Dundee Road Westbound | | | | | | Cameron Road Northbound | | | | | | Reidel Drive Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 7:00 AM | 2 | 51 | 9 | 0 | 0 | 62 | 4 | 34 | 1 | 0 | 0 | 39 | 17 | 3 | 0 | 0 | 0 | 20 | 3 | 5 | 2 | 0 | 1 | 10 | 131 |
| 7:15 AM | 2 | 66 | 19 | 0 | 0 | 87 | 3 | 34 | 0 | 0 | 0 | 37 | 10 | 7 | 0 | 0 | 0 | 17 | 4 | 8 | 2 | 0 | 0 | 14 | 155 |
| 7:30 AM | 3 | 76 | 16 | 0 | 0 | 95 | 4 | 47 | 1 | 0 | 0 | 52 | 10 | 3 | 3 | 0 | 0 | 16 | 4 | 14 | 6 | 0 | 0 | 24 | 187 |
| 7:45 AM | 3 | 72 | 24 | 0 | 0 | 99 | 1 | 51 | 1 | 0 | 0 | 53 | 12 | 10 | 8 | 0 | 0 | 30 | 1 | 7 | 3 | 0 | 0 | 11 | 193 |
| Hourly Total | 10 | 265 | 68 | 0 | 0 | 343 | 12 | 166 | 3 | 0 | 0 | 181 | 49 | 23 | 11 | 0 | 0 | 83 | 12 | 34 | 13 | 0 | 1 | 59 | 666 |
| 8:00 AM | 3 | 89 | 20 | 0 | 0 | 112 | 3 | 58 | 3 | 0 | 0 | 64 | 12 | 3 | 5 | 0 | 0 | 20 | 4 | 7 | 0 | 0 | 0 | 11 | 207 |
| 8:15 AM | 2 | 73 | 22 | 0 | 0 | 97 | 5 | 53 | 5 | 0 | 0 | 63 | 11 | 7 | 8 | 0 | 0 | 26 | 3 | 13 | 3 | 0 | 0 | 19 | 205 |
| 8:30 AM | 6 | 72 | 16 | 0 | 0 | 94 | 4 | 58 | 3 | 0 | 0 | 65 | 9 | 6 | 3 | 0 | 0 | 18 | 0 | 4 | 4 | 0 | 0 | 8 | 185 |
| 8:45 AM | 3 | 57 | 12 | 0 | 0 | 72 | 4 | 52 | 1 | 0 | 0 | 57 | 6 | 8 | 4 | 0 | 0 | 18 | 1 | 8 | 7 | 0 | 0 | 16 | 163 |
| Hourly Total | 14 | 291 | 70 | 0 | 0 | 375 | 16 | 221 | 12 | 0 | 0 | 249 | 38 | 24 | 20 | 0 | 0 | 82 | 8 | 32 | 14 | 0 | 0 | 54 | 760 |
| 9:00 AM | 5 | 53 | 13 | 0 | 0 | 71 | 5 | 41 | 0 | 0 | 0 | 46 | 7 | 5 | 5 | 0 | 0 | 17 | 1 | 0 | 5 | 0 | 0 | 6 | 140 |
| 9:15 AM | 1 | 43 | 7 | 0 | 0 | 51 | 4 | 33 | 2 | 0 | 0 | 39 | 10 | 1 | 5 | 0 | 0 | 16 | 2 | 4 | 3 | 0 | 0 | 9 | 115 |
| 9:30 AM | 3 | 44 | 6 | 0 | 0 | 53 | 4 | 48 | 1 | 0 | 0 | 53 | 8 | 3 | 2 | 0 | 0 | 13 | 2 | 8 | 4 | 0 | 0 | 14 | 133 |
| 9:45 AM | 2 | 35 | 12 | 0 | 0 | 49 | 8 | 42 | 0 | 0 | 0 | 50 | 8 | 2 | 4 | 0 | 0 | 14 | 3 | 2 | 2 | 0 | 0 | 7 | 120 |
| Hourly Total | 11 | 175 | 38 | 0 | 0 | 224 | 21 | 164 | 3 | 0 | 0 | 188 | 33 | 11 | 16 | 0 | 0 | 60 | 8 | 14 | 14 | 0 | 0 | 36 | 508 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 11:30 AM | 2 | 43 | 12 | 0 | 0 | 57 | 5 | 32 | 1 | 0 | 0 | 38 | 8 | 2 | 0 | 0 | 0 | 10 | 0 | 2 | 1 | 0 | 0 | 3 | 108 |
| 11:45 AM | 3 | 32 | 3 | 0 | 0 | 38 | 5 | 35 | 0 | 0 | 0 | 40 | 10 | 3 | 3 | 0 | 0 | 16 | 0 | 4 | 7 | 0 | 0 | 11 | 105 |
| Hourly Total | 5 | 75 | 15 | 0 | 0 | 95 | 10 | 67 | 1 | 0 | 0 | 78 | 18 | 5 | 3 | 0 | 0 | 26 | 0 | 6 | 8 | 0 | 0 | 14 | 213 |
| 12:00 PM | 1 | 28 | 3 | 0 | 0 | 32 | 1 | 34 | 1 | 0 | 0 | 36 | 6 | 7 | 5 | 0 | 0 | 18 | 0 | 2 | 4 | 0 | 0 | 6 | 92 |
| 12:15 PM | 2 | 37 | 8 | 0 | 0 | 47 | 3 | 45 | 1 | 0 | 0 | 49 | 8 | 0 | 3 | 0 | 0 | 11 | 2 | 2 | 2 | 0 | 0 | 6 | 113 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 3 | 65 | 11 | 0 | 0 | 79 | 4 | 79 | 2 | 0 | 0 | 85 | 14 | 7 | 8 | 0 | 0 | 29 | 2 | 4 | 6 | 0 | 0 | 12 | 205 |
| 2:00 PM | 4 | 44 | 6 | 0 | 0 | 54 | 2 | 53 | 1 | 0 | 0 | 56 | 9 | 22 | 3 | 0 | 0 | 34 | 0 | 1 | 2 | 0 | 0 | 3 | 147 |
| 2:15 PM | 1 | 46 | 9 | 0 | 0 | 56 | 6 | 56 | 5 | 0 | 0 | 67 | 12 | 6 | 5 | 0 | 0 | 23 | 1 | 3 | 4 | 0 | 0 | 8 | 154 |
| 2:30 PM | 1 | 51 | 6 | 0 | 0 | 58 | 3 | 54 | 2 | 0 | 0 | 59 | 12 | 4 | 4 | 0 | 0 | 20 | 1 | 4 | 5 | 0 | 0 | 10 | 147 |
| 2:45 PM | 5 | 44 | 8 | 0 | 0 | 57 | 4 | 74 | 5 | 0 | 0 | 83 | 13 | 4 | 5 | 0 | 0 | 22 | 2 | 3 | 4 | 0 | 0 | 9 | 171 |
| Hourly Total | 11 | 185 | 29 | 0 | 0 | 225 | 15 | 237 | 13 | 0 | 0 | 265 | 46 | 36 | 17 | 0 | 0 | 99 | 4 | 11 | 15 | 0 | 0 | 30 | 619 |
| 3:00 PM | 5 | 77 | 9 | 0 | 0 | 91 | 3 | 74 | 6 | 0 | 0 | 83 | 16 | 7 | 4 | 0 | 0 | 27 | 2 | 6 | 1 | 0 | 0 | 9 | 210 |
| 3:15 PM | 5 | 55 | 15 | 0 | 0 | 75 | 1 | 76 | 2 | 0 | 0 | 79 | 8 | 3 | 2 | 0 | 0 | 13 | 1 | 6 | 0 | 0 | 0 | 7 | 174 |
| 3:30 PM | 3 | 64 | 16 | 0 | 0 | 83 | 6 | 69 | 5 | 0 | 0 | 80 | 13 | 8 | 4 | 0 | 0 | 25 | 0 | 1 | 1 | 0 | 0 | 2 | 190 |
| 3:45 PM | 1 | 44 | 23 | 0 | 0 | 68 | 2 | 89 | 4 | 0 | 0 | 95 | 15 | 12 | 6 | 0 | 0 | 33 | 4 | 3 | 10 | 0 | 0 | 17 | 213 |
| Hourly Total | 14 | 240 | 63 | 0 | 0 | 317 | 12 | 308 | 17 | 0 | 0 | 337 | 52 | 30 | 16 | 0 | 0 | 98 | 7 | 16 | 12 | 0 | 0 | 35 | 787 |
| 4:00 PM | 6 | 53 | 18 | 0 | 0 | 77 | 8 | 88 | 5 | 0 | 0 | 101 | 11 | 12 | 1 | 0 | 0 | 24 | 2 | 8 | 6 | 0 | 0 | 16 | 218 |
| 4:15 PM | 3 | 64 | 11 | 0 | 0 | 78 | 3 | 120 | 2 | 0 | 0 | 125 | 22 | 14 | 3 | 0 | 0 | 39 | 1 | 5 | 6 | 0 | 0 | 12 | 254 |

| | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:30 PM | 5 | 73 | 21 | 0 | 0 | 99 | 2 | 93 | 5 | 0 | 0 | 100 | 15 | 19 | 4 | 0 | 0 | 38 | 0 | 7 | 2 | 0 | 0 | 9 | 246 |
| 4:45 PM | 5 | 72 | 19 | 0 | 0 | 96 | 5 | 82 | 5 | 0 | 0 | 92 | 18 | 20 | 7 | 0 | 0 | 45 | 1 | 6 | 8 | 0 | 0 | 15 | 248 |
| Hourly Total | 19 | 262 | 69 | 0 | 0 | 350 | 18 | 383 | 17 | 0 | 0 | 418 | 66 | 65 | 15 | 0 | 0 | 146 | 4 | 26 | 22 | 0 | 0 | 52 | 966 |
| 5:00 PM | 10 | 98 | 23 | 0 | 0 | 131 | 2 | 100 | 8 | 0 | 0 | 110 | 11 | 15 | 3 | 0 | 0 | 29 | 0 | 13 | 2 | 0 | 0 | 15 | 285 |
| 5:15 PM | 8 | 72 | 29 | 0 | 0 | 109 | 10 | 73 | 3 | 0 | 0 | 86 | 25 | 19 | 7 | 0 | 0 | 51 | 1 | 10 | 4 | 0 | 0 | 15 | 261 |
| 5:30 PM | 2 | 80 | 18 | 0 | 0 | 100 | 3 | 113 | 2 | 0 | 0 | 118 | 14 | 21 | 2 | 0 | 0 | 37 | 2 | 5 | 5 | 0 | 0 | 12 | 267 |
| 5:45 PM | 5 | 66 | 23 | 0 | 0 | 94 | 3 | 73 | 2 | 0 | 0 | 78 | 10 | 13 | 4 | 0 | 0 | 27 | 5 | 8 | 5 | 0 | 0 | 18 | 217 |
| Hourly Total | 25 | 316 | 93 | 0 | 0 | 434 | 18 | 359 | 15 | 0 | 0 | 392 | 60 | 68 | 16 | 0 | 0 | 144 | 8 | 36 | 16 | 0 | 0 | 60 | 1030 |
| Grand Total | 112 | 1874 | 456 | 0 | 0 | 2442 | 126 | 1984 | 83 | 0 | 0 | 2193 | 376 | 269 | 122 | 0 | 0 | 767 | 53 | 179 | 120 | 0 | 1 | 352 | 5754 |
| Approach % | 4.6 | 76.7 | 18.7 | 0.0 | - | - | 5.7 | 90.5 | 3.8 | 0.0 | - | - | 49.0 | 35.1 | 15.9 | 0.0 | - | - | 15.1 | 50.9 | 34.1 | 0.0 | - | - | - |
| Total % | 1.9 | 32.6 | 7.9 | 0.0 | - | 42.4 | 2.2 | 34.5 | 1.4 | 0.0 | - | 38.1 | 6.5 | 4.7 | 2.1 | 0.0 | - | 13.3 | 0.9 | 3.1 | 2.1 | 0.0 | - | 6.1 | - |
| Motorcycles | 1 | 15 | 5 | 0 | - | 21 | 1 | 15 | 0 | 0 | - | 16 | 4 | 3 | 1 | 0 | - | 8 | 1 | 2 | 0 | 0 | - | 3 | 48 |
| % Motorcycles | 0.9 | 0.8 | 1.1 | - | - | 0.9 | 0.8 | 0.8 | 0.0 | - | - | 0.7 | 1.1 | 1.1 | 0.8 | - | - | 1.0 | 1.9 | 1.1 | 0.0 | - | - | 0.9 | 0.8 |
| Cars & Light Goods | 108 | 1757 | 425 | 0 | - | 2290 | 98 | 1854 | 78 | 0 | - | 2030 | 361 | 260 | 107 | 0 | - | 728 | 52 | 173 | 118 | 0 | - | 343 | 5391 |
| % Cars & Light Goods | 96.4 | 93.8 | 93.2 | - | - | 93.8 | 77.8 | 93.4 | 94.0 | - | - | 92.6 | 96.0 | 96.7 | 87.7 | - | - | 94.9 | 98.1 | 96.6 | 98.3 | - | - | 97.4 | 93.7 |
| Buses | 2 | 5 | 6 | 0 | - | 13 | 1 | 7 | 5 | 0 | - | 13 | 1 | 2 | 0 | 0 | - | 3 | 0 | 2 | 1 | 0 | - | 3 | 32 |
| % Buses | 1.8 | 0.3 | 1.3 | - | - | 0.5 | 0.8 | 0.4 | 6.0 | - | - | 0.6 | 0.3 | 0.7 | 0.0 | - | - | 0.4 | 0.0 | 1.1 | 0.8 | - | - | 0.9 | 0.6 |
| Single-Unit Trucks | 1 | 75 | 15 | 0 | - | 91 | 20 | 91 | 0 | 0 | - | 111 | 10 | 3 | 11 | 0 | - | 24 | 0 | 2 | 0 | 0 | - | 2 | 228 |
| % Single-Unit Trucks | 0.9 | 4.0 | 3.3 | - | - | 3.7 | 15.9 | 4.6 | 0.0 | - | - | 5.1 | 2.7 | 1.1 | 9.0 | - | - | 3.1 | 0.0 | 1.1 | 0.0 | - | - | 0.6 | 4.0 |
| Articulated Trucks | 0 | 20 | 4 | 0 | - | 24 | 5 | 16 | 0 | 0 | - | 21 | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 46 |
| % Articulated Trucks | 0.0 | 1.1 | 0.9 | - | - | 1.0 | 4.0 | 0.8 | 0.0 | - | - | 1.0 | 0.0 | 0.0 | 0.8 | - | - | 0.1 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.8 |
| Bicycles on Road | 0 | 2 | 1 | 0 | - | 3 | 1 | 1 | 0 | 0 | - | 2 | 0 | 1 | 2 | 0 | - | 3 | 0 | 0 | 1 | 0 | - | 1 | 9 |
| % Bicycles on Road | 0.0 | 0.1 | 0.2 | - | - | 0.1 | 0.8 | 0.1 | 0.0 | - | - | 0.1 | 0.0 | 0.4 | 1.6 | - | - | 0.4 | 0.0 | 0.0 | 0.8 | - | - | 0.3 | 0.2 |
| Bicycles on Crosswalk | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 1 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023


Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023

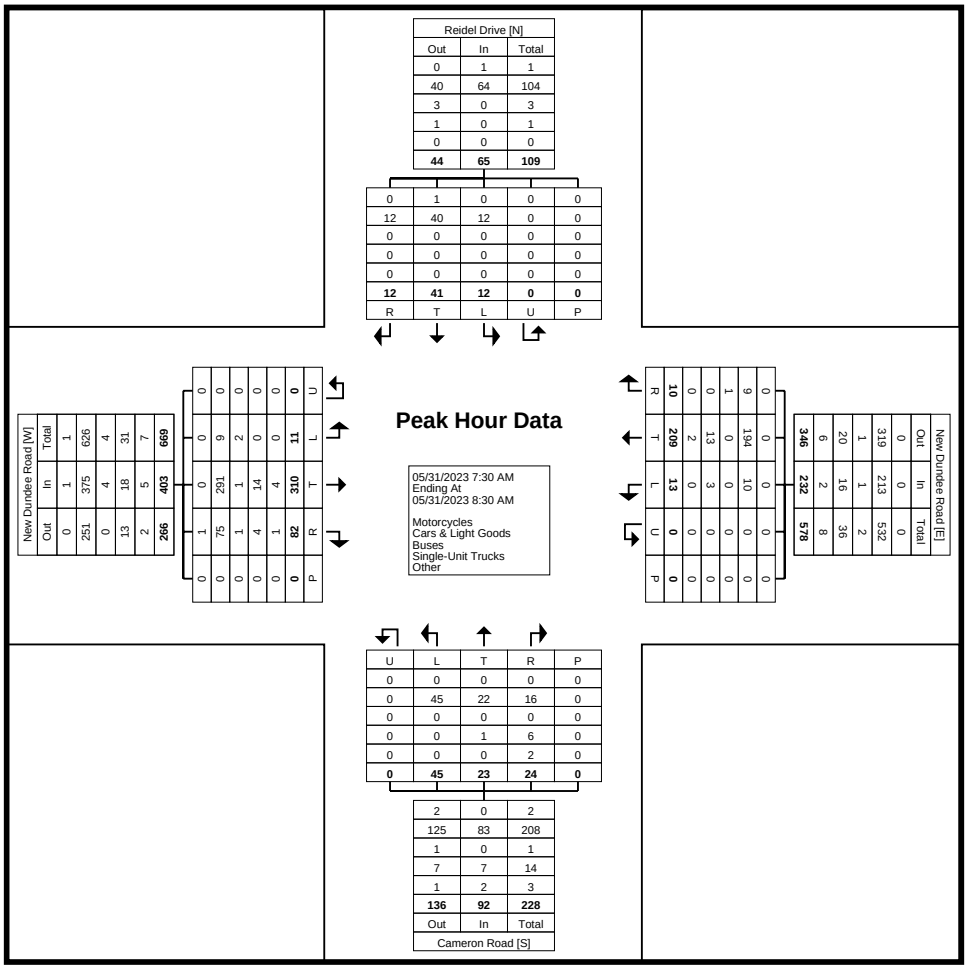

# Turning Movement Peak Hour Data (7:30 AM)

| Start Time | New Dundee Road Eastbound | | | | | | New Dundee Road Westbound | | | | | | Cameron Road Northbound | | | | | | Reidel Drive Southbound | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Int. Total |
| 7:30 AM | 3 | 76 | 16 | 0 | 0 | 95 | 4 | 47 | 1 | 0 | 0 | 52 | 10 | 3 | 3 | 0 | 0 | 16 | 4 | 14 | 6 | 0 | 0 | 24 | 187 |
| 7:45 AM | 3 | 72 | 24 | 0 | 0 | 99 | 1 | 51 | 1 | 0 | 0 | 53 | 12 | 10 | 8 | 0 | 0 | 30 | 1 | 7 | 3 | 0 | 0 | 11 | 193 |
| 8:00 AM | 3 | 89 | 20 | 0 | 0 | 112 | 3 | 58 | 3 | 0 | 0 | 64 | 12 | 3 | 5 | 0 | 0 | 20 | 4 | 7 | 0 | 0 | 0 | 11 | 207 |
| 8:15 AM | 2 | 73 | 22 | 0 | 0 | 97 | 5 | 53 | 5 | 0 | 0 | 63 | 11 | 7 | 8 | 0 | 0 | 26 | 3 | 13 | 3 | 0 | 0 | 19 | 205 |
| Total | 11 | 310 | 82 | 0 | 0 | 403 | 13 | 209 | 10 | 0 | 0 | 232 | 45 | 23 | 24 | 0 | 0 | 92 | 12 | 41 | 12 | 0 | 0 | 65 | 792 |
| Approach % | 2.7 | 76.9 | 20.3 | 0.0 | - | - | 5.6 | 90.1 | 4.3 | 0.0 | - | - | 48.9 | 25.0 | 26.1 | 0.0 | - | - | 18.5 | 63.1 | 18.5 | 0.0 | - | - | - |
| Total % | 1.4 | 39.1 | 10.4 | 0.0 | - | 50.9 | 1.6 | 26.4 | 1.3 | 0.0 | - | 29.3 | 5.7 | 2.9 | 3.0 | 0.0 | - | 11.6 | 1.5 | 5.2 | 1.5 | 0.0 | - | 8.2 | - |
| PHF | 0.917 | 0.871 | 0.854 | 0.000 | - | 0.900 | 0.650 | 0.901 | 0.500 | 0.000 | - | 0.906 | 0.938 | 0.575 | 0.750 | 0.000 | - | 0.767 | 0.750 | 0.732 | 0.500 | 0.000 | - | 0.677 | 0.957 |
| Motorcycles | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 1 | 0 | 0 | - | 1 | 2 |
| % Motorcycles | 0.0 | 0.0 | 1.2 | - | - | 0.2 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 2.4 | 0.0 | - | - | 1.5 | 0.3 |
| Cars & Light Goods | 9 | 291 | 75 | 0 | - | 375 | 10 | 194 | 9 | 0 | - | 213 | 45 | 22 | 16 | 0 | - | 83 | 12 | 40 | 12 | 0 | - | 64 | 735 |
| % Cars & Light Goods | 81.8 | 93.9 | 91.5 | - | - | 93.1 | 76.9 | 92.8 | 90.0 | - | - | 91.8 | 100.0 | 95.7 | 66.7 | - | - | 90.2 | 100.0 | 97.6 | 100.0 | - | - | 98.5 | 92.8 |
| Buses | 2 | 1 | 1 | 0 | - | 4 | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 5 |
| % Buses | 18.2 | 0.3 | 1.2 | - | - | 1.0 | 0.0 | 0.0 | 10.0 | - | - | 0.4 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.6 |
| Single-Unit Trucks | 0 | 14 | 4 | 0 | - | 18 | 3 | 13 | 0 | 0 | - | 16 | 0 | 1 | 6 | 0 | - | 7 | 0 | 0 | 0 | 0 | - | 0 | 41 |
| % Single-Unit Trucks | 0.0 | 4.5 | 4.9 | - | - | 4.5 | 23.1 | 6.2 | 0.0 | - | - | 6.9 | 0.0 | 4.3 | 25.0 | - | - | 7.6 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 5.2 |
| Articulated Trucks | 0 | 4 | 1 | 0 | - | 5 | 0 | 2 | 0 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 7 |
| % Articulated Trucks | 0.0 | 1.3 | 1.2 | - | - | 1.2 | 0.0 | 1.0 | 0.0 | - | - | 0.9 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.9 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 2 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 2 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 8.3 | - | - | 2.2 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.3 |
| Bicycles on Crosswalk | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023


Turning Movement Peak Hour Data Plot (7:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023

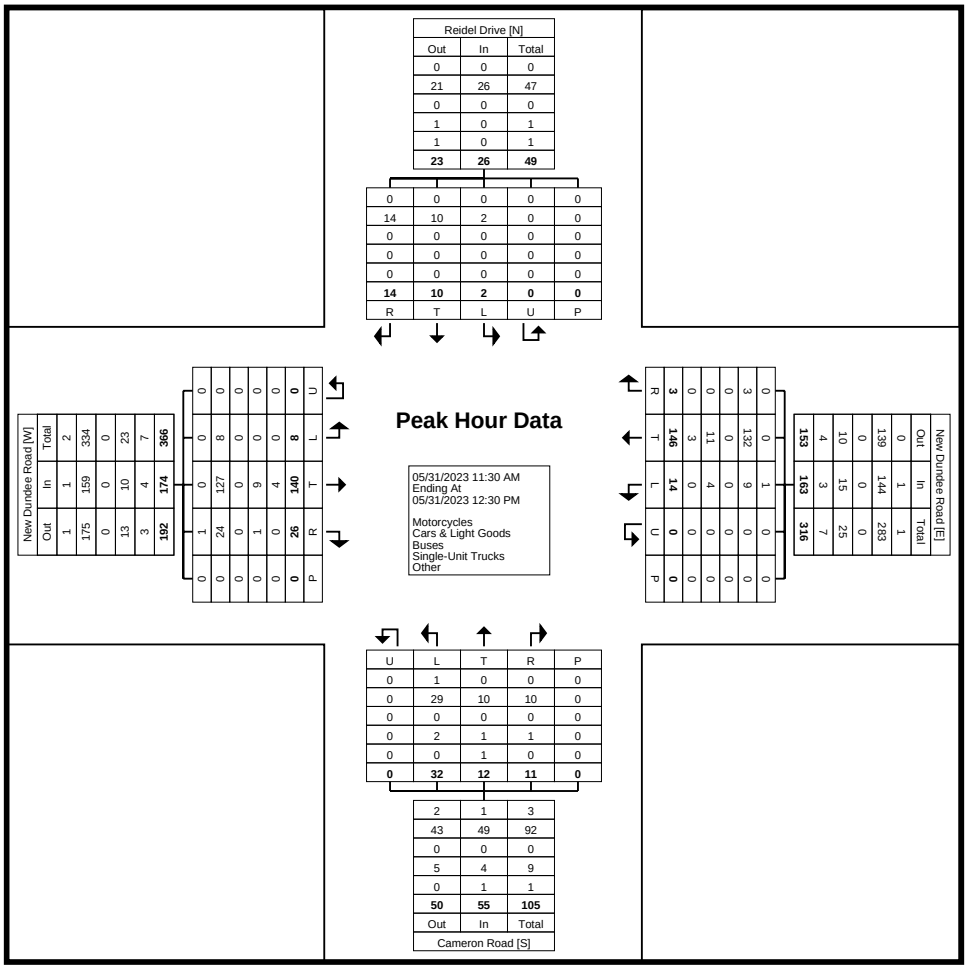

# Turning Movement Peak Hour Data (11:30 AM)

| Start Time | New Dundee Road Eastbound | | | | | | New Dundee Road Westbound | | | | | | Cameron Road Northbound | | | | | | Reidel Drive Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 11:30 AM | 2 | 43 | 12 | 0 | 0 | 57 | 5 | 32 | 1 | 0 | 0 | 38 | 8 | 2 | 0 | 0 | 0 | 10 | 0 | 2 | 1 | 0 | 0 | 3 | 108 |
| 11:45 AM | 3 | 32 | 3 | 0 | 0 | 38 | 5 | 35 | 0 | 0 | 0 | 40 | 10 | 3 | 3 | 0 | 0 | 16 | 0 | 4 | 7 | 0 | 0 | 11 | 105 |
| 12:00 PM | 1 | 28 | 3 | 0 | 0 | 32 | 1 | 34 | 1 | 0 | 0 | 36 | 6 | 7 | 5 | 0 | 0 | 18 | 0 | 2 | 4 | 0 | 0 | 6 | 92 |
| 12:15 PM | 2 | 37 | 8 | 0 | 0 | 47 | 3 | 45 | 1 | 0 | 0 | 49 | 8 | 0 | 3 | 0 | 0 | 11 | 2 | 2 | 2 | 0 | 0 | 6 | 113 |
| Total | 8 | 140 | 26 | 0 | 0 | 174 | 14 | 146 | 3 | 0 | 0 | 163 | 32 | 12 | 11 | 0 | 0 | 55 | 2 | 10 | 14 | 0 | 0 | 26 | 418 |
| Approach % | 4.6 | 80.5 | 14.9 | 0.0 | - | - | 8.6 | 89.6 | 1.8 | 0.0 | - | - | 58.2 | 21.8 | 20.0 | 0.0 | - | - | 7.7 | 38.5 | 53.8 | 0.0 | - | - | - |
| Total % | 1.9 | 33.5 | 6.2 | 0.0 | - | 41.6 | 3.3 | 34.9 | 0.7 | 0.0 | - | 39.0 | 7.7 | 2.9 | 2.6 | 0.0 | - | 13.2 | 0.5 | 2.4 | 3.3 | 0.0 | - | 6.2 | - |
| PHF | 0.667 | 0.814 | 0.542 | 0.000 | - | 0.763 | 0.700 | 0.811 | 0.750 | 0.000 | - | 0.832 | 0.800 | 0.429 | 0.550 | 0.000 | - | 0.764 | 0.250 | 0.625 | 0.500 | 0.000 | - | 0.591 | 0.925 |
| Motorcycles | 0 | 0 | 1 | 0 | - | 1 | 1 | 0 | 0 | 0 | - | 1 | 1 | 0 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 3 |
| % Motorcycles | 0.0 | 0.0 | 3.8 | - | - | 0.6 | 7.1 | 0.0 | 0.0 | - | - | 0.6 | 3.1 | 0.0 | 0.0 | - | - | 1.8 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.7 |
| Cars & Light Goods | 8 | 127 | 24 | 0 | - | 159 | 9 | 132 | 3 | 0 | - | 144 | 29 | 10 | 10 | 0 | - | 49 | 2 | 10 | 14 | 0 | - | 26 | 378 |
| % Cars & Light Goods | 100.0 | 90.7 | 92.3 | - | - | 91.4 | 64.3 | 90.4 | 100.0 | - | - | 88.3 | 90.6 | 83.3 | 90.9 | - | - | 89.1 | 100.0 | 100.0 | 100.0 | - | - | 100.0 | 90.4 |
| Buses | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Buses | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Single-Unit Trucks | 0 | 9 | 1 | 0 | - | 10 | 4 | 11 | 0 | 0 | - | 15 | 2 | 1 | 1 | 0 | - | 4 | 0 | 0 | 0 | 0 | - | 0 | 29 |
| % Single-Unit Trucks | 0.0 | 6.4 | 3.8 | - | - | 5.7 | 28.6 | 7.5 | 0.0 | - | - | 9.2 | 6.3 | 8.3 | 9.1 | - | - | 7.3 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 6.9 |
| Articulated Trucks | 0 | 3 | 0 | 0 | - | 3 | 0 | 2 | 0 | 0 | - | 2 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 5 |
| % Articulated Trucks | 0.0 | 2.1 | 0.0 | - | - | 1.7 | 0.0 | 1.4 | 0.0 | - | - | 1.2 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 1.2 |
| Bicycles on Road | 0 | 1 | 0 | 0 | - | 1 | 0 | 1 | 0 | 0 | - | 1 | 0 | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 3 |
| % Bicycles on Road | 0.0 | 0.7 | 0.0 | - | - | 0.6 | 0.0 | 0.7 | 0.0 | - | - | 0.6 | 0.0 | 8.3 | 0.0 | - | - | 1.8 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.7 |
| Bicycles on Crosswalk | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023


Turning Movement Peak Hour Data Plot (11:30 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023

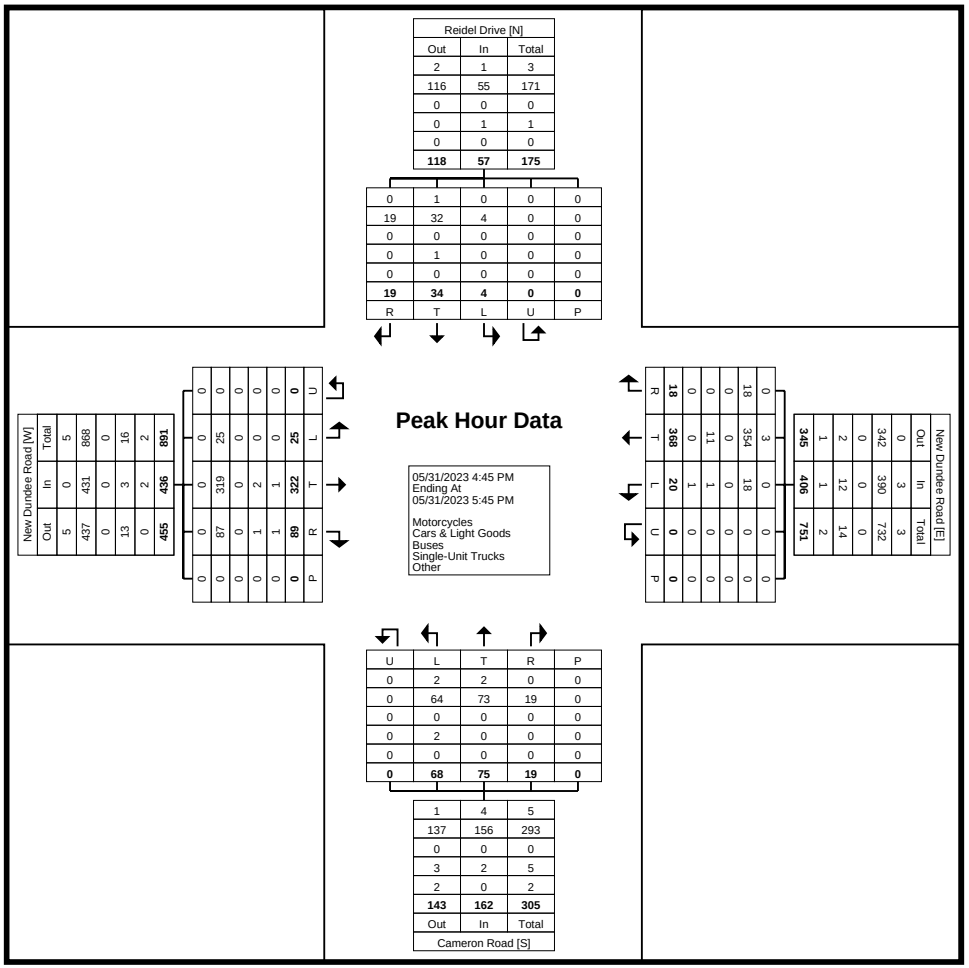

# Turning Movement Peak Hour Data (4:45 PM)

| Start Time | New Dundee Road Eastbound | | | | | | New Dundee Road Westbound | | | | | | Cameron Road Northbound | | | | | | Reidel Drive Southbound | | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | Right | U-Turn | Peds | App. Total | |
| 4:45 PM | 5 | 72 | 19 | 0 | 0 | 96 | 5 | 82 | 5 | 0 | 0 | 92 | 18 | 20 | 7 | 0 | 0 | 45 | 1 | 6 | 8 | 0 | 0 | 15 | 248 |
| 5:00 PM | 10 | 98 | 23 | 0 | 0 | 131 | 2 | 100 | 8 | 0 | 0 | 110 | 11 | 15 | 3 | 0 | 0 | 29 | 0 | 13 | 2 | 0 | 0 | 15 | 285 |
| 5:15 PM | 8 | 72 | 29 | 0 | 0 | 109 | 10 | 73 | 3 | 0 | 0 | 86 | 25 | 19 | 7 | 0 | 0 | 51 | 1 | 10 | 4 | 0 | 0 | 15 | 261 |
| 5:30 PM | 2 | 80 | 18 | 0 | 0 | 100 | 3 | 113 | 2 | 0 | 0 | 118 | 14 | 21 | 2 | 0 | 0 | 37 | 2 | 5 | 5 | 0 | 0 | 12 | 267 |
| Total | 25 | 322 | 89 | 0 | 0 | 436 | 20 | 368 | 18 | 0 | 0 | 406 | 68 | 75 | 19 | 0 | 0 | 162 | 4 | 34 | 19 | 0 | 0 | 57 | 1061 |
| Approach % | 5.7 | 73.9 | 20.4 | 0.0 | - | - | 4.9 | 90.6 | 4.4 | 0.0 | - | - | 42.0 | 46.3 | 11.7 | 0.0 | - | - | 7.0 | 59.6 | 33.3 | 0.0 | - | - | - |
| Total % | 2.4 | 30.3 | 8.4 | 0.0 | - | 41.1 | 1.9 | 34.7 | 1.7 | 0.0 | - | 38.3 | 6.4 | 7.1 | 1.8 | 0.0 | - | 15.3 | 0.4 | 3.2 | 1.8 | 0.0 | - | 5.4 | - |
| PHF | 0.625 | 0.821 | 0.767 | 0.000 | - | 0.832 | 0.500 | 0.814 | 0.563 | 0.000 | - | 0.860 | 0.680 | 0.893 | 0.679 | 0.000 | - | 0.794 | 0.500 | 0.654 | 0.594 | 0.000 | - | 0.950 | 0.931 |
| Motorcycles | 0 | 0 | 0 | 0 | - | 0 | 0 | 3 | 0 | 0 | - | 3 | 2 | 2 | 0 | 0 | - | 4 | 0 | 1 | 0 | 0 | - | 1 | 8 |
| % Motorcycles | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.8 | 0.0 | - | - | 0.7 | 2.9 | 2.7 | 0.0 | - | - | 2.5 | 0.0 | 2.9 | 0.0 | - | - | 1.8 | 0.8 |
| Cars & Light Goods | 25 | 319 | 87 | 0 | - | 431 | 18 | 354 | 18 | 0 | - | 390 | 64 | 73 | 19 | 0 | - | 156 | 4 | 32 | 19 | 0 | - | 55 | 1032 |
| % Cars & Light Goods | 100.0 | 99.1 | 97.8 | - | - | 98.9 | 90.0 | 96.2 | 100.0 | - | - | 96.1 | 94.1 | 97.3 | 100.0 | - | - | 96.3 | 100.0 | 94.1 | 100.0 | - | - | 96.5 | 97.3 |
| Buses | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Buses | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Single-Unit Trucks | 0 | 2 | 1 | 0 | - | 3 | 1 | 11 | 0 | 0 | - | 12 | 2 | 0 | 0 | 0 | - | 2 | 0 | 1 | 0 | 0 | - | 1 | 18 |
| % Single-Unit Trucks | 0.0 | 0.6 | 1.1 | - | - | 0.7 | 5.0 | 3.0 | 0.0 | - | - | 3.0 | 2.9 | 0.0 | 0.0 | - | - | 1.2 | 0.0 | 2.9 | 0.0 | - | - | 1.8 | 1.7 |
| Articulated Trucks | 0 | 1 | 1 | 0 | - | 2 | 1 | 0 | 0 | 0 | - | 1 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 3 |
| % Articulated Trucks | 0.0 | 0.3 | 1.1 | - | - | 0.5 | 5.0 | 0.0 | 0.0 | - | - | 0.2 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.3 |
| Bicycles on Road | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Bicycles on Road | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Pedestrians | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: New Dundee Road & Reidel Drive
Site Code: 230070
Start Date: 05/31/2023


Turning Movement Peak Hour Data Plot (4:45 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Data

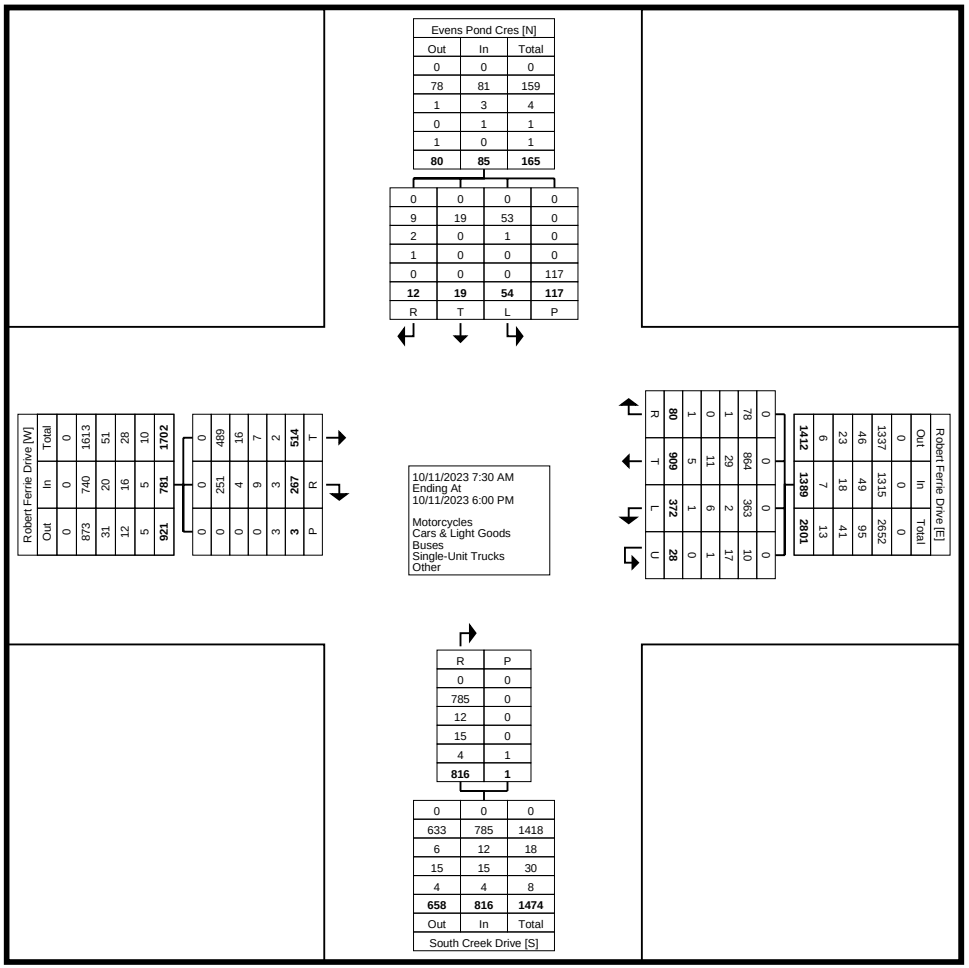
| Start Time | Robert Ferrie Drive Eastbound | | | | Robert Ferrie Drive Westbound | | | | | South Creek Drive Northbound | | | Evens Pond Cres Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | Peds | App. Total | Left | Thru | Right | U-Turn | App. Total | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 7:30 AM | 15 | 5 | 0 | 20 | 7 | 44 | 1 | 0 | 52 | 39 | 0 | 39 | 3 | 2 | 0 | 8 | 5 | 116 |
| 7:45 AM | 11 | 11 | 1 | 22 | 5 | 45 | 0 | 1 | 51 | 32 | 1 | 32 | 3 | 0 | 0 | 0 | 3 | 108 |
| Hourly Total | 26 | 16 | 1 | 42 | 12 | 89 | 1 | 1 | 103 | 71 | 1 | 71 | 6 | 2 | 0 | 8 | 8 | 224 |
| 8:00 AM | 20 | 10 | 0 | 30 | 2 | 44 | 0 | 1 | 47 | 31 | 0 | 31 | 1 | 0 | 1 | 4 | 2 | 110 |
| 8:15 AM | 21 | 9 | 0 | 30 | 11 | 39 | 0 | 0 | 50 | 34 | 0 | 34 | 4 | 1 | 0 | 7 | 5 | 119 |
| 8:30 AM | 12 | 14 | 0 | 26 | 10 | 35 | 3 | 0 | 48 | 29 | 0 | 29 | 5 | 0 | 0 | 5 | 5 | 108 |
| 8:45 AM | 14 | 13 | 0 | 27 | 17 | 40 | 1 | 2 | 60 | 33 | 0 | 33 | 1 | 1 | 3 | 2 | 5 | 125 |
| Hourly Total | 67 | 46 | 0 | 113 | 40 | 158 | 4 | 3 | 205 | 127 | 0 | 127 | 11 | 2 | 4 | 18 | 17 | 462 |
| 9:00 AM | 18 | 12 | 1 | 30 | 10 | 47 | 5 | 1 | 63 | 46 | 0 | 46 | 3 | 6 | 0 | 2 | 9 | 148 |
| 9:15 AM | 13 | 4 | 0 | 17 | 6 | 37 | 4 | 1 | 48 | 33 | 0 | 33 | 3 | 0 | 0 | 0 | 3 | 101 |
| 9:30 AM | 12 | 2 | 0 | 14 | 4 | 13 | 1 | 1 | 19 | 16 | 0 | 16 | 0 | 0 | 0 | 6 | 0 | 49 |
| 9:45 AM | 14 | 4 | 0 | 18 | 7 | 21 | 0 | 1 | 29 | 23 | 0 | 23 | 0 | 0 | 0 | 4 | 0 | 70 |
| Hourly Total | 57 | 22 | 1 | 79 | 27 | 118 | 10 | 4 | 159 | 118 | 0 | 118 | 6 | 6 | 0 | 12 | 12 | 368 |
| 10:00 AM | 11 | 4 | 0 | 15 | 6 | 16 | 0 | 2 | 24 | 12 | 0 | 12 | 0 | 0 | 0 | 4 | 0 | 51 |
| 10:15 AM | 11 | 2 | 0 | 13 | 15 | 16 | 1 | 1 | 33 | 19 | 0 | 19 | 0 | 0 | 0 | 3 | 0 | 65 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 22 | 6 | 0 | 28 | 21 | 32 | 1 | 3 | 57 | 31 | 0 | 31 | 0 | 0 | 0 | 7 | 0 | 116 |
| 12:00 PM | 9 | 1 | 0 | 10 | 9 | 18 | 1 | 1 | 29 | 17 | 0 | 17 | 0 | 0 | 1 | 4 | 1 | 57 |
| 12:15 PM | 15 | 3 | 0 | 18 | 6 | 18 | 2 | 0 | 26 | 10 | 0 | 10 | 4 | 0 | 0 | 2 | 4 | 58 |
| 12:30 PM | 5 | 5 | 0 | 10 | 7 | 25 | 2 | 1 | 35 | 23 | 0 | 23 | 1 | 0 | 1 | 8 | 2 | 70 |
| 12:45 PM | 13 | 1 | 0 | 14 | 9 | 11 | 0 | 0 | 20 | 14 | 0 | 14 | 0 | 2 | 0 | 1 | 2 | 50 |
| Hourly Total | 42 | 10 | 0 | 52 | 31 | 72 | 5 | 2 | 110 | 64 | 0 | 64 | 5 | 2 | 2 | 15 | 9 | 235 |
| 1:00 PM | 11 | 3 | 0 | 14 | 8 | 11 | 4 | 1 | 24 | 18 | 0 | 18 | 2 | 0 | 0 | 7 | 2 | 58 |
| 1:15 PM | 10 | 9 | 0 | 19 | 9 | 14 | 1 | 0 | 24 | 15 | 0 | 15 | 0 | 1 | 0 | 1 | 1 | 59 |
| 1:30 PM | 13 | 5 | 0 | 18 | 2 | 7 | 1 | 1 | 11 | 12 | 0 | 12 | 0 | 1 | 0 | 8 | 1 | 42 |
| 1:45 PM | 10 | 5 | 0 | 15 | 13 | 18 | 2 | 0 | 33 | 22 | 0 | 22 | 2 | 0 | 0 | 2 | 2 | 72 |
| Hourly Total | 44 | 22 | 0 | 66 | 32 | 50 | 8 | 2 | 92 | 67 | 0 | 67 | 4 | 2 | 0 | 18 | 6 | 231 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 16 | 11 | 1 | 27 | 14 | 17 | 6 | 2 | 39 | 12 | 0 | 12 | 0 | 0 | 2 | 5 | 2 | 80 |
| 3:15 PM | 15 | 9 | 0 | 24 | 12 | 25 | 4 | 1 | 42 | 19 | 0 | 19 | 2 | 1 | 2 | 4 | 5 | 90 |
| 3:30 PM | 15 | 10 | 0 | 25 | 14 | 42 | 6 | 0 | 62 | 44 | 0 | 44 | 1 | 0 | 0 | 7 | 1 | 132 |
| 3:45 PM | 22 | 13 | 0 | 35 | 17 | 24 | 1 | 1 | 43 | 23 | 0 | 23 | 2 | 1 | 0 | 6 | 3 | 104 |
| Hourly Total | 68 | 43 | 1 | 111 | 57 | 108 | 17 | 4 | 186 | 98 | 0 | 98 | 5 | 2 | 4 | 22 | 11 | 406 |
| 4:00 PM | 27 | 16 | 0 | 43 | 12 | 40 | 5 | 3 | 60 | 24 | 0 | 24 | 1 | 0 | 0 | 0 | 1 | 128 |
| 4:15 PM | 22 | 8 | 0 | 30 | 9 | 35 | 3 | 1 | 48 | 36 | 0 | 36 | 4 | 1 | 0 | 0 | 5 | 119 |
| 4:30 PM | 18 | 11 | 0 | 29 | 16 | 35 | 1 | 1 | 53 | 22 | 0 | 22 | 1 | 0 | 0 | 0 | 1 | 105 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:45 PM | 29 | 15 | 0 | 44 | 17 | 28 | 3 | 1 | 49 | 26 | 0 | 26 | 2 | 0 | 1 | 0 | 3 | 122 |
| Hourly Total | 96 | 50 | 0 | 146 | 54 | 138 | 12 | 6 | 210 | 108 | 0 | 108 | 8 | 1 | 1 | 0 | 10 | 474 |
| 5:00 PM | 26 | 13 | 0 | 39 | 28 | 47 | 6 | 0 | 81 | 45 | 0 | 45 | 1 | 0 | 0 | 7 | 1 | 166 |
| 5:15 PM | 28 | 12 | 0 | 40 | 24 | 36 | 3 | 1 | 64 | 33 | 0 | 33 | 4 | 0 | 0 | 1 | 4 | 141 |
| 5:30 PM | 19 | 13 | 0 | 32 | 28 | 26 | 1 | 2 | 57 | 21 | 0 | 21 | 2 | 0 | 1 | 2 | 3 | 113 |
| 5:45 PM | 19 | 14 | 0 | 33 | 18 | 35 | 12 | 0 | 65 | 33 | 0 | 33 | 2 | 2 | 0 | 7 | 4 | 135 |
| Hourly Total | 92 | 52 | 0 | 144 | 98 | 144 | 22 | 3 | 267 | 132 | 0 | 132 | 9 | 2 | 1 | 17 | 12 | 555 |
| Grand Total | 514 | 267 | 3 | 781 | 372 | 909 | 80 | 28 | 1389 | 816 | 1 | 816 | 54 | 19 | 12 | 117 | 85 | 3071 |
| Approach % | 65.8 | 34.2 | - | - | 26.8 | 65.4 | 5.8 | 2.0 | - | 100.0 | - | - | 63.5 | 22.4 | 14.1 | - | - | - |
| Total % | 16.7 | 8.7 | - | 25.4 | 12.1 | 29.6 | 2.6 | 0.9 | 45.2 | 26.6 | - | 26.6 | 1.8 | 0.6 | 0.4 | - | 2.8 | - |
| Motorcycles | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Cars & Light Goods | 489 | 251 | - | 740 | 363 | 864 | 78 | 10 | 1315 | 785 | - | 785 | 53 | 19 | 9 | - | 81 | 2921 |
| % Cars & Light Goods | 95.1 | 94.0 | - | 94.8 | 97.6 | 95.0 | 97.5 | 35.7 | 94.7 | 96.2 | - | 96.2 | 98.1 | 100.0 | 75.0 | - | 95.3 | 95.1 |
| Buses | 16 | 4 | - | 20 | 2 | 29 | 1 | 17 | 49 | 12 | - | 12 | 1 | 0 | 2 | - | 3 | 84 |
| % Buses | 3.1 | 1.5 | - | 2.6 | 0.5 | 3.2 | 1.3 | 60.7 | 3.5 | 1.5 | - | 1.5 | 1.9 | 0.0 | 16.7 | - | 3.5 | 2.7 |
| Single-Unit Trucks | 7 | 9 | - | 16 | 6 | 11 | 0 | 1 | 18 | 15 | - | 15 | 0 | 0 | 1 | - | 1 | 50 |
| % Single-Unit Trucks | 1.4 | 3.4 | - | 2.0 | 1.6 | 1.2 | 0.0 | 3.6 | 1.3 | 1.8 | - | 1.8 | 0.0 | 0.0 | 8.3 | - | 1.2 | 1.6 |
| Articulated Trucks | 0 | 1 | - | 1 | 0 | 3 | 0 | 0 | 3 | 1 | - | 1 | 0 | 0 | 0 | - | 0 | 5 |
| % Articulated Trucks | 0.0 | 0.4 | - | 0.1 | 0.0 | 0.3 | 0.0 | 0.0 | 0.2 | 0.1 | - | 0.1 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.2 |
| Bicycles on Road | 2 | 2 | - | 4 | 1 | 2 | 1 | 0 | 4 | 3 | - | 3 | 0 | 0 | 0 | - | 0 | 11 |
| % Bicycles on Road | 0.4 | 0.7 | - | 0.5 | 0.3 | 0.2 | 1.3 | 0.0 | 0.3 | 0.4 | - | 0.4 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.4 |
| Bicycles on Crosswalk | - | - | 0 | - | - | - | - | - | - | - | 1 | - | - | - | - | 4 | - | - |
| % Bicycles on Crosswalk | - | - | 0.0 | - | - | - | - | - | - | - | 100.0 | - | - | - | - | 3.4 | - | - |
| Pedestrians | - | - | 3 | - | - | - | - | - | - | - | 0 | - | - | - | - | 113 | - | - |
| % Pedestrians | - | - | 100.0 | - | - | - | - | - | - | - | 0.0 | - | - | - | - | 96.6 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023

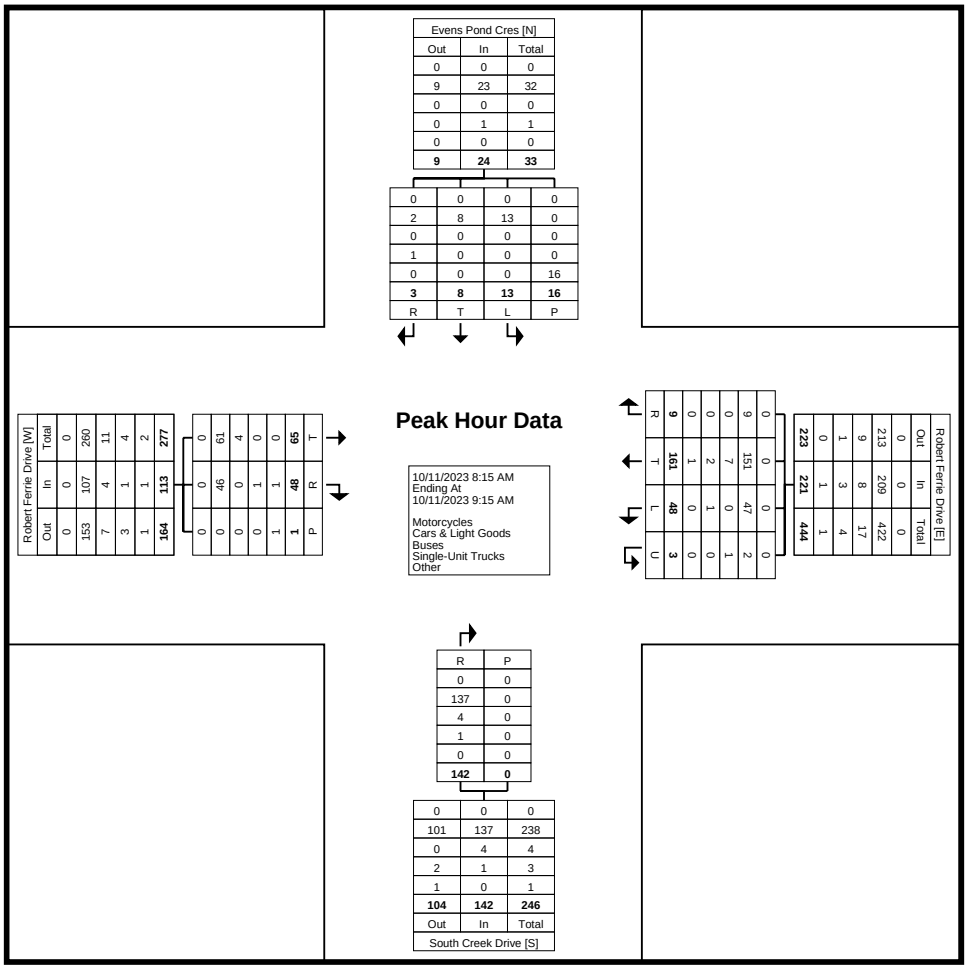

# Turning Movement Peak Hour Data (8:15 AM)

| Start Time | Robert Ferrie Drive Eastbound | | | | Robert Ferrie Drive Westbound | | | | | South Creek Drive Northbound | | | Evens Pond Cres Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | Peds | App. Total | Left | Thru | Right | U-Turn | App. Total | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 8:15 AM | 21 | 9 | 0 | 30 | 11 | 39 | 0 | 0 | 50 | 34 | 0 | 34 | 4 | 1 | 0 | 7 | 5 | 119 |
| 8:30 AM | 12 | 14 | 0 | 26 | 10 | 35 | 3 | 0 | 48 | 29 | 0 | 29 | 5 | 0 | 0 | 5 | 5 | 108 |
| 8:45 AM | 14 | 13 | 0 | 27 | 17 | 40 | 1 | 2 | 60 | 33 | 0 | 33 | 1 | 1 | 3 | 2 | 5 | 125 |
| 9:00 AM | 18 | 12 | 1 | 30 | 10 | 47 | 5 | 1 | 63 | 46 | 0 | 46 | 3 | 6 | 0 | 2 | 9 | 148 |
| Total | 65 | 48 | 1 | 113 | 48 | 161 | 9 | 3 | 221 | 142 | 0 | 142 | 13 | 8 | 3 | 16 | 24 | 500 |
| Approach % | 57.5 | 42.5 | - | - | 21.7 | 72.9 | 4.1 | 1.4 | - | 100.0 | - | - | 54.2 | 33.3 | 12.5 | - | - | - |
| Total % | 13.0 | 9.6 | - | 22.6 | 9.6 | 32.2 | 1.8 | 0.6 | 44.2 | 28.4 | - | 28.4 | 2.6 | 1.6 | 0.6 | - | 4.8 | - |
| PHF | 0.774 | 0.857 | - | 0.942 | 0.706 | 0.856 | 0.450 | 0.375 | 0.877 | 0.772 | - | 0.772 | 0.650 | 0.333 | 0.250 | - | 0.667 | 0.845 |
| Motorcycles | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Cars & Light Goods | 61 | 46 | - | 107 | 47 | 151 | 9 | 2 | 209 | 137 | - | 137 | 13 | 8 | 2 | - | 23 | 476 |
| % Cars & Light Goods | 93.8 | 95.8 | - | 94.7 | 97.9 | 93.8 | 100.0 | 66.7 | 94.6 | 96.5 | - | 96.5 | 100.0 | 100.0 | 66.7 | - | 95.8 | 95.2 |
| Buses | 4 | 0 | - | 4 | 0 | 7 | 0 | 1 | 8 | 4 | - | 4 | 0 | 0 | 0 | - | 0 | 16 |
| % Buses | 6.2 | 0.0 | - | 3.5 | 0.0 | 4.3 | 0.0 | 33.3 | 3.6 | 2.8 | - | 2.8 | 0.0 | 0.0 | 0.0 | - | 0.0 | 3.2 |
| Single-Unit Trucks | 0 | 1 | - | 1 | 1 | 2 | 0 | 0 | 3 | 1 | - | 1 | 0 | 0 | 1 | - | 1 | 6 |
| % Single-Unit Trucks | 0.0 | 2.1 | - | 0.9 | 2.1 | 1.2 | 0.0 | 0.0 | 1.4 | 0.7 | - | 0.7 | 0.0 | 0.0 | 33.3 | - | 4.2 | 1.2 |
| Articulated Trucks | 0 | 0 | - | 0 | 0 | 1 | 0 | 0 | 1 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Articulated Trucks | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.6 | 0.0 | 0.0 | 0.5 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.2 |
| Bicycles on Road | 0 | 1 | - | 1 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Bicycles on Road | 0.0 | 2.1 | - | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.2 |
| Bicycles on Crosswalk | - | - | 0 | - | - | - | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | 0.0 | - | - | - | - | - | - | - | - | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | 1 | - | - | - | - | - | - | - | 0 | - | - | - | - | 16 | - | - |
| % Pedestrians | - | - | 100.0 | - | - | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (8:15 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023

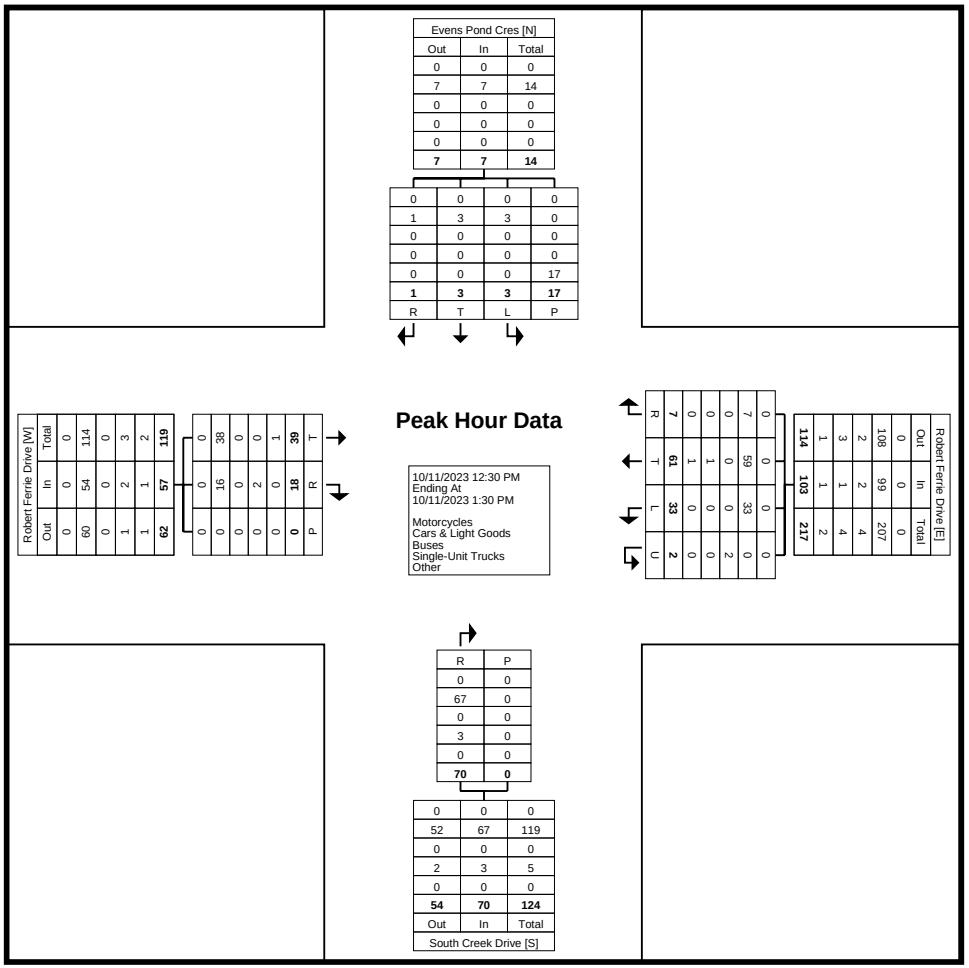

# Turning Movement Peak Hour Data (12:30 PM)

| Start Time | Robert Ferrie Drive Eastbound | | | | Robert Ferrie Drive Westbound | | | | | South Creek Drive Northbound | | | Evens Pond Cres Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | Peds | App. Total | Left | Thru | Right | U-Turn | App. Total | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 12:30 PM | 5 | 5 | 0 | 10 | 7 | 25 | 2 | 1 | 35 | 23 | 0 | 23 | 1 | 0 | 1 | 8 | 2 | 70 |
| 12:45 PM | 13 | 1 | 0 | 14 | 9 | 11 | 0 | 0 | 20 | 14 | 0 | 14 | 0 | 2 | 0 | 1 | 2 | 50 |
| 1:00 PM | 11 | 3 | 0 | 14 | 8 | 11 | 4 | 1 | 24 | 18 | 0 | 18 | 2 | 0 | 0 | 7 | 2 | 58 |
| 1:15 PM | 10 | 9 | 0 | 19 | 9 | 14 | 1 | 0 | 24 | 15 | 0 | 15 | 0 | 1 | 0 | 1 | 1 | 59 |
| Total | 39 | 18 | 0 | 57 | 33 | 61 | 7 | 2 | 103 | 70 | 0 | 70 | 3 | 3 | 1 | 17 | 7 | 237 |
| Approach % | 68.4 | 31.6 | - | - | 32.0 | 59.2 | 6.8 | 1.9 | - | 100.0 | - | - | 42.9 | 42.9 | 14.3 | - | - | - |
| Total % | 16.5 | 7.6 | - | 24.1 | 13.9 | 25.7 | 3.0 | 0.8 | 43.5 | 29.5 | - | 29.5 | 1.3 | 1.3 | 0.4 | - | 3.0 | - |
| PHF | 0.750 | 0.500 | - | 0.750 | 0.917 | 0.610 | 0.438 | 0.500 | 0.736 | 0.761 | - | 0.761 | 0.375 | 0.375 | 0.250 | - | 0.875 | 0.846 |
| Motorcycles | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Cars & Light Goods | 38 | 16 | - | 54 | 33 | 59 | 7 | 0 | 99 | 67 | - | 67 | 3 | 3 | 1 | - | 7 | 227 |
| % Cars & Light Goods | 97.4 | 88.9 | - | 94.7 | 100.0 | 96.7 | 100.0 | 0.0 | 96.1 | 95.7 | - | 95.7 | 100.0 | 100.0 | 100.0 | - | 100.0 | 95.8 |
| Buses | 0 | 0 | - | 0 | 0 | 0 | 0 | 2 | 2 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 2 |
| % Buses | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 100.0 | 1.9 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.8 |
| Single-Unit Trucks | 0 | 2 | - | 2 | 0 | 1 | 0 | 0 | 1 | 3 | - | 3 | 0 | 0 | 0 | - | 0 | 6 |
| % Single-Unit Trucks | 0.0 | 11.1 | - | 3.5 | 0.0 | 1.6 | 0.0 | 0.0 | 1.0 | 4.3 | - | 4.3 | 0.0 | 0.0 | 0.0 | - | 0.0 | 2.5 |
| Articulated Trucks | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Bicycles on Road | 1 | 0 | - | 1 | 0 | 1 | 0 | 0 | 1 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 2 |
| % Bicycles on Road | 2.6 | 0.0 | - | 1.8 | 0.0 | 1.6 | 0.0 | 0.0 | 1.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.8 |
| Bicycles on Crosswalk | - | - | 0 | - | - | - | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | 0 | - | - | - | - | - | - | - | 0 | - | - | - | - | 17 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (12:30 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023

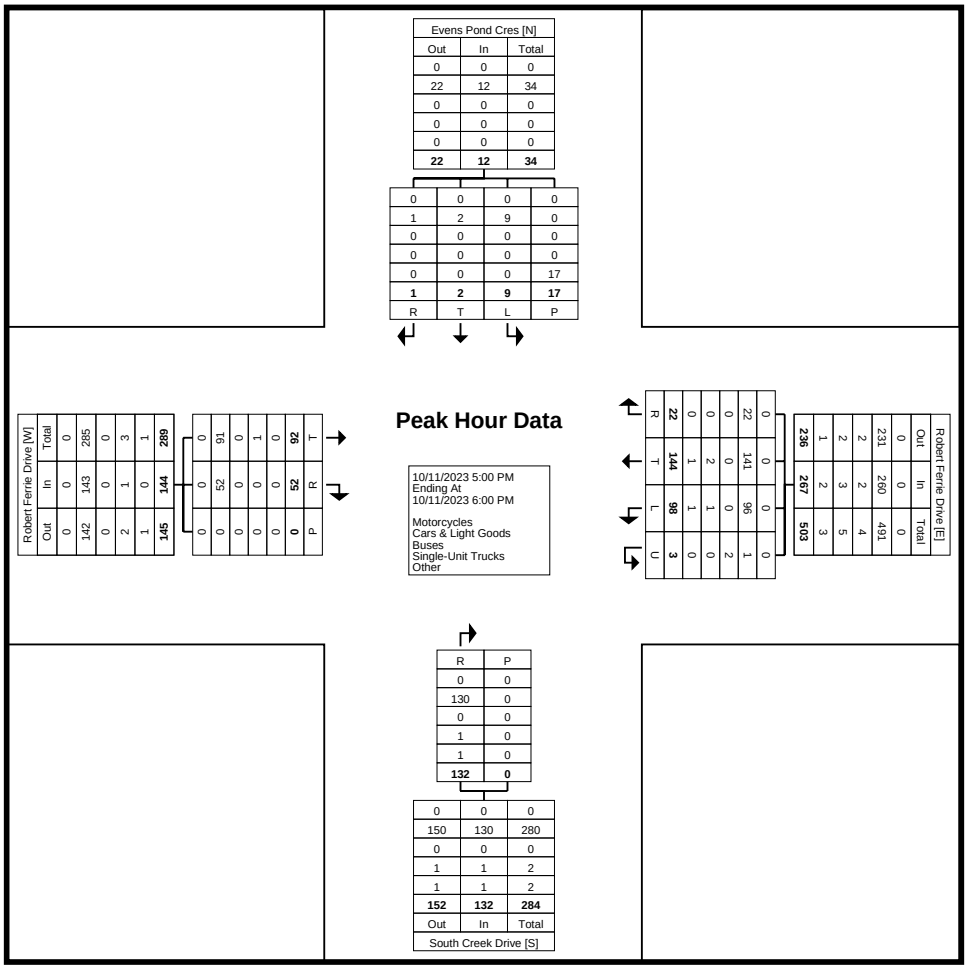

# Turning Movement Peak Hour Data (5:00 PM)

| Start Time | Robert Ferrie Drive Eastbound | | | | Robert Ferrie Drive Westbound | | | | | South Creek Drive Northbound | | | Evens Pond Cres Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | Peds | App. Total | Left | Thru | Right | U-Turn | App. Total | Right | Peds | App. Total | Left | Thru | Right | Peds | App. Total | Int. Total |
| 5:00 PM | 26 | 13 | 0 | 39 | 28 | 47 | 6 | 0 | 81 | 45 | 0 | 45 | 1 | 0 | 0 | 7 | 1 | 166 |
| 5:15 PM | 28 | 12 | 0 | 40 | 24 | 36 | 3 | 1 | 64 | 33 | 0 | 33 | 4 | 0 | 0 | 1 | 4 | 141 |
| 5:30 PM | 19 | 13 | 0 | 32 | 28 | 26 | 1 | 2 | 57 | 21 | 0 | 21 | 2 | 0 | 1 | 2 | 3 | 113 |
| 5:45 PM | 19 | 14 | 0 | 33 | 18 | 35 | 12 | 0 | 65 | 33 | 0 | 33 | 2 | 2 | 0 | 7 | 4 | 135 |
| Total | 92 | 52 | 0 | 144 | 98 | 144 | 22 | 3 | 267 | 132 | 0 | 132 | 9 | 2 | 1 | 17 | 12 | 555 |
| Approach % | 63.9 | 36.1 | - | - | 36.7 | 53.9 | 8.2 | 1.1 | - | 100.0 | - | - | 75.0 | 16.7 | 8.3 | - | - | - |
| Total % | 16.6 | 9.4 | - | 25.9 | 17.7 | 25.9 | 4.0 | 0.5 | 48.1 | 23.8 | - | 23.8 | 1.6 | 0.4 | 0.2 | - | 2.2 | - |
| PHF | 0.821 | 0.929 | - | 0.900 | 0.875 | 0.766 | 0.458 | 0.375 | 0.824 | 0.733 | - | 0.733 | 0.563 | 0.250 | 0.250 | - | 0.750 | 0.836 |
| Motorcycles | 0 | 0 | - | 0 | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 |
| Cars & Light Goods | 91 | 52 | - | 143 | 96 | 141 | 22 | 1 | 260 | 130 | - | 130 | 9 | 2 | 1 | - | 12 | 545 |
| % Cars & Light Goods | 98.9 | 100.0 | - | 99.3 | 98.0 | 97.9 | 100.0 | 33.3 | 97.4 | 98.5 | - | 98.5 | 100.0 | 100.0 | 100.0 | - | 100.0 | 98.2 |
| Buses | 0 | 0 | - | 0 | 0 | 0 | 0 | 2 | 2 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 2 |
| % Buses | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | 66.7 | 0.7 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.4 |
| Single-Unit Trucks | 1 | 0 | - | 1 | 1 | 2 | 0 | 0 | 3 | 1 | - | 1 | 0 | 0 | 0 | - | 0 | 5 |
| % Single-Unit Trucks | 1.1 | 0.0 | - | 0.7 | 1.0 | 1.4 | 0.0 | 0.0 | 1.1 | 0.8 | - | 0.8 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.9 |
| Articulated Trucks | 0 | 0 | - | 0 | 0 | 1 | 0 | 0 | 1 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Articulated Trucks | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.4 | 0.0 | - | 0.0 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.2 |
| Bicycles on Road | 0 | 0 | - | 0 | 1 | 0 | 0 | 0 | 1 | 1 | - | 1 | 0 | 0 | 0 | - | 0 | 2 |
| % Bicycles on Road | 0.0 | 0.0 | - | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.8 | - | 0.8 | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.4 |
| Bicycles on Crosswalk | - | - | 0 | - | - | - | - | - | - | - | 0 | - | - | - | - | 3 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 17.6 | - | - |
| Pedestrians | - | - | 0 | - | - | - | - | - | - | - | 0 | - | - | - | - | 14 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | 82.4 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive & South Creek Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (5:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Data

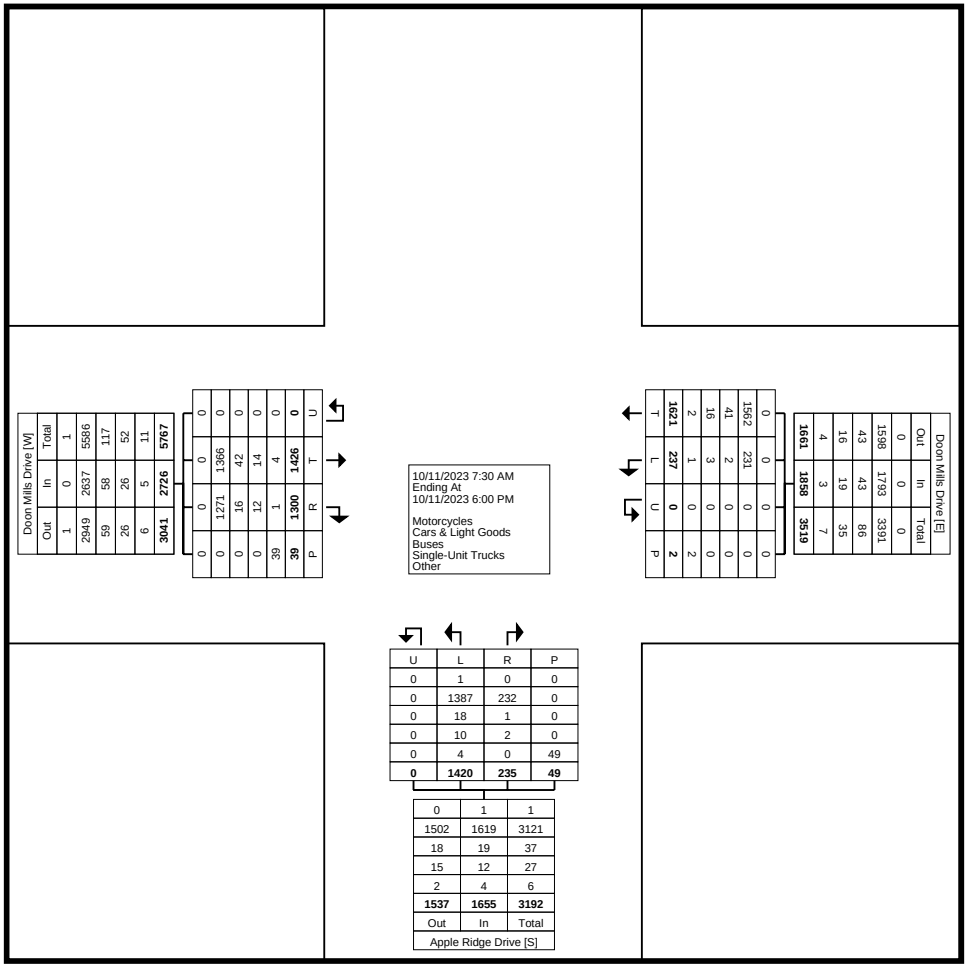
| Start Time | Doon Mills Drive Eastbound | | | | | Doon Mills Drive Westbound | | | | | Apple Ridge Drive Northbound | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | |
| 7:30 AM | 21 | 15 | 0 | 4 | 36 | 3 | 66 | 0 | 0 | 69 | 59 | 11 | 0 | 2 | 70 | 175 |
| 7:45 AM | 34 | 22 | 0 | 0 | 56 | 2 | 68 | 0 | 0 | 70 | 61 | 13 | 0 | 2 | 74 | 200 |
| Hourly Total | 55 | 37 | 0 | 4 | 92 | 5 | 134 | 0 | 0 | 139 | 120 | 24 | 0 | 4 | 144 | 375 |
| 8:00 AM | 35 | 31 | 0 | 0 | 66 | 3 | 63 | 0 | 0 | 66 | 59 | 11 | 0 | 2 | 70 | 202 |
| 8:15 AM | 41 | 33 | 0 | 4 | 74 | 8 | 68 | 0 | 1 | 76 | 67 | 20 | 0 | 1 | 87 | 237 |
| 8:30 AM | 37 | 38 | 0 | 0 | 75 | 10 | 73 | 0 | 0 | 83 | 42 | 11 | 0 | 2 | 53 | 211 |
| 8:45 AM | 32 | 41 | 0 | 2 | 73 | 11 | 89 | 0 | 0 | 100 | 53 | 10 | 0 | 0 | 63 | 236 |
| Hourly Total | 145 | 143 | 0 | 6 | 288 | 32 | 293 | 0 | 1 | 325 | 221 | 52 | 0 | 5 | 273 | 886 |
| 9:00 AM | 36 | 35 | 0 | 3 | 71 | 12 | 62 | 0 | 0 | 74 | 59 | 15 | 0 | 0 | 74 | 219 |
| 9:15 AM | 30 | 26 | 0 | 1 | 56 | 1 | 53 | 0 | 0 | 54 | 42 | 13 | 0 | 5 | 55 | 165 |
| 9:30 AM | 30 | 19 | 0 | 0 | 49 | 5 | 48 | 0 | 0 | 53 | 25 | 9 | 0 | 6 | 34 | 136 |
| 9:45 AM | 15 | 25 | 0 | 0 | 40 | 4 | 42 | 0 | 0 | 46 | 36 | 5 | 0 | 1 | 41 | 127 |
| Hourly Total | 111 | 105 | 0 | 4 | 216 | 22 | 205 | 0 | 0 | 227 | 162 | 42 | 0 | 12 | 204 | 647 |
| 10:00 AM | 25 | 14 | 0 | 0 | 39 | 5 | 36 | 0 | 1 | 41 | 37 | 8 | 0 | 2 | 45 | 125 |
| 10:15 AM | 24 | 26 | 0 | 0 | 50 | 3 | 35 | 0 | 0 | 38 | 33 | 4 | 0 | 1 | 37 | 125 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 49 | 40 | 0 | 0 | 89 | 8 | 71 | 0 | 1 | 79 | 70 | 12 | 0 | 3 | 82 | 250 |
| 12:00 PM | 41 | 28 | 0 | 0 | 69 | 5 | 44 | 0 | 0 | 49 | 31 | 4 | 0 | 0 | 35 | 153 |
| 12:15 PM | 35 | 33 | 0 | 0 | 68 | 2 | 37 | 0 | 0 | 39 | 35 | 3 | 0 | 2 | 38 | 145 |
| 12:30 PM | 33 | 36 | 0 | 0 | 69 | 3 | 31 | 0 | 0 | 34 | 33 | 4 | 0 | 2 | 37 | 140 |
| 12:45 PM | 36 | 25 | 0 | 0 | 61 | 6 | 34 | 0 | 0 | 40 | 29 | 3 | 0 | 2 | 32 | 133 |
| Hourly Total | 145 | 122 | 0 | 0 | 267 | 16 | 146 | 0 | 0 | 162 | 128 | 14 | 0 | 6 | 142 | 571 |
| 1:00 PM | 37 | 28 | 0 | 0 | 65 | 2 | 25 | 0 | 0 | 27 | 29 | 0 | 0 | 2 | 29 | 121 |
| 1:15 PM | 23 | 36 | 0 | 0 | 59 | 1 | 32 | 0 | 0 | 33 | 42 | 2 | 0 | 0 | 44 | 136 |
| 1:30 PM | 39 | 23 | 0 | 0 | 62 | 4 | 28 | 0 | 0 | 32 | 37 | 2 | 0 | 1 | 39 | 133 |
| 1:45 PM | 33 | 32 | 0 | 2 | 65 | 3 | 45 | 0 | 0 | 48 | 25 | 3 | 0 | 0 | 28 | 141 |
| Hourly Total | 132 | 119 | 0 | 2 | 251 | 10 | 130 | 0 | 0 | 140 | 133 | 7 | 0 | 3 | 140 | 531 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 46 | 69 | 0 | 3 | 115 | 16 | 39 | 0 | 0 | 55 | 32 | 5 | 0 | 1 | 37 | 207 |
| 3:15 PM | 61 | 69 | 0 | 3 | 130 | 19 | 41 | 0 | 0 | 60 | 43 | 6 | 0 | 3 | 49 | 239 |
| 3:30 PM | 52 | 42 | 0 | 9 | 94 | 10 | 50 | 0 | 0 | 60 | 65 | 18 | 0 | 1 | 83 | 237 |
| 3:45 PM | 65 | 55 | 0 | 3 | 120 | 8 | 62 | 0 | 0 | 70 | 35 | 9 | 0 | 3 | 44 | 234 |
| Hourly Total | 224 | 235 | 0 | 18 | 459 | 53 | 192 | 0 | 0 | 245 | 175 | 38 | 0 | 8 | 213 | 917 |
| 4:00 PM | 58 | 41 | 0 | 1 | 99 | 6 | 48 | 0 | 0 | 54 | 37 | 2 | 0 | 1 | 39 | 192 |
| 4:15 PM | 69 | 52 | 0 | 1 | 121 | 2 | 47 | 0 | 0 | 49 | 66 | 9 | 0 | 2 | 75 | 245 |
| 4:30 PM | 68 | 51 | 0 | 0 | 119 | 12 | 56 | 0 | 0 | 68 | 47 | 3 | 0 | 2 | 50 | 237 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:45 PM | 58 | 64 | 0 | 1 | 122 | 21 | 73 | 0 | 0 | 94 | 46 | 2 | 0 | 2 | 48 | 264 |
| Hourly Total | 253 | 208 | 0 | 3 | 461 | 41 | 224 | 0 | 0 | 265 | 196 | 16 | 0 | 7 | 212 | 938 |
| 5:00 PM | 80 | 79 | 0 | 0 | 159 | 13 | 53 | 0 | 0 | 66 | 57 | 6 | 0 | 0 | 63 | 288 |
| 5:15 PM | 79 | 59 | 0 | 1 | 138 | 16 | 50 | 0 | 0 | 66 | 58 | 8 | 0 | 1 | 66 | 270 |
| 5:30 PM | 86 | 72 | 0 | 0 | 158 | 10 | 64 | 0 | 0 | 74 | 46 | 10 | 0 | 0 | 56 | 288 |
| 5:45 PM | 67 | 81 | 0 | 1 | 148 | 11 | 59 | 0 | 0 | 70 | 54 | 6 | 0 | 0 | 60 | 278 |
| Hourly Total | 312 | 291 | 0 | 2 | 603 | 50 | 226 | 0 | 0 | 276 | 215 | 30 | 0 | 1 | 245 | 1124 |
| Grand Total | 1426 | 1300 | 0 | 39 | 2726 | 237 | 1621 | 0 | 2 | 1858 | 1420 | 235 | 0 | 49 | 1655 | 6239 |
| Approach % | 52.3 | 47.7 | 0.0 | - | - | 12.8 | 87.2 | 0.0 | - | - | 85.8 | 14.2 | 0.0 | - | - | - |
| Total % | 22.9 | 20.8 | 0.0 | - | 43.7 | 3.8 | 26.0 | 0.0 | - | 29.8 | 22.8 | 3.8 | 0.0 | - | 26.5 | - |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 1 |
| % Motorcycles | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.1 | 0.0 | - | - | 0.1 | 0.0 |
| Cars & Light Goods | 1366 | 1271 | 0 | - | 2637 | 231 | 1562 | 0 | - | 1793 | 1387 | 232 | 0 | - | 1619 | 6049 |
| % Cars & Light Goods | 95.8 | 97.8 | - | - | 96.7 | 97.5 | 96.4 | - | - | 96.5 | 97.7 | 98.7 | - | - | 97.8 | 97.0 |
| Buses | 42 | 16 | 0 | - | 58 | 2 | 41 | 0 | - | 43 | 18 | 1 | 0 | - | 19 | 120 |
| % Buses | 2.9 | 1.2 | - | - | 2.1 | 0.8 | 2.5 | - | - | 2.3 | 1.3 | 0.4 | - | - | 1.1 | 1.9 |
| Single-Unit Trucks | 14 | 12 | 0 | - | 26 | 3 | 16 | 0 | - | 19 | 10 | 2 | 0 | - | 12 | 57 |
| % Single-Unit Trucks | 1.0 | 0.9 | - | - | 1.0 | 1.3 | 1.0 | - | - | 1.0 | 0.7 | 0.9 | - | - | 0.7 | 0.9 |
| Articulated Trucks | 1 | 0 | 0 | - | 1 | 0 | 1 | 0 | - | 1 | 2 | 0 | 0 | - | 2 | 4 |
| % Articulated Trucks | 0.1 | 0.0 | - | - | 0.0 | 0.0 | 0.1 | - | - | 0.1 | 0.1 | 0.0 | - | - | 0.1 | 0.1 |
| Bicycles on Road | 3 | 1 | 0 | - | 4 | 1 | 1 | 0 | - | 2 | 2 | 0 | 0 | - | 2 | 8 |
| % Bicycles on Road | 0.2 | 0.1 | - | - | 0.1 | 0.4 | 0.1 | - | - | 0.1 | 0.1 | 0.0 | - | - | 0.1 | 0.1 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 2 | - | - |
| % Bicycles on Crosswalk | - | - | - | 0.0 | - | - | - | - | 0.0 | - | - | - | - | 4.1 | - | - |
| Pedestrians | - | - | - | 39 | - | - | - | - | 2 | - | - | - | - | 47 | - | - |
| % Pedestrians | - | - | - | 100.0 | - | - | - | - | 100.0 | - | - | - | - | 95.9 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023
Page No: 3




Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023

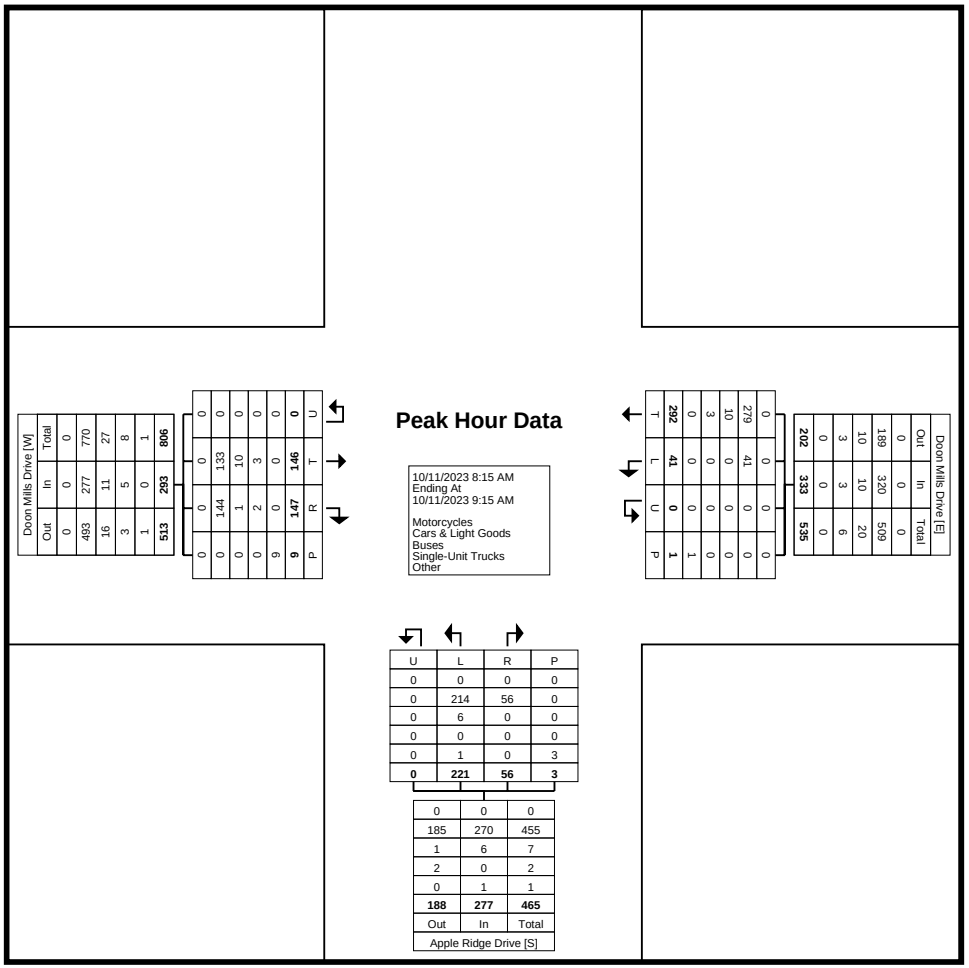

# Turning Movement Peak Hour Data (8:15 AM)

| Start Time | Doon Mills Drive Eastbound | | | | | Doon Mills Drive Westbound | | | | | Apple Ridge Drive Northbound | | | | | Int. Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | |
| 8:15 AM | 41 | 33 | 0 | 4 | 74 | 8 | 68 | 0 | 1 | 76 | 67 | 20 | 0 | 1 | 87 | 237 |
| 8:30 AM | 37 | 38 | 0 | 0 | 75 | 10 | 73 | 0 | 0 | 83 | 42 | 11 | 0 | 2 | 53 | 211 |
| 8:45 AM | 32 | 41 | 0 | 2 | 73 | 11 | 89 | 0 | 0 | 100 | 53 | 10 | 0 | 0 | 63 | 236 |
| 9:00 AM | 36 | 35 | 0 | 3 | 71 | 12 | 62 | 0 | 0 | 74 | 59 | 15 | 0 | 0 | 74 | 219 |
| Total | 146 | 147 | 0 | 9 | 293 | 41 | 292 | 0 | 1 | 333 | 221 | 56 | 0 | 3 | 277 | 903 |
| Approach % | 49.8 | 50.2 | 0.0 | - | - | 12.3 | 87.7 | 0.0 | - | - | 79.8 | 20.2 | 0.0 | - | - | - |
| Total % | 16.2 | 16.3 | 0.0 | - | 32.4 | 4.5 | 32.3 | 0.0 | - | 36.9 | 24.5 | 6.2 | 0.0 | - | 30.7 | - |
| PHF | 0.890 | 0.896 | 0.000 | - | 0.977 | 0.854 | 0.820 | 0.000 | - | 0.833 | 0.825 | 0.700 | 0.000 | - | 0.796 | 0.953 |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 133 | 144 | 0 | - | 277 | 41 | 279 | 0 | - | 320 | 214 | 56 | 0 | - | 270 | 867 |
| % Cars & Light Goods | 91.1 | 98.0 | - | - | 94.5 | 100.0 | 95.5 | - | - | 96.1 | 96.8 | 100.0 | - | - | 97.5 | 96.0 |
| Buses | 10 | 1 | 0 | - | 11 | 0 | 10 | 0 | - | 10 | 6 | 0 | 0 | - | 6 | 27 |
| % Buses | 6.8 | 0.7 | - | - | 3.8 | 0.0 | 3.4 | - | - | 3.0 | 2.7 | 0.0 | - | - | 2.2 | 3.0 |
| Single-Unit Trucks | 3 | 2 | 0 | - | 5 | 0 | 3 | 0 | - | 3 | 0 | 0 | 0 | - | 0 | 8 |
| % Single-Unit Trucks | 2.1 | 1.4 | - | - | 1.7 | 0.0 | 1.0 | - | - | 0.9 | 0.0 | 0.0 | - | - | 0.0 | 0.9 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Road | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 1 |
| % Bicycles on Road | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.5 | 0.0 | - | - | 0.4 | 0.1 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | 0.0 | - | - | - | - | 0.0 | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | 9 | - | - | - | - | 1 | - | - | - | - | 3 | - | - |
| % Pedestrians | - | - | - | 100.0 | - | - | - | - | 100.0 | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (8:15 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023

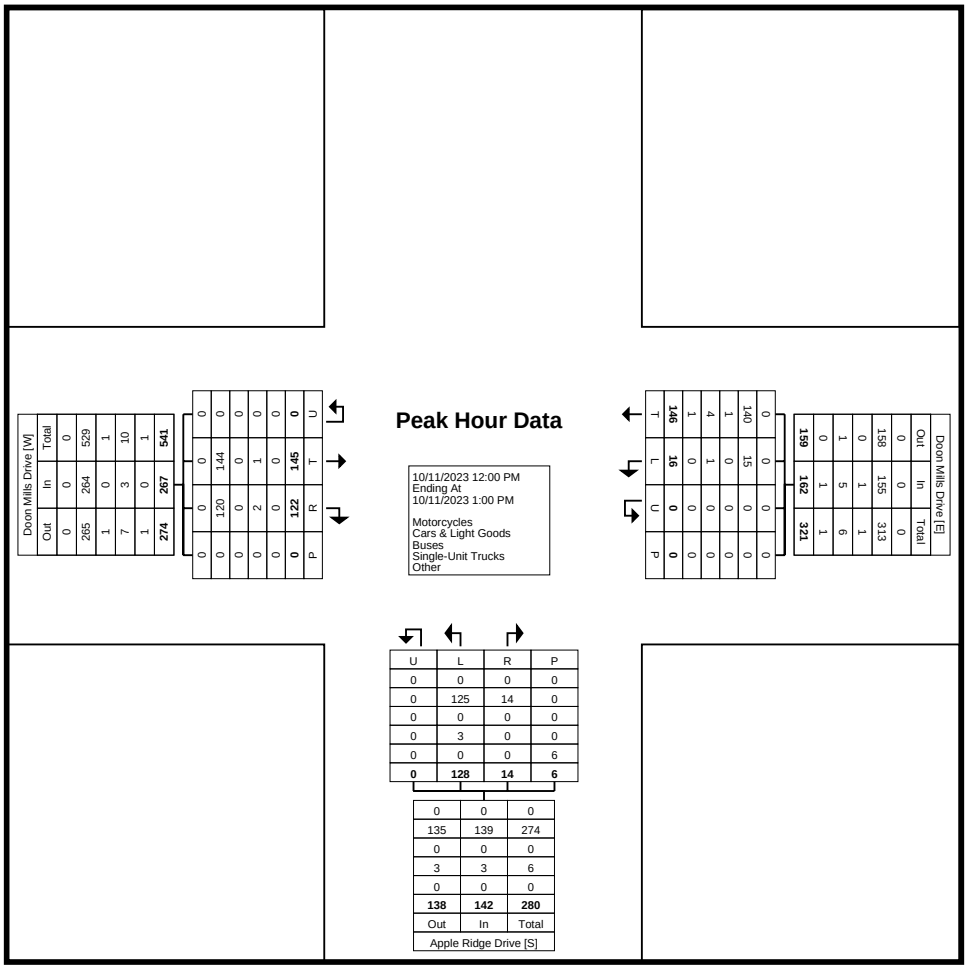

# Turning Movement Peak Hour Data (12:00 PM)

| Start Time | Doon Mills Drive Eastbound | | | | | Doon Mills Drive Westbound | | | | | Apple Ridge Drive Northbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | Int. Total |
| 12:00 PM | 41 | 28 | 0 | 0 | 69 | 5 | 44 | 0 | 0 | 49 | 31 | 4 | 0 | 0 | 35 | 153 |
| 12:15 PM | 35 | 33 | 0 | 0 | 68 | 2 | 37 | 0 | 0 | 39 | 35 | 3 | 0 | 2 | 38 | 145 |
| 12:30 PM | 33 | 36 | 0 | 0 | 69 | 3 | 31 | 0 | 0 | 34 | 33 | 4 | 0 | 2 | 37 | 140 |
| 12:45 PM | 36 | 25 | 0 | 0 | 61 | 6 | 34 | 0 | 0 | 40 | 29 | 3 | 0 | 2 | 32 | 133 |
| Total | 145 | 122 | 0 | 0 | 267 | 16 | 146 | 0 | 0 | 162 | 128 | 14 | 0 | 6 | 142 | 571 |
| Approach % | 54.3 | 45.7 | 0.0 | - | - | 9.9 | 90.1 | 0.0 | - | - | 90.1 | 9.9 | 0.0 | - | - | - |
| Total % | 25.4 | 21.4 | 0.0 | - | 46.8 | 2.8 | 25.6 | 0.0 | - | 28.4 | 22.4 | 2.5 | 0.0 | - | 24.9 | - |
| PHF | 0.884 | 0.847 | 0.000 | - | 0.967 | 0.667 | 0.830 | 0.000 | - | 0.827 | 0.914 | 0.875 | 0.000 | - | 0.934 | 0.933 |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 144 | 120 | 0 | - | 264 | 15 | 140 | 0 | - | 155 | 125 | 14 | 0 | - | 139 | 558 |
| % Cars & Light Goods | 99.3 | 98.4 | - | - | 98.9 | 93.8 | 95.9 | - | - | 95.7 | 97.7 | 100.0 | - | - | 97.9 | 97.7 |
| Buses | 0 | 0 | 0 | - | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | - | 0 | 1 |
| % Buses | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.7 | - | - | 0.6 | 0.0 | 0.0 | - | - | 0.0 | 0.2 |
| Single-Unit Trucks | 1 | 2 | 0 | - | 3 | 1 | 4 | 0 | - | 5 | 3 | 0 | 0 | - | 3 | 11 |
| % Single-Unit Trucks | 0.7 | 1.6 | - | - | 1.1 | 6.3 | 2.7 | - | - | 3.1 | 2.3 | 0.0 | - | - | 2.1 | 1.9 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Road | 0 | 0 | 0 | - | 0 | 0 | 1 | 0 | - | 1 | 0 | 0 | 0 | - | 0 | 1 |
| % Bicycles on Road | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.7 | - | - | 0.6 | 0.0 | 0.0 | - | - | 0.0 | 0.2 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 1 | - | - |
| % Bicycles on Crosswalk | - | - | - | - | - | - | - | - | - | - | - | - | - | 16.7 | - | - |
| Pedestrians | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 5 | - | - |
| % Pedestrians | - | - | - | - | - | - | - | - | - | - | - | - | - | 83.3 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (12:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023

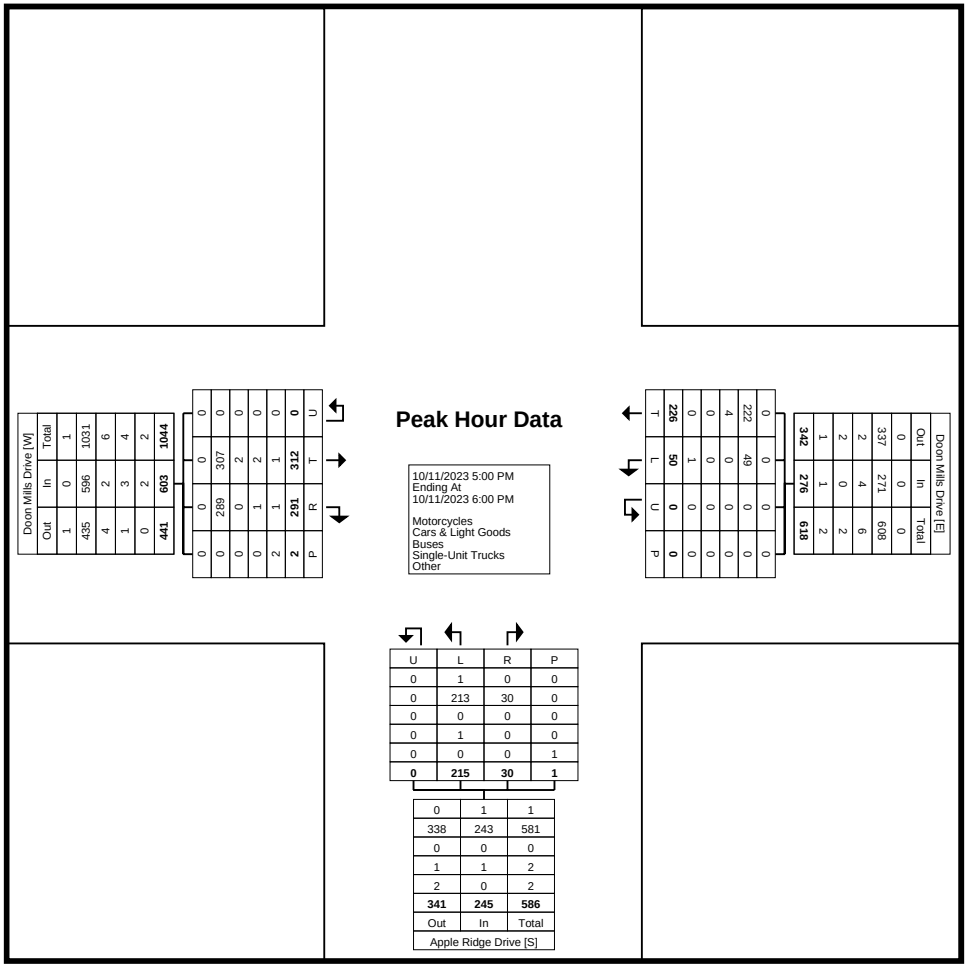

# Turning Movement Peak Hour Data (5:00 PM)

| Start Time | Doon Mills Drive Eastbound | | | | | Doon Mills Drive Westbound | | | | | Apple Ridge Drive Northbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Left | Right | U-Turn | Peds | App. Total | Int. Total |
| 5:00 PM | 80 | 79 | 0 | 0 | 159 | 13 | 53 | 0 | 0 | 66 | 57 | 6 | 0 | 0 | 63 | 288 |
| 5:15 PM | 79 | 59 | 0 | 1 | 138 | 16 | 50 | 0 | 0 | 66 | 58 | 8 | 0 | 1 | 66 | 270 |
| 5:30 PM | 86 | 72 | 0 | 0 | 158 | 10 | 64 | 0 | 0 | 74 | 46 | 10 | 0 | 0 | 56 | 288 |
| 5:45 PM | 67 | 81 | 0 | 1 | 148 | 11 | 59 | 0 | 0 | 70 | 54 | 6 | 0 | 0 | 60 | 278 |
| Total | 312 | 291 | 0 | 2 | 603 | 50 | 226 | 0 | 0 | 276 | 215 | 30 | 0 | 1 | 245 | 1124 |
| Approach % | 51.7 | 48.3 | 0.0 | - | - | 18.1 | 81.9 | 0.0 | - | - | 87.8 | 12.2 | 0.0 | - | - | - |
| Total % | 27.8 | 25.9 | 0.0 | - | 53.6 | 4.4 | 20.1 | 0.0 | - | 24.6 | 19.1 | 2.7 | 0.0 | - | 21.8 | - |
| PHF | 0.907 | 0.898 | 0.000 | - | 0.948 | 0.781 | 0.883 | 0.000 | - | 0.932 | 0.927 | 0.750 | 0.000 | - | 0.928 | 0.976 |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 1 |
| % Motorcycles | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.5 | 0.0 | - | - | 0.4 | 0.1 |
| Cars & Light Goods | 307 | 289 | 0 | - | 596 | 49 | 222 | 0 | - | 271 | 213 | 30 | 0 | - | 243 | 1110 |
| % Cars & Light Goods | 98.4 | 99.3 | - | - | 98.8 | 98.0 | 98.2 | - | - | 98.2 | 99.1 | 100.0 | - | - | 99.2 | 98.8 |
| Buses | 2 | 0 | 0 | - | 2 | 0 | 4 | 0 | - | 4 | 0 | 0 | 0 | - | 0 | 6 |
| % Buses | 0.6 | 0.0 | - | - | 0.3 | 0.0 | 1.8 | - | - | 1.4 | 0.0 | 0.0 | - | - | 0.0 | 0.5 |
| Single-Unit Trucks | 2 | 1 | 0 | - | 3 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 4 |
| % Single-Unit Trucks | 0.6 | 0.3 | - | - | 0.5 | 0.0 | 0.0 | - | - | 0.0 | 0.5 | 0.0 | - | - | 0.4 | 0.4 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Road | 1 | 1 | 0 | - | 2 | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | - | 0 | 3 |
| % Bicycles on Road | 0.3 | 0.3 | - | - | 0.3 | 2.0 | 0.0 | - | - | 0.4 | 0.0 | 0.0 | - | - | 0.0 | 0.3 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | 0.0 | - | - | - | - | - | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | 2 | - | - | - | - | 0 | - | - | - | - | 1 | - | - |
| % Pedestrians | - | - | - | 100.0 | - | - | - | - | - | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Road & Apple Ridge Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (5:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Data

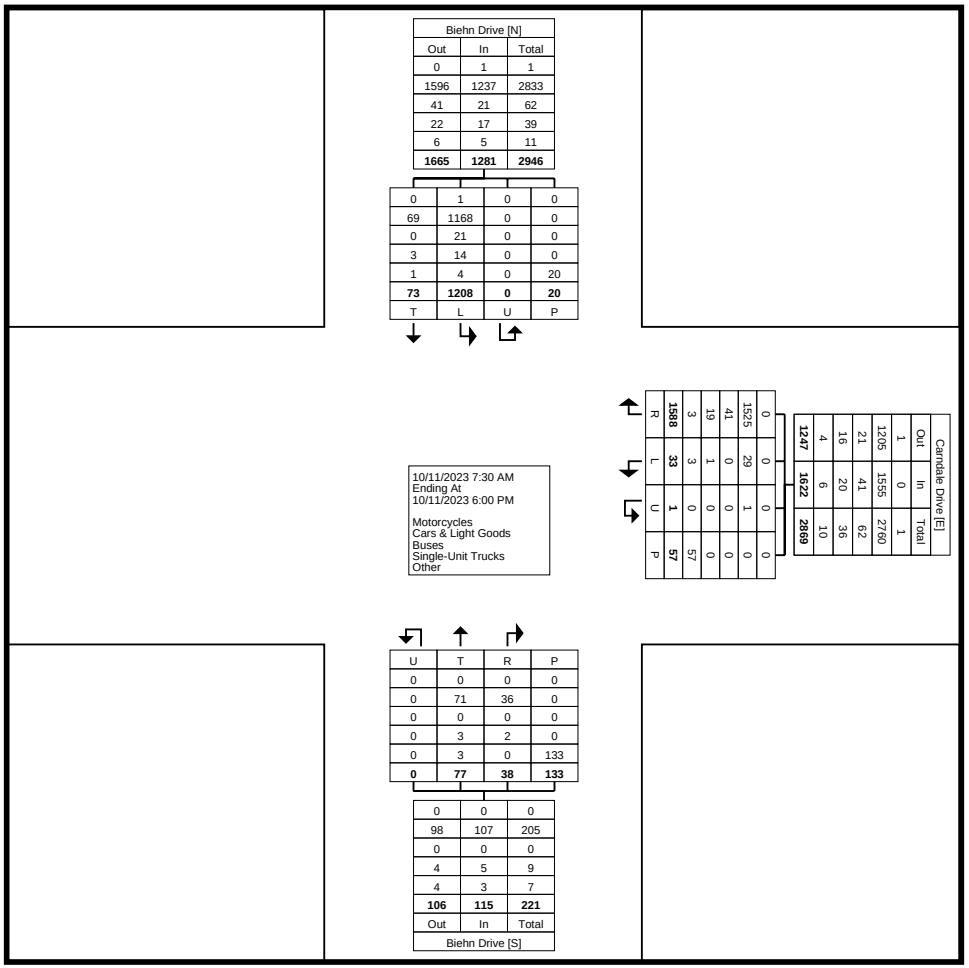
| Start Time | Carndale Drive Westbound | | | | | Biehn Drive Northbound | | | | | Biehn Drive Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Right | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Int. Total |
| 7:30 AM | 2 | 57 | 0 | 1 | 59 | 8 | 2 | 0 | 1 | 10 | 21 | 0 | 0 | 0 | 21 | 90 |
| 7:45 AM | 1 | 97 | 0 | 1 | 98 | 2 | 1 | 0 | 1 | 3 | 44 | 0 | 0 | 0 | 44 | 145 |
| Hourly Total | 3 | 154 | 0 | 2 | 157 | 10 | 3 | 0 | 2 | 13 | 65 | 0 | 0 | 0 | 65 | 235 |
| 8:00 AM | 0 | 71 | 0 | 4 | 71 | 3 | 2 | 0 | 4 | 5 | 40 | 2 | 0 | 1 | 42 | 118 |
| 8:15 AM | 2 | 64 | 0 | 3 | 66 | 4 | 0 | 0 | 3 | 4 | 34 | 1 | 0 | 1 | 35 | 105 |
| 8:30 AM | 1 | 73 | 0 | 1 | 74 | 5 | 1 | 0 | 0 | 6 | 46 | 2 | 0 | 0 | 48 | 128 |
| 8:45 AM | 0 | 58 | 0 | 0 | 58 | 2 | 0 | 0 | 4 | 2 | 26 | 1 | 0 | 0 | 27 | 87 |
| Hourly Total | 3 | 266 | 0 | 8 | 269 | 14 | 3 | 0 | 11 | 17 | 146 | 6 | 0 | 2 | 152 | 438 |
| 9:00 AM | 0 | 53 | 0 | 2 | 53 | 1 | 4 | 0 | 14 | 5 | 41 | 1 | 0 | 3 | 42 | 100 |
| 9:15 AM | 1 | 74 | 0 | 11 | 75 | 2 | 2 | 0 | 28 | 4 | 54 | 2 | 0 | 0 | 56 | 135 |
| 9:30 AM | 0 | 52 | 0 | 0 | 52 | 1 | 2 | 0 | 6 | 3 | 25 | 1 | 0 | 1 | 26 | 81 |
| 9:45 AM | 0 | 35 | 0 | 2 | 35 | 2 | 1 | 0 | 0 | 3 | 18 | 1 | 0 | 0 | 19 | 57 |
| Hourly Total | 1 | 214 | 0 | 15 | 215 | 6 | 9 | 0 | 48 | 15 | 138 | 5 | 0 | 4 | 143 | 373 |
| 10:00 AM | 1 | 26 | 0 | 0 | 27 | 5 | 0 | 0 | 0 | 5 | 14 | 2 | 0 | 0 | 16 | 48 |
| 10:15 AM | 0 | 29 | 0 | 0 | 29 | 1 | 0 | 0 | 0 | 1 | 14 | 0 | 0 | 0 | 14 | 44 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Hourly Total | 1 | 55 | 0 | 0 | 56 | 6 | 0 | 0 | 0 | 6 | 28 | 2 | 0 | 0 | 30 | 92 |
| 12:00 PM | 2 | 39 | 0 | 2 | 41 | 2 | 0 | 0 | 1 | 2 | 24 | 5 | 0 | 0 | 29 | 72 |
| 12:15 PM | 1 | 26 | 0 | 0 | 27 | 6 | 1 | 0 | 0 | 7 | 17 | 1 | 0 | 0 | 18 | 52 |
| 12:30 PM | 0 | 31 | 0 | 0 | 31 | 2 | 0 | 0 | 0 | 2 | 20 | 4 | 0 | 0 | 24 | 57 |
| 12:45 PM | 1 | 24 | 0 | 1 | 25 | 1 | 1 | 0 | 0 | 2 | 23 | 4 | 0 | 5 | 27 | 54 |
| Hourly Total | 4 | 120 | 0 | 3 | 124 | 11 | 2 | 0 | 1 | 13 | 84 | 14 | 0 | 5 | 98 | 235 |
| 1:00 PM | 0 | 24 | 1 | 0 | 25 | 1 | 1 | 0 | 0 | 2 | 27 | 2 | 0 | 0 | 29 | 56 |
| 1:15 PM | 0 | 25 | 0 | 2 | 25 | 0 | 2 | 0 | 0 | 2 | 28 | 3 | 0 | 0 | 31 | 58 |
| 1:30 PM | 0 | 26 | 0 | 0 | 26 | 0 | 5 | 0 | 3 | 5 | 32 | 2 | 0 | 1 | 34 | 65 |
| 1:45 PM | 2 | 27 | 0 | 1 | 29 | 0 | 1 | 0 | 1 | 1 | 22 | 4 | 0 | 1 | 26 | 56 |
| Hourly Total | 2 | 102 | 1 | 3 | 105 | 1 | 9 | 0 | 4 | 10 | 109 | 11 | 0 | 2 | 120 | 235 |
| *** BREAK *** | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 3:00 PM | 1 | 41 | 0 | 2 | 42 | 3 | 2 | 0 | 4 | 5 | 43 | 8 | 0 | 2 | 51 | 98 |
| 3:15 PM | 2 | 32 | 0 | 7 | 34 | 2 | 1 | 0 | 3 | 3 | 50 | 1 | 0 | 1 | 51 | 88 |
| 3:30 PM | 0 | 49 | 0 | 3 | 49 | 3 | 0 | 0 | 15 | 3 | 57 | 3 | 0 | 0 | 60 | 112 |
| 3:45 PM | 3 | 86 | 0 | 3 | 89 | 6 | 0 | 0 | 31 | 6 | 56 | 5 | 0 | 0 | 61 | 156 |
| Hourly Total | 6 | 208 | 0 | 15 | 214 | 14 | 3 | 0 | 53 | 17 | 206 | 17 | 0 | 3 | 223 | 454 |
| 4:00 PM | 3 | 63 | 0 | 1 | 66 | 2 | 2 | 0 | 0 | 4 | 50 | 4 | 0 | 0 | 54 | 124 |
| 4:15 PM | 1 | 71 | 0 | 0 | 72 | 3 | 0 | 0 | 3 | 3 | 45 | 1 | 0 | 0 | 46 | 121 |
| 4:30 PM | 1 | 52 | 0 | 1 | 53 | 1 | 2 | 0 | 1 | 3 | 52 | 1 | 0 | 0 | 53 | 109 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4:45 PM | 1 | 69 | 0 | 0 | 70 | 1 | 1 | 0 | 4 | 2 | 66 | 3 | 0 | 0 | 69 | 141 |
| Hourly Total | 6 | 255 | 0 | 2 | 261 | 7 | 5 | 0 | 8 | 12 | 213 | 9 | 0 | 0 | 222 | 495 |
| 5:00 PM | 2 | 68 | 0 | 2 | 70 | 3 | 1 | 0 | 2 | 4 | 53 | 1 | 0 | 0 | 54 | 128 |
| 5:15 PM | 0 | 52 | 0 | 3 | 52 | 3 | 1 | 0 | 0 | 4 | 66 | 3 | 0 | 1 | 69 | 125 |
| 5:30 PM | 4 | 49 | 0 | 1 | 53 | 1 | 2 | 0 | 0 | 3 | 58 | 2 | 0 | 1 | 60 | 116 |
| 5:45 PM | 1 | 45 | 0 | 3 | 46 | 1 | 0 | 0 | 4 | 1 | 42 | 3 | 0 | 2 | 45 | 92 |
| Hourly Total | 7 | 214 | 0 | 9 | 221 | 8 | 4 | 0 | 6 | 12 | 219 | 9 | 0 | 4 | 228 | 461 |
| Grand Total | 33 | 1588 | 1 | 57 | 1622 | 77 | 38 | 0 | 133 | 115 | 1208 | 73 | 0 | 20 | 1281 | 3018 |
| Approach % | 2.0 | 97.9 | 0.1 | - | - | 67.0 | 33.0 | 0.0 | - | - | 94.3 | 5.7 | 0.0 | - | - | - |
| Total % | 1.1 | 52.6 | 0.0 | - | 53.7 | 2.6 | 1.3 | 0.0 | - | 3.8 | 40.0 | 2.4 | 0.0 | - | 42.4 | - |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 1 |
| % Motorcycles | 0.0 | 0.0 | 0.0 | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.1 | 0.0 | - | - | 0.1 | 0.0 |
| Cars & Light Goods | 29 | 1525 | 1 | - | 1555 | 71 | 36 | 0 | - | 107 | 1168 | 69 | 0 | - | 1237 | 2899 |
| % Cars & Light Goods | 87.9 | 96.0 | 100.0 | - | 95.9 | 92.2 | 94.7 | - | - | 93.0 | 96.7 | 94.5 | - | - | 96.6 | 96.1 |
| Buses | 0 | 41 | 0 | - | 41 | 0 | 0 | 0 | - | 0 | 21 | 0 | 0 | - | 21 | 62 |
| % Buses | 0.0 | 2.6 | 0.0 | - | 2.5 | 0.0 | 0.0 | - | - | 0.0 | 1.7 | 0.0 | - | - | 1.6 | 2.1 |
| Single-Unit Trucks | 1 | 19 | 0 | - | 20 | 3 | 2 | 0 | - | 5 | 14 | 3 | 0 | - | 17 | 42 |
| % Single-Unit Trucks | 3.0 | 1.2 | 0.0 | - | 1.2 | 3.9 | 5.3 | - | - | 4.3 | 1.2 | 4.1 | - | - | 1.3 | 1.4 |
| Articulated Trucks | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 2 |
| % Articulated Trucks | 3.0 | 0.0 | 0.0 | - | 0.1 | 0.0 | 0.0 | - | - | 0.0 | 0.1 | 0.0 | - | - | 0.1 | 0.1 |
| Bicycles on Road | 2 | 3 | 0 | - | 5 | 3 | 0 | 0 | - | 3 | 3 | 1 | 0 | - | 4 | 12 |
| % Bicycles on Road | 6.1 | 0.2 | 0.0 | - | 0.3 | 3.9 | 0.0 | - | - | 2.6 | 0.2 | 1.4 | - | - | 0.3 | 0.4 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 10 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | 0.0 | - | - | - | - | 7.5 | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | 57 | - | - | - | - | 123 | - | - | - | - | 20 | - | - |
| % Pedestrians | - | - | - | 100.0 | - | - | - | - | 92.5 | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
Site Code: 230376
Start Date: 10/11/2023
Page No: 3




Turning Movement Data Plot

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
Site Code: 230376
Start Date: 10/11/2023

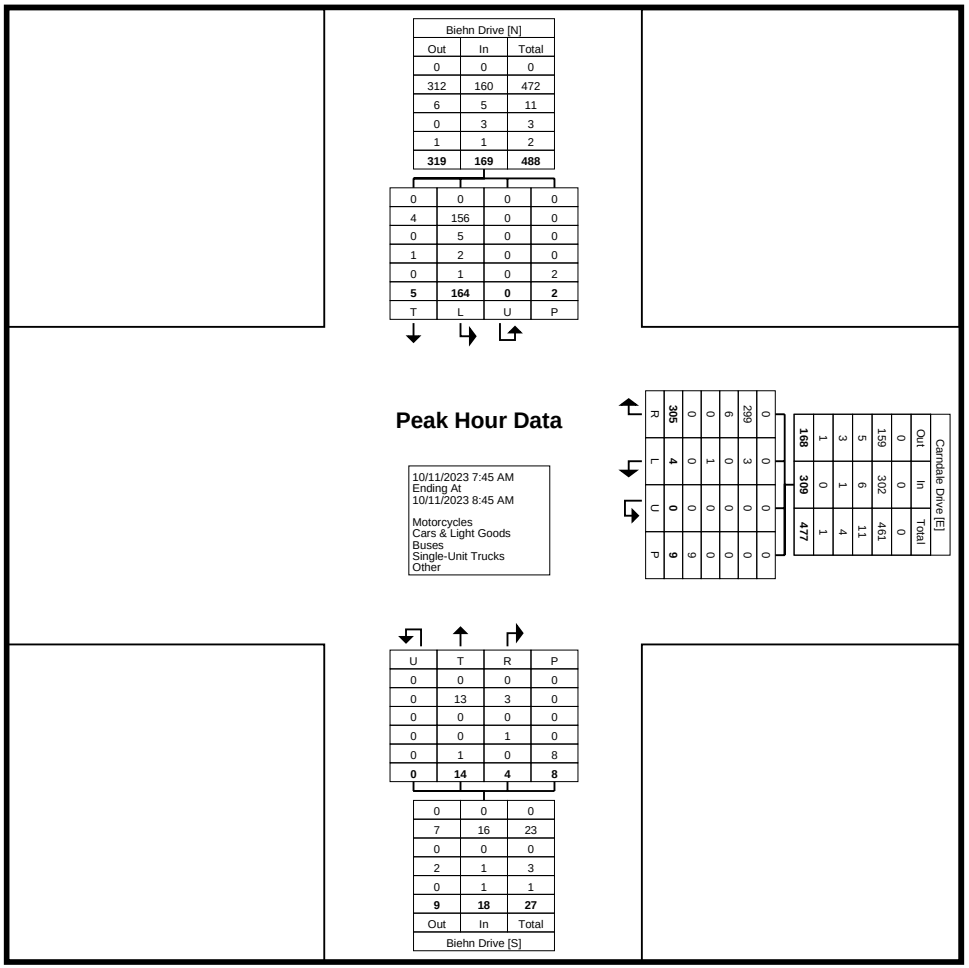

# Turning Movement Peak Hour Data (7:45 AM)

| Start Time | Carndale Drive Westbound | | | | | Biehn Drive Northbound | | | | | Biehn Drive Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Right | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Int. Total |
| 7:45 AM | 1 | 97 | 0 | 1 | 98 | 2 | 1 | 0 | 1 | 3 | 44 | 0 | 0 | 0 | 44 | 145 |
| 8:00 AM | 0 | 71 | 0 | 4 | 71 | 3 | 2 | 0 | 4 | 5 | 40 | 2 | 0 | 1 | 42 | 118 |
| 8:15 AM | 2 | 64 | 0 | 3 | 66 | 4 | 0 | 0 | 3 | 4 | 34 | 1 | 0 | 1 | 35 | 105 |
| 8:30 AM | 1 | 73 | 0 | 1 | 74 | 5 | 1 | 0 | 0 | 6 | 46 | 2 | 0 | 0 | 48 | 128 |
| Total | 4 | 305 | 0 | 9 | 309 | 14 | 4 | 0 | 8 | 18 | 164 | 5 | 0 | 2 | 169 | 496 |
| Approach % | 1.3 | 98.7 | 0.0 | - | - | 77.8 | 22.2 | 0.0 | - | - | 97.0 | 3.0 | 0.0 | - | - | - |
| Total % | 0.8 | 61.5 | 0.0 | - | 62.3 | 2.8 | 0.8 | 0.0 | - | 3.6 | 33.1 | 1.0 | 0.0 | - | 34.1 | - |
| PHF | 0.500 | 0.786 | 0.000 | - | 0.788 | 0.700 | 0.500 | 0.000 | - | 0.750 | 0.891 | 0.625 | 0.000 | - | 0.880 | 0.855 |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 3 | 299 | 0 | - | 302 | 13 | 3 | 0 | - | 16 | 156 | 4 | 0 | - | 160 | 478 |
| % Cars & Light Goods | 75.0 | 98.0 | - | - | 97.7 | 92.9 | 75.0 | - | - | 88.9 | 95.1 | 80.0 | - | - | 94.7 | 96.4 |
| Buses | 0 | 6 | 0 | - | 6 | 0 | 0 | 0 | - | 0 | 5 | 0 | 0 | - | 5 | 11 |
| % Buses | 0.0 | 2.0 | - | - | 1.9 | 0.0 | 0.0 | - | - | 0.0 | 3.0 | 0.0 | - | - | 3.0 | 2.2 |
| Single-Unit Trucks | 1 | 0 | 0 | - | 1 | 0 | 1 | 0 | - | 1 | 2 | 1 | 0 | - | 3 | 5 |
| % Single-Unit Trucks | 25.0 | 0.0 | - | - | 0.3 | 0.0 | 25.0 | - | - | 5.6 | 1.2 | 20.0 | - | - | 1.8 | 1.0 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Road | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 1 | 0 | 0 | - | 1 | 2 |
| % Bicycles on Road | 0.0 | 0.0 | - | - | 0.0 | 7.1 | 0.0 | - | - | 5.6 | 0.6 | 0.0 | - | - | 0.6 | 0.4 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 1 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | 0.0 | - | - | - | - | 12.5 | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | 9 | - | - | - | - | 7 | - | - | - | - | 2 | - | - |
| % Pedestrians | - | - | - | 100.0 | - | - | - | - | 87.5 | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (7:45 AM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
Site Code: 230376
Start Date: 10/11/2023

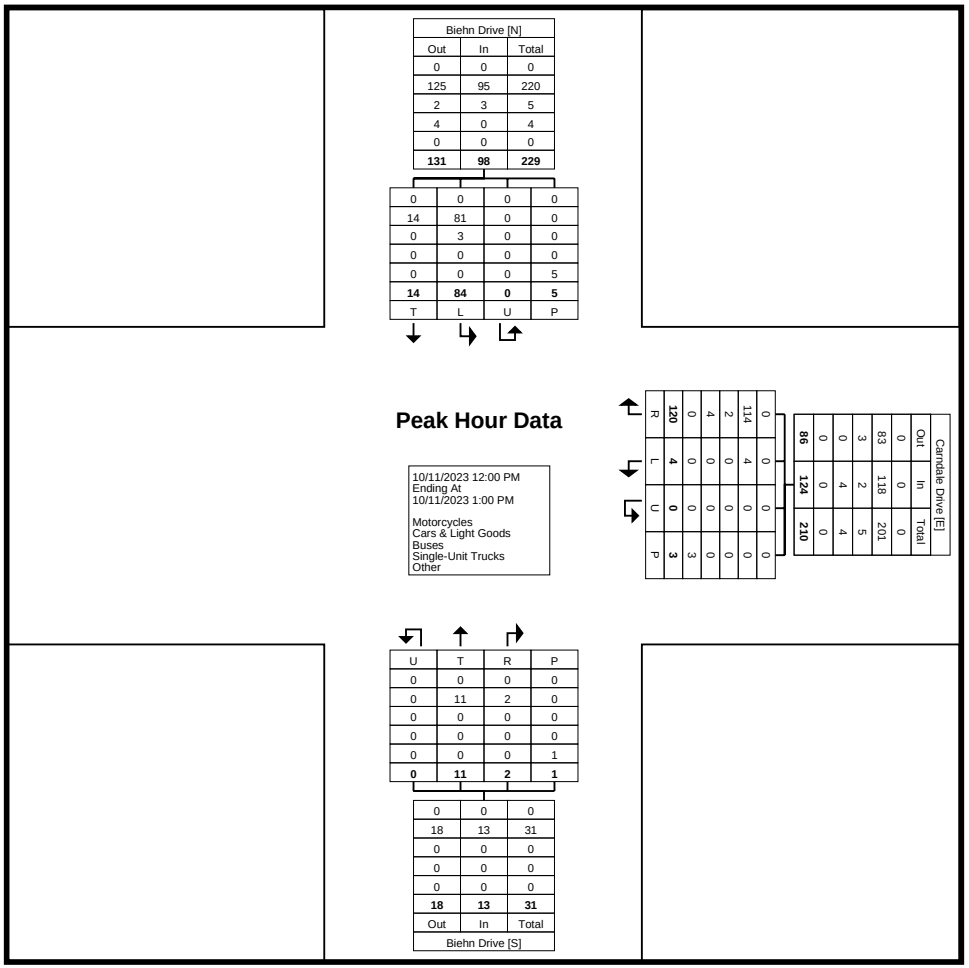

# Turning Movement Peak Hour Data (12:00 PM)

| Start Time | Carndale Drive Westbound | | | | | Biehn Drive Northbound | | | | | Biehn Drive Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Right | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Int. Total |
| 12:00 PM | 2 | 39 | 0 | 2 | 41 | 2 | 0 | 0 | 1 | 2 | 24 | 5 | 0 | 0 | 29 | 72 |
| 12:15 PM | 1 | 26 | 0 | 0 | 27 | 6 | 1 | 0 | 0 | 7 | 17 | 1 | 0 | 0 | 18 | 52 |
| 12:30 PM | 0 | 31 | 0 | 0 | 31 | 2 | 0 | 0 | 0 | 2 | 20 | 4 | 0 | 0 | 24 | 57 |
| 12:45 PM | 1 | 24 | 0 | 1 | 25 | 1 | 1 | 0 | 0 | 2 | 23 | 4 | 0 | 5 | 27 | 54 |
| Total | 4 | 120 | 0 | 3 | 124 | 11 | 2 | 0 | 1 | 13 | 84 | 14 | 0 | 5 | 98 | 235 |
| Approach % | 3.2 | 96.8 | 0.0 | - | - | 84.6 | 15.4 | 0.0 | - | - | 85.7 | 14.3 | 0.0 | - | - | - |
| Total % | 1.7 | 51.1 | 0.0 | - | 52.8 | 4.7 | 0.9 | 0.0 | - | 5.5 | 35.7 | 6.0 | 0.0 | - | 41.7 | - |
| PHF | 0.500 | 0.769 | 0.000 | - | 0.756 | 0.458 | 0.500 | 0.000 | - | 0.464 | 0.875 | 0.700 | 0.000 | - | 0.845 | 0.816 |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 4 | 114 | 0 | - | 118 | 11 | 2 | 0 | - | 13 | 81 | 14 | 0 | - | 95 | 226 |
| % Cars & Light Goods | 100.0 | 95.0 | - | - | 95.2 | 100.0 | 100.0 | - | - | 100.0 | 96.4 | 100.0 | - | - | 96.9 | 96.2 |
| Buses | 0 | 2 | 0 | - | 2 | 0 | 0 | 0 | - | 0 | 3 | 0 | 0 | - | 3 | 5 |
| % Buses | 0.0 | 1.7 | - | - | 1.6 | 0.0 | 0.0 | - | - | 0.0 | 3.6 | 0.0 | - | - | 3.1 | 2.1 |
| Single-Unit Trucks | 0 | 4 | 0 | - | 4 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 4 |
| % Single-Unit Trucks | 0.0 | 3.3 | - | - | 3.2 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 1.7 |
| Articulated Trucks | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Articulated Trucks | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Road | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Bicycles on Road | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 0 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | 0.0 | - | - | - | - | 0.0 | - | - | - | - | 0.0 | - | - |
| Pedestrians | - | - | - | 3 | - | - | - | - | 1 | - | - | - | - | 5 | - | - |
| % Pedestrians | - | - | - | 100.0 | - | - | - | - | 100.0 | - | - | - | - | 100.0 | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
Site Code: 230376
Start Date: 10/11/2023


Turning Movement Peak Hour Data Plot (12:00 PM)

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
Site Code: 230376
Start Date: 10/11/2023


# Turning Movement Peak Hour Data (3:30 PM)

| Start Time | Carndale Drive Westbound | | | | | Biehn Drive Northbound | | | | | Biehn Drive Southbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Left | Right | U-Turn | Peds | App. Total | Thru | Right | U-Turn | Peds | App. Total | Left | Thru | U-Turn | Peds | App. Total | Int. Total |
| 3:30 PM | 0 | 49 | 0 | 3 | 49 | 3 | 0 | 0 | 15 | 3 | 57 | 3 | 0 | 0 | 60 | 112 |
| 3:45 PM | 3 | 86 | 0 | 3 | 89 | 6 | 0 | 0 | 31 | 6 | 56 | 5 | 0 | 0 | 61 | 156 |
| 4:00 PM | 3 | 63 | 0 | 1 | 66 | 2 | 2 | 0 | 0 | 4 | 50 | 4 | 0 | 0 | 54 | 124 |
| 4:15 PM | 1 | 71 | 0 | 0 | 72 | 3 | 0 | 0 | 3 | 3 | 45 | 1 | 0 | 0 | 46 | 121 |
| Total | 7 | 269 | 0 | 7 | 276 | 14 | 2 | 0 | 49 | 16 | 208 | 13 | 0 | 0 | 221 | 513 |
| Approach % | 2.5 | 97.5 | 0.0 | - | - | 87.5 | 12.5 | 0.0 | - | - | 94.1 | 5.9 | 0.0 | - | - | - |
| Total % | 1.4 | 52.4 | 0.0 | - | 53.8 | 2.7 | 0.4 | 0.0 | - | 3.1 | 40.5 | 2.5 | 0.0 | - | 43.1 | - |
| PHF | 0.583 | 0.782 | 0.000 | - | 0.775 | 0.583 | 0.250 | 0.000 | - | 0.667 | 0.912 | 0.650 | 0.000 | - | 0.906 | 0.822 |
| Motorcycles | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 0 |
| % Motorcycles | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.0 |
| Cars & Light Goods | 5 | 254 | 0 | - | 259 | 14 | 2 | 0 | - | 16 | 198 | 13 | 0 | - | 211 | 486 |
| % Cars & Light Goods | 71.4 | 94.4 | - | - | 93.8 | 100.0 | 100.0 | - | - | 100.0 | 95.2 | 100.0 | - | - | 95.5 | 94.7 |
| Buses | 0 | 11 | 0 | - | 11 | 0 | 0 | 0 | - | 0 | 7 | 0 | 0 | - | 7 | 18 |
| % Buses | 0.0 | 4.1 | - | - | 4.0 | 0.0 | 0.0 | - | - | 0.0 | 3.4 | 0.0 | - | - | 3.2 | 3.5 |
| Single-Unit Trucks | 0 | 2 | 0 | - | 2 | 0 | 0 | 0 | - | 0 | 2 | 0 | 0 | - | 2 | 4 |
| % Single-Unit Trucks | 0.0 | 0.7 | - | - | 0.7 | 0.0 | 0.0 | - | - | 0.0 | 1.0 | 0.0 | - | - | 0.9 | 0.8 |
| Articulated Trucks | 1 | 0 | 0 | - | 1 | 0 | 0 | 0 | - | 0 | 0 | 0 | 0 | - | 0 | 1 |
| % Articulated Trucks | 14.3 | 0.0 | - | - | 0.4 | 0.0 | 0.0 | - | - | 0.0 | 0.0 | 0.0 | - | - | 0.0 | 0.2 |
| Bicycles on Road | 1 | 2 | 0 | - | 3 | 0 | 0 | 0 | - | 0 | 1 | 0 | 0 | - | 1 | 4 |
| % Bicycles on Road | 14.3 | 0.7 | - | - | 1.1 | 0.0 | 0.0 | - | - | 0.0 | 0.5 | 0.0 | - | - | 0.5 | 0.8 |
| Bicycles on Crosswalk | - | - | - | 0 | - | - | - | - | 3 | - | - | - | - | 0 | - | - |
| % Bicycles on Crosswalk | - | - | - | 0.0 | - | - | - | - | 6.1 | - | - | - | - | - | - | - |
| Pedestrians | - | - | - | 7 | - | - | - | - | 46 | - | - | - | - | 0 | - | - |
| % Pedestrians | - | - | - | 100.0 | - | - | - | - | 93.9 | - | - | - | - | - | - | - |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

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519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive & Caryndale Drive
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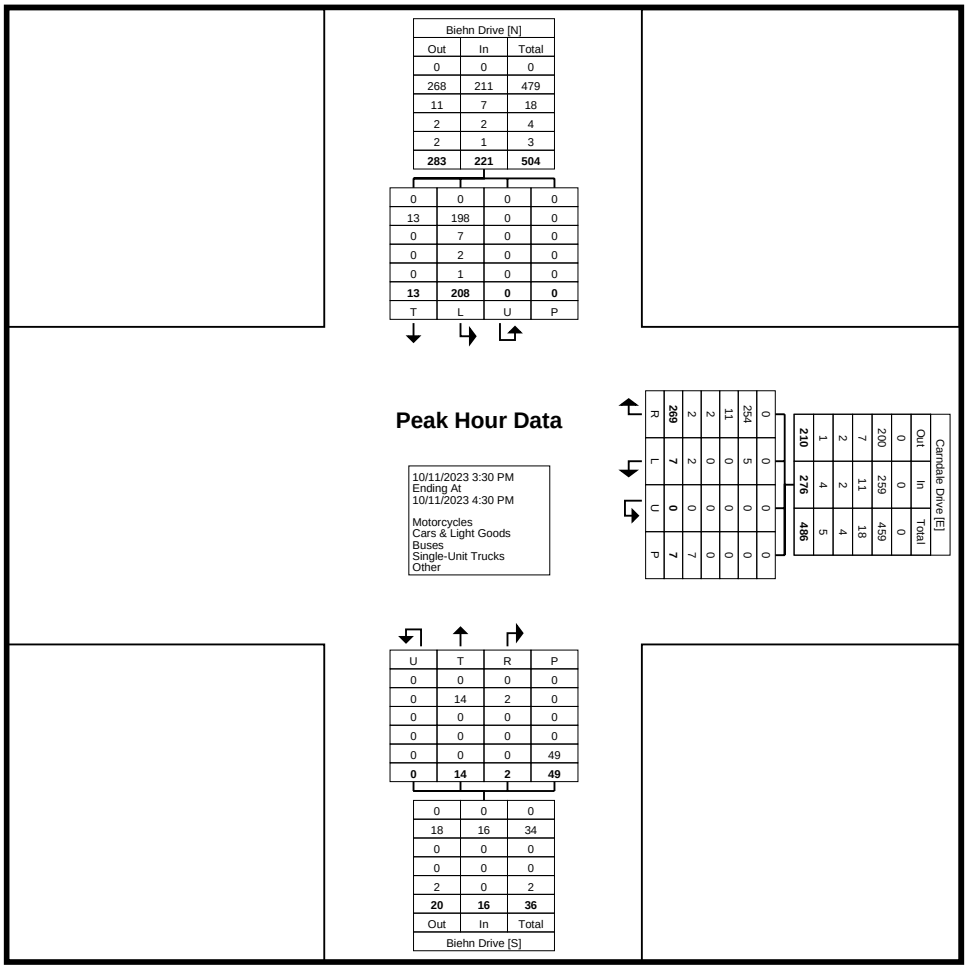
Start Date: 10/11/2023
Page No: 9




Turning Movement Peak Hour Data Plot (3:30 PM)

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Morning Peak Diagram

**Count Period**
**From:** 7:30 AM
**To:** 10:30 AM

**Peak Hour**
**From:** 7:45 AM
**To:** 8:45 AM

**Municipality:** Kitchener
**Intersection:** Doon Village Rd @ Pioneer Dr
**Control:** Signalized
**Major Road:** Doon Village Rd

**Weather conditions:** Cloudy/Wet

**Person(s) who counted:** Cam

**GeoID:** 21941
**Count Date:** Tuesday, 18-Oct-22

**North Leg Total:** 910
**North Entering:** 365
**North Peds:** 10
**Peds Cross:** ⋈

| % Trks | 3% | 10% | 11% | |
|---|---|---|---|---|
| Heavys | 2 | 12 | 5 | 19 |
| Trucks | 0 | 10 | 1 | 11 |
| Cars | 76 | 209 | 50 | 335 |
| Total | 78 | 231 | 56 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 8 | 2 | 151 | 161 |

| Heavys | 16 |
|---|---|
| Trucks | 2 |
| Cars | 527 |
| Total | 545 |

**East Leg Total:** 252
**East Entering:** 118
**East Peds:** 5
**Peds Cross:** ⧖

**Doon Village Rd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 74 | 67 | 1 | 6 | 9% |
| 39 | 36 | 2 | 1 | 8% |
| 5 | 4 | 0 | 1 | 20% |
| | 107 | 3 | 8 | |

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**Pioneer Dr**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 4% | 4 | 0 | 85 | 89 |
| 3% | 2 | 0 | 73 | 75 |
| 13% | 3 | 0 | 20 | 23 |
| | 9 | 0 | 178 | |

**Pioneer Dr**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 126 | 1 | 7 | 134 |

**Doon Village Rd**

| | | | | |
|---|---|---|---|---|
| Total | 44 | 382 | 3 | |
| Cars | 39 | 375 | 3 | 417 |
| Trucks | 0 | 1 | 0 | 1 |
| Heavys | 5 | 6 | 0 | 11 |
| % Trks | 11% | 2% | 0% | |

**Peds Cross:** ⧖
**West Peds:** 15
**West Entering:** 187
**West leg Total:** 348

| Heavys | 16 |
|---|---|
| Trucks | 10 |
| Cars | 233 |
| Total | 259 |

**Peds Cross:** ⋈
**South Peds:** 11
**South Entering:** 429
**South leg Total:** 688

### Comments

To determine total vehicles entering the intersection during morning peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **1,099**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **187**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Mid-day Peak Diagram

**Count Period**
**From:** 12:00 PM
**To:** 2:00 PM

**Peak Hour**
**From:** 12:00 PM
**To:** 1:00 PM

**Municipality:** Kitchener
**Intersection:** Doon Village Rd @ Pioneer Dr
**Control:** Signalized
**Major Road:** Doon Village Rd

**Weather conditions:** Cloudy/Wet

**Person(s) who counted:** Cam

**GeoID:** 21941
**Count Date:** Tuesday, 18-Oct-22

**North Leg Total:** 780
**North Entering:** 385
**North Peds:** 4
**Peds Cross:** ⋈

| | | | | |
|---|---|---|---|---|
| % Trks | 2% | 2% | 8% | |
| Heavys | 1 | 2 | 4 | 7 |
| Trucks | 0 | 4 | 3 | 7 |
| Cars | 52 | 236 | 83 | 371 |
| Total | 53 | 242 | 90 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 1 | 0 | 116 | 117 |

**Pioneer Dr**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 0% | 0 | 0 | 50 | 50 |
| 4% | 1 | 1 | 44 | 46 |
| 14% | 1 | 0 | 6 | 7 |
| | 2 | 1 | 100 | |

**Doon Village Rd**

| Heavys | 7 |
|---|---|
| Trucks | 5 |
| Cars | 383 |
| Total | 395 |

**East Leg Total:** 284
**East Entering:** 140
**East Peds:** 3
**Peds Cross:** ⧖

**Doon Village Rd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 76 | 70 | 2 | 4 | 8% |
| 58 | 58 | 0 | 0 | 0% |
| 6 | 6 | 0 | 0 | 0% |
| | 134 | 2 | 4 | |

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**Pioneer Dr**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 135 | 4 | 5 | 144 |

**Doon Village Rd**

**Peds Cross:** ⧖
**West Peds:** 8
**West Entering:** 103
**West leg Total:** 220

| | |
|---|---|
| Heavys | 3 |
| Trucks | 4 |
| Cars | 248 |
| Total | 255 |

| | | | | |
|---|---|---|---|---|
| Total | 6 | 269 | 8 | |
| Cars | 6 | 263 | 8 | 277 |
| Trucks | 0 | 3 | 0 | 3 |
| Heavys | 0 | 3 | 0 | 3 |
| % Trks | 0% | 2% | 0% | |

**Peds Cross:** ⋈
**South Peds:** 3
**South Entering:** 283
**South leg Total:** 538

### Comments

To determine total vehicles entering the intersection during mid-day peak hour, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **911**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **103**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Afternoon Peak Diagram

**Count Period**
**From:** 3:00 PM
**To:** 6:00 PM

**Peak Hour**
**From:** 3:30 PM
**To:** 4:30 PM

**Municipality:** Kitchener
**Intersection:** Doon Village Rd @ Pioneer Dr
**Control:** Signalized
**Major Road:** Doon Village Rd

**Weather conditions:** Cloudy/Wet

**Person(s) who counted:** Cam

**GeoID:** 21941
**Count Date:** Tuesday, 18-Oct-22

**North Leg Total:** 1,135
**North Entering:** 643
**North Peds:** 23
**Peds Cross:** ⋈

| | | | | |
|---|---|---|---|---|
| % Trks | 4% | 2% | 4% | |
| Heavys | 3 | 7 | 5 | 15 |
| Trucks | 0 | 0 | 0 | 0 |
| Cars | 66 | 432 | 130 | 628 |
| Total | 69 | 439 | 135 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 4 | 0 | 176 | 180 |

**Pioneer Dr**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 2% | 1 | 0 | 62 | 63 |
| 1% | 1 | 0 | 71 | 72 |
| 0% | 0 | 0 | 14 | 14 |
| | 2 | 0 | 147 | |

| Heavys | 16 |
|---|---|
| Trucks | 1 |
| Cars | 475 |
| Total | 492 |

**East Leg Total:** 443
**East Entering:** 224
**East Peds:** 9
**Peds Cross:** ⧖

**Doon Village Rd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 101 | 97 | 0 | 4 | 4% |
| 98 | 97 | 0 | 1 | 1% |
| 25 | 25 | 0 | 0 | 0% |
| | 219 | 0 | 5 | |

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**Pioneer Dr**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 213 | 0 | 6 | 219 |

**Doon Village Rd**

**Peds Cross:** ⧖
**West Peds:** 21
**West Entering:** 149
**West leg Total:** 329

| | |
|---|---|
| Heavys | 7 |
| Trucks | 0 |
| Cars | 471 |
| Total | 478 |

| | | | | |
|---|---|---|---|---|
| Total | 13 | 328 | 12 | |
| Cars | 13 | 316 | 12 | 341 |
| Trucks | 0 | 1 | 0 | 1 |
| Heavys | 0 | 11 | 0 | 11 |
| % Trks | 0% | 4% | 0% | |

**Peds Cross:** ⋈
**South Peds:** 10
**South Entering:** 353
**South leg Total:** 831

### Comments

To determine total vehicles entering the intersection during afternoon peak hour, add all leg totals entering.

Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering

Example 1: Therefore, total vehicles entering intersection = **1,369**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn

Therefore, vehicles entering from the west = **149**

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Total Count Diagram

**Municipality:** Kitchener
**Intersection:** Doon Village Rd @ Pioneer Dr
**Control:** Signalized
**Major Road:** Doon Village Rd

**Weather conditions:** Cloudy/Wet

**Person(s) who counted:** Cam

**GeoID:** 21941
**Count Date:** Tuesday, 18-Oct-22

| | |
|---|---|
| **North Leg Total:** | 7,200 |
| **North Entering:** | 3,622 |
| **North Peds:** | 76 |
| **Peds Cross:** | ⋈ |
| **Bicycles Entering:** | 4 |
| **Buggies Entering:** | 0 |

| % Trks | 2% | 3% | 6% | |
|---|---|---|---|---|
| Heavys | 7 | 43 | 37 | 87 |
| Trucks | 4 | 29 | 5 | 38 |
| Cars | 467 | 2,372 | 658 | 3,497 |
| Total | 478 | 2,444 | 700 | |

| | |
|---|---|
| Heavys | 89 |
| Trucks | 30 |
| Cars | 3,459 |
| Total | 3,578 |

| | |
|---|---|
| **East Leg Total:** | 2,405 |
| **East Entering:** | 1,243 |
| **East Peds:** | 48 |
| **Peds Cross:** | ⧖ |
| **Bicycles Entering:** | 2 |
| **Buggies Entering:** | 0 |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 20 | 6 | 1,061 | 1,087 |

**Doon Village Rd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 657 | 613 | 8 | 36 | 7% |
| 500 | 495 | 2 | 3 | 1% |
| 86 | 84 | 1 | 1 | 2% |
| | 1,192 | 11 | 40 | |

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**Pioneer Dr**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 2% | 7 | 2 | 478 | 487 |
| 2% | 6 | 3 | 396 | 405 |
| 10% | 8 | 2 | 95 | 105 |
| | 21 | 7 | 969 | |

**Pioneer Dr**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 1,108 | 11 | 43 | 1,162 |

**Doon Village Rd**

| | | | | |
|---|---|---|---|---|
| Total | 109 | 2,434 | 57 | |
| Cars | 99 | 2,368 | 54 | 2,521 |
| Trucks | 0 | 20 | 3 | 23 |
| Heavys | 10 | 46 | 0 | 56 |
| % Trks | 9% | 3% | 5% | |

| | |
|---|---|
| **Peds Cross:** | ⧖ |
| **West Peds:** | 90 |
| **West Entering:** | 997 |
| **West leg Total:** | 2,084 |
| **Bicycles Entering:** | 1 |
| **Buggies Entering:** | 0 |

| | |
|---|---|
| Heavys | 52 |
| Trucks | 32 |
| Cars | 2,551 |
| Total | 2,635 |

| | |
|---|---|
| **Peds Cross:** | ⋈ |
| **South Peds:** | 67 |
| **South Entering:** | 2,600 |
| **South leg Total:** | 5,235 |
| **Bicycles Entering:** | 2 |
| **Buggies Entering:** | 0 |

### Comments

To determine total vehicles entering the intersection, add all leg totals entering.

Example 1: Total Entering = West leg total entering + South leg total entering + East leg total entering + North leg total entering
Therefore, total vehicles entering intersection = **8,462**

Example 2: Total vehicles entering from the west = eastbound left turn + eastbound through + eastbound right turn
Therefore, vehicles entering from the west = **997**

Notes: None

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Estimated Daily Traffic

Total Factor = Monthly Factor 1 x Daily Factor 1 x 24 Hour Factor 1.74 = 1.740000

**Municipality:** Kitchener
**Intersection:** Doon Village Rd @ Pioneer Dr
**Control:** Signalized
**Major Road:** Doon Village Rd

**Weather conditions:** Cloudy/Wet

**Person(s) who counted:** Cam

**GeoID:** 21941
**Count Date:** Tuesday, 18-Oct-22

**North Leg Total:** 12,528
**North Entering:** 6,302
**North Peds:** N/A
**Peds Cross:** ⋈

| | % Trks | 2% | 3% | 6% | |
|---|---|---|---|---|---|
| Heavys | | 12 | 75 | 64 | 151 |
| Trucks | | 7 | 50 | 9 | 66 |
| Cars | | 813 | 4,127 | 1,145 | 6,085 |
| Total | | 832 | 4,253 | 1,218 | |

| Heavys | Trucks | Cars | Total |
|---|---|---|---|
| 35 | 10 | 1,846 | 1,891 |

**Pioneer Dr**

| % Trks | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| 2% | 12 | 3 | 832 | 847 |
| 2% | 10 | 5 | 689 | 705 |
| 10% | 14 | 3 | 165 | 183 |
| | 37 | 12 | 1,686 | |

**Doon Village Rd**

| | Heavys | Trucks | Cars | Total |
|---|---|---|---|---|
| | 155 | 52 | 6,019 | 6226 |

**East Leg Total:** 4,185
**East Entering:** 2,163
**East Peds:** N/A
**Peds Cross:** ⋈

**Doon Village Rd**

| Total | Cars | Trucks | Heavys | % Trks |
|---|---|---|---|---|
| 1,143 | 1,067 | 14 | 63 | 7% |
| 870 | 861 | 3 | 5 | 1% |
| 150 | 146 | 2 | 2 | 2% |
| | 2,074 | 19 | 70 | |

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**Pioneer Dr**

| Cars | Trucks | Heavys | Total |
|---|---|---|---|
| 1,928 | 19 | 75 | 2,022 |

**Doon Village Rd**

**Peds Cross:** ⋈
**West Peds:** N/A
**West Entering:** 1,735
**West leg Total:** 3,626

| | | |
|---|---|---|
| Heavys | 90 | |
| Trucks | 56 | |
| Cars | 4,439 | |
| Total | 4,585 | |

| | | | | |
|---|---|---|---|---|
| Total | 190 | 4,235 | 99 | |
| Cars | 172 | 4,120 | 94 | 4,387 |
| Trucks | 0 | 35 | 5 | 40 |
| Heavys | 17 | 80 | 0 | 97 |
| % Trks | 9% | 3% | 5% | |

**Peds Cross:** ⋈
**South Peds:** N/A
**South Entering:** 4,524
**South leg Total:** 9,109

### Comments

To determine the EDT (Estimated Daily Traffic), add all four leg totals and divide by two.
This will give you the approximate number of vehicles entering and exiting the intersection in a 24-hour period

Example: $\frac{\text{(West leg total + South leg total + East leg total + North leg total)}}{2}$ ***EDT =*** ***14,724***

# REGIONAL MUNICIPALITY OF WATERLOO
# TURNING MOVEMENT COUNT

Region of Waterloo

## Peak Hour Factor By Movement

**Municipality:** Kitchener
**Intersection:** Doon Village Rd @ Pioneer Dr
**Control:** Signalized
**Major Road:** Doon Village Rd

**Weather conditions:** Cloudy/Wet

**Person(s) who counted:** Cam

**GeoID:** 21941
**Count Date:** Tuesday, 18-Oct-22

**North Approach PHF**

| | |
|---|---|
| AM Peak: | 0.91 |
| Mid-day Peak: | 0.92 |
| PM Peak: | 0.89 |

| | Movement | | |
|---|---|---|---|
| PM | 0.78 | 0.91 | 0.87 |
| MID | 0.88 | 0.90 | 0.80 |
| AM | 0.85 | 0.85 | 0.82 |

**Doon Village Rd**

AM AM Peak Hour
MID Mid-day Peak Hour
PM PM Peak Hour

**Pioneer Dr**

| Movement | | | |
|---|---|---|---|
| | AM | MID | PM |
| | 0.71 | 0.86 | 0.84 |
| | 0.89 | 0.91 | 0.84 |
| | 0.63 | 0.75 | 0.42 |

Movement

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| Movement | | | |
|---|---|---|---|
| | PM | MID | AM |
| | 0.75 | 0.83 | 0.74 |
| | 0.67 | 0.61 | 0.69 |
| | 0.58 | 0.58 | 0.44 |

**Doon Village Rd**

**Pioneer Dr**

**East Approach PHF**

| | |
|---|---|
| AM Peak: | 0.82 |
| Mid-day Peak: | 0.88 |
| PM Peak: | 0.90 |

**West Approach PHF**

| | |
|---|---|
| AM Peak: | 0.67 |
| Mid-day Peak: | 0.70 |
| PM Peak: | 0.75 |

| | | | |
|---|---|---|---|
| 0.65 | 0.89 | 0.38 | AM |
| 0.75 | 0.88 | 0.67 | MID |
| 0.41 | 0.88 | 0.38 | PM |

Movement

**South Approach PHF**

| | |
|---|---|
| AM Peak: | 0.94 |
| Mid-day Peak: | 0.90 |
| PM Peak: | 0.86 |

**Comments**

**Intersection:** Doon Village Rd @ Pioneer Dr
**GeoID:** 21941
**Municipality:** Kitchener
**Major Road:** Doon Village Rd

**Intersection Control:** Signalized
**Date:** Tuesday, 18-Oct-22
**Name:** Cam
**Weather:** Cloudy/Wet

| | | | EASTBOUND | | | WESTBOUND | | | NORTHBOUND | | | SOUTHBOUND | | | TOTAL | TOTAL HOUR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Approach Control* | | | ***Signalized*** | | | ***Signalized*** | | | ***Signalized*** | | | ***Signalized*** | | | | |
| 7:30 | to | 7:45 | 16 | 12 | 2 | 0 | 8 | 18 | 3 | 119 | 0 | 15 | 38 | 10 | 241 | |
| 7:45 | to | 8:00 | 16 | 16 | 2 | 1 | 9 | 26 | 5 | 107 | 2 | 17 | 47 | 18 | 266 | |
| 8:00 | to | 8:15 | 19 | 14 | 3 | 1 | 9 | 19 | 9 | 102 | 0 | 10 | 68 | 21 | 275 | |
| 8:15 | to | 8:30 | 24 | 18 | 5 | 1 | 11 | 15 | 17 | 86 | 1 | 15 | 62 | 23 | 278 | 1,060 |
| 8:30 | to | 8:45 | 30 | 27 | 13 | 2 | 10 | 14 | 13 | 87 | 0 | 14 | 54 | 16 | 280 | 1,099 |
| 8:45 | to | 9:00 | 13 | 14 | 3 | 12 | 10 | 19 | 3 | 75 | 6 | 19 | 62 | 11 | 247 | 1,080 |
| 9:00 | to | 9:15 | 13 | 10 | 3 | 3 | 14 | 27 | 4 | 101 | 4 | 15 | 39 | 13 | 246 | 1,051 |
| 9:15 | to | 9:30 | 21 | 16 | 2 | 5 | 12 | 13 | 3 | 82 | 0 | 14 | 40 | 9 | 217 | 990 |
| 9:30 | to | 9:45 | 11 | 11 | 2 | 0 | 6 | 20 | 2 | 72 | 2 | 11 | 34 | 8 | 179 | 889 |
| 9:45 | to | 10:00 | 10 | 11 | 0 | 0 | 6 | 20 | 0 | 66 | 0 | 18 | 40 | 6 | 177 | 819 |
| 10:00 | to | 10:15 | 12 | 6 | 3 | 3 | 5 | 22 | 4 | 47 | 1 | 16 | 39 | 12 | 170 | 743 |
| 10:15 | to | 10:30 | 12 | 3 | 1 | 0 | 9 | 13 | 0 | 46 | 0 | 18 | 35 | 7 | 144 | 670 |
| **AM Peak Hour** | | | | | | | | | | | | | | | | |
| **7:45** | **to** | **8:45** | **89** | **75** | **23** | **5** | **39** | **74** | **44** | **382** | **3** | **56** | **231** | **78** | **1,099** | |
| **# of trucks in peak** | | | 0 | 0 | 0 | 0 | 2 | 1 | 0 | 1 | 0 | 1 | 10 | 0 | 15 | |
| **# of heavies in peak** | | | 4 | 2 | 3 | 1 | 1 | 6 | 5 | 6 | 0 | 5 | 12 | 2 | 47 | |
| **% heavies (Total)** | | | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% | 6% | |
| 12:00 | to | 12:15 | 12 | 6 | 2 | 2 | 13 | 22 | 2 | 71 | 2 | 24 | 67 | 14 | 237 | |
| 12:15 | to | 12:30 | 15 | 19 | 3 | 2 | 16 | 22 | 1 | 56 | 3 | 17 | 59 | 13 | 226 | |
| 12:30 | to | 12:45 | 15 | 10 | 2 | 2 | 13 | 18 | 1 | 66 | 2 | 28 | 54 | 11 | 222 | |
| 12:45 | to | 13:00 | 8 | 11 | 0 | 0 | 16 | 14 | 2 | 76 | 1 | 21 | 62 | 15 | 226 | 911 |
| 13:00 | to | 13:15 | 11 | 9 | 2 | 0 | 9 | 14 | 1 | 57 | 0 | 16 | 68 | 18 | 205 | 879 |
| 13:15 | to | 13:30 | 15 | 10 | 1 | 0 | 9 | 21 | 0 | 60 | 0 | 29 | 78 | 12 | 235 | 888 |
| 13:30 | to | 13:45 | 9 | 12 | 1 | 2 | 13 | 15 | 2 | 59 | 2 | 13 | 58 | 5 | 191 | 857 |
| 13:45 | to | 14:00 | 10 | 7 | 0 | 2 | 6 | 13 | 0 | 53 | 4 | 21 | 71 | 11 | 198 | 829 |
| **Midday Peak Hour** | | | | | | | | | | | | | | | | |
| **12:00** | **to** | **13:00** | **50** | **46** | **7** | **6** | **58** | **76** | **6** | **269** | **8** | **90** | **242** | **53** | **911** | |
| **# of trucks in peak** | | | 0 | 1 | 0 | 0 | 0 | 2 | 0 | 3 | 0 | 3 | 4 | 0 | 13 | |
| **# of heavies in peak** | | | 0 | 1 | 1 | 0 | 0 | 4 | 0 | 3 | 0 | 4 | 2 | 1 | 16 | |
| **% heavies (Total)** | | | 0% | 4% | 14% | 0% | 0% | 8% | 0% | 2% | 0% | 8% | 2% | 2% | 3% | |
| 15:00 | to | 15:15 | 26 | 20 | 18 | 6 | 19 | 26 | 8 | 77 | 5 | 11 | 98 | 12 | 326 | |
| 15:15 | to | 15:30 | 15 | 11 | 8 | 3 | 21 | 26 | 2 | 66 | 2 | 27 | 114 | 21 | 316 | |
| 15:30 | to | 15:45 | 21 | 15 | 4 | 15 | 17 | 30 | 2 | 93 | 8 | 28 | 97 | 10 | 340 | |
| 15:45 | to | 16:00 | 17 | 27 | 6 | 8 | 29 | 18 | 8 | 82 | 4 | 38 | 103 | 18 | 358 | 1,340 |
| 16:00 | to | 16:15 | 14 | 16 | 4 | 2 | 29 | 26 | 2 | 65 | 0 | 30 | 119 | 19 | 326 | 1,340 |
| 16:15 | to | 16:30 | 11 | 14 | 0 | 0 | 23 | 27 | 1 | 88 | 0 | 39 | 120 | 22 | 345 | 1,369 |
| 16:30 | to | 16:45 | 13 | 10 | 2 | 3 | 22 | 23 | 4 | 94 | 1 | 23 | 118 | 14 | 327 | 1,356 |
| 16:45 | to | 17:00 | 10 | 11 | 1 | 2 | 19 | 25 | 3 | 79 | 2 | 30 | 114 | 29 | 325 | 1,323 |
| 17:00 | to | 17:15 | 16 | 8 | 2 | 2 | 26 | 37 | 3 | 81 | 1 | 41 | 116 | 22 | 355 | 1,352 |
| 17:15 | to | 17:30 | 19 | 8 | 3 | 3 | 42 | 27 | 1 | 62 | 2 | 31 | 135 | 19 | 352 | 1,359 |
| 17:30 | to | 17:45 | 10 | 13 | 3 | 2 | 23 | 16 | 2 | 71 | 0 | 29 | 106 | 29 | 304 | 1,336 |
| 17:45 | to | 18:00 | 23 | 10 | 4 | 2 | 26 | 11 | 1 | 88 | 2 | 22 | 129 | 10 | 328 | 1,339 |
| **PM Peak Hour** | | | | | | | | | | | | | | | | |
| **15:30** | **to** | **16:30** | **63** | **72** | **14** | **25** | **98** | **101** | **13** | **328** | **12** | **135** | **439** | **69** | **1,369** | |
| **# of trucks in peak** | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | |
| **# of heavies in peak** | | | 1 | 1 | 0 | 0 | 1 | 4 | 0 | 11 | 0 | 5 | 7 | 3 | 33 | |
| **% heavies (Total)** | | | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% | 2% | |

**Intersection:** Doon Village Rd @ Pioneer Dr
**GeoID:** 21941
**Municipality:** Kitchener
**Major Road:** Doon Village Rd

**Intersection Control:** Signalized
**Date:** Tuesday, 18-Oct-22
**Name:** Cam
**Weather:** Cloudy/Wet

| PEDESTRIAN CROSSING | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Time | | | Crossing Approach | | | | | |
| | | | East App. | West App. | North App. | South App. | TOTAL | TOTAL HOUR |
| 7:30 | to | 7:45 | 3 | 1 | 1 | 4 | 9 | |
| 7:45 | to | 8:00 | 1 | 4 | 1 | 0 | 6 | |
| 8:00 | to | 8:15 | 1 | 3 | 1 | 0 | 5 | |
| 8:15 | to | 8:30 | 2 | 5 | 4 | 5 | 16 | 36 |
| 8:30 | to | 8:45 | 1 | 3 | 4 | 6 | 14 | 41 |
| 8:45 | to | 9:00 | 1 | 8 | 6 | 2 | 17 | 52 |
| 9:00 | to | 9:15 | 2 | 9 | 4 | 3 | 18 | 65 |
| 9:15 | to | 9:30 | 2 | 3 | 1 | 5 | 11 | 60 |
| 9:30 | to | 9:45 | 1 | 3 | 0 | 0 | 4 | 50 |
| 9:45 | to | 10:00 | 1 | 1 | 1 | 1 | 4 | 37 |
| 10:00 | to | 10:15 | 0 | 3 | 3 | 0 | 6 | 25 |
| 10:15 | to | 10:30 | 0 | 2 | 1 | 0 | 3 | 17 |
| **AM Peak Hour** | | | | | | | **113** | |
| **7:45** | **to** | **8:45** | **5** | **15** | **10** | **11** | **41** | |
| 12:00 | to | 12:15 | 1 | 0 | 2 | 2 | 5 | |
| 12:15 | to | 12:30 | 1 | 3 | 0 | 0 | 4 | |
| 12:30 | to | 12:45 | 0 | 3 | 0 | 0 | 3 | |
| 12:45 | to | 13:00 | 1 | 2 | 2 | 1 | 6 | 18 |
| 13:00 | to | 13:15 | 2 | 0 | 1 | 2 | 5 | 18 |
| 13:15 | to | 13:30 | 1 | 0 | 1 | 2 | 4 | 18 |
| 13:30 | to | 13:45 | 1 | 0 | 2 | 2 | 5 | 20 |
| 13:45 | to | 14:00 | 1 | 0 | 0 | 1 | 2 | 16 |
| **Midday Peak Hour** | | | | | | | **34** | |
| **12:00** | **to** | **13:00** | 3 | 8 | 4 | 3 | **18** | |
| 15:00 | to | 15:15 | 1 | 4 | 7 | 5 | 17 | |
| 15:15 | to | 15:30 | 3 | 6 | 4 | 7 | 20 | |
| 15:30 | to | 15:45 | 2 | 5 | 5 | 2 | 14 | |
| 15:45 | to | 16:00 | 2 | 12 | 11 | 6 | 31 | 82 |
| 16:00 | to | 16:15 | 3 | 4 | 4 | 1 | 12 | 77 |
| 16:15 | to | 16:30 | 2 | 0 | 3 | 1 | 6 | 63 |
| 16:30 | to | 16:45 | 0 | 2 | 1 | 0 | 3 | 52 |
| 16:45 | to | 17:00 | 6 | 1 | 2 | 4 | 13 | 34 |
| 17:00 | to | 17:15 | 2 | 0 | 1 | 3 | 6 | 28 |
| 17:15 | to | 17:30 | 2 | 0 | 0 | 1 | 3 | 25 |
| 17:30 | to | 17:45 | 0 | 1 | 2 | 1 | 4 | 26 |
| 17:45 | to | 18:00 | 2 | 2 | 1 | 0 | 5 | 18 |
| **PM Peak Hour** | | | | | | | **134** | |
| **15:30** | **to** | **16:30** | 9 | 21 | 23 | 10 | **63** | |

Region of Waterloo

# CURRENT TRAFFIC SIGNAL TIMING

INT # 763 | HOMER WATSON BLVD @ Manitou Dr/Doon Village Dr | T08-50/ 74K

Date Prepared: October 13, 2023

Mode of Control: Pre-timed running SEMI-ACTUATED

Left Info

| | | | | | |
|---|---|---|---|---|---|
| Actuated | WB | LT | - | HOMER WATSON BLVD |
| Actuated | EB | LT | - | HOMER WATSON BLVD |
| Actuated | SB | LT | - | MANITOU DRIVE(Dual LT) |
| Actuated | NB | LT | - | DOON VILLAGE |

*Offsets are a percentage of the cycle length and refers to the beginning of Main Street green

**Max 1** 05:30-10:00 & 14:00-19:00 Monday-Friday

**HOMER WATSON BLVD**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EBL | Green Arrow | Min | 5.0 | seconds | WBL | Green Arrow | | | Min | 5.0 | seconds |
| | | Ext | 3.0 | seconds | | | | | Ext | 3.0 | seconds |
| | | Max | 25.0 | seconds | | | | | Max | 6.0 | seconds |
| EBL | Amber Arrow | | 3.0 | seconds | WBL | Amber Arrow | | | | 3.0 | seconds |
| All Red | | | 1.0 | seconds | All Red | | | | | 1.0 | seconds |
| Green | | | 40.0 | seconds | | | | | | | |
| Amber | | | 4.2 | seconds | Walk | | 22.0 | seconds | | | |
| All Red | | | 2.9 | seconds | FDW | | 18.0 | seconds | | | |

**Manitou Dr/Doon Village Dr**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SBL | Green Arrow | Min | 5.0 | seconds | NBL | Green Arrow | | | Min | 5.0 | seconds |
| | | Ext | 5.0 | seconds | | | | | Ext | 3.0 | seconds |
| | | Max | 30.0 | seconds | | | | | Max | 25.0 | seconds |
| SBL | Amber Arrow | | 4.0 | seconds | NBL | Amber Arrow | | | | 3.0 | seconds |
| All Red | | | 2.0 | seconds | All Red | | | | | 1.0 | seconds |
| | | | | | Pedestrian Call | | | | | | |
| Green | | Min | 15.0 | seconds | Green/Walk | | 10.0 | seconds | | | |
| | | Ext | 3.0 | seconds | Green/FDW | | 19.0 | seconds | | | |
| | | Max | 20.0 | seconds | Green/SDW | | 0.0 | seconds | | | |
| Amber | | | 3.7 | seconds | Amber | | 3.7 | seconds | | | |
| All Red | | | 3.6 | seconds | All Red | | 3.6 | seconds | | | |
| TOTAL | | | 139.4 | seconds | | | | | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

**Max 2** 10:00-14:00 & 19:00-22:00 M-F, 8:00-22:00 Sat, 9:00-20:00 Sun

**HOMER WATSON BLVD**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EBL | Green Arrow | Min | 5.0 | seconds | WBL | Green Arrow | | | Min | 5.0 | seconds |
| | | Ext | 3.0 | seconds | | | | | Ext | 3.0 | seconds |
| | | Max | 14.0 | seconds | | | | | Max | 6.0 | seconds |
| EBL | Amber Arrow | | 3.0 | seconds | WBL | Amber Arrow | | | | 3.0 | seconds |
| All Red | | | 1.0 | seconds | All Red | | | | | 1.0 | seconds |
| Green | | | 30.0 | seconds | | | | | | | |
| Amber | | | 4.2 | seconds | Walk | | 12.0 | seconds | | | |
| All Red | | | 2.9 | seconds | FDW | | 18.0 | seconds | | | |

**Manitou Dr/Doon Village Dr**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SBL | Green Arrow | Min | 5.0 | seconds | NBL | Green Arrow | | | Min | 5.0 | seconds |
| | | Ext | 5.0 | seconds | | | | | Ext | 3.0 | seconds |
| | | Max | 30.0 | seconds | | | | | Max | 15.0 | seconds |
| SBL | Amber Arrow | | 4.0 | seconds | NBL | Amber Arrow | | | | 3.0 | seconds |
| All Red | | | 2.0 | seconds | All Red | | | | | 1.0 | seconds |
| | | | | | Pedestrian Call | | | | | | |
| Green | | Min | 15.0 | seconds | Green/Walk | | 10.0 | seconds | | | |
| | | Ext | 3.0 | seconds | Green/FDW | | 19.0 | seconds | | | |
| | | Max | 25.0 | seconds | Green/SDW | | 0.0 | seconds | | | |
| Amber | | | 3.7 | seconds | Amber | | 3.7 | seconds | | | |
| All Red | | | 3.6 | seconds | All Red | | 3.6 | seconds | | | |
| TOTAL | | | 123.4 | seconds | | | | | | | |

**Max 3** All Other Times

**HOMER WATSON BLVD**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Green | | | 30.0 | seconds | | | | |
| Amber | | | 4.2 | seconds | Walk | 12.0 | seconds | |
| All Red | | | 2.9 | seconds | FDW | 18.0 | seconds | |

**Manitou Dr/Doon Village Dr**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SBL | Green Arrow | Min | 5.0 | seconds | | | |
| | | Ext | 5.0 | seconds | | | |
| | | Max | 15.0 | seconds | | | |
| SBL | Amber Arrow | | 4.0 | seconds | | | |
| All Red | | | 2.0 | seconds | | | |
| | | | | | Pedestrian Call | | |
| Green | | Min | 15.0 | seconds | Green/Walk | 10.0 | seconds |
| | | Ext | 3.0 | seconds | Green/FDW | 19.0 | seconds |
| | | Max | 15.0 | seconds | Green/SDW | 0.0 | seconds |
| Amber | | | 3.7 | seconds | Amber | 3.7 | seconds |
| All Red | | | 3.6 | seconds | All Red | 3.6 | seconds |
| TOTAL | | | 80.4 | seconds | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

Region of Waterloo

# CURRENT TRAFFIC SIGNAL TIMING

INT # 765 HOMER WATSON BLVD @ Doon South Dr-Monarch Trail T08-50/ 177K

Date Prepared: October 13, 2023

Mode of Control FULLY-ACTUATED

Left Info Actuated - Fully Protected NB LT - HOMER WATSON BLVD

**Max 1** 06:00-10:00, 14:00-19:00 Monday to Friday

**HOMER WATSON BLVD**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| NBL | Green Arrow | Min | 10.0 | seconds | | | |
| | | Ext | 3.0 | seconds | | | |
| | | Max | 20.0 | seconds | | | |
| NBL | Amber Arrow | | 3.0 | seconds | | | |
| All Red | | | 2.0 | seconds | | | |
| | | | | | Pedestrian Call | | |
| Green | | Min | 20.0 | seconds | Green/Walk | 7.0 | seconds |
| | | Ext | 5.0 | seconds | Green/FDW | 13.0 | seconds |
| | | Max | 45.0 | seconds | Green/SDW | 25.0 | seconds |
| Amber | | | 4.2 | seconds | Amber | 4.2 | seconds |
| All Red | | | 2.4 | seconds | All Red | 2.4 | seconds |

**Doon South Dr-Monarch Trail**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | Pedestrian Call | | |
| Green | | Min | 8.0 | seconds | Green/Walk | 8.0 | seconds |
| | | Ext | 3.0 | seconds | Green/FDW | 15.0 | seconds |
| | | Max | 35.0 | seconds | Green/SDW | 12.0 | seconds |
| Amber | | | 4.0 | seconds | Amber | 4.0 | seconds |
| All Red | | | 2.0 | seconds | All Red | 2.0 | seconds |
| TOTAL | | | 116.6 | seconds | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

**Max 2** All Other Times

**HOMER WATSON BLVD**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| NBL | Green Arrow | Min | 10.0 | seconds | | | |
| | | Ext | 3.0 | seconds | | | |
| | | Max | 15.0 | seconds | | | |
| NBL | Amber Arrow | | 3.0 | seconds | | | |
| All Red | | | 2.0 | seconds | | | |
| | | | | | Pedestrian Call | | |
| Green | | Min | 20.0 | seconds | Green/Walk | 7.0 | seconds |
| | | Ext | 5.0 | seconds | Green/FDW | 13.0 | seconds |
| | | Max | 30.0 | seconds | Green/SDW | 10.0 | seconds |
| Amber | | | 4.2 | seconds | Amber | 4.2 | seconds |
| All Red | | | 2.4 | seconds | All Red | 2.4 | seconds |

**Doon South Dr-Monarch Trail**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | Pedestrian Call | | |
| Green | | Min | 8.0 | seconds | Green/Walk | 8.0 | seconds |
| | | Ext | 3.0 | seconds | Green/FDW | 15.0 | seconds |
| | | Max | 25.0 | seconds | Green/SDW | 2.0 | seconds |
| Amber | | | 4.0 | seconds | Amber | 4.0 | seconds |
| All Red | | | 2.0 | seconds | All Red | 2.0 | seconds |
| TOTAL | | | 86.6 | seconds | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

Region of Waterloo

# CURRENT TRAFFIC SIGNAL TIMING

INT # 914 HOMER WATSON BOULEVARD @ Conestoga College Boulevard T08-50/ 181K

Date Prepared: October 13, 2023

Mode of Control FULLY-ACTUATED

| Left Info | | | | | |
|---|---|---|---|---|---|
| Actuated | NB | LT | - | HOMER WATSON BOULEVARD |
| Actuated (Dual) | SB | LT | - | HOMER WATSON BOULEVARD |
| Actuated | EB | LT | - | CONESTOGA COLLEGE BOULEVAR |
| Actuated | WB | LT | - | CONESTOGA COLLEGE BOULEVAR |

**Max 2** 06:00-20:00 Monday to Friday, 07:00-18:00 Saturday, 09:00-18:00 Sunday

**HOMER WATSON BOULEVARD**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SBL | Green Arrow | Min | 10.0 | seconds | NBL | Green Arrow | | | Min | 5.0 | seconds |
| | | Ext | 3.0 | seconds | | | | | Ext | 3.0 | seconds |
| | | Max | 25.0 | seconds | | | | | Max | 15.0 | seconds |
| SBL | Amber Arrow | | 4.0 | seconds | NBL | Amber Arrow | | | | 3.0 | seconds |
| All Red | | | 2.0 | seconds | All Red | | | | | 1.0 | seconds |
| | | | | | Pedestrian Call | | | | | | |
| Green | | Min | 20.0 | seconds | Green/Walk | | 7.0 | seconds | | | |
| | | Ext | 4.0 | seconds | Green/FDW | | 19.0 | seconds | | | |
| | | Max | 40.0 | seconds | Green/SDW | | 14.0 | seconds | | | |
| Amber | | | 4.2 | seconds | Amber | | 4.2 | seconds | | | |
| All Red | | | 2.2 | seconds | All Red | | 2.2 | seconds | | | |

**Conestoga College Boulevard**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| EBL | Green Arrow | Min | 5.0 | seconds | WBL | Green Arrow | | | Min | 5.0 | seconds |
| | | Ext | 3.0 | seconds | | | | | Ext | 0.0 | seconds |
| | | Max | 7.0 | seconds | | | | | Max | 25.0 | seconds |
| EBL | Amber Arrow | | 3.0 | seconds | WBL | Amber Arrow | | | | 3.0 | seconds |
| All Red | | | 1.0 | seconds | All Red | | | | | 1.0 | seconds |
| | | | | | Pedestrian Call | | | | | | |
| Green | | Min | 10.0 | seconds | Green/Walk | | 10.0 | seconds | | | |
| | | Ext | 3.0 | seconds | Green/FDW | | 24.0 | seconds | | | |
| | | Max | 25.0 | seconds | Green/SDW | | 0.0 | seconds | | | |
| Amber | | | 3.7 | seconds | Amber | | 3.7 | seconds | | | |
| All Red | | | 2.7 | seconds | All Red | | 2.7 | seconds | | | |
| TOTAL | | | 137.8 | seconds | | | | | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

**Max 1** All other times

**HOMER WATSON BOULEVARD**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SBL | Green Arrow | Min | 10.0 | seconds | NBL | Green Arrow | | | Min | 5.0 | seconds |
| | | Ext | 3.0 | seconds | | | | | Ext | 3.0 | seconds |
| | | Max | 7.0 | seconds | | | | | Max | 15.0 | seconds |
| SBL | Amber Arrow | | 4.0 | seconds | NBL | Amber Arrow | | | | 3.0 | seconds |
| All Red | | | 2.0 | seconds | All Red | | | | | 1.0 | seconds |
| | | | | | Pedestrian Call | | | | | | |
| Green | | Min | 20.0 | seconds | Green/Walk | | 7.0 | seconds | | | |
| | | Ext | 4.0 | seconds | Green/FDW | | 19.0 | seconds | | | |
| | | Max | 35.0 | seconds | Green/SDW | | 9.0 | seconds | | | |
| Amber | | | 4.2 | seconds | Amber | | 4.2 | seconds | | | |
| All Red | | | 2.2 | seconds | All Red | | 2.2 | seconds | | | |

**Conestoga College Boulevard**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | Pedestrian Call | | | |
| Green | Min | 10.0 | seconds | Green/Walk | 10.0 | seconds | |
| | Ext | 3.0 | seconds | Green/FDW | 24.0 | seconds | |
| | Max | 25.0 | seconds | Green/SDW | 0.0 | seconds | |
| Amber | | 3.7 | seconds | Amber | 3.7 | seconds | |
| All Red | | 2.7 | seconds | All Red | 2.7 | seconds | |
| TOTAL | | 91.8 | seconds | | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

# CURRENT TRAFFIC SIGNAL TIMING

INT # 916 | HOMER WATSON @ HWY 401 WB Ramp/New Dundee Road | T08-50/ 182K

Date Prepared: October 13, 2023

Mode of Control: FULLY-ACTUATED

Left Info

| | | | | |
|---|---|---|---|---|
| Actuated | NB | LT | - | HOMER WATSON |
| Actuated | WB | LT | - | HWY 401 WB RAMP/NEW DUNDEE |

**Max 1** 06:00-20:00 Mon to Fri, 7:00-19:00 Sat, 09:00-18:00 Sun

**HOMER WATSON**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | NBL | Green Arrow | | Min | 5.0 | seconds |
| | | | | | | | Ext | 3.0 | seconds |
| | | | | | | | Max | 10.0 | seconds |
| | | | | NBL | Amber Arrow | | | 3.0 | seconds |
| | | | | All Red | | | | 1.0 | seconds |
| | | | | Pedestrian Call | | | | | |
| Green | Min | 20.0 | seconds | Green/Walk | | 15.0 | seconds | | |
| | Ext | 5.0 | seconds | Green/FDW | | 5.0 | seconds | | |
| | Max | 55.0 | seconds | Green/SDW | | 35.0 | seconds | | |
| Amber | | 4.2 | seconds | Amber | | 4.2 | seconds | | |
| All Red | | 2.7 | seconds | All Red | | 2.7 | seconds | | |

**HWY 401 WB Ramp/New Dundee**

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | WBL | Green Arrow | | Min | 5.0 | seconds |
| | | | | | | | Ext | 5.0 | seconds |
| | | | | | | | Max | 10.0 | seconds |
| | | | | WBL | Amber Arrow | | | 3.0 | seconds |
| | | | | All Red | | | | 1.0 | seconds |
| | | | | Pedestrian Call | | | | | |
| Green | Min | 10.0 | seconds | Green/Walk | | 7.0 | seconds | | |
| | Ext | 5.0 | seconds | Green/FDW | | 19.0 | seconds | | |
| | Max | 30.0 | seconds | Green/SDW | | 4.0 | seconds | | |
| Amber | | 3.7 | seconds | Amber | | 3.7 | seconds | | |
| All Red | | 3.5 | seconds | All Red | | 3.5 | seconds | | |
| TOTAL | | 127.1 | seconds | | | | | | |

**Max 2** All Other Times

**HOMER WATSON**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Pedestrian Call | | |
| Green | Min | 20.0 | seconds | Green/Walk | 15.0 | seconds |
| | Ext | 5.0 | seconds | Green/FDW | 5.0 | seconds |
| | Max | 40.0 | seconds | Green/SDW | 20.0 | seconds |
| Amber | | 4.2 | seconds | Amber | 4.2 | seconds |
| All Red | | 2.7 | seconds | All Red | 2.7 | seconds |

**HWY 401 WB Ramp/New Dundee**

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | Pedestrian Call | | |
| Green | Min | 10.0 | seconds | Green/Walk | 7.0 | seconds |
| | Ext | 5.0 | seconds | Green/FDW | 19.0 | seconds |
| | Max | 30.0 | seconds | Green/SDW | 4.0 | seconds |
| Amber | | 3.7 | seconds | Amber | 3.7 | seconds |
| All Red | | 3.5 | seconds | All Red | 3.5 | seconds |
| TOTAL | | 84.1 | seconds | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

# CURRENT TRAFFIC SIGNAL TIMING

INT # **854** **DOON VILLIAGE ROAD @ Pioneer Drive** T08-50/ **254K**

Date Prepared: **October 13, 2023**

Mode of Control **Fixed Time**

LPI **5** second **LPI Monday-Friday (Sept-June), 8:30-9:05 & 15:25-15:55, all legs.**

| **Max 1** | All Other Times | | | | |
|---|---|---|---|---|---|
| **DOON VILLAGE ROAD** | | | | | |
| Green | 30.0 | seconds | | | |
| Amber | 4.0 | seconds | Walk | 16.0 | seconds |
| All Red | 2.0 | seconds | FDW | 14.0 | seconds |
| | | | | | |
| **Pioneer Drive** | | | | | |
| Green | 20.0 | seconds | | | |
| Amber | 4.0 | seconds | Walk | 9.0 | seconds |
| All Red | 2.0 | seconds | FDW | 11.0 | seconds |
| TOTAL | 62.0 | seconds | | | |

| **Max 1 (Timing Plan 2)** | LPI: 8:30-9:05 & 15:25-15:55 Monday-Friday (Sept-June) | | | | |
|---|---|---|---|---|---|
| **DOON VILLAGE ROAD** | | | | | |
| Green | 35.0 | seconds | | | |
| Amber | 4.0 | seconds | Walk | 21.0 | seconds |
| All Red | 2.0 | seconds | FDW | 14.0 | seconds |
| | | | | | |
| **Pioneer Drive** | | | | | |
| Green | 25.0 | seconds | | | |
| Amber | 4.0 | seconds | Walk | 14.0 | seconds |
| All Red | 2.0 | seconds | FDW | 11.0 | seconds |
| TOTAL | 72.0 | seconds | | | |

Min=Minimum Time
Ext=Extension Time
Max=Maximum Time

**This signal timing cannot be presented as evidence in a court of law.**

# Appendix B

## ATR Data

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Apple Ridge Drive (Forest Creek Drive to Doon Mills Rd)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Westbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 7:15 AM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 7:30 AM | 0 | 15 | 1 | 0 | 0 | 0 | 16 |
| 7:45 AM | 0 | 23 | 0 | 2 | 0 | 0 | 25 |
| 8:00 AM | 0 | 39 | 0 | 1 | 0 | 0 | 40 |
| 8:15 AM | 0 | 43 | 1 | 1 | 0 | 0 | 45 |
| 8:30 AM | 0 | 29 | 1 | 1 | 0 | 0 | 31 |
| 8:45 AM | 0 | 35 | 1 | 0 | 0 | 0 | 36 |
| 9:00 AM | 0 | 22 | 1 | 2 | 0 | 0 | 25 |
| 9:15 AM | 0 | 18 | 3 | 0 | 0 | 0 | 21 |
| 9:30 AM | 0 | 28 | 1 | 0 | 0 | 0 | 29 |
| 9:45 AM | 0 | 19 | 0 | 1 | 0 | 0 | 20 |
| 10:00 AM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 10:15 AM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 10:30 AM | 0 | 28 | 1 | 1 | 0 | 0 | 30 |
| 10:45 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 11:00 AM | 0 | 24 | 0 | 2 | 0 | 0 | 26 |
| 11:15 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 11:30 AM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 11:45 AM | 0 | 38 | 0 | 0 | 0 | 0 | 38 |
| 12:00 PM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 12:15 PM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 12:30 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 12:45 PM | 0 | 33 | 0 | 1 | 0 | 1 | 35 |
| 1:00 PM | 0 | 27 | 0 | 1 | 0 | 0 | 28 |
| 1:15 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 1:30 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 1:45 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 2:00 PM | 0 | 35 | 1 | 0 | 0 | 0 | 36 |
| 2:15 PM | 0 | 38 | 0 | 0 | 0 | 0 | 38 |
| 2:30 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 2:45 PM | 0 | 47 | 2 | 0 | 0 | 0 | 49 |
| 3:00 PM | 0 | 51 | 2 | 0 | 0 | 0 | 53 |
| 3:15 PM | 0 | 41 | 1 | 0 | 0 | 0 | 42 |
| 3:30 PM | 0 | 53 | 1 | 0 | 0 | 0 | 54 |
| 3:45 PM | 0 | 49 | 2 | 0 | 0 | 0 | 51 |
| 4:00 PM | 0 | 57 | 0 | 0 | 0 | 0 | 57 |
| 4:15 PM | 0 | 76 | 1 | 0 | 0 | 0 | 77 |
| 4:30 PM | 0 | 55 | 0 | 0 | 0 | 0 | 55 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 71 | 0 | 0 | 0 | 0 | 71 |
| 5:00 PM | 0 | 54 | 0 | 0 | 0 | 0 | 54 |
| 5:15 PM | 0 | 83 | 0 | 0 | 0 | 0 | 83 |
| 5:30 PM | 0 | 81 | 0 | 1 | 0 | 0 | 82 |
| 5:45 PM | 0 | 63 | 0 | 0 | 0 | 0 | 63 |
| Total | 0 | 1621 | 21 | 15 | 0 | 1 | 1658 |
| Total % | 0.0 | 97.8 | 1.3 | 0.9 | 0.0 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 8:15 AM | 9:00 AM | 7:00 AM | 7:00 AM | 7:30 AM |
| AM Peaks | 0 | 120 | 4 | 3 | 0 | 0 | 126 |
| PM Times | 12:00 PM | 4:00 PM | 2:45 PM | 12:45 PM | 12:00 PM | 12:00 PM | 3:30 PM |
| PM Peaks | 0 | 259 | 6 | 2 | 0 | 1 | 239 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Apple Ridge Drive (Forest Creek Drive to Doon Mills Rd)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Eastbound)

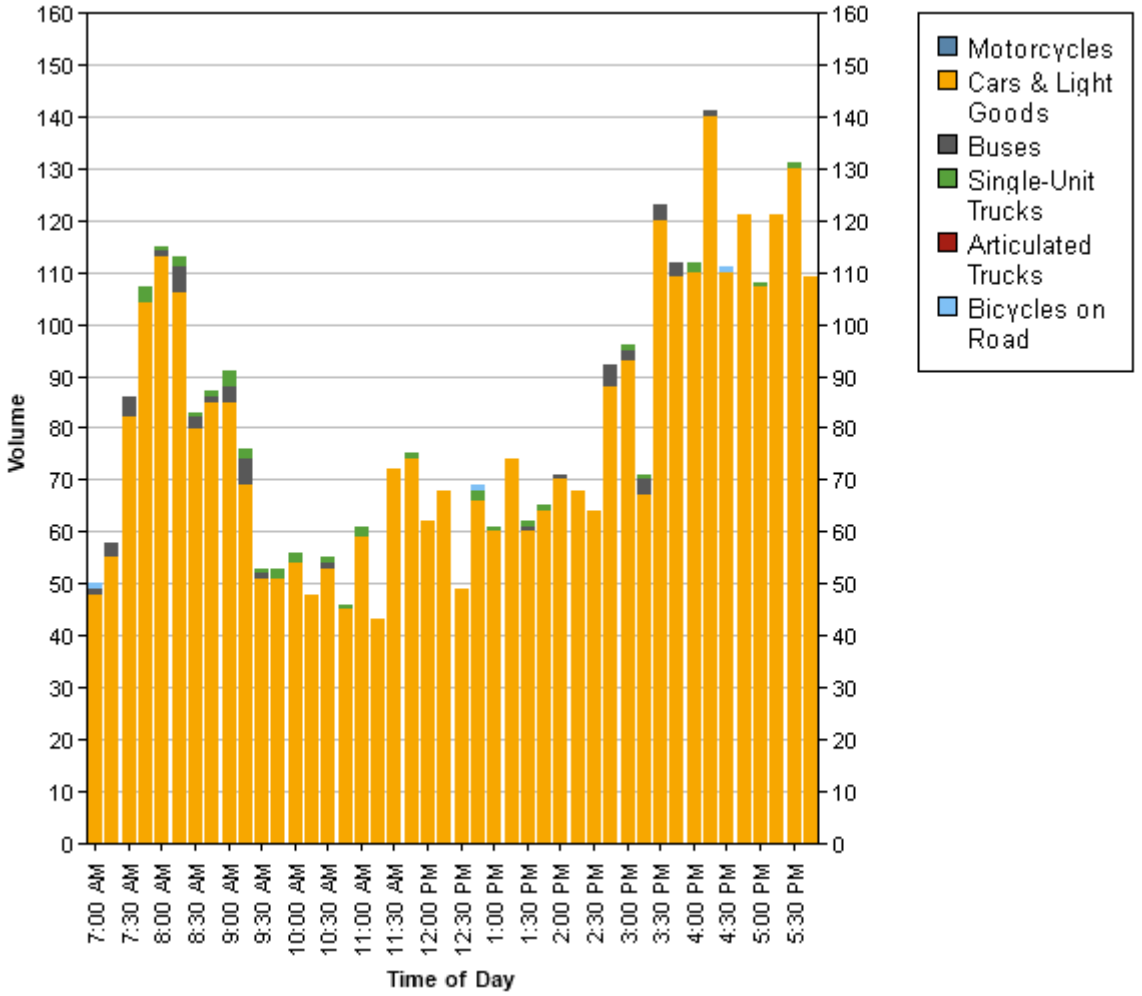
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 34 | 1 | 0 | 0 | 1 | 36 |
| 7:15 AM | 0 | 39 | 2 | 0 | 0 | 0 | 41 |
| 7:30 AM | 0 | 67 | 3 | 0 | 0 | 0 | 70 |
| 7:45 AM | 0 | 81 | 0 | 1 | 0 | 0 | 82 |
| 8:00 AM | 0 | 74 | 1 | 0 | 0 | 0 | 75 |
| 8:15 AM | 0 | 63 | 4 | 1 | 0 | 0 | 68 |
| 8:30 AM | 0 | 51 | 1 | 0 | 0 | 0 | 52 |
| 8:45 AM | 0 | 50 | 0 | 1 | 0 | 0 | 51 |
| 9:00 AM | 0 | 63 | 2 | 1 | 0 | 0 | 66 |
| 9:15 AM | 0 | 51 | 2 | 2 | 0 | 0 | 55 |
| 9:30 AM | 0 | 23 | 0 | 1 | 0 | 0 | 24 |
| 9:45 AM | 0 | 32 | 0 | 1 | 0 | 0 | 33 |
| 10:00 AM | 0 | 33 | 0 | 1 | 0 | 0 | 34 |
| 10:15 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 10:30 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 10:45 AM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 11:00 AM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 11:15 AM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 11:30 AM | 0 | 44 | 0 | 0 | 0 | 0 | 44 |
| 11:45 AM | 0 | 36 | 0 | 1 | 0 | 0 | 37 |
| 12:00 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 12:15 PM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| 12:30 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 12:45 PM | 0 | 33 | 0 | 1 | 0 | 0 | 34 |
| 1:00 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 1:15 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 1:30 PM | 0 | 33 | 1 | 1 | 0 | 0 | 35 |
| 1:45 PM | 0 | 30 | 0 | 1 | 0 | 0 | 31 |
| 2:00 PM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 2:15 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 2:30 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 2:45 PM | 0 | 41 | 2 | 0 | 0 | 0 | 43 |
| 3:00 PM | 0 | 42 | 0 | 1 | 0 | 0 | 43 |
| 3:15 PM | 0 | 26 | 2 | 1 | 0 | 0 | 29 |
| 3:30 PM | 0 | 67 | 2 | 0 | 0 | 0 | 69 |
| 3:45 PM | 0 | 60 | 1 | 0 | 0 | 0 | 61 |
| 4:00 PM | 0 | 53 | 0 | 2 | 0 | 0 | 55 |
| 4:15 PM | 0 | 64 | 0 | 0 | 0 | 0 | 64 |
| 4:30 PM | 0 | 55 | 0 | 0 | 0 | 1 | 56 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 50 | 0 | 0 | 0 | 0 | 50 |
| 5:00 PM | 0 | 53 | 0 | 1 | 0 | 0 | 54 |
| 5:15 PM | 0 | 38 | 0 | 0 | 0 | 0 | 38 |
| 5:30 PM | 0 | 49 | 0 | 0 | 0 | 0 | 49 |
| 5:45 PM | 0 | 46 | 0 | 0 | 0 | 0 | 46 |
| Total | 0 | 1886 | 24 | 19 | 0 | 2 | 1931 |
| Total % | 0.0 | 97.7 | 1.2 | 1.0 | 0.0 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 8:15 AM | 9:00 AM | 7:00 AM | 7:00 AM | 7:30 AM |
| AM Peaks | 0 | 285 | 7 | 5 | 0 | 1 | 295 |
| PM Times | 12:00 PM | 4:00 PM | 2:45 PM | 12:45 PM | 12:00 PM | 12:00 PM | 3:30 PM |
| PM Peaks | 0 | 222 | 6 | 2 | 0 | 0 | 249 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Apple Ridge Drive (Forest Creek Drive to Doon Mills Rd)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive (Caryndale Drive to Black Walnut Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 18 | 1 | 0 | 0 | 1 | 20 |
| 7:15 AM | 0 | 24 | 3 | 0 | 0 | 0 | 27 |
| 7:30 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 7:45 AM | 0 | 48 | 3 | 0 | 0 | 1 | 52 |
| 8:00 AM | 0 | 50 | 0 | 0 | 0 | 0 | 50 |
| 8:15 AM | 0 | 36 | 2 | 1 | 0 | 0 | 39 |
| 8:30 AM | 0 | 54 | 0 | 0 | 0 | 0 | 54 |
| 8:45 AM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 9:00 AM | 0 | 47 | 1 | 0 | 0 | 0 | 48 |
| 9:15 AM | 0 | 58 | 1 | 0 | 0 | 2 | 61 |
| 9:30 AM | 0 | 28 | 1 | 1 | 0 | 0 | 30 |
| 9:45 AM | 0 | 24 | 0 | 2 | 0 | 0 | 26 |
| 10:00 AM | 0 | 15 | 0 | 1 | 0 | 1 | 17 |
| 10:15 AM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 10:30 AM | 0 | 25 | 0 | 2 | 0 | 0 | 27 |
| 10:45 AM | 0 | 21 | 0 | 3 | 0 | 1 | 25 |
| 11:00 AM | 0 | 33 | 0 | 1 | 1 | 0 | 35 |
| 11:15 AM | 0 | 27 | 0 | 1 | 0 | 0 | 28 |
| 11:30 AM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 11:45 AM | 0 | 24 | 0 | 2 | 0 | 0 | 26 |
| 12:00 PM | 0 | 36 | 3 | 0 | 0 | 0 | 39 |
| 12:15 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 12:30 PM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 12:45 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 1:00 PM | 0 | 44 | 0 | 2 | 0 | 0 | 46 |
| 1:15 PM | 0 | 37 | 0 | 2 | 0 | 0 | 39 |
| 1:30 PM | 0 | 43 | 0 | 0 | 0 | 0 | 43 |
| 1:45 PM | 1 | 31 | 1 | 0 | 0 | 0 | 33 |
| 2:00 PM | 0 | 30 | 0 | 1 | 0 | 0 | 31 |
| 2:15 PM | 0 | 27 | 2 | 0 | 0 | 0 | 29 |
| 2:30 PM | 0 | 45 | 0 | 2 | 0 | 0 | 47 |
| 2:45 PM | 0 | 76 | 9 | 0 | 0 | 0 | 85 |
| 3:00 PM | 0 | 69 | 0 | 0 | 0 | 1 | 70 |
| 3:15 PM | 0 | 56 | 1 | 0 | 0 | 0 | 57 |
| 3:30 PM | 0 | 77 | 2 | 1 | 0 | 1 | 81 |
| 3:45 PM | 0 | 67 | 4 | 0 | 0 | 0 | 71 |
| 4:00 PM | 0 | 66 | 1 | 1 | 0 | 0 | 68 |
| 4:15 PM | 0 | 65 | 0 | 0 | 0 | 0 | 65 |
| 4:30 PM | 0 | 67 | 1 | 0 | 0 | 0 | 68 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 79 | 0 | 2 | 0 | 0 | 81 |
| 5:00 PM | 0 | 67 | 0 | 1 | 0 | 1 | 69 |
| 5:15 PM | 0 | 85 | 0 | 1 | 0 | 0 | 86 |
| 5:30 PM | 0 | 85 | 0 | 0 | 0 | 0 | 85 |
| 5:45 PM | 0 | 51 | 0 | 1 | 0 | 0 | 52 |
| Total | 1 | 1944 | 36 | 29 | 1 | 9 | 2020 |
| Total % | 0.0 | 96.2 | 1.8 | 1.4 | 0.0 | 0.4 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 10:00 AM | 10:15 AM | 9:15 AM | 7:45 AM |
| AM Peaks | 0 | 188 | 7 | 7 | 1 | 3 | 195 |
| PM Times | 1:00 PM | 4:45 PM | 3:15 PM | 2:00 PM | 3:15 PM | 3:00 PM | 3:30 PM |
| PM Peaks | 1 | 316 | 8 | 3 | 0 | 2 | 285 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive (Caryndale Drive to Black Walnut Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Northbound)

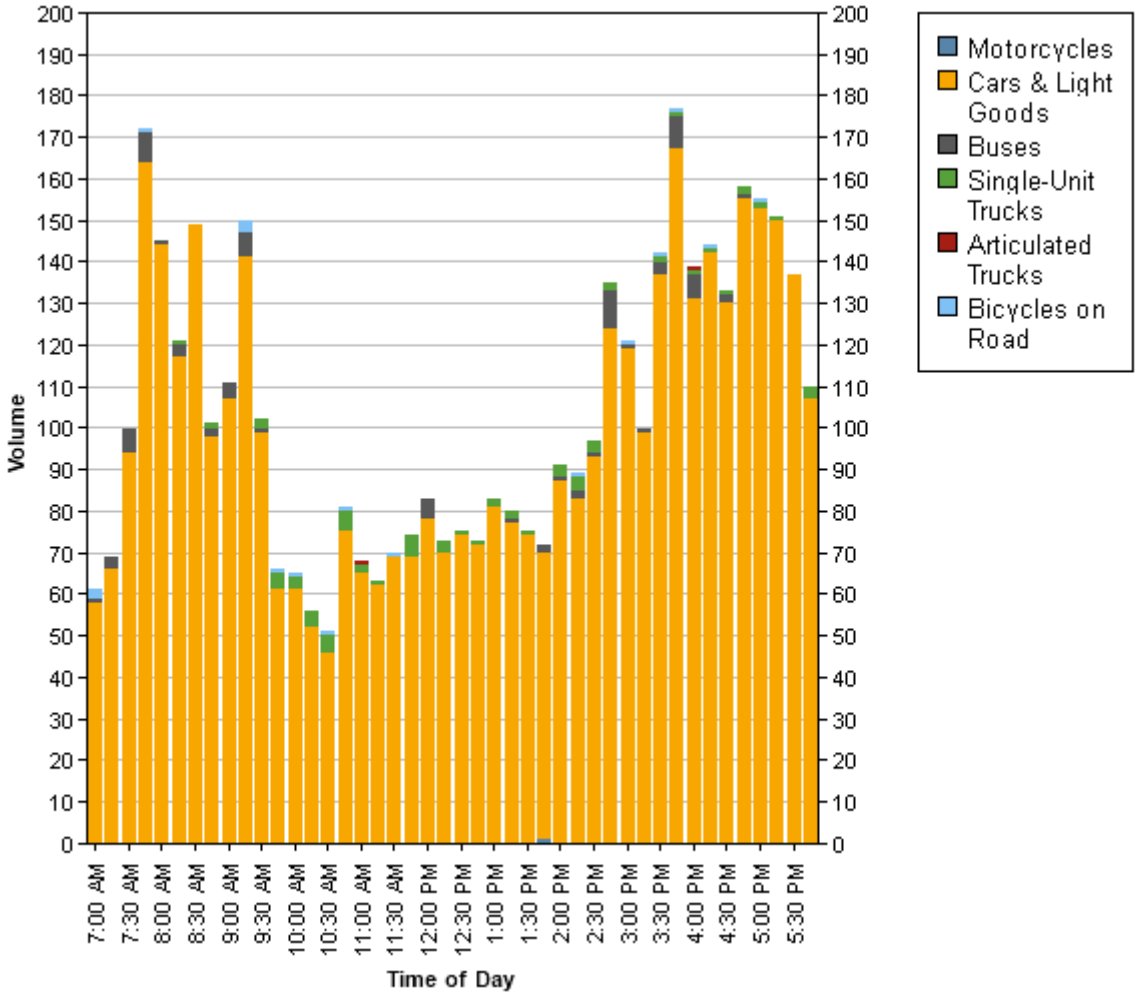
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 40 | 0 | 0 | 0 | 1 | 41 |
| 7:15 AM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| 7:30 AM | 0 | 69 | 6 | 0 | 0 | 0 | 75 |
| 7:45 AM | 0 | 116 | 4 | 0 | 0 | 0 | 120 |
| 8:00 AM | 0 | 94 | 1 | 0 | 0 | 0 | 95 |
| 8:15 AM | 0 | 81 | 1 | 0 | 0 | 0 | 82 |
| 8:30 AM | 0 | 95 | 0 | 0 | 0 | 0 | 95 |
| 8:45 AM | 0 | 67 | 2 | 1 | 0 | 0 | 70 |
| 9:00 AM | 0 | 60 | 3 | 0 | 0 | 0 | 63 |
| 9:15 AM | 0 | 83 | 5 | 0 | 0 | 1 | 89 |
| 9:30 AM | 0 | 71 | 0 | 1 | 0 | 0 | 72 |
| 9:45 AM | 0 | 37 | 0 | 2 | 0 | 1 | 40 |
| 10:00 AM | 0 | 46 | 0 | 2 | 0 | 0 | 48 |
| 10:15 AM | 0 | 31 | 0 | 3 | 0 | 0 | 34 |
| 10:30 AM | 0 | 21 | 0 | 2 | 0 | 1 | 24 |
| 10:45 AM | 0 | 54 | 0 | 2 | 0 | 0 | 56 |
| 11:00 AM | 0 | 32 | 0 | 1 | 0 | 0 | 33 |
| 11:15 AM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 11:30 AM | 0 | 37 | 0 | 0 | 0 | 1 | 38 |
| 11:45 AM | 0 | 45 | 0 | 3 | 0 | 0 | 48 |
| 12:00 PM | 0 | 42 | 2 | 0 | 0 | 0 | 44 |
| 12:15 PM | 0 | 41 | 0 | 3 | 0 | 0 | 44 |
| 12:30 PM | 0 | 42 | 0 | 1 | 0 | 0 | 43 |
| 12:45 PM | 0 | 33 | 0 | 1 | 0 | 0 | 34 |
| 1:00 PM | 0 | 37 | 0 | 0 | 0 | 0 | 37 |
| 1:15 PM | 0 | 40 | 1 | 0 | 0 | 0 | 41 |
| 1:30 PM | 0 | 31 | 0 | 1 | 0 | 0 | 32 |
| 1:45 PM | 0 | 38 | 1 | 0 | 0 | 0 | 39 |
| 2:00 PM | 0 | 57 | 1 | 2 | 0 | 0 | 60 |
| 2:15 PM | 0 | 56 | 0 | 3 | 0 | 1 | 60 |
| 2:30 PM | 0 | 48 | 1 | 1 | 0 | 0 | 50 |
| 2:45 PM | 0 | 48 | 0 | 2 | 0 | 0 | 50 |
| 3:00 PM | 0 | 50 | 1 | 0 | 0 | 0 | 51 |
| 3:15 PM | 0 | 43 | 0 | 0 | 0 | 0 | 43 |
| 3:30 PM | 0 | 60 | 1 | 0 | 0 | 0 | 61 |
| 3:45 PM | 0 | 100 | 4 | 1 | 0 | 1 | 106 |
| 4:00 PM | 0 | 65 | 5 | 0 | 1 | 0 | 71 |
| 4:15 PM | 0 | 77 | 0 | 1 | 0 | 1 | 79 |
| 4:30 PM | 0 | 63 | 1 | 1 | 0 | 0 | 65 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 76 | 1 | 0 | 0 | 0 | 77 |
| 5:00 PM | 0 | 86 | 0 | 0 | 0 | 0 | 86 |
| 5:15 PM | 0 | 65 | 0 | 0 | 0 | 0 | 65 |
| 5:30 PM | 0 | 52 | 0 | 0 | 0 | 0 | 52 |
| 5:45 PM | 0 | 56 | 0 | 2 | 0 | 0 | 58 |
| Total | 0 | 2462 | 41 | 36 | 1 | 8 | 2548 |
| Total % | 0.0 | 96.6 | 1.6 | 1.4 | 0.0 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 10:00 AM | 10:15 AM | 9:15 AM | 7:45 AM |
| AM Peaks | 0 | 386 | 10 | 9 | 0 | 2 | 392 |
| PM Times | 1:00 PM | 4:45 PM | 3:15 PM | 2:00 PM | 3:15 PM | 3:00 PM | 3:30 PM |
| PM Peaks | 0 | 279 | 10 | 8 | 1 | 1 | 317 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Biehn Drive (Caryndale Drive to Black Walnut Drive)
Site Code: 230376
Start Date: 10/11/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Caryndale Drive (Evenstone Avenue to Chapel Hill Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 13 | 1 | 0 | 0 | 1 | 15 |
| 7:15 AM | 0 | 21 | 1 | 0 | 0 | 0 | 22 |
| 7:30 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 7:45 AM | 0 | 32 | 3 | 0 | 0 | 0 | 35 |
| 8:00 AM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 8:15 AM | 0 | 25 | 1 | 0 | 1 | 0 | 27 |
| 8:30 AM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 8:45 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 9:00 AM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 9:15 AM | 0 | 41 | 0 | 0 | 0 | 1 | 42 |
| 9:30 AM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 9:45 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 10:00 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 10:15 AM | 0 | 8 | 0 | 1 | 0 | 0 | 9 |
| 10:30 AM | 0 | 11 | 0 | 1 | 0 | 0 | 12 |
| 10:45 AM | 0 | 16 | 0 | 2 | 0 | 0 | 18 |
| 11:00 AM | 0 | 11 | 0 | 1 | 1 | 0 | 13 |
| 11:15 AM | 0 | 9 | 0 | 1 | 0 | 0 | 10 |
| 11:30 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 11:45 AM | 0 | 17 | 0 | 3 | 0 | 0 | 20 |
| 12:00 PM | 0 | 16 | 1 | 1 | 0 | 0 | 18 |
| 12:15 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:30 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 12:45 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 1:00 PM | 0 | 20 | 0 | 0 | 0 | 1 | 21 |
| 1:15 PM | 0 | 21 | 0 | 0 | 0 | 1 | 22 |
| 1:30 PM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 1:45 PM | 0 | 14 | 0 | 0 | 0 | 1 | 15 |
| 2:00 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 2:15 PM | 0 | 10 | 1 | 1 | 0 | 0 | 12 |
| 2:30 PM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 2:45 PM | 0 | 40 | 9 | 0 | 0 | 0 | 49 |
| 3:00 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 3:15 PM | 0 | 27 | 3 | 0 | 0 | 0 | 30 |
| 3:30 PM | 0 | 30 | 1 | 1 | 0 | 0 | 32 |
| 3:45 PM | 0 | 64 | 4 | 1 | 0 | 0 | 69 |
| 4:00 PM | 0 | 49 | 2 | 1 | 0 | 0 | 52 |
| 4:15 PM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 4:30 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 49 | 0 | 1 | 0 | 0 | 50 |
| 5:00 PM | 0 | 45 | 0 | 2 | 0 | 0 | 47 |
| 5:15 PM | 0 | 49 | 0 | 1 | 0 | 0 | 50 |
| 5:30 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 5:45 PM | 0 | 28 | 0 | 2 | 0 | 0 | 30 |
| Total | 0 | 1066 | 29 | 22 | 2 | 5 | 1124 |
| Total % | 0.0 | 94.8 | 2.6 | 2.0 | 0.2 | 0.4 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 10:00 AM | 7:30 AM | 7:00 AM | 7:45 AM |
| AM Peaks | 0 | 108 | 6 | 4 | 1 | 1 | 113 |
| PM Times | 12:00 PM | 4:45 PM | 3:15 PM | 5:00 PM | 1:45 PM | 1:00 PM | 3:45 PM |
| PM Peaks | 0 | 184 | 10 | 5 | 0 | 3 | 191 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Caryndale Drive (Evenstone Avenue to Chapel Hill Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Northbound)

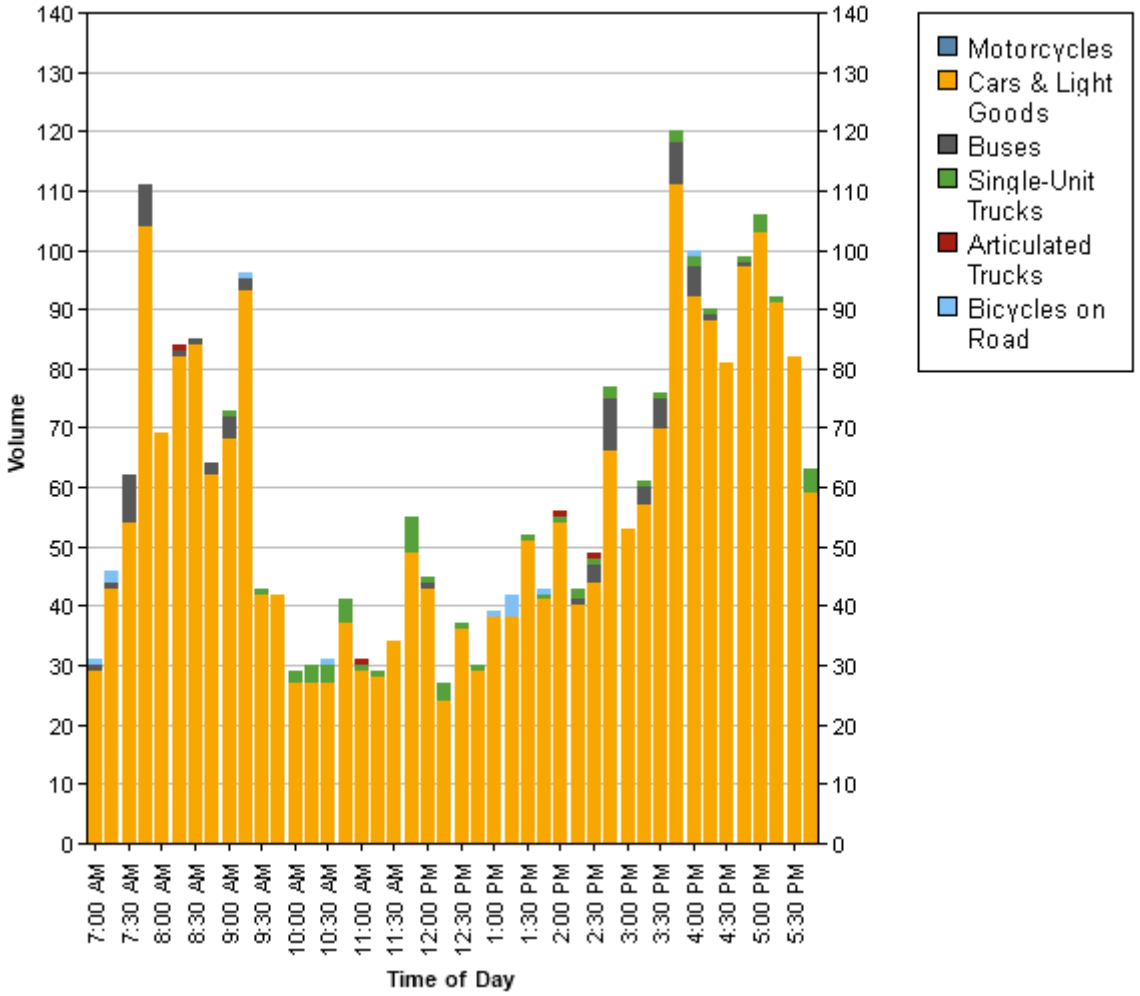
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 7:15 AM | 0 | 22 | 0 | 0 | 0 | 2 | 24 |
| 7:30 AM | 0 | 41 | 7 | 0 | 0 | 0 | 48 |
| 7:45 AM | 0 | 72 | 4 | 0 | 0 | 0 | 76 |
| 8:00 AM | 0 | 49 | 0 | 0 | 0 | 0 | 49 |
| 8:15 AM | 0 | 57 | 0 | 0 | 0 | 0 | 57 |
| 8:30 AM | 0 | 53 | 1 | 0 | 0 | 0 | 54 |
| 8:45 AM | 0 | 43 | 2 | 0 | 0 | 0 | 45 |
| 9:00 AM | 0 | 48 | 4 | 1 | 0 | 0 | 53 |
| 9:15 AM | 0 | 52 | 2 | 0 | 0 | 0 | 54 |
| 9:30 AM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 9:45 AM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 10:00 AM | 0 | 16 | 0 | 2 | 0 | 0 | 18 |
| 10:15 AM | 0 | 19 | 0 | 2 | 0 | 0 | 21 |
| 10:30 AM | 0 | 16 | 0 | 2 | 0 | 1 | 19 |
| 10:45 AM | 0 | 21 | 0 | 2 | 0 | 0 | 23 |
| 11:00 AM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 11:15 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 11:30 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 11:45 AM | 0 | 32 | 0 | 3 | 0 | 0 | 35 |
| 12:00 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 12:15 PM | 0 | 15 | 0 | 3 | 0 | 0 | 18 |
| 12:30 PM | 0 | 26 | 0 | 1 | 0 | 0 | 27 |
| 12:45 PM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 1:00 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 1:15 PM | 0 | 17 | 0 | 0 | 0 | 3 | 20 |
| 1:30 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 1:45 PM | 0 | 27 | 0 | 1 | 0 | 0 | 28 |
| 2:00 PM | 0 | 37 | 0 | 1 | 1 | 0 | 39 |
| 2:15 PM | 0 | 30 | 0 | 1 | 0 | 0 | 31 |
| 2:30 PM | 0 | 26 | 2 | 1 | 1 | 0 | 30 |
| 2:45 PM | 0 | 26 | 0 | 2 | 0 | 0 | 28 |
| 3:00 PM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 3:15 PM | 0 | 30 | 0 | 1 | 0 | 0 | 31 |
| 3:30 PM | 0 | 40 | 4 | 0 | 0 | 0 | 44 |
| 3:45 PM | 0 | 47 | 3 | 1 | 0 | 0 | 51 |
| 4:00 PM | 0 | 43 | 3 | 1 | 0 | 1 | 48 |
| 4:15 PM | 0 | 57 | 1 | 1 | 0 | 0 | 59 |
| 4:30 PM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 48 | 1 | 0 | 0 | 0 | 49 |
| 5:00 PM | 0 | 58 | 0 | 1 | 0 | 0 | 59 |
| 5:15 PM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| 5:30 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 5:45 PM | 0 | 31 | 0 | 2 | 0 | 0 | 33 |
| Total | 0 | 1452 | 34 | 30 | 2 | 7 | 1525 |
| Total % | 0.0 | 95.2 | 2.2 | 2.0 | 0.1 | 0.5 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 10:00 AM | 7:30 AM | 7:00 AM | 7:45 AM |
| AM Peaks | 0 | 231 | 11 | 8 | 0 | 2 | 236 |
| PM Times | 12:00 PM | 4:45 PM | 3:15 PM | 5:00 PM | 1:45 PM | 1:00 PM | 3:45 PM |
| PM Peaks | 0 | 189 | 10 | 3 | 2 | 3 | 200 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Caryndale Drive (Evenstone Avenue to Chapel Hill Drive)
Site Code: 230376
Start Date: 10/11/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Caryndale Drive (Evenstone Avenue to Stauffer Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 7:15 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 7:30 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 7:45 AM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 8:00 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 8:15 AM | 0 | 14 | 0 | 2 | 0 | 0 | 16 |
| 8:30 AM | 0 | 17 | 0 | 1 | 0 | 0 | 18 |
| 8:45 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 9:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 9:15 AM | 0 | 6 | 0 | 0 | 0 | 1 | 7 |
| 9:30 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 9:45 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 10:00 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 10:15 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 10:30 AM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 10:45 AM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 11:00 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 11:15 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 11:30 AM | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 11:45 AM | 0 | 6 | 0 | 1 | 0 | 0 | 7 |
| 12:00 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:15 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 12:30 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 12:45 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 1:00 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 1:15 PM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 1:30 PM | 0 | 11 | 0 | 1 | 0 | 1 | 13 |
| 1:45 PM | 1 | 7 | 0 | 1 | 0 | 0 | 9 |
| 2:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 2:15 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 2:30 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 2:45 PM | 0 | 4 | 1 | 0 | 0 | 0 | 5 |
| 3:00 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 3:15 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 3:30 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 3:45 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 4:00 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 4:15 PM | 0 | 17 | 1 | 0 | 0 | 0 | 18 |
| 4:30 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 5:00 PM | 0 | 19 | 0 | 1 | 0 | 0 | 20 |
| 5:15 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 5:30 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 5:45 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| Total | 1 | 420 | 3 | 7 | 0 | 2 | 433 |
| Total % | 0.2 | 97.0 | 0.7 | 1.6 | 0.0 | 0.5 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 7:45 AM | 7:00 AM | 8:30 AM | 7:45 AM |
| AM Peaks | 0 | 66 | 0 | 3 | 0 | 1 | 69 |
| PM Times | 1:00 PM | 4:15 PM | 2:30 PM | 1:30 PM | 12:00 PM | 1:00 PM | 4:15 PM |
| PM Peaks | 1 | 65 | 1 | 2 | 0 | 1 | 67 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Caryndale Drive (Evenstone Avenue to Stauffer Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Northbound)

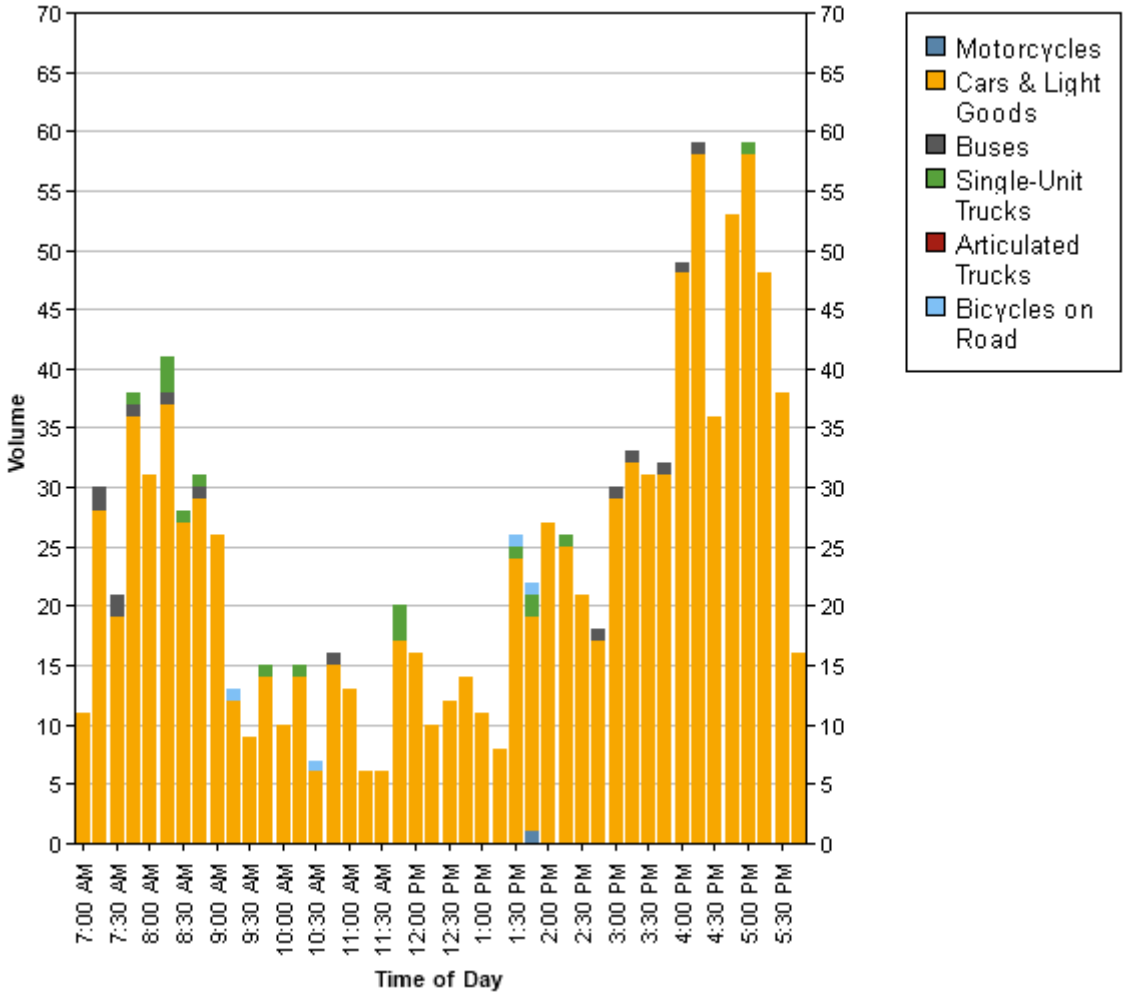
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 7:15 AM | 0 | 3 | 2 | 0 | 0 | 0 | 5 |
| 7:30 AM | 0 | 6 | 2 | 0 | 0 | 0 | 8 |
| 7:45 AM | 0 | 16 | 1 | 1 | 0 | 0 | 18 |
| 8:00 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 8:15 AM | 0 | 23 | 1 | 1 | 0 | 0 | 25 |
| 8:30 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 8:45 AM | 0 | 14 | 1 | 1 | 0 | 0 | 16 |
| 9:00 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 9:15 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 9:30 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 9:45 AM | 0 | 8 | 0 | 1 | 0 | 0 | 9 |
| 10:00 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 10:15 AM | 0 | 10 | 0 | 1 | 0 | 0 | 11 |
| 10:30 AM | 0 | 4 | 0 | 0 | 0 | 1 | 5 |
| 10:45 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 11:00 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:15 AM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 11:30 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 11:45 AM | 0 | 11 | 0 | 2 | 0 | 0 | 13 |
| 12:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:15 PM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 12:30 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 12:45 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 1:00 PM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 1:15 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 1:30 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 1:45 PM | 0 | 11 | 0 | 1 | 0 | 1 | 13 |
| 2:00 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 2:15 PM | 0 | 20 | 0 | 1 | 0 | 0 | 21 |
| 2:30 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 2:45 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 3:00 PM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 3:15 PM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 3:30 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 3:45 PM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 4:00 PM | 0 | 32 | 1 | 0 | 0 | 0 | 33 |
| 4:15 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 4:30 PM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 5:00 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 5:15 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 5:30 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 5:45 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| Total | 0 | 627 | 11 | 9 | 0 | 2 | 649 |
| Total % | 0.0 | 96.6 | 1.7 | 1.4 | 0.0 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 7:45 AM | 7:00 AM | 8:30 AM | 7:45 AM |
| AM Peaks | 0 | 65 | 5 | 2 | 0 | 0 | 69 |
| PM Times | 1:00 PM | 4:15 PM | 2:30 PM | 1:30 PM | 12:00 PM | 1:00 PM | 4:15 PM |
| PM Peaks | 0 | 140 | 2 | 2 | 0 | 1 | 140 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Caryndale Drive (Evenstone Avenue to Stauffer Drive)
Site Code: 230376
Start Date: 10/11/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Anvil Street to Tilt Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 27 | 5 | 1 | 0 | 0 | 33 |
| 7:15 AM | 0 | 28 | 4 | 0 | 0 | 0 | 32 |
| 7:30 AM | 0 | 44 | 9 | 2 | 0 | 0 | 55 |
| 7:45 AM | 0 | 55 | 3 | 0 | 0 | 0 | 58 |
| 8:00 AM | 0 | 85 | 4 | 1 | 0 | 0 | 90 |
| 8:15 AM | 0 | 61 | 5 | 0 | 0 | 0 | 66 |
| 8:30 AM | 0 | 72 | 3 | 1 | 0 | 0 | 76 |
| 8:45 AM | 0 | 66 | 2 | 0 | 0 | 0 | 68 |
| 9:00 AM | 0 | 56 | 3 | 1 | 0 | 0 | 60 |
| 9:15 AM | 0 | 41 | 3 | 0 | 0 | 0 | 44 |
| 9:30 AM | 0 | 43 | 2 | 1 | 0 | 1 | 47 |
| 9:45 AM | 0 | 44 | 0 | 2 | 0 | 0 | 46 |
| 10:00 AM | 0 | 40 | 1 | 1 | 0 | 0 | 42 |
| 10:15 AM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| 10:30 AM | 0 | 63 | 2 | 0 | 0 | 0 | 65 |
| 10:45 AM | 0 | 43 | 0 | 1 | 0 | 0 | 44 |
| 11:00 AM | 0 | 52 | 0 | 2 | 0 | 0 | 54 |
| 11:15 AM | 0 | 51 | 1 | 0 | 0 | 0 | 52 |
| 11:30 AM | 0 | 63 | 0 | 0 | 0 | 0 | 63 |
| 11:45 AM | 0 | 62 | 0 | 0 | 0 | 0 | 62 |
| 12:00 PM | 0 | 73 | 0 | 1 | 0 | 0 | 74 |
| 12:15 PM | 0 | 59 | 0 | 0 | 0 | 0 | 59 |
| 12:30 PM | 0 | 61 | 0 | 1 | 0 | 0 | 62 |
| 12:45 PM | 1 | 66 | 0 | 0 | 0 | 1 | 68 |
| 1:00 PM | 0 | 58 | 0 | 2 | 0 | 0 | 60 |
| 1:15 PM | 1 | 76 | 0 | 1 | 0 | 0 | 78 |
| 1:30 PM | 0 | 72 | 0 | 0 | 0 | 0 | 72 |
| 1:45 PM | 0 | 65 | 0 | 0 | 0 | 0 | 65 |
| 2:00 PM | 0 | 72 | 1 | 0 | 0 | 1 | 74 |
| 2:15 PM | 0 | 68 | 0 | 0 | 0 | 0 | 68 |
| 2:30 PM | 0 | 75 | 1 | 0 | 0 | 0 | 76 |
| 2:45 PM | 0 | 98 | 5 | 0 | 0 | 0 | 103 |
| 3:00 PM | 1 | 114 | 5 | 0 | 0 | 0 | 120 |
| 3:15 PM | 1 | 104 | 4 | 1 | 0 | 0 | 110 |
| 3:30 PM | 0 | 111 | 3 | 1 | 0 | 0 | 115 |
| 3:45 PM | 0 | 125 | 2 | 0 | 0 | 1 | 128 |
| 4:00 PM | 1 | 144 | 3 | 0 | 0 | 1 | 149 |
| 4:15 PM | 0 | 154 | 1 | 1 | 0 | 1 | 157 |
| 4:30 PM | 0 | 138 | 2 | 0 | 0 | 0 | 140 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 133 | 0 | 0 | 0 | 0 | 133 |
| 5:00 PM | 0 | 153 | 1 | 0 | 0 | 1 | 155 |
| 5:15 PM | 0 | 158 | 0 | 1 | 0 | 1 | 160 |
| 5:30 PM | 0 | 152 | 1 | 1 | 0 | 0 | 154 |
| 5:45 PM | 0 | 133 | 0 | 0 | 0 | 0 | 133 |
| Total | 5 | 3500 | 76 | 23 | 0 | 8 | 3612 |
| Total % | 0.1 | 96.9 | 2.1 | 0.6 | 0.0 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 9:15 AM | 7:00 AM | 8:45 AM | 7:30 AM |
| AM Peaks | 0 | 273 | 21 | 4 | 0 | 1 | 269 |
| PM Times | 12:45 PM | 5:00 PM | 2:45 PM | 1:00 PM | 12:00 PM | 4:45 PM | 5:00 PM |
| PM Peaks | 2 | 596 | 17 | 3 | 0 | 2 | 602 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Anvil Street to Tilt Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

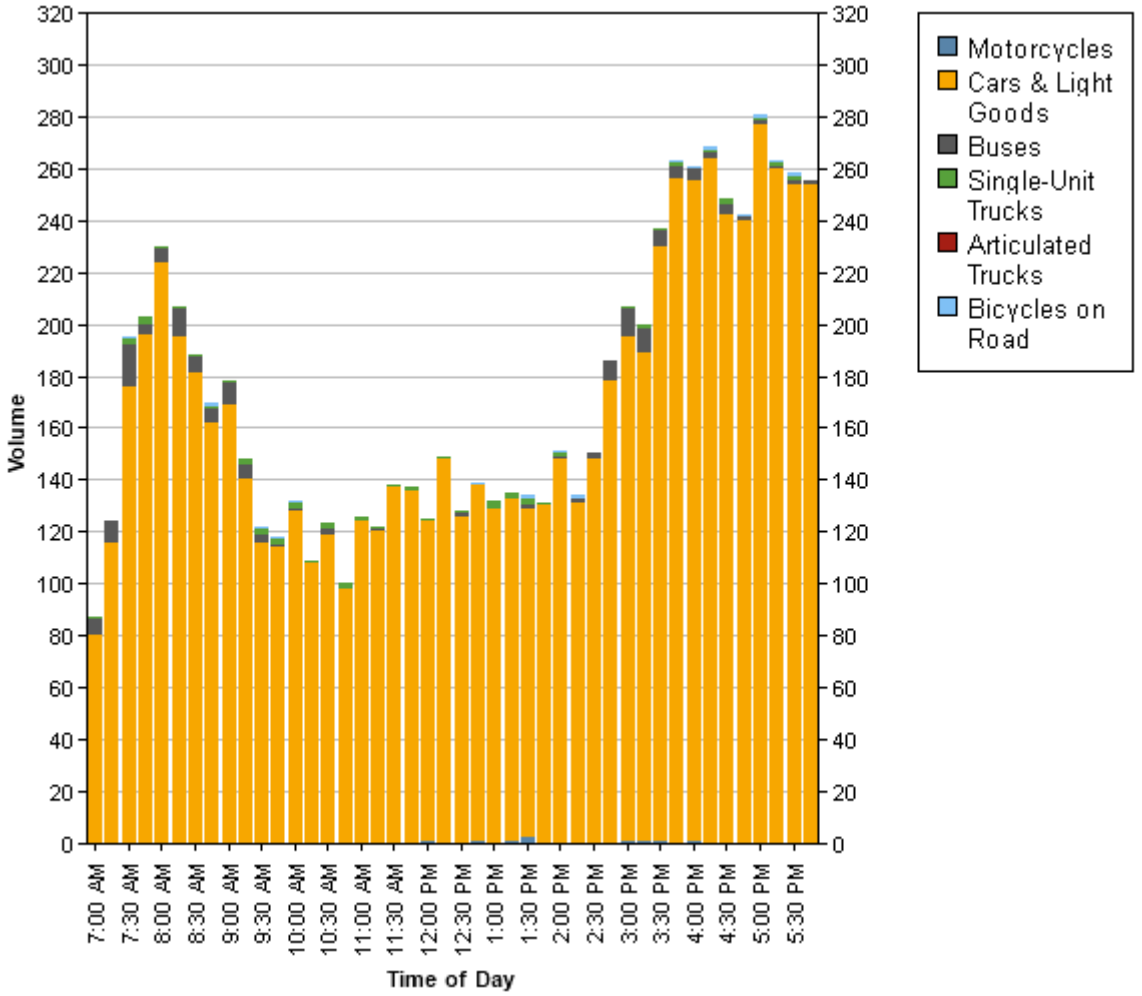
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 53 | 1 | 0 | 0 | 0 | 54 |
| 7:15 AM | 0 | 88 | 4 | 0 | 0 | 0 | 92 |
| 7:30 AM | 0 | 132 | 7 | 0 | 0 | 1 | 140 |
| 7:45 AM | 0 | 141 | 1 | 3 | 0 | 0 | 145 |
| 8:00 AM | 0 | 139 | 1 | 0 | 0 | 0 | 140 |
| 8:15 AM | 0 | 134 | 6 | 1 | 0 | 0 | 141 |
| 8:30 AM | 0 | 109 | 3 | 0 | 0 | 0 | 112 |
| 8:45 AM | 0 | 96 | 3 | 1 | 0 | 2 | 102 |
| 9:00 AM | 0 | 113 | 5 | 0 | 0 | 0 | 118 |
| 9:15 AM | 0 | 99 | 3 | 2 | 0 | 0 | 104 |
| 9:30 AM | 0 | 73 | 1 | 1 | 0 | 0 | 75 |
| 9:45 AM | 0 | 70 | 1 | 0 | 0 | 1 | 72 |
| 10:00 AM | 0 | 88 | 0 | 1 | 0 | 1 | 90 |
| 10:15 AM | 0 | 66 | 0 | 1 | 0 | 0 | 67 |
| 10:30 AM | 0 | 56 | 0 | 2 | 0 | 0 | 58 |
| 10:45 AM | 0 | 55 | 0 | 1 | 0 | 0 | 56 |
| 11:00 AM | 0 | 72 | 0 | 0 | 0 | 0 | 72 |
| 11:15 AM | 0 | 69 | 0 | 1 | 0 | 0 | 70 |
| 11:30 AM | 0 | 74 | 0 | 1 | 0 | 0 | 75 |
| 11:45 AM | 0 | 74 | 0 | 1 | 0 | 0 | 75 |
| 12:00 PM | 1 | 50 | 0 | 0 | 0 | 0 | 51 |
| 12:15 PM | 0 | 89 | 0 | 1 | 0 | 0 | 90 |
| 12:30 PM | 0 | 65 | 1 | 0 | 0 | 0 | 66 |
| 12:45 PM | 0 | 71 | 0 | 0 | 0 | 0 | 71 |
| 1:00 PM | 0 | 71 | 0 | 1 | 0 | 0 | 72 |
| 1:15 PM | 0 | 56 | 0 | 1 | 0 | 0 | 57 |
| 1:30 PM | 2 | 55 | 1 | 3 | 0 | 1 | 62 |
| 1:45 PM | 0 | 65 | 0 | 1 | 0 | 0 | 66 |
| 2:00 PM | 0 | 76 | 0 | 1 | 0 | 0 | 77 |
| 2:15 PM | 0 | 63 | 2 | 0 | 0 | 1 | 66 |
| 2:30 PM | 0 | 73 | 1 | 0 | 0 | 0 | 74 |
| 2:45 PM | 0 | 80 | 3 | 0 | 0 | 0 | 83 |
| 3:00 PM | 0 | 80 | 6 | 1 | 0 | 0 | 87 |
| 3:15 PM | 0 | 84 | 5 | 1 | 0 | 0 | 90 |
| 3:30 PM | 1 | 118 | 3 | 0 | 0 | 0 | 122 |
| 3:45 PM | 0 | 131 | 3 | 1 | 0 | 0 | 135 |
| 4:00 PM | 0 | 110 | 2 | 0 | 0 | 0 | 112 |
| 4:15 PM | 0 | 110 | 1 | 0 | 0 | 0 | 111 |
| 4:30 PM | 0 | 104 | 2 | 2 | 0 | 0 | 108 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 107 | 1 | 0 | 0 | 1 | 109 |
| 5:00 PM | 0 | 124 | 0 | 1 | 0 | 1 | 126 |
| 5:15 PM | 0 | 102 | 1 | 0 | 0 | 0 | 103 |
| 5:30 PM | 0 | 102 | 0 | 1 | 0 | 1 | 104 |
| 5:45 PM | 0 | 121 | 1 | 0 | 0 | 0 | 122 |
| Total | 4 | 3908 | 69 | 31 | 0 | 10 | 4022 |
| Total % | 0.1 | 97.2 | 1.7 | 0.8 | 0.0 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 9:15 AM | 7:00 AM | 8:45 AM | 7:30 AM |
| AM Peaks | 0 | 523 | 15 | 4 | 0 | 2 | 566 |
| PM Times | 12:45 PM | 5:00 PM | 2:45 PM | 1:00 PM | 12:00 PM | 4:45 PM | 5:00 PM |
| PM Peaks | 2 | 449 | 17 | 6 | 0 | 3 | 455 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Anvil Street to Tilt Drive)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Pine Valley Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 7:15 AM | 0 | 46 | 3 | 0 | 0 | 0 | 49 |
| 7:30 AM | 0 | 44 | 4 | 0 | 0 | 0 | 48 |
| 7:45 AM | 0 | 58 | 1 | 1 | 0 | 0 | 60 |
| 8:00 AM | 0 | 57 | 0 | 0 | 0 | 0 | 57 |
| 8:15 AM | 0 | 68 | 2 | 0 | 0 | 0 | 70 |
| 8:30 AM | 0 | 67 | 2 | 0 | 0 | 0 | 69 |
| 8:45 AM | 0 | 46 | 5 | 0 | 0 | 1 | 52 |
| 9:00 AM | 0 | 51 | 1 | 1 | 0 | 0 | 53 |
| 9:15 AM | 0 | 44 | 1 | 0 | 0 | 0 | 45 |
| 9:30 AM | 0 | 45 | 1 | 0 | 0 | 0 | 46 |
| 9:45 AM | 0 | 33 | 1 | 0 | 0 | 0 | 34 |
| 10:00 AM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| 10:15 AM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 10:30 AM | 0 | 25 | 0 | 1 | 0 | 0 | 26 |
| 10:45 AM | 0 | 26 | 0 | 1 | 0 | 0 | 27 |
| 11:00 AM | 0 | 37 | 0 | 0 | 0 | 0 | 37 |
| 11:15 AM | 0 | 37 | 0 | 1 | 0 | 0 | 38 |
| 11:30 AM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 11:45 AM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 12:00 PM | 1 | 16 | 0 | 1 | 0 | 0 | 18 |
| 12:15 PM | 0 | 44 | 0 | 1 | 0 | 0 | 45 |
| 12:30 PM | 0 | 38 | 1 | 0 | 0 | 0 | 39 |
| 12:45 PM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 1:00 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 1:15 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 1:30 PM | 2 | 22 | 0 | 1 | 0 | 0 | 25 |
| 1:45 PM | 0 | 43 | 0 | 0 | 0 | 0 | 43 |
| 2:00 PM | 0 | 35 | 0 | 0 | 0 | 1 | 36 |
| 2:15 PM | 0 | 46 | 1 | 0 | 0 | 0 | 47 |
| 2:30 PM | 0 | 43 | 1 | 0 | 0 | 0 | 44 |
| 2:45 PM | 0 | 53 | 2 | 0 | 0 | 0 | 55 |
| 3:00 PM | 0 | 44 | 7 | 0 | 0 | 0 | 51 |
| 3:15 PM | 0 | 63 | 4 | 0 | 0 | 0 | 67 |
| 3:30 PM | 1 | 49 | 0 | 0 | 0 | 0 | 50 |
| 3:45 PM | 0 | 69 | 3 | 0 | 0 | 0 | 72 |
| 4:00 PM | 0 | 60 | 2 | 0 | 0 | 1 | 63 |
| 4:15 PM | 0 | 64 | 1 | 0 | 0 | 0 | 65 |
| 4:30 PM | 0 | 52 | 3 | 0 | 0 | 0 | 55 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 70 | 0 | 0 | 0 | 0 | 70 |
| 5:00 PM | 1 | 73 | 0 | 0 | 0 | 0 | 74 |
| 5:15 PM | 0 | 78 | 1 | 0 | 0 | 0 | 79 |
| 5:30 PM | 0 | 60 | 0 | 1 | 0 | 0 | 61 |
| 5:45 PM | 0 | 79 | 1 | 0 | 0 | 0 | 80 |
| Total | 5 | 2047 | 48 | 9 | 0 | 3 | 2112 |
| Total % | 0.2 | 96.9 | 2.3 | 0.4 | 0.0 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 10:30 AM | 7:00 AM | 8:00 AM | 7:45 AM |
| AM Peaks | 0 | 250 | 7 | 3 | 0 | 1 | 256 |
| PM Times | 3:15 PM | 4:45 PM | 3:00 PM | 1:00 PM | 12:00 PM | 12:00 PM | 4:45 PM |
| PM Peaks | 1 | 281 | 14 | 1 | 0 | 0 | 284 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Pine Valley Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

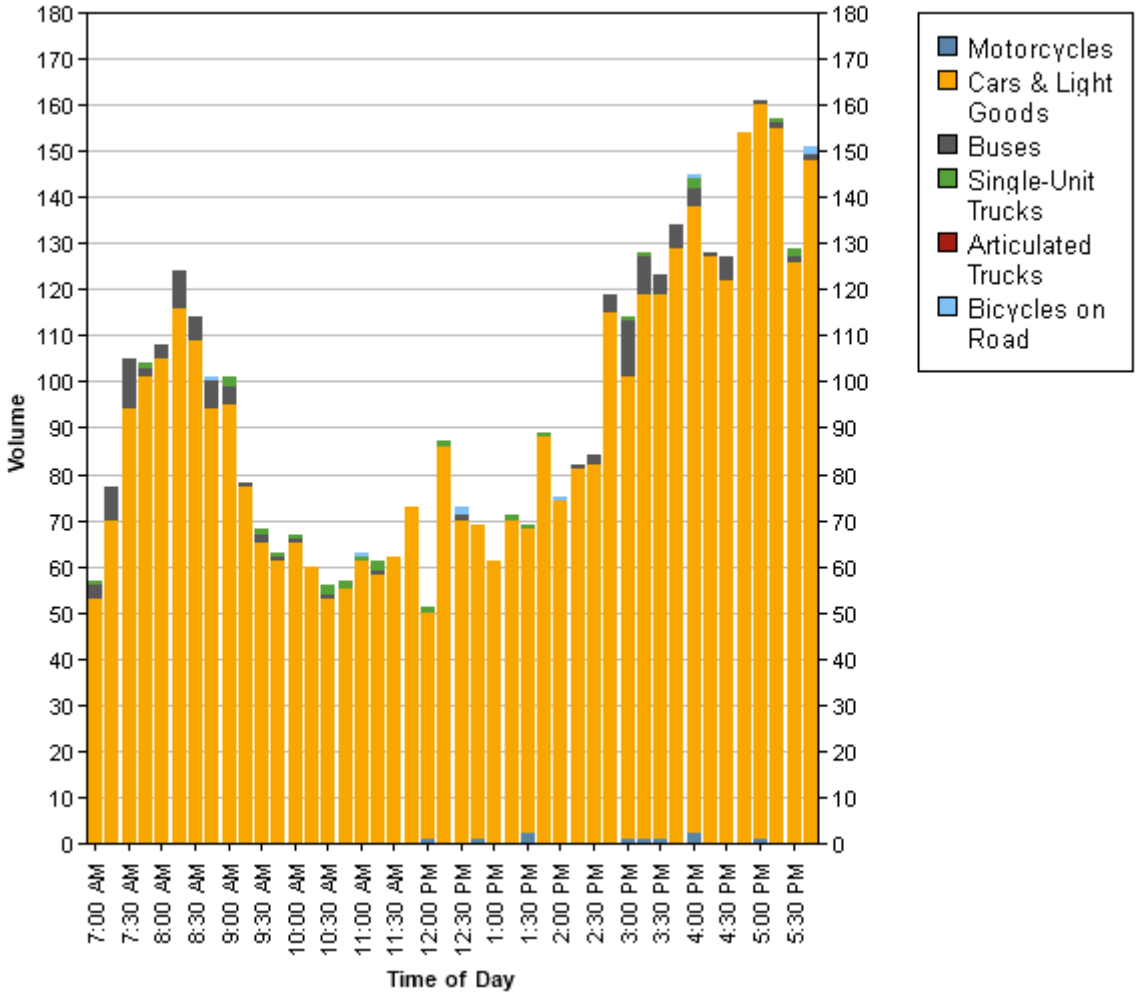
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 28 | 3 | 1 | 0 | 0 | 32 |
| 7:15 AM | 0 | 24 | 4 | 0 | 0 | 0 | 28 |
| 7:30 AM | 0 | 50 | 7 | 0 | 0 | 0 | 57 |
| 7:45 AM | 0 | 43 | 1 | 0 | 0 | 0 | 44 |
| 8:00 AM | 0 | 48 | 3 | 0 | 0 | 0 | 51 |
| 8:15 AM | 0 | 48 | 6 | 0 | 0 | 0 | 54 |
| 8:30 AM | 0 | 42 | 3 | 0 | 0 | 0 | 45 |
| 8:45 AM | 0 | 48 | 1 | 0 | 0 | 0 | 49 |
| 9:00 AM | 0 | 44 | 3 | 1 | 0 | 0 | 48 |
| 9:15 AM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 9:30 AM | 0 | 20 | 1 | 1 | 0 | 0 | 22 |
| 9:45 AM | 0 | 28 | 0 | 1 | 0 | 0 | 29 |
| 10:00 AM | 0 | 23 | 1 | 1 | 0 | 0 | 25 |
| 10:15 AM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 10:30 AM | 0 | 28 | 1 | 1 | 0 | 0 | 30 |
| 10:45 AM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 11:00 AM | 0 | 24 | 0 | 1 | 0 | 1 | 26 |
| 11:15 AM | 0 | 21 | 1 | 1 | 0 | 0 | 23 |
| 11:30 AM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 11:45 AM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 12:00 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 12:15 PM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| 12:30 PM | 0 | 32 | 0 | 0 | 0 | 2 | 34 |
| 12:45 PM | 1 | 36 | 0 | 0 | 0 | 0 | 37 |
| 1:00 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 1:15 PM | 0 | 41 | 0 | 1 | 0 | 0 | 42 |
| 1:30 PM | 0 | 44 | 0 | 0 | 0 | 0 | 44 |
| 1:45 PM | 0 | 45 | 0 | 1 | 0 | 0 | 46 |
| 2:00 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 2:15 PM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 2:30 PM | 0 | 39 | 1 | 0 | 0 | 0 | 40 |
| 2:45 PM | 0 | 62 | 2 | 0 | 0 | 0 | 64 |
| 3:00 PM | 1 | 56 | 5 | 1 | 0 | 0 | 63 |
| 3:15 PM | 1 | 55 | 4 | 1 | 0 | 0 | 61 |
| 3:30 PM | 0 | 69 | 4 | 0 | 0 | 0 | 73 |
| 3:45 PM | 0 | 60 | 2 | 0 | 0 | 0 | 62 |
| 4:00 PM | 2 | 76 | 2 | 2 | 0 | 0 | 82 |
| 4:15 PM | 0 | 63 | 0 | 0 | 0 | 0 | 63 |
| 4:30 PM | 0 | 70 | 2 | 0 | 0 | 0 | 72 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 84 | 0 | 0 | 0 | 0 | 84 |
| 5:00 PM | 0 | 86 | 1 | 0 | 0 | 0 | 87 |
| 5:15 PM | 0 | 77 | 0 | 1 | 0 | 0 | 78 |
| 5:30 PM | 0 | 66 | 1 | 1 | 0 | 0 | 68 |
| 5:45 PM | 0 | 69 | 0 | 0 | 0 | 2 | 71 |
| Total | 5 | 1982 | 59 | 17 | 0 | 5 | 2068 |
| Total % | 0.2 | 95.8 | 2.9 | 0.8 | 0.0 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 10:30 AM | 7:00 AM | 8:00 AM | 7:45 AM |
| AM Peaks | 0 | 181 | 17 | 4 | 0 | 0 | 194 |
| PM Times | 3:15 PM | 4:45 PM | 3:00 PM | 1:00 PM | 12:00 PM | 12:00 PM | 4:45 PM |
| PM Peaks | 3 | 313 | 15 | 2 | 0 | 2 | 317 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Pine Valley Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Tilt Drive to Apple Ridge Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 23 | 4 | 1 | 0 | 0 | 28 |
| 7:15 AM | 0 | 24 | 4 | 0 | 0 | 0 | 28 |
| 7:30 AM | 0 | 38 | 9 | 0 | 0 | 0 | 47 |
| 7:45 AM | 0 | 47 | 2 | 2 | 0 | 0 | 51 |
| 8:00 AM | 0 | 77 | 4 | 1 | 0 | 0 | 82 |
| 8:15 AM | 0 | 63 | 6 | 0 | 0 | 0 | 69 |
| 8:30 AM | 0 | 63 | 3 | 1 | 0 | 0 | 67 |
| 8:45 AM | 0 | 62 | 2 | 0 | 0 | 0 | 64 |
| 9:00 AM | 0 | 59 | 5 | 0 | 0 | 0 | 64 |
| 9:15 AM | 0 | 36 | 3 | 0 | 0 | 0 | 39 |
| 9:30 AM | 0 | 42 | 2 | 2 | 0 | 0 | 46 |
| 9:45 AM | 0 | 34 | 0 | 2 | 0 | 0 | 36 |
| 10:00 AM | 0 | 42 | 1 | 1 | 0 | 0 | 44 |
| 10:15 AM | 0 | 40 | 0 | 0 | 0 | 0 | 40 |
| 10:30 AM | 0 | 59 | 2 | 0 | 0 | 0 | 61 |
| 10:45 AM | 0 | 41 | 0 | 1 | 0 | 0 | 42 |
| 11:00 AM | 0 | 50 | 0 | 2 | 0 | 0 | 52 |
| 11:15 AM | 0 | 43 | 0 | 1 | 0 | 0 | 44 |
| 11:30 AM | 0 | 56 | 0 | 0 | 0 | 0 | 56 |
| 11:45 AM | 0 | 62 | 0 | 0 | 0 | 0 | 62 |
| 12:00 PM | 0 | 64 | 0 | 1 | 0 | 0 | 65 |
| 12:15 PM | 0 | 55 | 0 | 1 | 0 | 0 | 56 |
| 12:30 PM | 0 | 59 | 0 | 0 | 0 | 0 | 59 |
| 12:45 PM | 1 | 61 | 0 | 0 | 0 | 1 | 63 |
| 1:00 PM | 0 | 55 | 0 | 2 | 0 | 0 | 57 |
| 1:15 PM | 0 | 77 | 0 | 1 | 0 | 0 | 78 |
| 1:30 PM | 0 | 61 | 0 | 0 | 0 | 0 | 61 |
| 1:45 PM | 0 | 72 | 0 | 0 | 0 | 0 | 72 |
| 2:00 PM | 0 | 72 | 1 | 0 | 0 | 0 | 73 |
| 2:15 PM | 0 | 63 | 0 | 0 | 0 | 0 | 63 |
| 2:30 PM | 0 | 71 | 1 | 0 | 0 | 0 | 72 |
| 2:45 PM | 0 | 96 | 5 | 0 | 0 | 0 | 101 |
| 3:00 PM | 1 | 116 | 5 | 0 | 0 | 0 | 122 |
| 3:15 PM | 1 | 104 | 4 | 1 | 0 | 0 | 110 |
| 3:30 PM | 0 | 108 | 3 | 1 | 0 | 0 | 112 |
| 3:45 PM | 0 | 119 | 2 | 0 | 0 | 0 | 121 |
| 4:00 PM | 2 | 135 | 3 | 1 | 0 | 0 | 141 |
| 4:15 PM | 0 | 138 | 2 | 1 | 0 | 0 | 141 |
| 4:30 PM | 0 | 128 | 2 | 1 | 0 | 0 | 131 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 140 | 0 | 0 | 0 | 0 | 140 |
| 5:00 PM | 0 | 142 | 1 | 0 | 0 | 0 | 143 |
| 5:15 PM | 0 | 158 | 0 | 1 | 0 | 0 | 159 |
| 5:30 PM | 0 | 147 | 1 | 1 | 0 | 0 | 149 |
| 5:45 PM | 0 | 132 | 0 | 0 | 0 | 0 | 132 |
| Total | 5 | 3334 | 77 | 26 | 0 | 1 | 3443 |
| Total % | 0.1 | 96.8 | 2.2 | 0.8 | 0.0 | 0.0 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 9:15 AM | 7:00 AM | 7:00 AM | 7:45 AM |
| AM Peaks | 0 | 250 | 21 | 5 | 0 | 0 | 269 |
| PM Times | 3:15 PM | 5:00 PM | 2:45 PM | 12:15 PM | 2:45 PM | 12:00 PM | 5:00 PM |
| PM Peaks | 3 | 579 | 17 | 3 | 0 | 1 | 583 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Mills Drive (Tilt Drive to Apple Ridge Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 57 | 1 | 0 | 0 | 1 | 59 |
| 7:15 AM | 0 | 89 | 4 | 0 | 0 | 0 | 93 |
| 7:30 AM | 0 | 124 | 7 | 0 | 0 | 0 | 131 |
| 7:45 AM | 0 | 140 | 1 | 2 | 0 | 0 | 143 |
| 8:00 AM | 0 | 140 | 1 | 0 | 0 | 0 | 141 |
| 8:15 AM | 0 | 121 | 6 | 1 | 0 | 0 | 128 |
| 8:30 AM | 0 | 111 | 3 | 1 | 0 | 0 | 115 |
| 8:45 AM | 0 | 90 | 2 | 1 | 0 | 0 | 93 |
| 9:00 AM | 0 | 106 | 5 | 0 | 0 | 0 | 111 |
| 9:15 AM | 0 | 94 | 4 | 2 | 0 | 0 | 100 |
| 9:30 AM | 0 | 75 | 1 | 1 | 0 | 0 | 77 |
| 9:45 AM | 0 | 63 | 1 | 0 | 0 | 1 | 65 |
| 10:00 AM | 0 | 85 | 0 | 1 | 0 | 0 | 86 |
| 10:15 AM | 0 | 61 | 0 | 1 | 0 | 0 | 62 |
| 10:30 AM | 0 | 51 | 0 | 1 | 0 | 0 | 52 |
| 10:45 AM | 0 | 51 | 0 | 1 | 0 | 0 | 52 |
| 11:00 AM | 0 | 71 | 0 | 0 | 0 | 0 | 71 |
| 11:15 AM | 0 | 63 | 0 | 1 | 0 | 0 | 64 |
| 11:30 AM | 0 | 69 | 0 | 0 | 0 | 0 | 69 |
| 11:45 AM | 0 | 70 | 0 | 1 | 0 | 0 | 71 |
| 12:00 PM | 1 | 52 | 0 | 0 | 0 | 0 | 53 |
| 12:15 PM | 0 | 83 | 0 | 3 | 0 | 0 | 86 |
| 12:30 PM | 0 | 66 | 1 | 0 | 0 | 0 | 67 |
| 12:45 PM | 0 | 68 | 0 | 0 | 0 | 0 | 68 |
| 1:00 PM | 0 | 64 | 0 | 1 | 0 | 0 | 65 |
| 1:15 PM | 0 | 55 | 0 | 0 | 0 | 0 | 55 |
| 1:30 PM | 2 | 51 | 1 | 2 | 0 | 0 | 56 |
| 1:45 PM | 0 | 64 | 0 | 1 | 0 | 0 | 65 |
| 2:00 PM | 0 | 73 | 0 | 0 | 0 | 0 | 73 |
| 2:15 PM | 0 | 60 | 2 | 0 | 0 | 1 | 63 |
| 2:30 PM | 0 | 66 | 1 | 1 | 0 | 0 | 68 |
| 2:45 PM | 0 | 80 | 3 | 0 | 0 | 0 | 83 |
| 3:00 PM | 0 | 69 | 6 | 0 | 0 | 0 | 75 |
| 3:15 PM | 0 | 77 | 5 | 0 | 0 | 0 | 82 |
| 3:30 PM | 1 | 120 | 3 | 0 | 1 | 0 | 125 |
| 3:45 PM | 0 | 122 | 3 | 1 | 0 | 0 | 126 |
| 4:00 PM | 0 | 103 | 2 | 0 | 0 | 0 | 105 |
| 4:15 PM | 0 | 106 | 1 | 0 | 0 | 0 | 107 |
| 4:30 PM | 0 | 97 | 2 | 1 | 0 | 0 | 100 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 105 | 1 | 0 | 0 | 0 | 106 |
| 5:00 PM | 1 | 118 | 0 | 1 | 0 | 0 | 120 |
| 5:15 PM | 0 | 91 | 1 | 0 | 0 | 0 | 92 |
| 5:30 PM | 0 | 98 | 0 | 1 | 0 | 1 | 100 |
| 5:45 PM | 0 | 122 | 1 | 0 | 0 | 0 | 123 |
| Total | 5 | 3741 | 69 | 26 | 1 | 4 | 3846 |
| Total % | 0.1 | 97.3 | 1.8 | 0.7 | 0.0 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 9:15 AM | 7:00 AM | 7:00 AM | 7:45 AM |
| AM Peaks | 0 | 512 | 15 | 4 | 0 | 1 | 527 |
| PM Times | 3:15 PM | 5:00 PM | 2:45 PM | 12:15 PM | 2:45 PM | 12:00 PM | 5:00 PM |
| PM Peaks | 1 | 429 | 17 | 4 | 1 | 0 | 435 |

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Site Code: 230376
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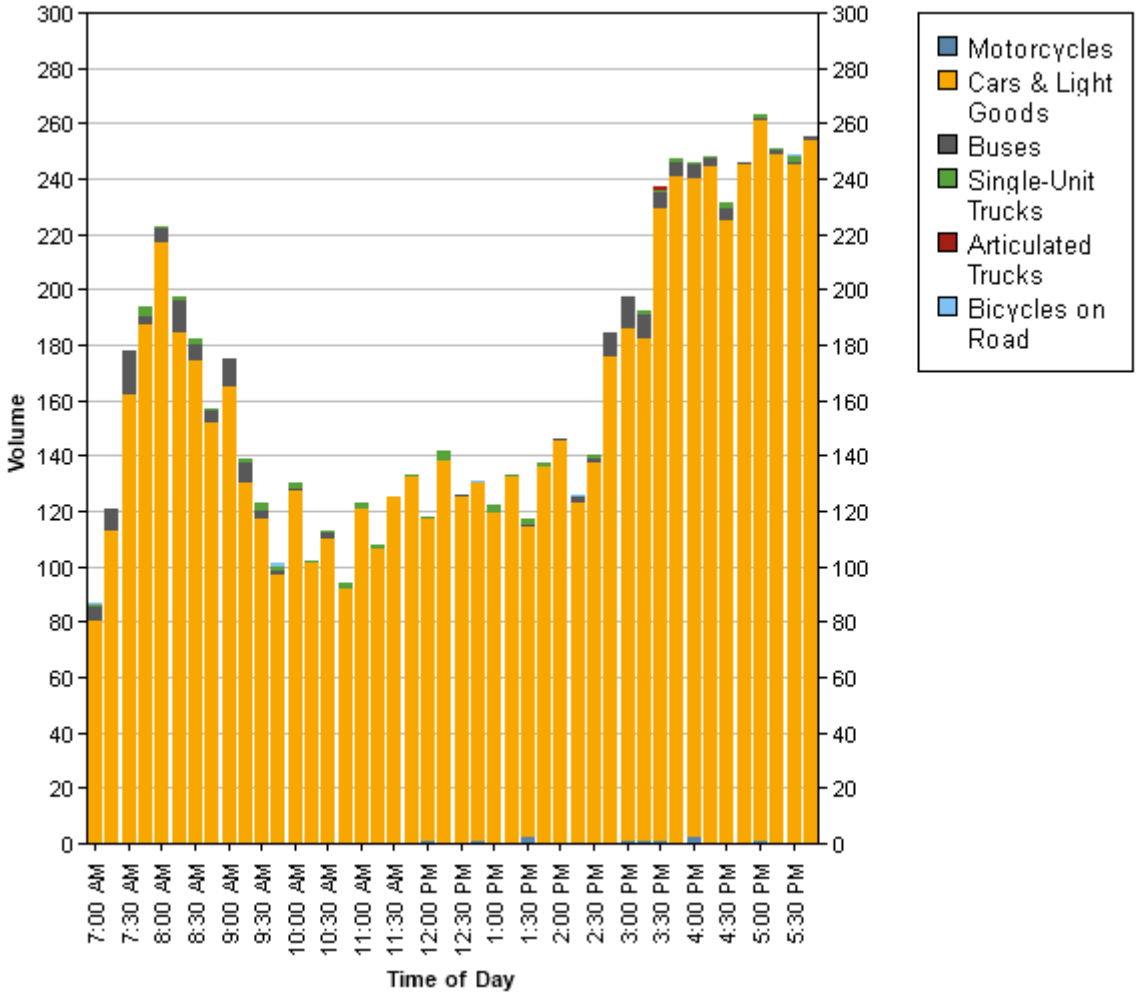

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Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Doon Mills Drive to Forest Edge Trail)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 7:15 AM | 0 | 9 | 3 | 0 | 0 | 0 | 12 |
| 7:30 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 7:45 AM | 0 | 14 | 1 | 2 | 0 | 0 | 17 |
| 8:00 AM | 0 | 22 | 0 | 1 | 0 | 0 | 23 |
| 8:15 AM | 0 | 28 | 1 | 0 | 0 | 0 | 29 |
| 8:30 AM | 0 | 39 | 6 | 0 | 0 | 0 | 45 |
| 8:45 AM | 0 | 26 | 1 | 0 | 0 | 0 | 27 |
| 9:00 AM | 0 | 19 | 2 | 1 | 0 | 0 | 22 |
| 9:15 AM | 0 | 32 | 1 | 0 | 0 | 0 | 33 |
| 9:30 AM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 9:45 AM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 10:00 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 10:15 AM | 0 | 15 | 0 | 2 | 0 | 0 | 17 |
| 10:30 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 10:45 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 11:00 AM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 11:15 AM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 11:30 AM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 11:45 AM | 0 | 30 | 0 | 1 | 0 | 0 | 31 |
| 12:00 PM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 12:15 PM | 1 | 22 | 0 | 0 | 0 | 0 | 23 |
| 12:30 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 12:45 PM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 1:00 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 1:15 PM | 2 | 23 | 0 | 0 | 1 | 0 | 26 |
| 1:30 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 1:45 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 2:00 PM | 0 | 29 | 0 | 0 | 0 | 1 | 30 |
| 2:15 PM | 0 | 27 | 1 | 0 | 0 | 0 | 28 |
| 2:30 PM | 0 | 35 | 1 | 0 | 0 | 1 | 37 |
| 2:45 PM | 0 | 42 | 3 | 0 | 0 | 0 | 45 |
| 3:00 PM | 0 | 50 | 5 | 0 | 0 | 0 | 55 |
| 3:15 PM | 0 | 33 | 2 | 0 | 0 | 0 | 35 |
| 3:30 PM | 1 | 42 | 2 | 0 | 0 | 0 | 45 |
| 3:45 PM | 0 | 52 | 2 | 0 | 0 | 1 | 55 |
| 4:00 PM | 0 | 59 | 2 | 0 | 0 | 1 | 62 |
| 4:15 PM | 1 | 46 | 2 | 0 | 0 | 0 | 49 |
| 4:30 PM | 0 | 60 | 0 | 0 | 0 | 0 | 60 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 61 | 1 | 0 | 0 | 0 | 62 |
| 5:00 PM | 0 | 69 | 0 | 0 | 0 | 0 | 69 |
| 5:15 PM | 0 | 68 | 1 | 0 | 0 | 0 | 69 |
| 5:30 PM | 0 | 57 | 0 | 0 | 0 | 0 | 57 |
| 5:45 PM | 0 | 57 | 1 | 0 | 0 | 0 | 58 |
| Total | 5 | 1386 | 40 | 8 | 1 | 4 | 1444 |
| Total % | 0.3 | 96.0 | 2.8 | 0.6 | 0.1 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 8:15 AM | 7:15 AM | 7:00 AM | 7:15 AM | 7:45 AM |
| AM Peaks | 0 | 77 | 10 | 3 | 0 | 0 | 114 |
| PM Times | 12:30 PM | 4:30 PM | 2:45 PM | 1:15 PM | 12:30 PM | 1:45 PM | 4:30 PM |
| PM Peaks | 2 | 258 | 12 | 0 | 1 | 2 | 260 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Doon Mills Drive to Forest Edge Trail)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

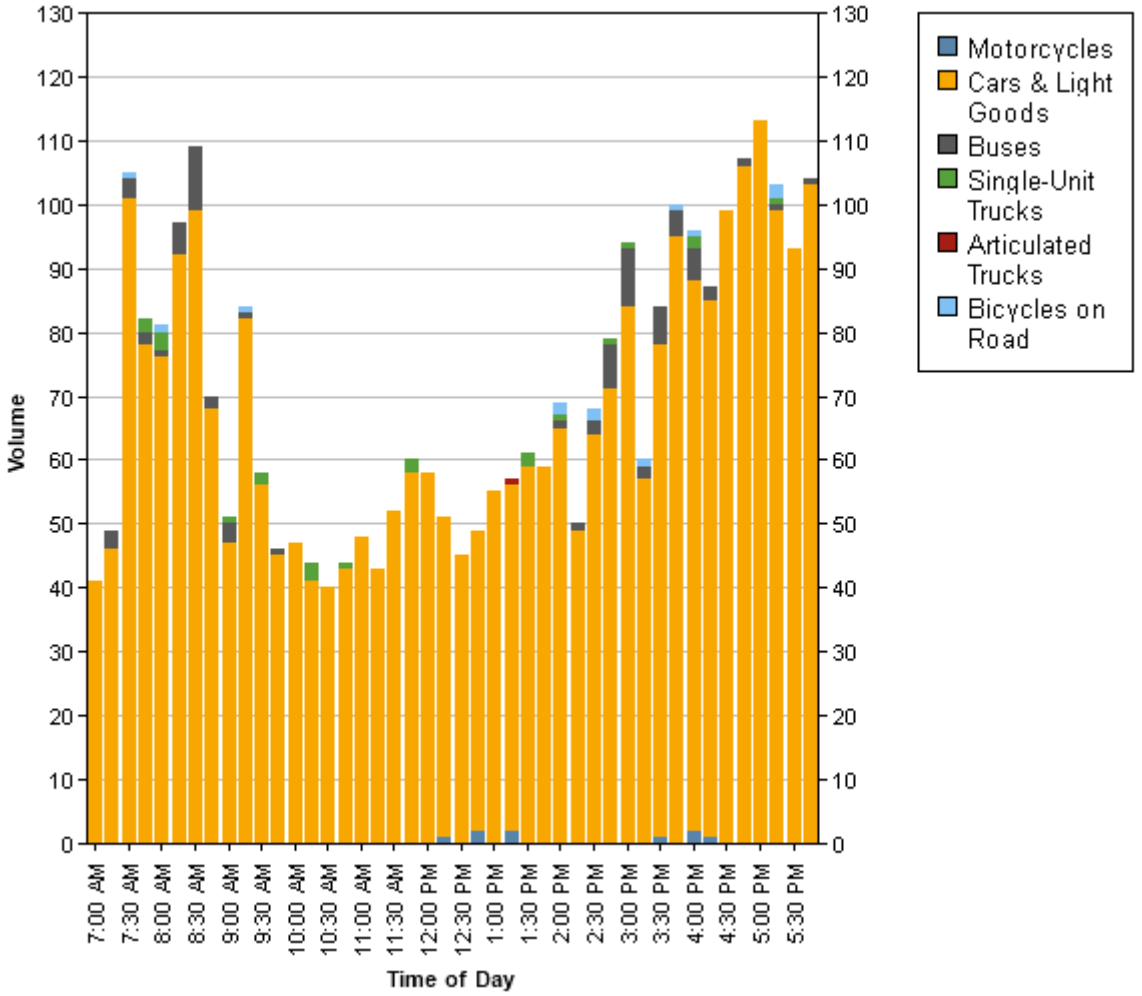
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 7:15 AM | 0 | 37 | 0 | 0 | 0 | 0 | 37 |
| 7:30 AM | 0 | 88 | 2 | 0 | 0 | 1 | 91 |
| 7:45 AM | 0 | 64 | 1 | 0 | 0 | 0 | 65 |
| 8:00 AM | 0 | 54 | 1 | 2 | 0 | 1 | 58 |
| 8:15 AM | 0 | 64 | 4 | 0 | 0 | 0 | 68 |
| 8:30 AM | 0 | 60 | 4 | 0 | 0 | 0 | 64 |
| 8:45 AM | 0 | 42 | 1 | 0 | 0 | 0 | 43 |
| 9:00 AM | 0 | 28 | 1 | 0 | 0 | 0 | 29 |
| 9:15 AM | 0 | 50 | 0 | 0 | 0 | 1 | 51 |
| 9:30 AM | 0 | 27 | 0 | 1 | 0 | 0 | 28 |
| 9:45 AM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 10:00 AM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 10:15 AM | 0 | 26 | 0 | 1 | 0 | 0 | 27 |
| 10:30 AM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 10:45 AM | 0 | 30 | 0 | 1 | 0 | 0 | 31 |
| 11:00 AM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 11:15 AM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 11:30 AM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 11:45 AM | 0 | 28 | 0 | 1 | 0 | 0 | 29 |
| 12:00 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 12:15 PM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 12:30 PM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 12:45 PM | 2 | 24 | 0 | 0 | 0 | 0 | 26 |
| 1:00 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 1:15 PM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 1:30 PM | 0 | 35 | 0 | 2 | 0 | 0 | 37 |
| 1:45 PM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 2:00 PM | 0 | 36 | 1 | 1 | 0 | 1 | 39 |
| 2:15 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 2:30 PM | 0 | 29 | 1 | 0 | 0 | 1 | 31 |
| 2:45 PM | 0 | 29 | 4 | 1 | 0 | 0 | 34 |
| 3:00 PM | 0 | 34 | 4 | 1 | 0 | 0 | 39 |
| 3:15 PM | 0 | 24 | 0 | 0 | 0 | 1 | 25 |
| 3:30 PM | 0 | 35 | 4 | 0 | 0 | 0 | 39 |
| 3:45 PM | 0 | 43 | 2 | 0 | 0 | 0 | 45 |
| 4:00 PM | 2 | 27 | 3 | 2 | 0 | 0 | 34 |
| 4:15 PM | 0 | 38 | 0 | 0 | 0 | 0 | 38 |
| 4:30 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 45 | 0 | 0 | 0 | 0 | 45 |
| 5:00 PM | 0 | 44 | 0 | 0 | 0 | 0 | 44 |
| 5:15 PM | 0 | 31 | 0 | 1 | 0 | 2 | 34 |
| 5:30 PM | 0 | 36 | 0 | 0 | 0 | 0 | 36 |
| 5:45 PM | 0 | 46 | 0 | 0 | 0 | 0 | 46 |
| Total | 4 | 1589 | 33 | 14 | 0 | 8 | 1648 |
| Total % | 0.2 | 96.4 | 2.0 | 0.8 | 0.0 | 0.5 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 8:15 AM | 7:15 AM | 7:00 AM | 7:15 AM | 7:45 AM |
| AM Peaks | 0 | 270 | 10 | 2 | 0 | 2 | 255 |
| PM Times | 12:30 PM | 4:30 PM | 2:45 PM | 1:15 PM | 12:30 PM | 1:45 PM | 4:30 PM |
| PM Peaks | 2 | 159 | 12 | 3 | 0 | 2 | 162 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Doon Mills Drive to Forest Edge Trail)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Doon South Drive to Robert Ferrie Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 13 | 1 | 1 | 0 | 0 | 15 |
| 7:15 AM | 0 | 19 | 2 | 0 | 0 | 0 | 21 |
| 7:30 AM | 0 | 22 | 8 | 0 | 0 | 0 | 30 |
| 7:45 AM | 0 | 31 | 1 | 0 | 0 | 0 | 32 |
| 8:00 AM | 0 | 28 | 2 | 1 | 0 | 0 | 31 |
| 8:15 AM | 0 | 40 | 2 | 0 | 0 | 0 | 42 |
| 8:30 AM | 0 | 38 | 7 | 0 | 0 | 0 | 45 |
| 8:45 AM | 0 | 41 | 1 | 0 | 0 | 0 | 42 |
| 9:00 AM | 0 | 30 | 4 | 0 | 0 | 0 | 34 |
| 9:15 AM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 9:30 AM | 0 | 33 | 0 | 2 | 0 | 0 | 35 |
| 9:45 AM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 10:00 AM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 10:15 AM | 0 | 22 | 0 | 2 | 0 | 0 | 24 |
| 10:30 AM | 0 | 26 | 1 | 1 | 0 | 0 | 28 |
| 10:45 AM | 0 | 24 | 0 | 1 | 0 | 0 | 25 |
| 11:00 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 11:15 AM | 0 | 25 | 1 | 1 | 0 | 0 | 27 |
| 11:30 AM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 11:45 AM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 12:00 PM | 0 | 43 | 0 | 0 | 0 | 0 | 43 |
| 12:15 PM | 1 | 31 | 0 | 0 | 0 | 0 | 32 |
| 12:30 PM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 12:45 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 1:00 PM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 1:15 PM | 2 | 32 | 0 | 0 | 1 | 0 | 35 |
| 1:30 PM | 0 | 42 | 0 | 0 | 0 | 1 | 43 |
| 1:45 PM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| 2:00 PM | 0 | 43 | 0 | 0 | 0 | 1 | 44 |
| 2:15 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 2:30 PM | 0 | 43 | 0 | 0 | 0 | 1 | 44 |
| 2:45 PM | 0 | 65 | 3 | 0 | 0 | 0 | 68 |
| 3:00 PM | 0 | 62 | 4 | 0 | 0 | 0 | 66 |
| 3:15 PM | 1 | 63 | 3 | 1 | 0 | 0 | 68 |
| 3:30 PM | 0 | 70 | 4 | 0 | 0 | 0 | 74 |
| 3:45 PM | 0 | 70 | 1 | 0 | 0 | 1 | 72 |
| 4:00 PM | 0 | 86 | 2 | 0 | 0 | 0 | 88 |
| 4:15 PM | 1 | 65 | 1 | 0 | 0 | 0 | 67 |
| 4:30 PM | 0 | 84 | 1 | 0 | 0 | 0 | 85 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 94 | 0 | 0 | 0 | 0 | 94 |
| 5:00 PM | 0 | 110 | 0 | 0 | 0 | 0 | 110 |
| 5:15 PM | 0 | 97 | 0 | 0 | 0 | 0 | 97 |
| 5:30 PM | 0 | 81 | 0 | 1 | 0 | 0 | 82 |
| 5:45 PM | 0 | 79 | 0 | 0 | 0 | 0 | 79 |
| Total | 5 | 2012 | 49 | 11 | 1 | 4 | 2082 |
| Total % | 0.2 | 96.6 | 2.4 | 0.5 | 0.0 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 8:15 AM | 10:00 AM | 7:00 AM | 7:15 AM | 7:45 AM |
| AM Peaks | 0 | 137 | 14 | 4 | 0 | 0 | 150 |
| PM Times | 12:45 PM | 4:45 PM | 2:45 PM | 1:15 PM | 12:30 PM | 1:15 PM | 4:45 PM |
| PM Peaks | 2 | 382 | 14 | 0 | 1 | 2 | 383 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Doon South Drive to Robert Ferrie Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

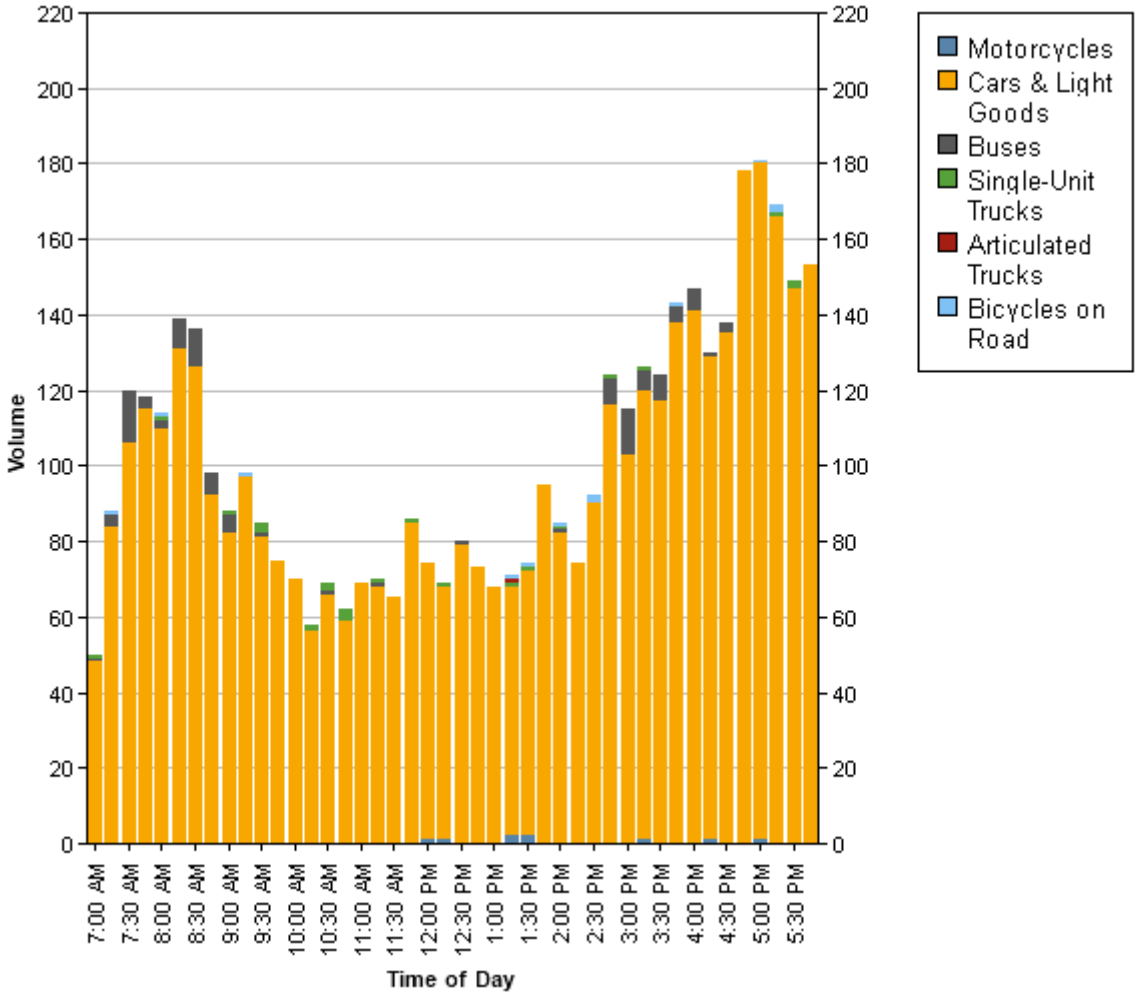
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 7:15 AM | 0 | 65 | 1 | 0 | 0 | 1 | 67 |
| 7:30 AM | 0 | 84 | 6 | 0 | 0 | 0 | 90 |
| 7:45 AM | 0 | 84 | 2 | 0 | 0 | 0 | 86 |
| 8:00 AM | 0 | 82 | 0 | 0 | 0 | 1 | 83 |
| 8:15 AM | 0 | 91 | 6 | 0 | 0 | 0 | 97 |
| 8:30 AM | 0 | 88 | 3 | 0 | 0 | 0 | 91 |
| 8:45 AM | 0 | 51 | 5 | 0 | 0 | 0 | 56 |
| 9:00 AM | 0 | 52 | 1 | 1 | 0 | 0 | 54 |
| 9:15 AM | 0 | 63 | 0 | 0 | 0 | 1 | 64 |
| 9:30 AM | 0 | 48 | 1 | 1 | 0 | 0 | 50 |
| 9:45 AM | 0 | 49 | 0 | 0 | 0 | 0 | 49 |
| 10:00 AM | 0 | 47 | 0 | 0 | 0 | 0 | 47 |
| 10:15 AM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 10:30 AM | 0 | 40 | 0 | 1 | 0 | 0 | 41 |
| 10:45 AM | 0 | 35 | 0 | 2 | 0 | 0 | 37 |
| 11:00 AM | 0 | 44 | 0 | 0 | 0 | 0 | 44 |
| 11:15 AM | 0 | 43 | 0 | 0 | 0 | 0 | 43 |
| 11:30 AM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 11:45 AM | 0 | 46 | 0 | 1 | 0 | 0 | 47 |
| 12:00 PM | 1 | 30 | 0 | 0 | 0 | 0 | 31 |
| 12:15 PM | 0 | 36 | 0 | 1 | 0 | 0 | 37 |
| 12:30 PM | 0 | 44 | 1 | 0 | 0 | 0 | 45 |
| 12:45 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 1:00 PM | 0 | 37 | 0 | 0 | 0 | 0 | 37 |
| 1:15 PM | 0 | 34 | 0 | 1 | 0 | 1 | 36 |
| 1:30 PM | 2 | 28 | 0 | 1 | 0 | 0 | 31 |
| 1:45 PM | 0 | 53 | 0 | 0 | 0 | 0 | 53 |
| 2:00 PM | 0 | 39 | 1 | 1 | 0 | 0 | 41 |
| 2:15 PM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 2:30 PM | 0 | 47 | 0 | 0 | 0 | 1 | 48 |
| 2:45 PM | 0 | 51 | 4 | 1 | 0 | 0 | 56 |
| 3:00 PM | 0 | 41 | 8 | 0 | 0 | 0 | 49 |
| 3:15 PM | 0 | 56 | 2 | 0 | 0 | 0 | 58 |
| 3:30 PM | 0 | 47 | 3 | 0 | 0 | 0 | 50 |
| 3:45 PM | 0 | 68 | 3 | 0 | 0 | 0 | 71 |
| 4:00 PM | 0 | 55 | 4 | 0 | 0 | 0 | 59 |
| 4:15 PM | 0 | 63 | 0 | 0 | 0 | 0 | 63 |
| 4:30 PM | 0 | 51 | 2 | 0 | 0 | 0 | 53 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 84 | 0 | 0 | 0 | 0 | 84 |
| 5:00 PM | 1 | 69 | 0 | 0 | 0 | 1 | 71 |
| 5:15 PM | 0 | 69 | 0 | 1 | 0 | 2 | 72 |
| 5:30 PM | 0 | 66 | 0 | 1 | 0 | 0 | 67 |
| 5:45 PM | 0 | 74 | 0 | 0 | 0 | 0 | 74 |
| Total | 4 | 2330 | 53 | 13 | 0 | 8 | 2408 |
| Total % | 0.2 | 96.8 | 2.2 | 0.5 | 0.0 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 8:15 AM | 10:00 AM | 7:00 AM | 7:15 AM | 7:45 AM |
| AM Peaks | 0 | 345 | 15 | 3 | 0 | 2 | 357 |
| PM Times | 12:45 PM | 4:45 PM | 2:45 PM | 1:15 PM | 12:30 PM | 1:15 PM | 4:45 PM |
| PM Peaks | 2 | 288 | 17 | 3 | 0 | 1 | 294 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Doon South Drive to Robert Ferrie Drive)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Homer Watson Boulevard to Doon Village Road)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 7:15 AM | 0 | 10 | 2 | 0 | 0 | 0 | 12 |
| 7:30 AM | 0 | 18 | 2 | 0 | 0 | 0 | 20 |
| 7:45 AM | 0 | 22 | 1 | 1 | 0 | 0 | 24 |
| 8:00 AM | 0 | 51 | 0 | 1 | 0 | 0 | 52 |
| 8:15 AM | 0 | 60 | 3 | 0 | 0 | 0 | 63 |
| 8:30 AM | 0 | 40 | 3 | 0 | 0 | 0 | 43 |
| 8:45 AM | 0 | 31 | 2 | 0 | 0 | 0 | 33 |
| 9:00 AM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 9:15 AM | 0 | 47 | 1 | 1 | 0 | 0 | 49 |
| 9:30 AM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 9:45 AM | 0 | 32 | 1 | 0 | 0 | 0 | 33 |
| 10:00 AM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 10:15 AM | 0 | 34 | 0 | 2 | 0 | 0 | 36 |
| 10:30 AM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 10:45 AM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 11:00 AM | 0 | 26 | 0 | 1 | 0 | 0 | 27 |
| 11:15 AM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 11:30 AM | 0 | 47 | 0 | 0 | 0 | 0 | 47 |
| 11:45 AM | 0 | 48 | 0 | 1 | 0 | 0 | 49 |
| 12:00 PM | 1 | 45 | 0 | 0 | 0 | 0 | 46 |
| 12:15 PM | 1 | 49 | 0 | 0 | 0 | 0 | 50 |
| 12:30 PM | 0 | 45 | 0 | 0 | 0 | 0 | 45 |
| 12:45 PM | 0 | 37 | 0 | 1 | 0 | 0 | 38 |
| 1:00 PM | 0 | 55 | 0 | 1 | 0 | 0 | 56 |
| 1:15 PM | 0 | 46 | 0 | 0 | 0 | 0 | 46 |
| 1:30 PM | 0 | 38 | 0 | 0 | 0 | 0 | 38 |
| 1:45 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 2:00 PM | 0 | 42 | 0 | 0 | 0 | 1 | 43 |
| 2:15 PM | 0 | 46 | 1 | 1 | 0 | 0 | 48 |
| 2:30 PM | 0 | 50 | 0 | 0 | 0 | 0 | 50 |
| 2:45 PM | 0 | 79 | 4 | 0 | 0 | 0 | 83 |
| 3:00 PM | 0 | 67 | 2 | 1 | 0 | 0 | 70 |
| 3:15 PM | 0 | 81 | 3 | 0 | 0 | 0 | 84 |
| 3:30 PM | 0 | 77 | 2 | 0 | 0 | 0 | 79 |
| 3:45 PM | 0 | 78 | 2 | 0 | 0 | 0 | 80 |
| 4:00 PM | 1 | 95 | 1 | 0 | 0 | 0 | 97 |
| 4:15 PM | 0 | 86 | 2 | 0 | 0 | 0 | 88 |
| 4:30 PM | 0 | 95 | 0 | 0 | 0 | 0 | 95 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 96 | 1 | 0 | 0 | 0 | 97 |
| 5:00 PM | 0 | 115 | 0 | 0 | 0 | 0 | 115 |
| 5:15 PM | 0 | 96 | 1 | 0 | 0 | 0 | 97 |
| 5:30 PM | 1 | 92 | 0 | 0 | 0 | 0 | 93 |
| 5:45 PM | 0 | 104 | 1 | 0 | 0 | 0 | 105 |
| Total | 4 | 2298 | 35 | 13 | 0 | 1 | 2351 |
| Total % | 0.2 | 97.7 | 1.5 | 0.6 | 0.0 | 0.0 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 9:00 AM | 7:00 AM | 10:45 AM | 7:45 AM |
| AM Peaks | 0 | 173 | 6 | 3 | 0 | 0 | 182 |
| PM Times | 12:00 PM | 4:15 PM | 2:45 PM | 12:45 PM | 12:00 PM | 1:45 PM | 5:00 PM |
| PM Peaks | 2 | 392 | 11 | 2 | 0 | 1 | 410 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Homer Watson Boulevard to Doon Village Road)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

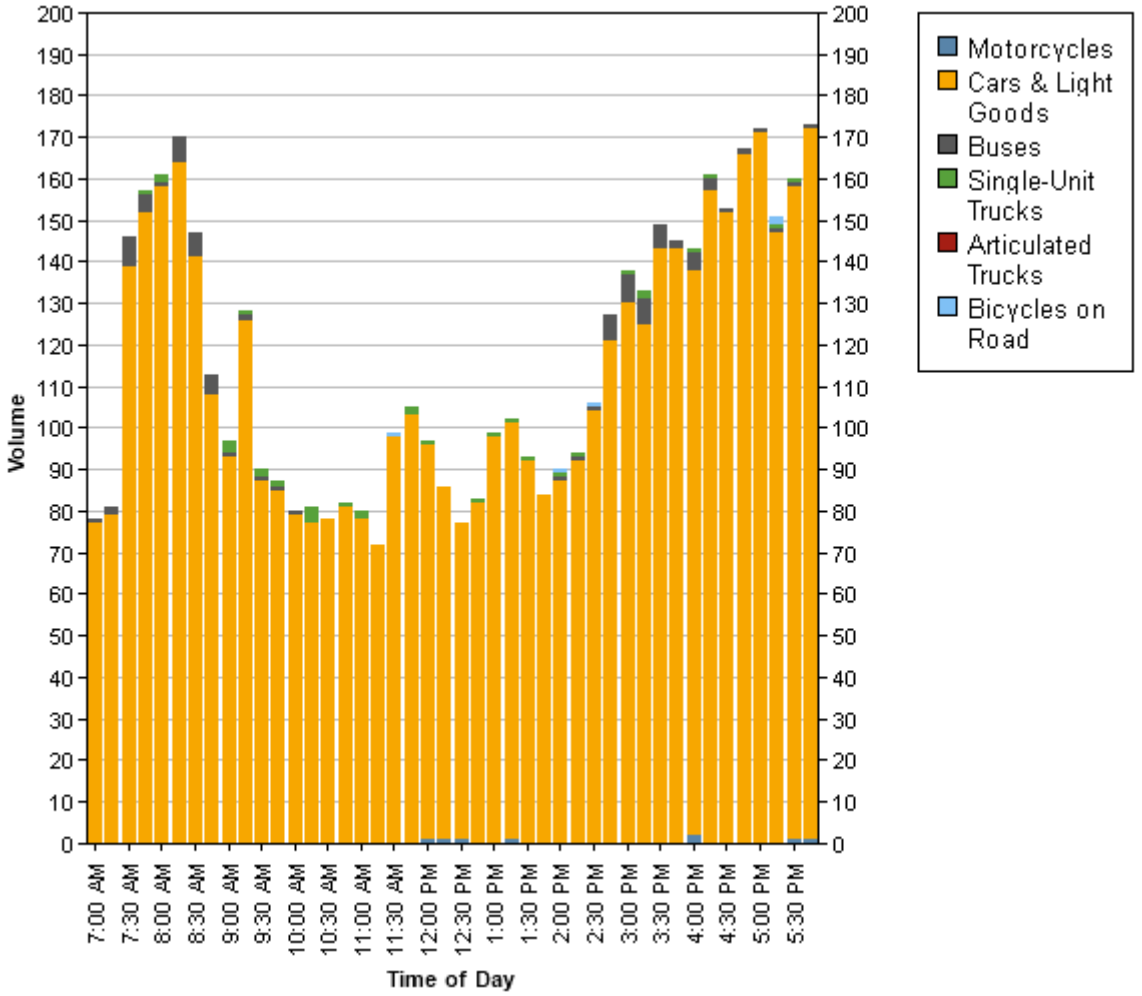
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 67 | 1 | 0 | 0 | 0 | 68 |
| 7:15 AM | 0 | 69 | 0 | 0 | 0 | 0 | 69 |
| 7:30 AM | 0 | 121 | 5 | 0 | 0 | 0 | 126 |
| 7:45 AM | 0 | 130 | 3 | 0 | 0 | 0 | 133 |
| 8:00 AM | 0 | 107 | 1 | 1 | 0 | 0 | 109 |
| 8:15 AM | 0 | 104 | 3 | 0 | 0 | 0 | 107 |
| 8:30 AM | 0 | 101 | 3 | 0 | 0 | 0 | 104 |
| 8:45 AM | 0 | 77 | 3 | 0 | 0 | 0 | 80 |
| 9:00 AM | 0 | 64 | 1 | 2 | 0 | 0 | 67 |
| 9:15 AM | 0 | 79 | 0 | 0 | 0 | 0 | 79 |
| 9:30 AM | 0 | 58 | 1 | 1 | 0 | 0 | 60 |
| 9:45 AM | 0 | 53 | 0 | 1 | 0 | 0 | 54 |
| 10:00 AM | 0 | 55 | 1 | 0 | 0 | 0 | 56 |
| 10:15 AM | 0 | 43 | 0 | 2 | 0 | 0 | 45 |
| 10:30 AM | 0 | 52 | 0 | 0 | 0 | 0 | 52 |
| 10:45 AM | 0 | 50 | 0 | 1 | 0 | 0 | 51 |
| 11:00 AM | 0 | 52 | 0 | 1 | 0 | 0 | 53 |
| 11:15 AM | 0 | 44 | 0 | 0 | 0 | 0 | 44 |
| 11:30 AM | 0 | 51 | 0 | 0 | 0 | 1 | 52 |
| 11:45 AM | 0 | 55 | 0 | 1 | 0 | 0 | 56 |
| 12:00 PM | 0 | 50 | 0 | 1 | 0 | 0 | 51 |
| 12:15 PM | 0 | 36 | 0 | 0 | 0 | 0 | 36 |
| 12:30 PM | 1 | 31 | 0 | 0 | 0 | 0 | 32 |
| 12:45 PM | 0 | 45 | 0 | 0 | 0 | 0 | 45 |
| 1:00 PM | 0 | 43 | 0 | 0 | 0 | 0 | 43 |
| 1:15 PM | 1 | 54 | 0 | 1 | 0 | 0 | 56 |
| 1:30 PM | 0 | 54 | 0 | 1 | 0 | 0 | 55 |
| 1:45 PM | 0 | 43 | 0 | 0 | 0 | 0 | 43 |
| 2:00 PM | 0 | 45 | 1 | 1 | 0 | 0 | 47 |
| 2:15 PM | 0 | 46 | 0 | 0 | 0 | 0 | 46 |
| 2:30 PM | 0 | 54 | 1 | 0 | 0 | 1 | 56 |
| 2:45 PM | 0 | 42 | 2 | 0 | 0 | 0 | 44 |
| 3:00 PM | 0 | 63 | 5 | 0 | 0 | 0 | 68 |
| 3:15 PM | 0 | 44 | 3 | 2 | 0 | 0 | 49 |
| 3:30 PM | 0 | 66 | 4 | 0 | 0 | 0 | 70 |
| 3:45 PM | 0 | 65 | 0 | 0 | 0 | 0 | 65 |
| 4:00 PM | 1 | 41 | 3 | 1 | 0 | 0 | 46 |
| 4:15 PM | 0 | 71 | 1 | 1 | 0 | 0 | 73 |
| 4:30 PM | 0 | 57 | 1 | 0 | 0 | 0 | 58 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 70 | 0 | 0 | 0 | 0 | 70 |
| 5:00 PM | 0 | 56 | 1 | 0 | 0 | 0 | 57 |
| 5:15 PM | 0 | 51 | 0 | 1 | 0 | 2 | 54 |
| 5:30 PM | 0 | 65 | 1 | 1 | 0 | 0 | 67 |
| 5:45 PM | 1 | 67 | 0 | 0 | 0 | 0 | 68 |
| Total | 4 | 2691 | 45 | 20 | 0 | 4 | 2764 |
| Total % | 0.1 | 97.4 | 1.6 | 0.7 | 0.0 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 9:00 AM | 7:00 AM | 10:45 AM | 7:45 AM |
| AM Peaks | 0 | 442 | 12 | 4 | 0 | 1 | 453 |
| PM Times | 12:00 PM | 4:15 PM | 2:45 PM | 12:45 PM | 12:00 PM | 1:45 PM | 5:00 PM |
| PM Peaks | 1 | 254 | 14 | 2 | 0 | 1 | 246 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Homer Watson Boulevard to Doon Village Road)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Robert Ferrie Drive to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 6 | 1 | 1 | 0 | 0 | 8 |
| 7:15 AM | 0 | 7 | 2 | 0 | 0 | 0 | 9 |
| 7:30 AM | 0 | 17 | 2 | 0 | 0 | 0 | 19 |
| 7:45 AM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 8:00 AM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 8:15 AM | 0 | 23 | 2 | 0 | 0 | 0 | 25 |
| 8:30 AM | 0 | 15 | 5 | 0 | 0 | 0 | 20 |
| 8:45 AM | 0 | 33 | 1 | 0 | 0 | 0 | 34 |
| 9:00 AM | 0 | 23 | 3 | 0 | 0 | 0 | 26 |
| 9:15 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 9:30 AM | 0 | 13 | 1 | 1 | 0 | 0 | 15 |
| 9:45 AM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 10:00 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 10:15 AM | 0 | 17 | 1 | 0 | 0 | 0 | 18 |
| 10:30 AM | 0 | 14 | 1 | 1 | 0 | 0 | 16 |
| 10:45 AM | 0 | 10 | 1 | 1 | 0 | 0 | 12 |
| 11:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 11:15 AM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 11:30 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 11:45 AM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 12:00 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 12:15 PM | 0 | 22 | 1 | 0 | 0 | 0 | 23 |
| 12:30 PM | 0 | 14 | 1 | 0 | 0 | 0 | 15 |
| 12:45 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 1:00 PM | 0 | 14 | 1 | 1 | 0 | 0 | 16 |
| 1:15 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 1:30 PM | 0 | 24 | 0 | 0 | 0 | 1 | 25 |
| 1:45 PM | 0 | 25 | 1 | 0 | 0 | 0 | 26 |
| 2:00 PM | 0 | 15 | 1 | 1 | 0 | 1 | 18 |
| 2:15 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 2:30 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 2:45 PM | 0 | 33 | 2 | 0 | 0 | 0 | 35 |
| 3:00 PM | 0 | 33 | 1 | 0 | 0 | 0 | 34 |
| 3:15 PM | 0 | 31 | 2 | 0 | 0 | 0 | 33 |
| 3:30 PM | 0 | 28 | 1 | 0 | 0 | 0 | 29 |
| 3:45 PM | 0 | 36 | 3 | 0 | 0 | 1 | 40 |
| 4:00 PM | 0 | 49 | 1 | 0 | 0 | 1 | 51 |
| 4:15 PM | 0 | 30 | 1 | 0 | 0 | 0 | 31 |
| 4:30 PM | 0 | 38 | 1 | 0 | 0 | 0 | 39 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 47 | 1 | 0 | 0 | 0 | 48 |
| 5:00 PM | 0 | 50 | 0 | 0 | 0 | 0 | 50 |
| 5:15 PM | 0 | 36 | 1 | 0 | 0 | 0 | 37 |
| 5:30 PM | 1 | 38 | 1 | 0 | 0 | 2 | 42 |
| 5:45 PM | 0 | 37 | 0 | 0 | 0 | 1 | 38 |
| Total | 1 | 1001 | 43 | 6 | 0 | 7 | 1058 |
| Total % | 0.1 | 94.6 | 4.1 | 0.6 | 0.0 | 0.7 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 8:15 AM | 10:00 AM | 7:00 AM | 8:00 AM | 8:15 AM |
| AM Peaks | 0 | 94 | 11 | 2 | 0 | 0 | 105 |
| PM Times | 4:45 PM | 4:45 PM | 3:15 PM | 12:15 PM | 12:00 PM | 5:00 PM | 4:45 PM |
| PM Peaks | 1 | 171 | 7 | 1 | 0 | 3 | 177 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Robert Ferrie Drive to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

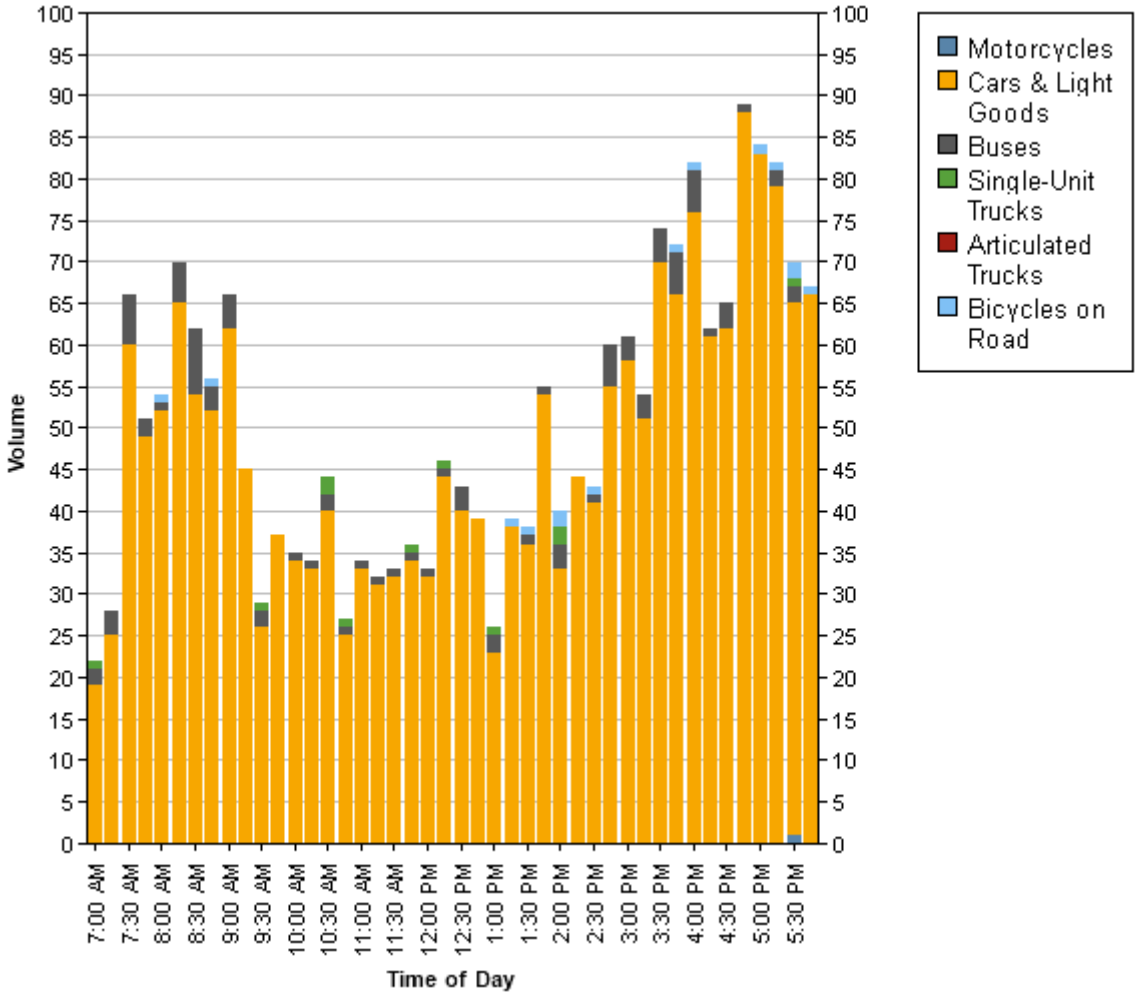
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 7:15 AM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 7:30 AM | 0 | 43 | 4 | 0 | 0 | 0 | 47 |
| 7:45 AM | 0 | 31 | 1 | 0 | 0 | 0 | 32 |
| 8:00 AM | 0 | 35 | 1 | 0 | 0 | 1 | 37 |
| 8:15 AM | 0 | 42 | 3 | 0 | 0 | 0 | 45 |
| 8:30 AM | 0 | 39 | 3 | 0 | 0 | 0 | 42 |
| 8:45 AM | 0 | 19 | 2 | 0 | 0 | 1 | 22 |
| 9:00 AM | 0 | 39 | 1 | 0 | 0 | 0 | 40 |
| 9:15 AM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 9:30 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 9:45 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 10:00 AM | 0 | 25 | 1 | 0 | 0 | 0 | 26 |
| 10:15 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 10:30 AM | 0 | 26 | 1 | 1 | 0 | 0 | 28 |
| 10:45 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 11:00 AM | 0 | 23 | 1 | 0 | 0 | 0 | 24 |
| 11:15 AM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 11:30 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 11:45 AM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 12:00 PM | 0 | 14 | 1 | 0 | 0 | 0 | 15 |
| 12:15 PM | 0 | 22 | 0 | 1 | 0 | 0 | 23 |
| 12:30 PM | 0 | 26 | 2 | 0 | 0 | 0 | 28 |
| 12:45 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 1:00 PM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 1:15 PM | 0 | 19 | 0 | 0 | 0 | 1 | 20 |
| 1:30 PM | 0 | 12 | 1 | 0 | 0 | 0 | 13 |
| 1:45 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 2:00 PM | 0 | 18 | 2 | 1 | 0 | 1 | 22 |
| 2:15 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 2:30 PM | 0 | 19 | 1 | 0 | 0 | 1 | 21 |
| 2:45 PM | 0 | 22 | 3 | 0 | 0 | 0 | 25 |
| 3:00 PM | 0 | 25 | 2 | 0 | 0 | 0 | 27 |
| 3:15 PM | 0 | 20 | 1 | 0 | 0 | 0 | 21 |
| 3:30 PM | 0 | 42 | 3 | 0 | 0 | 0 | 45 |
| 3:45 PM | 0 | 30 | 2 | 0 | 0 | 0 | 32 |
| 4:00 PM | 0 | 27 | 4 | 0 | 0 | 0 | 31 |
| 4:15 PM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 4:30 PM | 0 | 24 | 2 | 0 | 0 | 0 | 26 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 5:00 PM | 0 | 33 | 0 | 0 | 0 | 1 | 34 |
| 5:15 PM | 0 | 43 | 1 | 0 | 0 | 1 | 45 |
| 5:30 PM | 0 | 26 | 1 | 1 | 0 | 0 | 28 |
| 5:45 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| Total | 0 | 1110 | 49 | 5 | 0 | 7 | 1171 |
| Total % | 0.0 | 94.8 | 4.2 | 0.4 | 0.0 | 0.6 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 8:15 AM | 10:00 AM | 7:00 AM | 8:00 AM | 8:15 AM |
| AM Peaks | 0 | 139 | 9 | 1 | 0 | 2 | 149 |
| PM Times | 4:45 PM | 4:45 PM | 3:15 PM | 12:15 PM | 12:00 PM | 5:00 PM | 4:45 PM |
| PM Peaks | 0 | 143 | 10 | 1 | 0 | 2 | 148 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon South Drive (Robert Ferrie Drive to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road (Pioneer Drive to Bechtel Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 24 | 4 | 1 | 0 | 0 | 29 |
| 7:15 AM | 0 | 31 | 6 | 0 | 0 | 0 | 37 |
| 7:30 AM | 0 | 40 | 6 | 4 | 0 | 0 | 50 |
| 7:45 AM | 0 | 46 | 3 | 0 | 0 | 0 | 49 |
| 8:00 AM | 0 | 89 | 4 | 0 | 0 | 0 | 93 |
| 8:15 AM | 0 | 67 | 5 | 0 | 0 | 0 | 72 |
| 8:30 AM | 0 | 73 | 3 | 1 | 0 | 0 | 77 |
| 8:45 AM | 0 | 62 | 1 | 1 | 0 | 0 | 64 |
| 9:00 AM | 0 | 51 | 3 | 3 | 0 | 0 | 57 |
| 9:15 AM | 0 | 37 | 1 | 0 | 0 | 0 | 38 |
| 9:30 AM | 0 | 40 | 1 | 1 | 0 | 1 | 43 |
| 9:45 AM | 0 | 34 | 0 | 2 | 0 | 0 | 36 |
| 10:00 AM | 0 | 38 | 0 | 0 | 0 | 0 | 38 |
| 10:15 AM | 0 | 43 | 0 | 1 | 0 | 0 | 44 |
| 10:30 AM | 0 | 53 | 2 | 1 | 0 | 0 | 56 |
| 10:45 AM | 0 | 45 | 0 | 2 | 0 | 0 | 47 |
| 11:00 AM | 0 | 44 | 1 | 2 | 0 | 0 | 47 |
| 11:15 AM | 0 | 42 | 2 | 0 | 0 | 0 | 44 |
| 11:30 AM | 0 | 68 | 0 | 0 | 0 | 0 | 68 |
| 11:45 AM | 0 | 58 | 0 | 0 | 0 | 0 | 58 |
| 12:00 PM | 0 | 64 | 0 | 2 | 0 | 0 | 66 |
| 12:15 PM | 0 | 62 | 0 | 1 | 0 | 0 | 63 |
| 12:30 PM | 0 | 57 | 0 | 0 | 0 | 0 | 57 |
| 12:45 PM | 1 | 64 | 0 | 0 | 0 | 0 | 65 |
| 1:00 PM | 0 | 54 | 0 | 2 | 0 | 0 | 56 |
| 1:15 PM | 0 | 74 | 0 | 2 | 0 | 0 | 76 |
| 1:30 PM | 0 | 62 | 0 | 0 | 0 | 0 | 62 |
| 1:45 PM | 0 | 67 | 0 | 0 | 0 | 0 | 67 |
| 2:00 PM | 0 | 61 | 0 | 1 | 0 | 1 | 63 |
| 2:15 PM | 0 | 66 | 0 | 0 | 0 | 0 | 66 |
| 2:30 PM | 0 | 80 | 0 | 0 | 0 | 0 | 80 |
| 2:45 PM | 0 | 100 | 0 | 0 | 0 | 0 | 100 |
| 3:00 PM | 0 | 116 | 7 | 0 | 0 | 0 | 123 |
| 3:15 PM | 1 | 108 | 3 | 1 | 0 | 0 | 113 |
| 3:30 PM | 0 | 110 | 1 | 1 | 0 | 0 | 112 |
| 3:45 PM | 0 | 114 | 0 | 0 | 0 | 1 | 115 |
| 4:00 PM | 2 | 129 | 1 | 1 | 0 | 0 | 133 |
| 4:15 PM | 0 | 137 | 1 | 0 | 0 | 0 | 138 |
| 4:30 PM | 0 | 119 | 1 | 0 | 0 | 0 | 120 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 135 | 0 | 0 | 0 | 0 | 135 |
| 5:00 PM | 0 | 143 | 0 | 0 | 0 | 0 | 143 |
| 5:15 PM | 0 | 159 | 1 | 1 | 0 | 3 | 164 |
| 5:30 PM | 0 | 149 | 0 | 0 | 0 | 0 | 149 |
| 5:45 PM | 0 | 118 | 0 | 1 | 0 | 0 | 119 |
| Total | 4 | 3333 | 57 | 32 | 0 | 6 | 3432 |
| Total % | 0.1 | 97.1 | 1.7 | 0.9 | 0.0 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 10:15 AM | 7:00 AM | 7:15 AM | 7:45 AM |
| AM Peaks | 0 | 275 | 18 | 6 | 0 | 0 | 291 |
| PM Times | 12:45 PM | 4:45 PM | 2:45 PM | 1:00 PM | 12:00 PM | 4:45 PM | 4:45 PM |
| PM Peaks | 1 | 586 | 11 | 4 | 0 | 3 | 591 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road (Pioneer Drive to Bechtel Drive)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

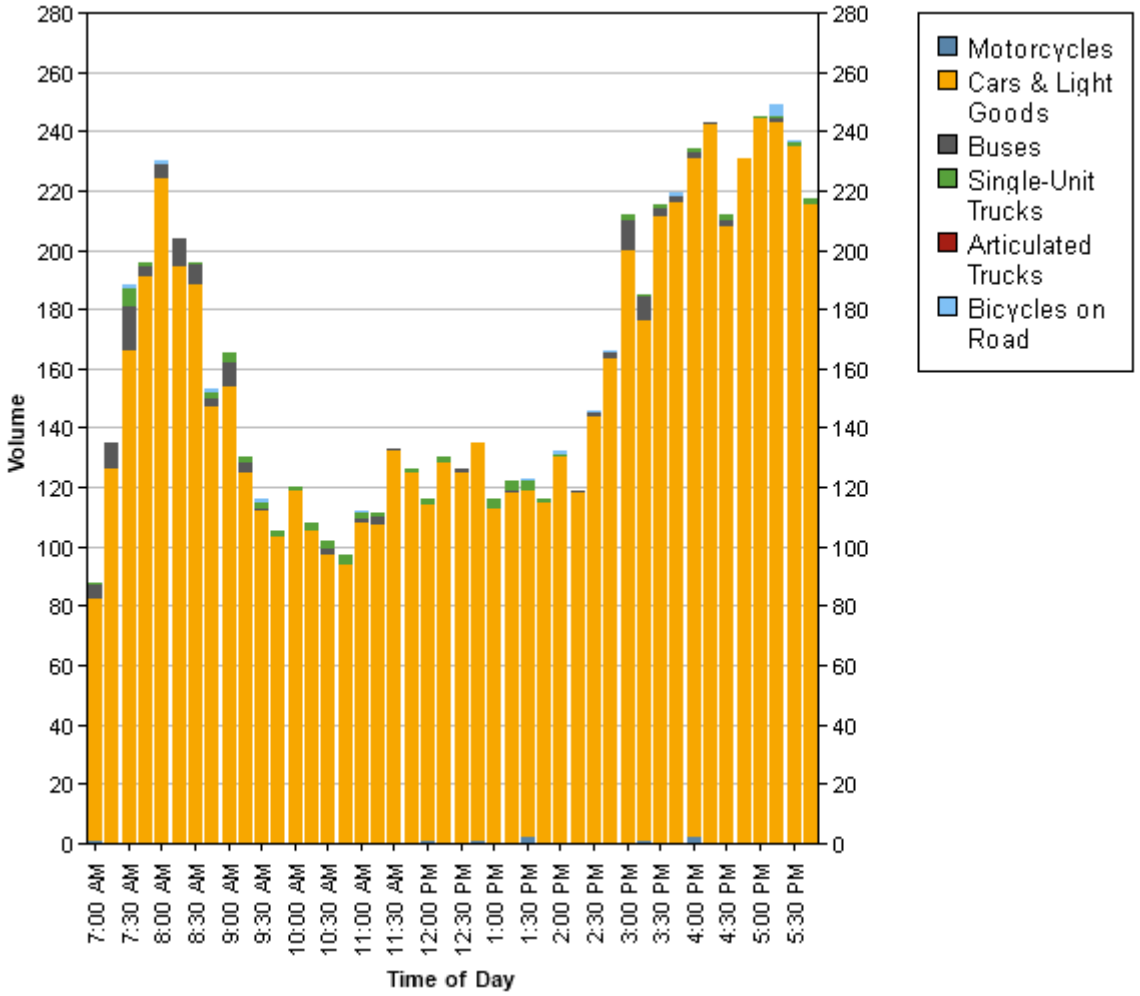
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 1 | 57 | 1 | 0 | 0 | 0 | 59 |
| 7:15 AM | 0 | 95 | 3 | 0 | 0 | 0 | 98 |
| 7:30 AM | 0 | 126 | 9 | 2 | 0 | 1 | 138 |
| 7:45 AM | 0 | 145 | 0 | 2 | 0 | 0 | 147 |
| 8:00 AM | 0 | 135 | 1 | 0 | 0 | 1 | 137 |
| 8:15 AM | 0 | 127 | 5 | 0 | 0 | 0 | 132 |
| 8:30 AM | 0 | 115 | 4 | 0 | 0 | 0 | 119 |
| 8:45 AM | 0 | 85 | 2 | 1 | 0 | 1 | 89 |
| 9:00 AM | 0 | 103 | 5 | 0 | 0 | 0 | 108 |
| 9:15 AM | 0 | 88 | 2 | 2 | 0 | 0 | 92 |
| 9:30 AM | 0 | 72 | 0 | 1 | 0 | 0 | 73 |
| 9:45 AM | 0 | 69 | 0 | 0 | 0 | 0 | 69 |
| 10:00 AM | 0 | 81 | 0 | 1 | 0 | 0 | 82 |
| 10:15 AM | 0 | 62 | 0 | 2 | 0 | 0 | 64 |
| 10:30 AM | 0 | 44 | 0 | 2 | 0 | 0 | 46 |
| 10:45 AM | 0 | 49 | 0 | 1 | 0 | 0 | 50 |
| 11:00 AM | 0 | 64 | 0 | 0 | 0 | 1 | 65 |
| 11:15 AM | 0 | 65 | 1 | 1 | 0 | 0 | 67 |
| 11:30 AM | 0 | 64 | 1 | 0 | 0 | 0 | 65 |
| 11:45 AM | 0 | 67 | 0 | 1 | 0 | 0 | 68 |
| 12:00 PM | 1 | 49 | 0 | 0 | 0 | 0 | 50 |
| 12:15 PM | 0 | 66 | 0 | 1 | 0 | 0 | 67 |
| 12:30 PM | 0 | 68 | 1 | 0 | 0 | 0 | 69 |
| 12:45 PM | 0 | 70 | 0 | 0 | 0 | 0 | 70 |
| 1:00 PM | 0 | 59 | 0 | 1 | 0 | 0 | 60 |
| 1:15 PM | 0 | 44 | 1 | 1 | 0 | 0 | 46 |
| 1:30 PM | 2 | 55 | 0 | 3 | 0 | 1 | 61 |
| 1:45 PM | 0 | 48 | 0 | 1 | 0 | 0 | 49 |
| 2:00 PM | 0 | 69 | 0 | 0 | 0 | 0 | 69 |
| 2:15 PM | 0 | 52 | 1 | 0 | 0 | 0 | 53 |
| 2:30 PM | 0 | 64 | 1 | 0 | 0 | 1 | 66 |
| 2:45 PM | 0 | 63 | 2 | 0 | 0 | 1 | 66 |
| 3:00 PM | 0 | 84 | 3 | 2 | 0 | 0 | 89 |
| 3:15 PM | 0 | 67 | 5 | 0 | 0 | 0 | 72 |
| 3:30 PM | 0 | 101 | 2 | 0 | 0 | 0 | 103 |
| 3:45 PM | 0 | 102 | 2 | 0 | 0 | 0 | 104 |
| 4:00 PM | 0 | 100 | 1 | 0 | 0 | 0 | 101 |
| 4:15 PM | 0 | 105 | 0 | 0 | 0 | 0 | 105 |
| 4:30 PM | 0 | 89 | 1 | 2 | 0 | 0 | 92 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 96 | 0 | 0 | 0 | 0 | 96 |
| 5:00 PM | 0 | 101 | 0 | 1 | 0 | 0 | 102 |
| 5:15 PM | 0 | 84 | 0 | 0 | 0 | 1 | 85 |
| 5:30 PM | 0 | 86 | 0 | 1 | 0 | 1 | 88 |
| 5:45 PM | 0 | 97 | 0 | 1 | 0 | 0 | 98 |
| Total | 4 | 3532 | 54 | 30 | 0 | 9 | 3629 |
| Total % | 0.1 | 97.3 | 1.5 | 0.8 | 0.0 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:30 AM | 10:15 AM | 7:00 AM | 7:15 AM | 7:45 AM |
| AM Peaks | 1 | 522 | 15 | 5 | 0 | 2 | 535 |
| PM Times | 12:45 PM | 4:45 PM | 2:45 PM | 1:00 PM | 12:00 PM | 4:45 PM | 4:45 PM |
| PM Peaks | 2 | 367 | 12 | 6 | 0 | 2 | 371 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road (Pioneer Drive to Bechtel Drive)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road (Pioneer Drive to Homer Watson Boulevard)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 33 | 5 | 1 | 0 | 0 | 39 |
| 7:15 AM | 0 | 38 | 7 | 0 | 0 | 1 | 46 |
| 7:30 AM | 0 | 63 | 8 | 4 | 0 | 0 | 75 |
| 7:45 AM | 0 | 82 | 5 | 0 | 0 | 0 | 87 |
| 8:00 AM | 0 | 110 | 5 | 5 | 0 | 0 | 120 |
| 8:15 AM | 0 | 107 | 5 | 1 | 0 | 0 | 113 |
| 8:30 AM | 0 | 78 | 3 | 1 | 0 | 0 | 82 |
| 8:45 AM | 0 | 85 | 3 | 2 | 0 | 0 | 90 |
| 9:00 AM | 0 | 68 | 3 | 2 | 0 | 0 | 73 |
| 9:15 AM | 0 | 72 | 2 | 1 | 0 | 0 | 75 |
| 9:30 AM | 0 | 61 | 2 | 2 | 0 | 1 | 66 |
| 9:45 AM | 0 | 50 | 2 | 4 | 0 | 0 | 56 |
| 10:00 AM | 0 | 58 | 2 | 1 | 0 | 0 | 61 |
| 10:15 AM | 0 | 68 | 3 | 4 | 1 | 0 | 76 |
| 10:30 AM | 0 | 85 | 3 | 3 | 0 | 0 | 91 |
| 10:45 AM | 0 | 66 | 1 | 3 | 0 | 0 | 70 |
| 11:00 AM | 0 | 70 | 2 | 1 | 0 | 0 | 73 |
| 11:15 AM | 0 | 65 | 3 | 0 | 0 | 0 | 68 |
| 11:30 AM | 0 | 97 | 1 | 4 | 0 | 0 | 102 |
| 11:45 AM | 0 | 100 | 1 | 2 | 0 | 0 | 103 |
| 12:00 PM | 1 | 102 | 1 | 1 | 0 | 0 | 105 |
| 12:15 PM | 0 | 91 | 1 | 1 | 0 | 1 | 94 |
| 12:30 PM | 0 | 89 | 1 | 0 | 0 | 1 | 91 |
| 12:45 PM | 1 | 94 | 2 | 1 | 0 | 0 | 98 |
| 1:00 PM | 0 | 70 | 1 | 2 | 0 | 0 | 73 |
| 1:15 PM | 1 | 104 | 1 | 3 | 0 | 0 | 109 |
| 1:30 PM | 0 | 96 | 2 | 0 | 0 | 0 | 98 |
| 1:45 PM | 0 | 96 | 1 | 0 | 0 | 0 | 97 |
| 2:00 PM | 0 | 102 | 3 | 1 | 0 | 1 | 107 |
| 2:15 PM | 0 | 98 | 1 | 0 | 0 | 0 | 99 |
| 2:30 PM | 0 | 106 | 2 | 0 | 0 | 0 | 108 |
| 2:45 PM | 0 | 141 | 7 | 0 | 0 | 0 | 148 |
| 3:00 PM | 0 | 135 | 5 | 0 | 0 | 0 | 140 |
| 3:15 PM | 1 | 147 | 3 | 2 | 0 | 0 | 153 |
| 3:30 PM | 0 | 147 | 3 | 1 | 0 | 0 | 151 |
| 3:45 PM | 2 | 161 | 2 | 1 | 0 | 1 | 167 |
| 4:00 PM | 0 | 175 | 3 | 1 | 0 | 0 | 179 |
| 4:15 PM | 0 | 180 | 2 | 0 | 0 | 0 | 182 |
| 4:30 PM | 0 | 182 | 1 | 0 | 0 | 0 | 183 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 198 | 2 | 0 | 0 | 0 | 200 |
| 5:00 PM | 0 | 211 | 1 | 0 | 0 | 1 | 213 |
| 5:15 PM | 1 | 213 | 2 | 1 | 0 | 2 | 219 |
| 5:30 PM | 0 | 205 | 1 | 0 | 0 | 0 | 206 |
| 5:45 PM | 0 | 173 | 1 | 1 | 0 | 0 | 175 |
| Total | 7 | 4772 | 115 | 57 | 1 | 9 | 4961 |
| Total % | 0.1 | 96.2 | 2.3 | 1.1 | 0.0 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 9:45 AM | 9:30 AM | 7:15 AM | 7:30 AM |
| AM Peaks | 0 | 377 | 25 | 12 | 1 | 1 | 395 |
| PM Times | 12:45 PM | 4:45 PM | 2:45 PM | 1:00 PM | 12:30 PM | 2:00 PM | 4:45 PM |
| PM Peaks | 2 | 827 | 18 | 5 | 0 | 1 | 838 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road (Pioneer Drive to Homer Watson Boulevard)
Site Code: 230376
Start Date: 10/17/2023


## Direction (Northbound)

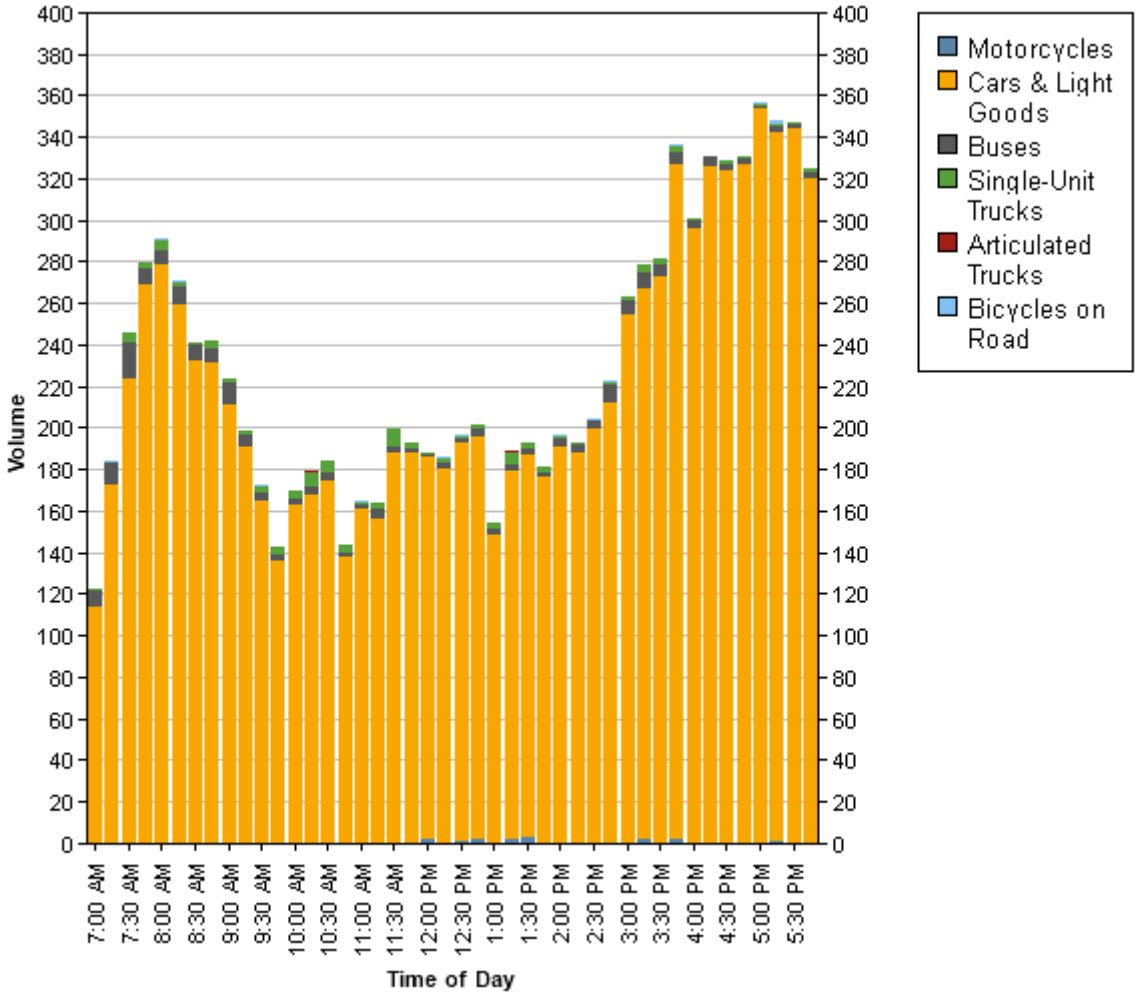
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 81 | 2 | 0 | 0 | 0 | 83 |
| 7:15 AM | 0 | 135 | 3 | 0 | 0 | 0 | 138 |
| 7:30 AM | 0 | 161 | 9 | 1 | 0 | 0 | 171 |
| 7:45 AM | 0 | 187 | 3 | 3 | 0 | 0 | 193 |
| 8:00 AM | 0 | 169 | 1 | 0 | 0 | 1 | 171 |
| 8:15 AM | 0 | 152 | 4 | 1 | 0 | 1 | 158 |
| 8:30 AM | 0 | 154 | 5 | 0 | 0 | 0 | 159 |
| 8:45 AM | 0 | 146 | 4 | 2 | 0 | 0 | 152 |
| 9:00 AM | 0 | 143 | 8 | 0 | 0 | 0 | 151 |
| 9:15 AM | 0 | 119 | 4 | 1 | 0 | 0 | 124 |
| 9:30 AM | 0 | 104 | 2 | 1 | 0 | 0 | 107 |
| 9:45 AM | 0 | 86 | 1 | 0 | 0 | 0 | 87 |
| 10:00 AM | 0 | 105 | 1 | 3 | 0 | 0 | 109 |
| 10:15 AM | 0 | 100 | 1 | 2 | 0 | 0 | 103 |
| 10:30 AM | 0 | 89 | 1 | 3 | 0 | 0 | 93 |
| 10:45 AM | 0 | 72 | 1 | 1 | 0 | 0 | 74 |
| 11:00 AM | 0 | 91 | 0 | 0 | 0 | 1 | 92 |
| 11:15 AM | 0 | 91 | 2 | 3 | 0 | 0 | 96 |
| 11:30 AM | 0 | 91 | 2 | 5 | 0 | 0 | 98 |
| 11:45 AM | 0 | 88 | 1 | 1 | 0 | 0 | 90 |
| 12:00 PM | 1 | 82 | 0 | 0 | 0 | 0 | 83 |
| 12:15 PM | 0 | 89 | 2 | 1 | 0 | 0 | 92 |
| 12:30 PM | 1 | 103 | 1 | 1 | 0 | 0 | 106 |
| 12:45 PM | 1 | 100 | 2 | 0 | 0 | 0 | 103 |
| 1:00 PM | 0 | 78 | 2 | 1 | 0 | 0 | 81 |
| 1:15 PM | 1 | 73 | 2 | 3 | 1 | 0 | 80 |
| 1:30 PM | 3 | 88 | 1 | 3 | 0 | 0 | 95 |
| 1:45 PM | 0 | 80 | 1 | 3 | 0 | 0 | 84 |
| 2:00 PM | 0 | 89 | 1 | 0 | 0 | 0 | 90 |
| 2:15 PM | 0 | 90 | 3 | 1 | 0 | 0 | 94 |
| 2:30 PM | 0 | 94 | 1 | 0 | 0 | 1 | 96 |
| 2:45 PM | 0 | 71 | 2 | 1 | 0 | 1 | 75 |
| 3:00 PM | 0 | 119 | 2 | 2 | 0 | 0 | 123 |
| 3:15 PM | 1 | 118 | 5 | 2 | 0 | 0 | 126 |
| 3:30 PM | 0 | 126 | 3 | 1 | 0 | 0 | 130 |
| 3:45 PM | 0 | 164 | 4 | 1 | 0 | 0 | 169 |
| 4:00 PM | 0 | 121 | 1 | 0 | 0 | 0 | 122 |
| 4:15 PM | 0 | 146 | 3 | 0 | 0 | 0 | 149 |
| 4:30 PM | 0 | 142 | 2 | 2 | 0 | 0 | 146 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 129 | 1 | 1 | 0 | 0 | 131 |
| 5:00 PM | 0 | 143 | 0 | 1 | 0 | 0 | 144 |
| 5:15 PM | 0 | 128 | 1 | 0 | 0 | 0 | 129 |
| 5:30 PM | 0 | 139 | 1 | 1 | 0 | 0 | 141 |
| 5:45 PM | 0 | 147 | 2 | 1 | 0 | 0 | 150 |
| Total | 8 | 5023 | 98 | 53 | 1 | 5 | 5188 |
| Total % | 0.2 | 96.8 | 1.9 | 1.0 | 0.0 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:45 AM | 7:00 AM | 9:45 AM | 9:30 AM | 7:15 AM | 7:30 AM |
| AM Peaks | 0 | 662 | 17 | 8 | 0 | 1 | 693 |
| PM Times | 12:45 PM | 4:45 PM | 2:45 PM | 1:00 PM | 12:30 PM | 2:00 PM | 4:45 PM |
| PM Peaks | 5 | 539 | 12 | 10 | 1 | 2 | 545 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Doon Village Road (Pioneer Drive to Homer Watson Boulevard)
Site Code: 230376
Start Date: 10/17/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Creek Drive (Robert Ferrie Drive to Appleridge Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 6 | 2 | 0 | 0 | 0 | 8 |
| 7:15 AM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 7:30 AM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 7:45 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 8:00 AM | 0 | 11 | 0 | 1 | 0 | 0 | 12 |
| 8:15 AM | 0 | 15 | 1 | 0 | 0 | 0 | 16 |
| 8:30 AM | 0 | 14 | 1 | 1 | 0 | 0 | 16 |
| 8:45 AM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 9:00 AM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 9:15 AM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 9:30 AM | 0 | 11 | 1 | 0 | 0 | 0 | 12 |
| 9:45 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 10:00 AM | 0 | 9 | 0 | 0 | 0 | 1 | 10 |
| 10:15 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 10:30 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 10:45 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 11:00 AM | 0 | 11 | 0 | 1 | 0 | 0 | 12 |
| 11:15 AM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 11:30 AM | 0 | 17 | 0 | 1 | 0 | 0 | 18 |
| 11:45 AM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 12:00 PM | 0 | 12 | 0 | 0 | 0 | 1 | 13 |
| 12:15 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 12:30 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 12:45 PM | 0 | 12 | 0 | 1 | 0 | 0 | 13 |
| 1:00 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 1:15 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 1:30 PM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 1:45 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 2:00 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 2:15 PM | 0 | 15 | 0 | 1 | 0 | 0 | 16 |
| 2:30 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 2:45 PM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 3:00 PM | 0 | 27 | 2 | 0 | 0 | 0 | 29 |
| 3:15 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 3:30 PM | 0 | 48 | 0 | 1 | 0 | 0 | 49 |
| 3:45 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 4:00 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 4:15 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 4:30 PM | 0 | 28 | 0 | 0 | 0 | 1 | 29 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 39 | 0 | 0 | 0 | 0 | 39 |
| 5:00 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 5:15 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 5:30 PM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 5:45 PM | 0 | 36 | 0 | 0 | 0 | 0 | 36 |
| Total | 0 | 848 | 9 | 10 | 0 | 3 | 870 |
| Total % | 0.0 | 97.5 | 1.0 | 1.1 | 0.0 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 7:00 AM | 10:45 AM | 7:00 AM | 9:15 AM | 8:15 AM |
| AM Peaks | 0 | 81 | 4 | 3 | 0 | 1 | 84 |
| PM Times | 12:00 PM | 4:30 PM | 2:45 PM | 12:45 PM | 12:00 PM | 12:00 PM | 4:30 PM |
| PM Peaks | 0 | 135 | 2 | 2 | 0 | 1 | 136 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Creek Drive (Robert Ferrie Drive to Appleridge Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Northbound)

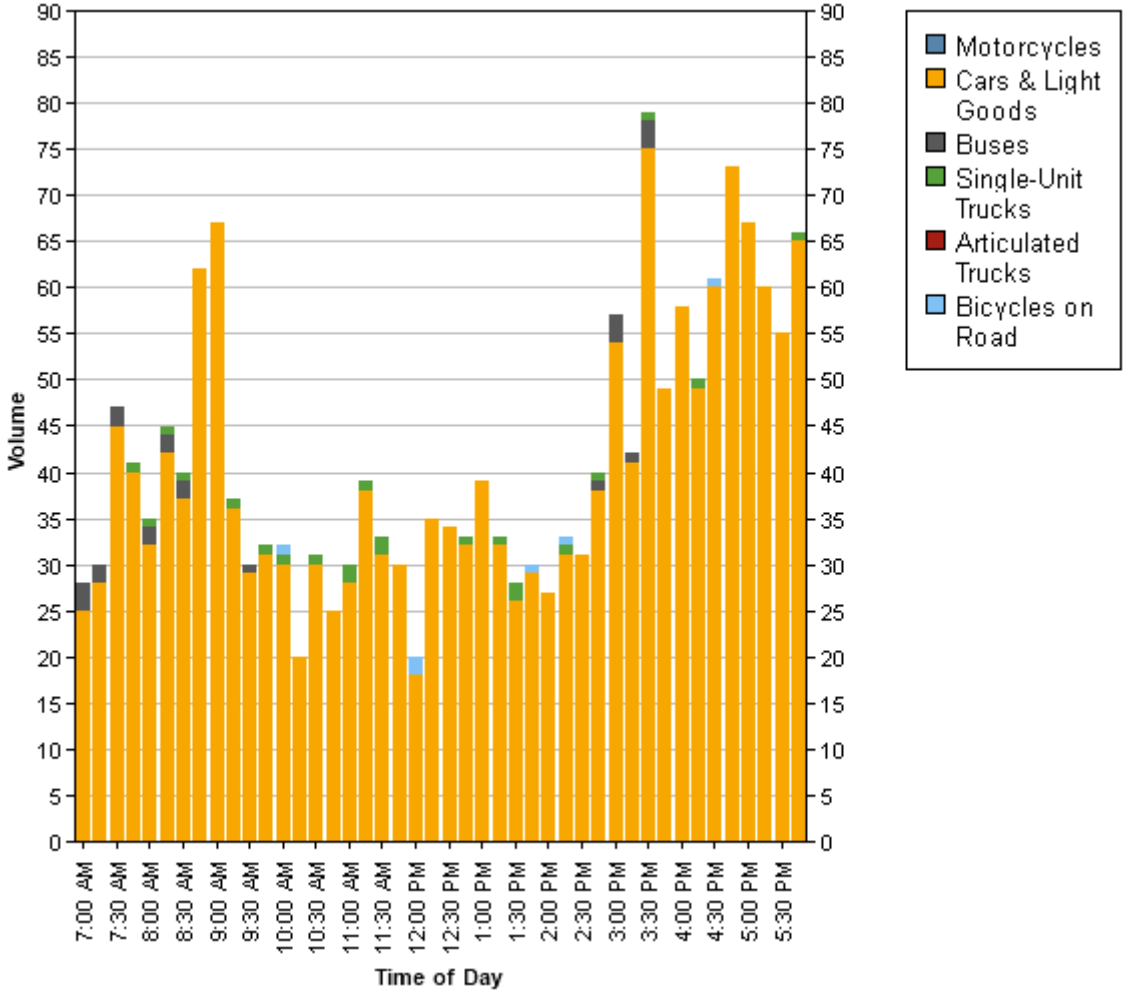
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 7:15 AM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 7:30 AM | 0 | 36 | 1 | 0 | 0 | 0 | 37 |
| 7:45 AM | 0 | 26 | 0 | 1 | 0 | 0 | 27 |
| 8:00 AM | 0 | 21 | 2 | 0 | 0 | 0 | 23 |
| 8:15 AM | 0 | 27 | 1 | 1 | 0 | 0 | 29 |
| 8:30 AM | 0 | 23 | 1 | 0 | 0 | 0 | 24 |
| 8:45 AM | 0 | 36 | 0 | 0 | 0 | 0 | 36 |
| 9:00 AM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 9:15 AM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 9:30 AM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 9:45 AM | 0 | 15 | 0 | 1 | 0 | 0 | 16 |
| 10:00 AM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 10:15 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 10:30 AM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 10:45 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 11:00 AM | 0 | 17 | 0 | 1 | 0 | 0 | 18 |
| 11:15 AM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 11:30 AM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 11:45 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 12:00 PM | 0 | 6 | 0 | 0 | 0 | 1 | 7 |
| 12:15 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 12:30 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 12:45 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 1:00 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 1:15 PM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 1:30 PM | 0 | 12 | 0 | 1 | 0 | 0 | 13 |
| 1:45 PM | 0 | 18 | 0 | 0 | 0 | 1 | 19 |
| 2:00 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 2:15 PM | 0 | 16 | 0 | 0 | 0 | 1 | 17 |
| 2:30 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 2:45 PM | 0 | 15 | 1 | 1 | 0 | 0 | 17 |
| 3:00 PM | 0 | 27 | 1 | 0 | 0 | 0 | 28 |
| 3:15 PM | 0 | 23 | 1 | 0 | 0 | 0 | 24 |
| 3:30 PM | 0 | 27 | 3 | 0 | 0 | 0 | 30 |
| 3:45 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 4:00 PM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 4:15 PM | 0 | 22 | 0 | 1 | 0 | 0 | 23 |
| 4:30 PM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 34 | 0 | 0 | 0 | 0 | 34 |
| 5:00 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 5:15 PM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 5:30 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 5:45 PM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| Total | 0 | 936 | 13 | 12 | 0 | 3 | 964 |
| Total % | 0.0 | 97.1 | 1.3 | 1.2 | 0.0 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 7:00 AM | 10:45 AM | 7:00 AM | 9:15 AM | 8:15 AM |
| AM Peaks | 0 | 127 | 3 | 2 | 0 | 0 | 130 |
| PM Times | 12:00 PM | 4:30 PM | 2:45 PM | 12:45 PM | 12:00 PM | 12:00 PM | 4:30 PM |
| PM Peaks | 0 | 125 | 6 | 2 | 0 | 1 | 125 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Creek Drive (Robert Ferrie Drive to Appleridge Drive)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Edge Trail (Doon South Drive to Windrush Trail)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Westbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:15 AM | 0 | 4 | 1 | 0 | 0 | 0 | 5 |
| 7:30 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 7:45 AM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 8:00 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 8:15 AM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 8:30 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 8:45 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 9:00 AM | 0 | 5 | 2 | 0 | 0 | 0 | 7 |
| 9:15 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 9:30 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 9:45 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 10:00 AM | 0 | 3 | 0 | 1 | 0 | 0 | 4 |
| 10:15 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 10:30 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 10:45 AM | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 11:00 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 11:15 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 11:30 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 11:45 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:00 PM | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 12:15 PM | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 12:30 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 12:45 PM | 0 | 3 | 0 | 1 | 0 | 0 | 4 |
| 1:00 PM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 1:15 PM | 0 | 6 | 0 | 1 | 0 | 0 | 7 |
| 1:30 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 1:45 PM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 2:00 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 2:15 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 2:30 PM | 0 | 4 | 1 | 0 | 0 | 0 | 5 |
| 2:45 PM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 3:00 PM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 3:15 PM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 3:30 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 3:45 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 4:00 PM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 4:15 PM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 4:30 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 5:00 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 5:15 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 5:30 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 5:45 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| Total | 0 | 234 | 8 | 3 | 0 | 0 | 245 |
| Total % | 0.0 | 95.5 | 3.3 | 1.2 | 0.0 | 0.0 | 100.0 |
| AM Times | 7:00 AM | 8:30 AM | 7:00 AM | 9:15 AM | 7:00 AM | 7:00 AM | 8:15 AM |
| AM Peaks | 0 | 29 | 1 | 1 | 0 | 0 | 34 |
| PM Times | 12:00 PM | 5:00 PM | 3:00 PM | 12:30 PM | 12:00 PM | 12:00 PM | 5:00 PM |
| PM Peaks | 0 | 36 | 2 | 2 | 0 | 0 | 36 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Edge Trail (Doon South Drive to Windrush Trail)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Eastbound)

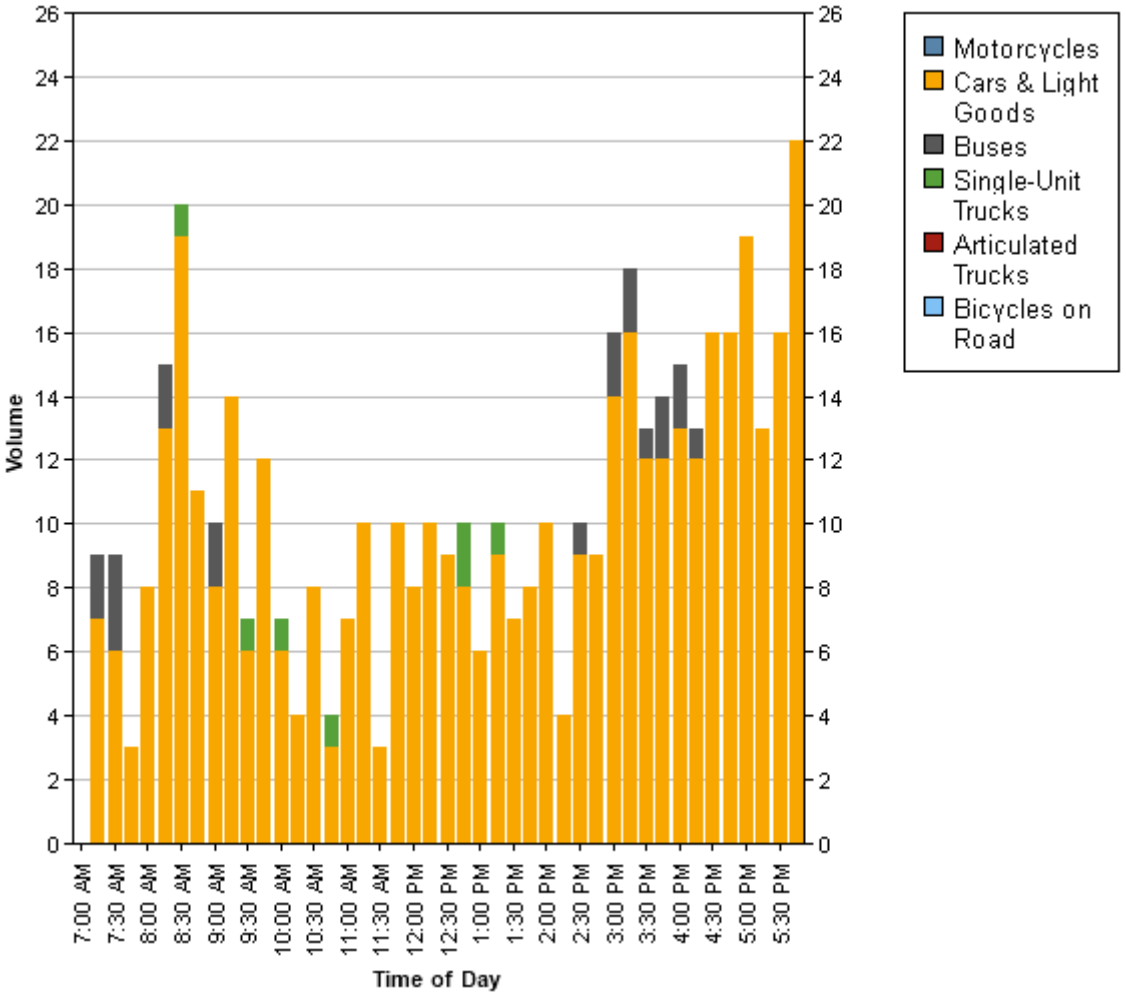
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 7:15 AM | 0 | 3 | 1 | 0 | 0 | 0 | 4 |
| 7:30 AM | 0 | 2 | 3 | 0 | 0 | 0 | 5 |
| 7:45 AM | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 8:00 AM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 8:15 AM | 0 | 6 | 1 | 0 | 0 | 0 | 7 |
| 8:30 AM | 0 | 6 | 0 | 1 | 0 | 0 | 7 |
| 8:45 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 9:00 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 9:15 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 9:30 AM | 0 | 3 | 0 | 1 | 0 | 0 | 4 |
| 9:45 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 10:00 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 10:15 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 10:30 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 10:45 AM | 0 | 2 | 0 | 1 | 0 | 0 | 3 |
| 11:00 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 11:15 AM | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 11:30 AM | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11:45 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 12:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:15 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:30 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 12:45 PM | 0 | 5 | 0 | 1 | 0 | 0 | 6 |
| 1:00 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 1:15 PM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 1:30 PM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 1:45 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 2:00 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 2:15 PM | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2:30 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 2:45 PM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 3:00 PM | 0 | 5 | 1 | 0 | 0 | 0 | 6 |
| 3:15 PM | 0 | 6 | 1 | 0 | 0 | 0 | 7 |
| 3:30 PM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 3:45 PM | 0 | 8 | 2 | 0 | 0 | 0 | 10 |
| 4:00 PM | 0 | 7 | 2 | 0 | 0 | 0 | 9 |
| 4:15 PM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 4:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 5:00 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 5:15 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 5:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 5:45 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| Total | 0 | 202 | 12 | 4 | 0 | 0 | 218 |
| Total % | 0.0 | 92.7 | 5.5 | 1.8 | 0.0 | 0.0 | 100.0 |
| AM Times | 7:00 AM | 8:30 AM | 7:00 AM | 9:15 AM | 7:00 AM | 7:00 AM | 8:15 AM |
| AM Peaks | 0 | 23 | 4 | 1 | 0 | 0 | 22 |
| PM Times | 12:00 PM | 5:00 PM | 3:00 PM | 12:30 PM | 12:00 PM | 12:00 PM | 5:00 PM |
| PM Peaks | 0 | 34 | 5 | 1 | 0 | 0 | 34 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Edge Trail (Doon South Drive to Windrush Trail)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Edge Trail (Windrush Trail to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 7:15 AM | 0 | 8 | 2 | 0 | 0 | 0 | 10 |
| 7:30 AM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 7:45 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 8:00 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 8:15 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 8:30 AM | 0 | 8 | 1 | 1 | 0 | 0 | 10 |
| 8:45 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 9:00 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 9:15 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 9:30 AM | 0 | 7 | 0 | 1 | 0 | 0 | 8 |
| 9:45 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 10:00 AM | 0 | 8 | 0 | 1 | 0 | 0 | 9 |
| 10:15 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 10:30 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 10:45 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 11:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 11:15 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 11:30 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 11:45 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:15 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 12:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:45 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 1:00 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 1:15 PM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 1:30 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 1:45 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 2:00 PM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 2:15 PM | 1 | 5 | 0 | 0 | 0 | 0 | 6 |
| 2:30 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 2:45 PM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 3:00 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 3:15 PM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 3:30 PM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 3:45 PM | 0 | 22 | 3 | 0 | 0 | 0 | 25 |
| 4:00 PM | 0 | 14 | 2 | 0 | 0 | 0 | 16 |
| 4:15 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 4:30 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 5:00 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 5:15 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 5:30 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 5:45 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| Total | 1 | 457 | 15 | 3 | 0 | 0 | 476 |
| Total % | 0.2 | 96.0 | 3.2 | 0.6 | 0.0 | 0.0 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 8:15 AM | 9:15 AM | 7:00 AM | 7:00 AM | 8:15 AM |
| AM Peaks | 0 | 32 | 4 | 2 | 0 | 0 | 37 |
| PM Times | 1:30 PM | 5:00 PM | 3:15 PM | 12:30 PM | 12:00 PM | 12:00 PM | 5:00 PM |
| PM Peaks | 1 | 92 | 7 | 0 | 0 | 0 | 92 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Edge Trail (Windrush Trail to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Northbound)

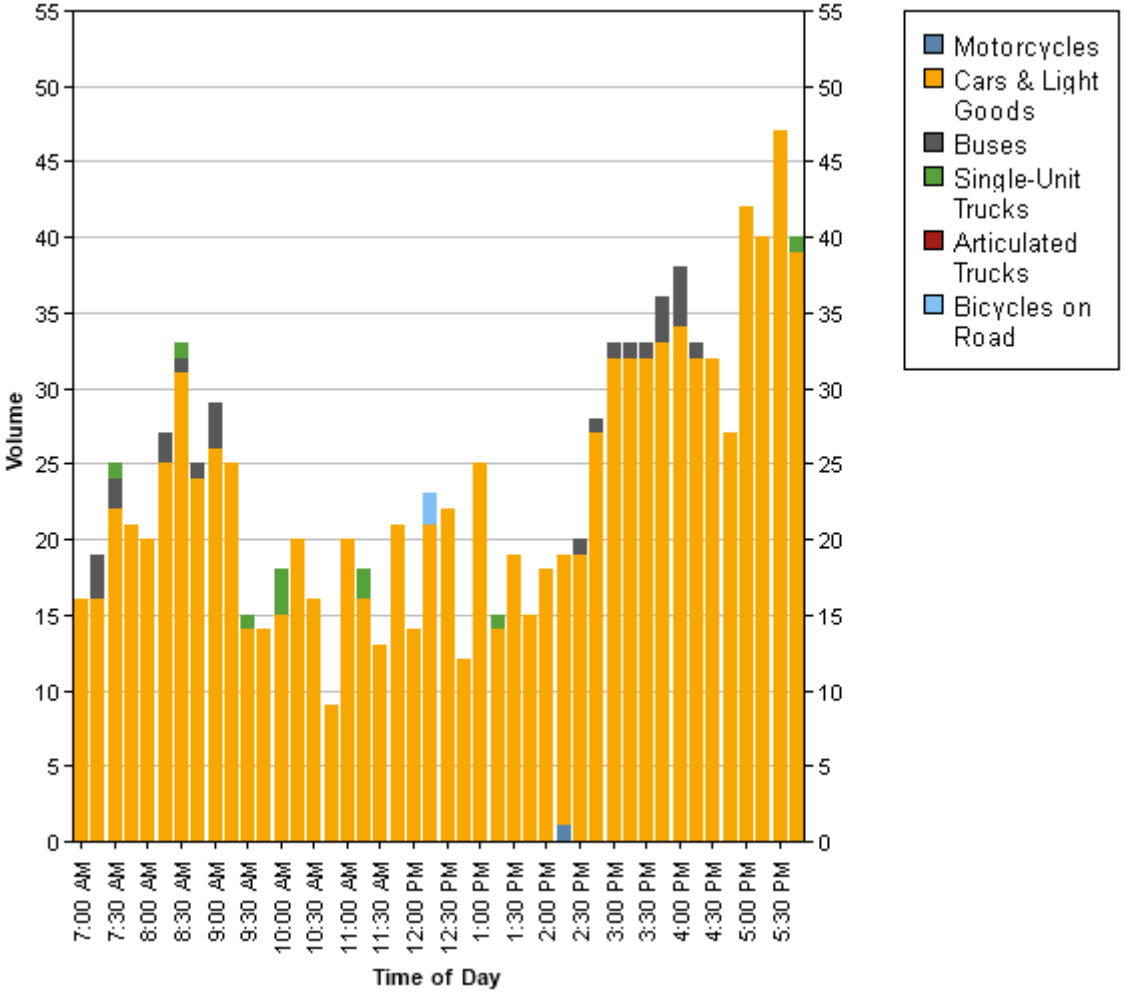
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 7:15 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 7:30 AM | 0 | 15 | 1 | 1 | 0 | 0 | 17 |
| 7:45 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 8:00 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 8:15 AM | 0 | 17 | 1 | 0 | 0 | 0 | 18 |
| 8:30 AM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 8:45 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 9:00 AM | 0 | 18 | 2 | 0 | 0 | 0 | 20 |
| 9:15 AM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 9:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 9:45 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 10:00 AM | 0 | 7 | 0 | 2 | 0 | 0 | 9 |
| 10:15 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 10:30 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 10:45 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 11:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 11:15 AM | 0 | 10 | 0 | 2 | 0 | 0 | 12 |
| 11:30 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 11:45 AM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 12:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:15 PM | 0 | 7 | 0 | 0 | 0 | 2 | 9 |
| 12:30 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 12:45 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 1:00 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 1:15 PM | 0 | 11 | 0 | 1 | 0 | 0 | 12 |
| 1:30 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 1:45 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 2:00 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 2:15 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 2:30 PM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 2:45 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 3:00 PM | 0 | 15 | 1 | 0 | 0 | 0 | 16 |
| 3:15 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 3:30 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 3:45 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 4:00 PM | 0 | 20 | 2 | 0 | 0 | 0 | 22 |
| 4:15 PM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 4:30 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 5:00 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 5:15 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 5:30 PM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 5:45 PM | 0 | 15 | 0 | 1 | 0 | 0 | 16 |
| Total | 0 | 573 | 10 | 7 | 0 | 2 | 592 |
| Total % | 0.0 | 96.8 | 1.7 | 1.2 | 0.0 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 8:15 AM | 9:15 AM | 7:00 AM | 7:00 AM | 8:15 AM |
| AM Peaks | 0 | 74 | 3 | 2 | 0 | 0 | 77 |
| PM Times | 1:30 PM | 5:00 PM | 3:15 PM | 12:30 PM | 12:00 PM | 12:00 PM | 5:00 PM |
| PM Peaks | 0 | 76 | 2 | 1 | 0 | 2 | 77 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Forest Edge Trail (Windrush Trail to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Riedel Drive (Stauffer Drive to New Dundee Road)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 7:15 AM | 1 | 13 | 0 | 0 | 0 | 0 | 14 |
| 7:30 AM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 7:45 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 8:00 AM | 0 | 12 | 0 | 1 | 0 | 0 | 13 |
| 8:15 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 8:30 AM | 1 | 20 | 0 | 0 | 0 | 0 | 21 |
| 8:45 AM | 0 | 9 | 0 | 1 | 0 | 0 | 10 |
| 9:00 AM | 0 | 14 | 0 | 0 | 0 | 1 | 15 |
| 9:15 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 9:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 9:45 AM | 0 | 9 | 0 | 0 | 0 | 1 | 10 |
| 10:00 AM | 0 | 4 | 0 | 0 | 0 | 1 | 5 |
| 10:15 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 10:30 AM | 0 | 4 | 0 | 1 | 0 | 0 | 5 |
| 10:45 AM | 0 | 5 | 0 | 1 | 0 | 0 | 6 |
| 11:00 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 11:15 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 11:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:45 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:00 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 12:15 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 12:30 PM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 12:45 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 1:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 1:15 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 1:30 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 1:45 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 2:00 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 2:15 PM | 0 | 4 | 0 | 1 | 0 | 0 | 5 |
| 2:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 2:45 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 3:00 PM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 3:15 PM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 3:30 PM | 0 | 13 | 0 | 1 | 0 | 0 | 14 |
| 3:45 PM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 4:00 PM | 0 | 20 | 1 | 0 | 0 | 0 | 21 |
| 4:15 PM | 0 | 12 | 1 | 0 | 0 | 0 | 13 |
| 4:30 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 5:00 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 5:15 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 5:30 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 5:45 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| Total | 2 | 454 | 5 | 6 | 0 | 3 | 470 |
| Total % | 0.4 | 96.6 | 1.1 | 1.3 | 0.0 | 0.6 | 100.0 |
| AM Times | 7:00 AM | 8:00 AM | 7:00 AM | 10:00 AM | 7:00 AM | 9:00 AM | 8:00 AM |
| AM Peaks | 1 | 60 | 0 | 2 | 0 | 2 | 63 |
| PM Times | 12:00 PM | 4:00 PM | 3:00 PM | 1:45 PM | 12:00 PM | 12:00 PM | 4:00 PM |
| PM Peaks | 0 | 63 | 3 | 1 | 0 | 0 | 65 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Riedel Drive (Stauffer Drive to New Dundee Road)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Northbound)

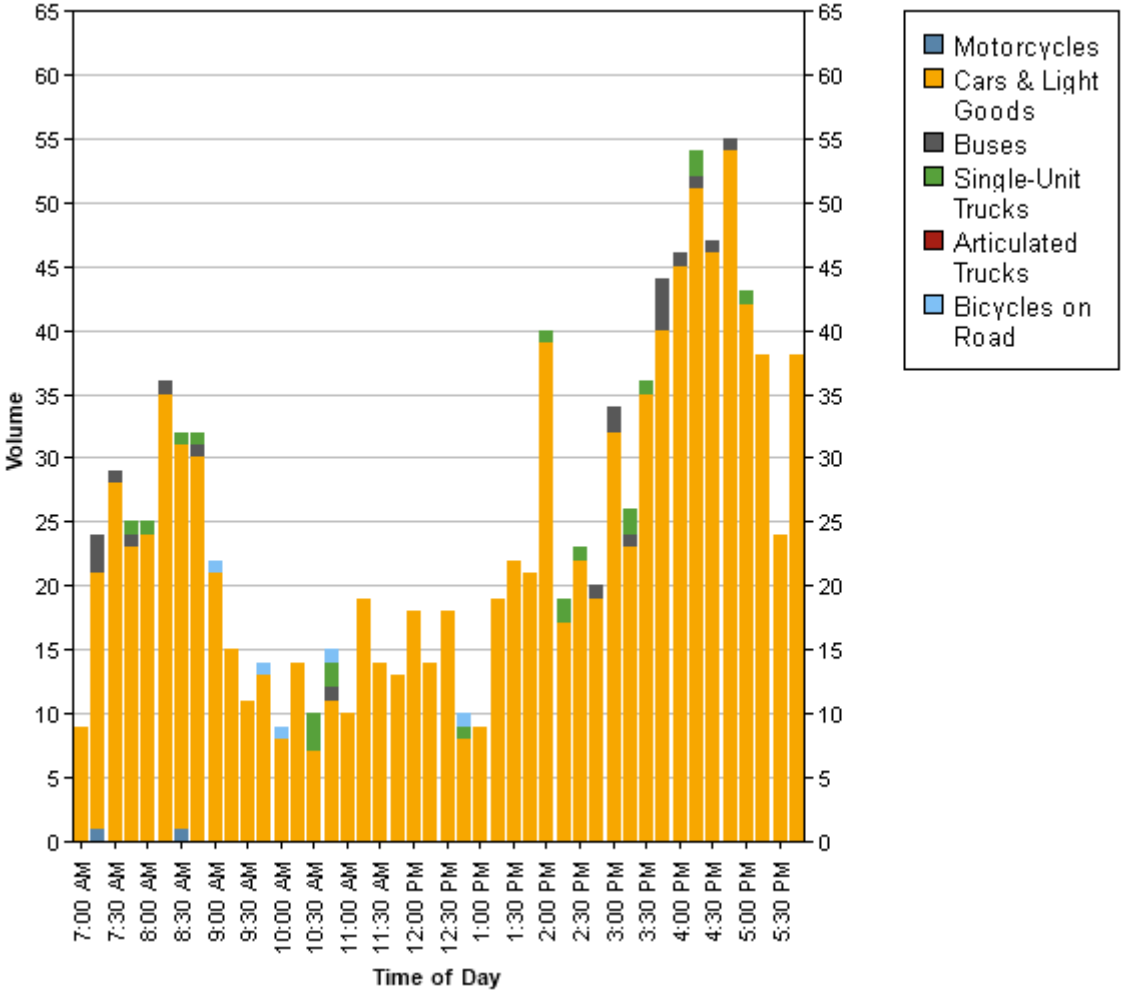
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 7:15 AM | 0 | 7 | 3 | 0 | 0 | 0 | 10 |
| 7:30 AM | 0 | 11 | 1 | 0 | 0 | 0 | 12 |
| 7:45 AM | 0 | 13 | 1 | 1 | 0 | 0 | 15 |
| 8:00 AM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 8:15 AM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 8:30 AM | 0 | 10 | 0 | 1 | 0 | 0 | 11 |
| 8:45 AM | 0 | 21 | 1 | 0 | 0 | 0 | 22 |
| 9:00 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 9:15 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 9:30 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 9:45 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 10:00 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 10:15 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 10:30 AM | 0 | 3 | 0 | 2 | 0 | 0 | 5 |
| 10:45 AM | 0 | 6 | 1 | 1 | 0 | 1 | 9 |
| 11:00 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 11:15 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 11:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:45 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 12:00 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 12:15 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:30 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 12:45 PM | 0 | 4 | 0 | 1 | 0 | 1 | 6 |
| 1:00 PM | 0 | 2 | 0 | 0 | 0 | 0 | 2 |
| 1:15 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 1:30 PM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 1:45 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 2:00 PM | 0 | 28 | 0 | 1 | 0 | 0 | 29 |
| 2:15 PM | 0 | 13 | 0 | 1 | 0 | 0 | 14 |
| 2:30 PM | 0 | 13 | 0 | 1 | 0 | 0 | 14 |
| 2:45 PM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 3:00 PM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 3:15 PM | 0 | 13 | 0 | 2 | 0 | 0 | 15 |
| 3:30 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 3:45 PM | 0 | 22 | 3 | 0 | 0 | 0 | 25 |
| 4:00 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 4:15 PM | 0 | 39 | 0 | 2 | 0 | 0 | 41 |
| 4:30 PM | 0 | 33 | 1 | 0 | 0 | 0 | 34 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 36 | 1 | 0 | 0 | 0 | 37 |
| 5:00 PM | 0 | 34 | 0 | 1 | 0 | 0 | 35 |
| 5:15 PM | 0 | 28 | 0 | 0 | 0 | 0 | 28 |
| 5:30 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 5:45 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| Total | 0 | 595 | 15 | 14 | 0 | 2 | 626 |
| Total % | 0.0 | 95.0 | 2.4 | 2.2 | 0.0 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 8:00 AM | 7:00 AM | 10:00 AM | 7:00 AM | 9:00 AM | 8:00 AM |
| AM Peaks | 0 | 59 | 5 | 3 | 0 | 0 | 62 |
| PM Times | 12:00 PM | 4:00 PM | 3:00 PM | 1:45 PM | 12:00 PM | 12:00 PM | 4:00 PM |
| PM Peaks | 0 | 133 | 4 | 3 | 0 | 1 | 137 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Riedel Drive (Stauffer Drive to New Dundee Road)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Blair Creek Drive to New Dundee Road)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 71 | 1 | 0 | 0 | 0 | 72 |
| 7:15 AM | 0 | 83 | 2 | 0 | 0 | 0 | 85 |
| 7:30 AM | 0 | 113 | 1 | 1 | 0 | 0 | 115 |
| 7:45 AM | 0 | 91 | 1 | 2 | 0 | 0 | 94 |
| 8:00 AM | 0 | 103 | 0 | 2 | 0 | 0 | 105 |
| 8:15 AM | 0 | 94 | 1 | 2 | 0 | 0 | 97 |
| 8:30 AM | 0 | 87 | 1 | 1 | 0 | 0 | 89 |
| 8:45 AM | 0 | 81 | 1 | 1 | 0 | 0 | 83 |
| 9:00 AM | 0 | 67 | 0 | 2 | 0 | 0 | 69 |
| 9:15 AM | 0 | 74 | 1 | 0 | 0 | 0 | 75 |
| 9:30 AM | 0 | 69 | 0 | 2 | 0 | 0 | 71 |
| 9:45 AM | 0 | 47 | 1 | 1 | 0 | 0 | 49 |
| 10:00 AM | 0 | 39 | 0 | 1 | 0 | 0 | 40 |
| 10:15 AM | 0 | 45 | 1 | 0 | 0 | 0 | 46 |
| 10:30 AM | 0 | 40 | 0 | 1 | 1 | 0 | 42 |
| 10:45 AM | 0 | 42 | 1 | 1 | 0 | 0 | 44 |
| 11:00 AM | 0 | 32 | 0 | 2 | 0 | 0 | 34 |
| 11:15 AM | 0 | 42 | 1 | 0 | 0 | 0 | 43 |
| 11:30 AM | 0 | 45 | 0 | 1 | 0 | 0 | 46 |
| 11:45 AM | 0 | 33 | 1 | 0 | 0 | 0 | 34 |
| 12:00 PM | 0 | 47 | 0 | 1 | 0 | 0 | 48 |
| 12:15 PM | 0 | 43 | 1 | 0 | 1 | 0 | 45 |
| 12:30 PM | 0 | 41 | 0 | 2 | 0 | 0 | 43 |
| 12:45 PM | 0 | 40 | 1 | 1 | 0 | 0 | 42 |
| 1:00 PM | 0 | 29 | 0 | 2 | 0 | 0 | 31 |
| 1:15 PM | 0 | 41 | 1 | 1 | 0 | 0 | 43 |
| 1:30 PM | 0 | 55 | 0 | 0 | 0 | 0 | 55 |
| 1:45 PM | 0 | 34 | 1 | 0 | 0 | 0 | 35 |
| 2:00 PM | 0 | 40 | 0 | 1 | 0 | 0 | 41 |
| 2:15 PM | 0 | 36 | 1 | 1 | 0 | 0 | 38 |
| 2:30 PM | 0 | 45 | 0 | 0 | 0 | 0 | 45 |
| 2:45 PM | 0 | 41 | 1 | 0 | 0 | 0 | 42 |
| 3:00 PM | 0 | 49 | 2 | 1 | 0 | 0 | 52 |
| 3:15 PM | 0 | 36 | 1 | 0 | 0 | 0 | 37 |
| 3:30 PM | 2 | 76 | 0 | 0 | 0 | 0 | 78 |
| 3:45 PM | 0 | 54 | 2 | 3 | 0 | 0 | 59 |
| 4:00 PM | 0 | 62 | 2 | 0 | 0 | 0 | 64 |
| 4:15 PM | 0 | 48 | 1 | 2 | 1 | 0 | 52 |
| 4:30 PM | 0 | 62 | 0 | 0 | 0 | 0 | 62 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 72 | 2 | 0 | 0 | 0 | 74 |
| 5:00 PM | 0 | 69 | 0 | 0 | 0 | 0 | 69 |
| 5:15 PM | 0 | 59 | 1 | 0 | 0 | 0 | 60 |
| 5:30 PM | 0 | 47 | 0 | 0 | 0 | 0 | 47 |
| 5:45 PM | 0 | 78 | 0 | 0 | 0 | 0 | 78 |
| Total | 2 | 2502 | 31 | 35 | 3 | 0 | 2573 |
| Total % | 0.1 | 97.2 | 1.2 | 1.4 | 0.1 | 0.0 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 7:00 AM | 7:30 AM | 10:00 AM | 11:00 AM | 7:30 AM |
| AM Peaks | 0 | 401 | 5 | 7 | 1 | 0 | 411 |
| PM Times | 3:30 PM | 4:45 PM | 3:45 PM | 12:30 PM | 12:00 PM | 4:00 PM | 4:30 PM |
| PM Peaks | 2 | 247 | 5 | 6 | 1 | 0 | 265 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Blair Creek Drive to New Dundee Road)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Northbound)

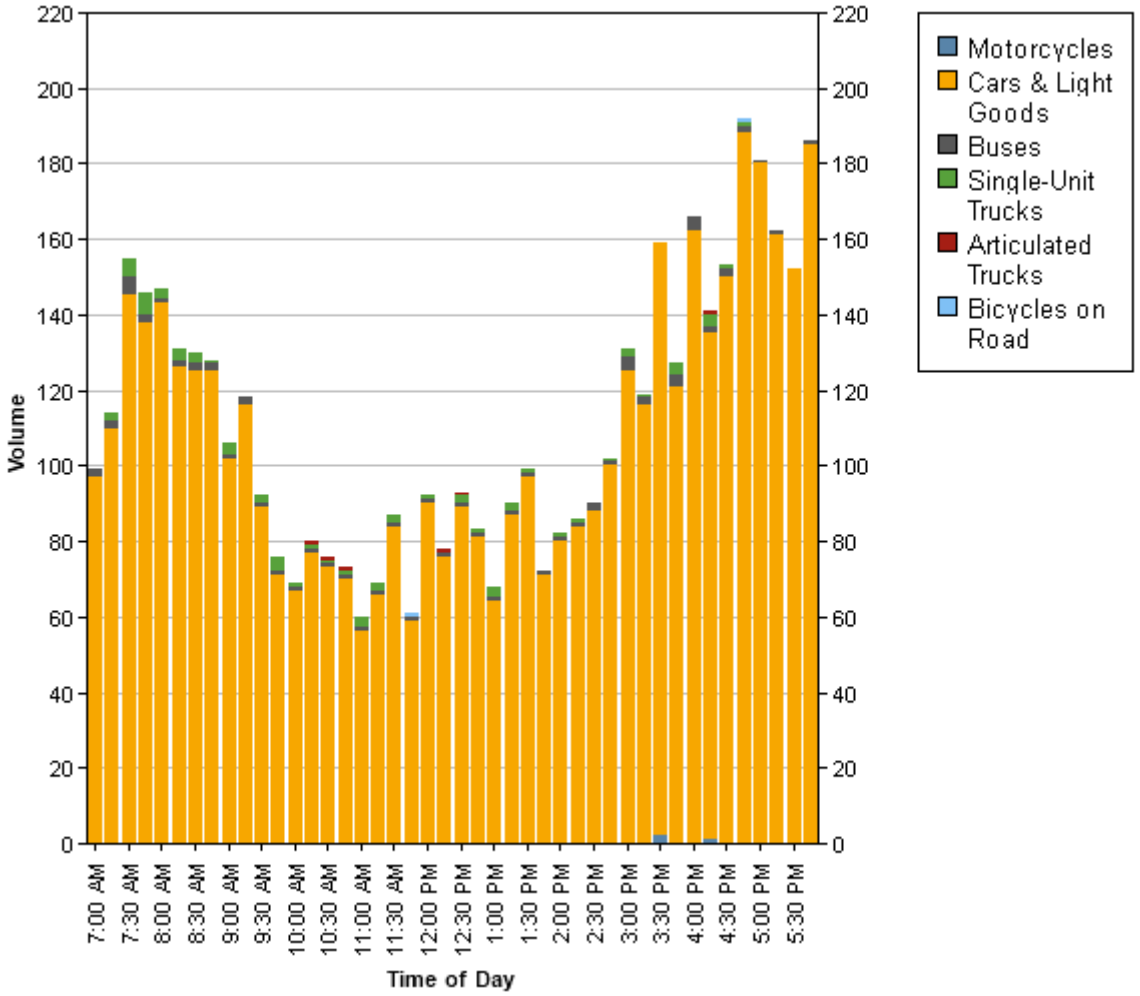
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 26 | 1 | 0 | 0 | 0 | 27 |
| 7:15 AM | 0 | 27 | 0 | 2 | 0 | 0 | 29 |
| 7:30 AM | 0 | 32 | 4 | 4 | 0 | 0 | 40 |
| 7:45 AM | 0 | 47 | 1 | 4 | 0 | 0 | 52 |
| 8:00 AM | 0 | 40 | 1 | 1 | 0 | 0 | 42 |
| 8:15 AM | 0 | 32 | 1 | 1 | 0 | 0 | 34 |
| 8:30 AM | 0 | 38 | 1 | 2 | 0 | 0 | 41 |
| 8:45 AM | 0 | 44 | 1 | 0 | 0 | 0 | 45 |
| 9:00 AM | 0 | 35 | 1 | 1 | 0 | 0 | 37 |
| 9:15 AM | 0 | 42 | 1 | 0 | 0 | 0 | 43 |
| 9:30 AM | 0 | 20 | 1 | 0 | 0 | 0 | 21 |
| 9:45 AM | 0 | 24 | 0 | 3 | 0 | 0 | 27 |
| 10:00 AM | 0 | 28 | 1 | 0 | 0 | 0 | 29 |
| 10:15 AM | 0 | 32 | 0 | 1 | 1 | 0 | 34 |
| 10:30 AM | 0 | 33 | 1 | 0 | 0 | 0 | 34 |
| 10:45 AM | 0 | 28 | 0 | 0 | 1 | 0 | 29 |
| 11:00 AM | 0 | 24 | 1 | 1 | 0 | 0 | 26 |
| 11:15 AM | 0 | 24 | 0 | 2 | 0 | 0 | 26 |
| 11:30 AM | 0 | 39 | 1 | 1 | 0 | 0 | 41 |
| 11:45 AM | 0 | 26 | 0 | 0 | 0 | 1 | 27 |
| 12:00 PM | 0 | 43 | 1 | 0 | 0 | 0 | 44 |
| 12:15 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 12:30 PM | 0 | 48 | 1 | 0 | 1 | 0 | 50 |
| 12:45 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 1:00 PM | 0 | 35 | 1 | 1 | 0 | 0 | 37 |
| 1:15 PM | 0 | 46 | 0 | 1 | 0 | 0 | 47 |
| 1:30 PM | 0 | 42 | 1 | 1 | 0 | 0 | 44 |
| 1:45 PM | 0 | 37 | 0 | 0 | 0 | 0 | 37 |
| 2:00 PM | 0 | 40 | 1 | 0 | 0 | 0 | 41 |
| 2:15 PM | 0 | 48 | 0 | 0 | 0 | 0 | 48 |
| 2:30 PM | 0 | 43 | 2 | 0 | 0 | 0 | 45 |
| 2:45 PM | 0 | 59 | 0 | 1 | 0 | 0 | 60 |
| 3:00 PM | 0 | 76 | 2 | 1 | 0 | 0 | 79 |
| 3:15 PM | 0 | 80 | 1 | 1 | 0 | 0 | 82 |
| 3:30 PM | 0 | 81 | 0 | 0 | 0 | 0 | 81 |
| 3:45 PM | 0 | 67 | 1 | 0 | 0 | 0 | 68 |
| 4:00 PM | 0 | 100 | 2 | 0 | 0 | 0 | 102 |
| 4:15 PM | 1 | 86 | 1 | 1 | 0 | 0 | 89 |
| 4:30 PM | 0 | 88 | 2 | 1 | 0 | 0 | 91 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 116 | 0 | 1 | 0 | 1 | 118 |
| 5:00 PM | 0 | 111 | 1 | 0 | 0 | 0 | 112 |
| 5:15 PM | 0 | 102 | 0 | 0 | 0 | 0 | 102 |
| 5:30 PM | 0 | 105 | 0 | 0 | 0 | 0 | 105 |
| 5:45 PM | 0 | 107 | 1 | 0 | 0 | 0 | 108 |
| Total | 1 | 2275 | 35 | 32 | 3 | 2 | 2348 |
| Total % | 0.0 | 96.9 | 1.5 | 1.4 | 0.1 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 7:00 AM | 7:30 AM | 10:00 AM | 11:00 AM | 7:30 AM |
| AM Peaks | 0 | 151 | 6 | 10 | 2 | 1 | 168 |
| PM Times | 3:30 PM | 4:45 PM | 3:45 PM | 12:30 PM | 12:00 PM | 4:00 PM | 4:30 PM |
| PM Peaks | 1 | 434 | 6 | 2 | 1 | 1 | 423 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Blair Creek Drive to New Dundee Road)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Doon South Drive to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Westbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 7:15 AM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 7:30 AM | 0 | 28 | 1 | 1 | 0 | 0 | 30 |
| 7:45 AM | 0 | 36 | 0 | 1 | 0 | 0 | 37 |
| 8:00 AM | 0 | 26 | 2 | 1 | 0 | 0 | 29 |
| 8:15 AM | 0 | 24 | 1 | 1 | 0 | 0 | 26 |
| 8:30 AM | 0 | 18 | 1 | 1 | 0 | 0 | 20 |
| 8:45 AM | 0 | 18 | 2 | 0 | 0 | 0 | 20 |
| 9:00 AM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 9:15 AM | 0 | 23 | 1 | 0 | 0 | 0 | 24 |
| 9:30 AM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 9:45 AM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 10:00 AM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 10:15 AM | 0 | 27 | 0 | 0 | 1 | 0 | 28 |
| 10:30 AM | 0 | 22 | 0 | 1 | 0 | 0 | 23 |
| 10:45 AM | 0 | 19 | 0 | 0 | 1 | 0 | 20 |
| 11:00 AM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 11:15 AM | 0 | 20 | 0 | 1 | 0 | 0 | 21 |
| 11:30 AM | 0 | 18 | 0 | 1 | 0 | 0 | 19 |
| 11:45 AM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 12:00 PM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 12:15 PM | 0 | 14 | 0 | 2 | 0 | 0 | 16 |
| 12:30 PM | 0 | 26 | 0 | 0 | 1 | 0 | 27 |
| 12:45 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 1:00 PM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 1:15 PM | 0 | 21 | 0 | 1 | 0 | 0 | 22 |
| 1:30 PM | 0 | 23 | 0 | 1 | 0 | 0 | 24 |
| 1:45 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 2:00 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 2:15 PM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 2:30 PM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 2:45 PM | 0 | 33 | 0 | 1 | 0 | 0 | 34 |
| 3:00 PM | 0 | 35 | 2 | 0 | 0 | 0 | 37 |
| 3:15 PM | 1 | 33 | 2 | 0 | 0 | 0 | 36 |
| 3:30 PM | 0 | 42 | 1 | 0 | 0 | 0 | 43 |
| 3:45 PM | 0 | 41 | 0 | 0 | 0 | 0 | 41 |
| 4:00 PM | 0 | 48 | 2 | 0 | 0 | 0 | 50 |
| 4:15 PM | 0 | 38 | 0 | 1 | 0 | 0 | 39 |
| 4:30 PM | 0 | 48 | 0 | 0 | 0 | 0 | 48 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 65 | 1 | 1 | 0 | 1 | 68 |
| 5:00 PM | 0 | 59 | 0 | 0 | 0 | 1 | 60 |
| 5:15 PM | 0 | 55 | 0 | 0 | 0 | 0 | 55 |
| 5:30 PM | 0 | 52 | 0 | 0 | 0 | 0 | 52 |
| 5:45 PM | 0 | 46 | 0 | 0 | 0 | 0 | 46 |
| Total | 1 | 1264 | 17 | 19 | 3 | 2 | 1306 |
| Total % | 0.1 | 96.8 | 1.3 | 1.5 | 0.2 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 8:00 AM | 10:30 AM | 10:00 AM | 7:00 AM | 7:30 AM |
| AM Peaks | 0 | 114 | 6 | 3 | 2 | 0 | 122 |
| PM Times | 2:45 PM | 4:45 PM | 3:00 PM | 3:30 PM | 12:00 PM | 4:30 PM | 4:45 PM |
| PM Peaks | 1 | 231 | 5 | 1 | 1 | 2 | 235 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Doon South Drive to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Eastbound)

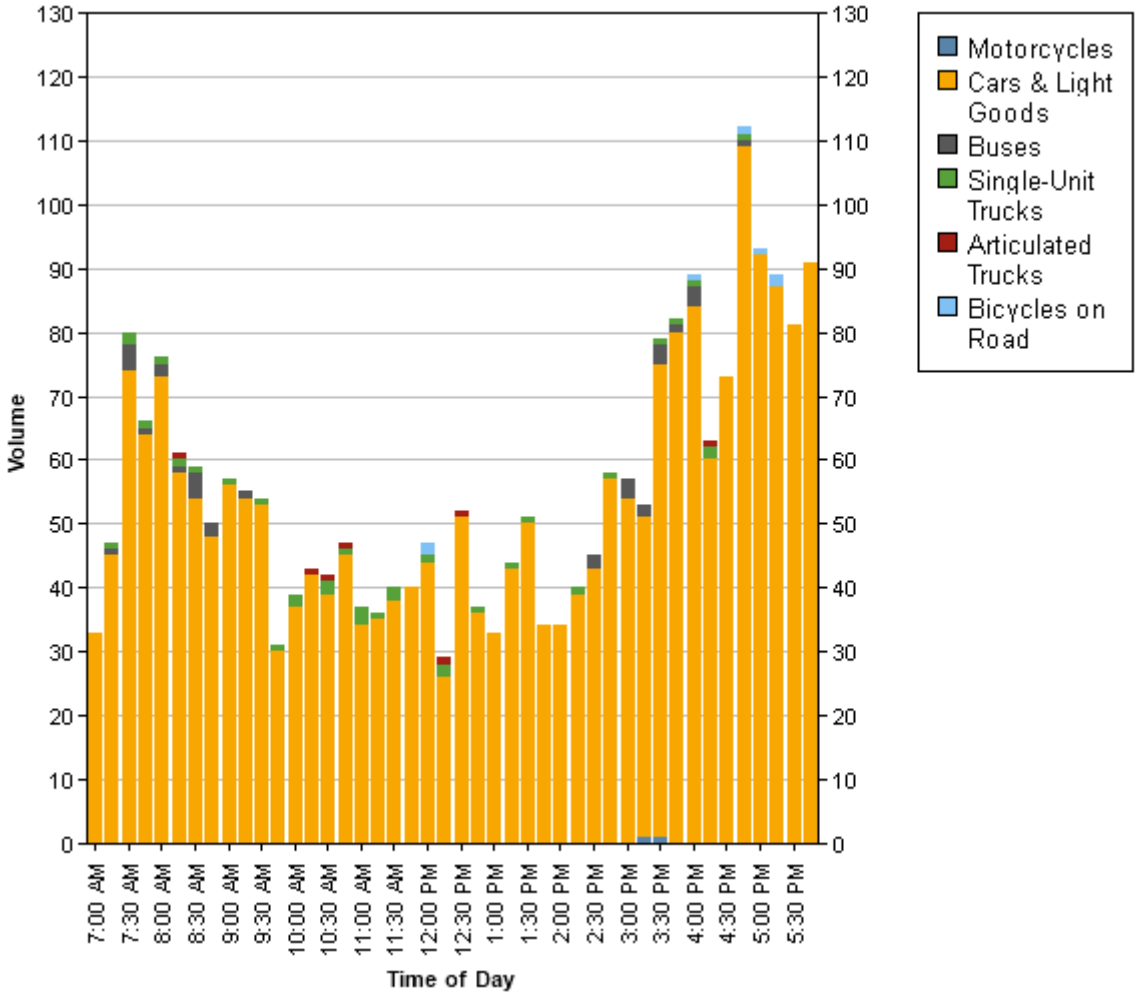
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 7:15 AM | 0 | 31 | 1 | 0 | 0 | 0 | 32 |
| 7:30 AM | 0 | 46 | 3 | 1 | 0 | 0 | 50 |
| 7:45 AM | 0 | 28 | 1 | 0 | 0 | 0 | 29 |
| 8:00 AM | 0 | 47 | 0 | 0 | 0 | 0 | 47 |
| 8:15 AM | 0 | 34 | 0 | 0 | 1 | 0 | 35 |
| 8:30 AM | 0 | 36 | 3 | 0 | 0 | 0 | 39 |
| 8:45 AM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 9:00 AM | 0 | 27 | 0 | 1 | 0 | 0 | 28 |
| 9:15 AM | 0 | 31 | 0 | 0 | 0 | 0 | 31 |
| 9:30 AM | 0 | 32 | 0 | 1 | 0 | 0 | 33 |
| 9:45 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 10:00 AM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 10:15 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 10:30 AM | 0 | 17 | 0 | 1 | 1 | 0 | 19 |
| 10:45 AM | 0 | 26 | 0 | 1 | 0 | 0 | 27 |
| 11:00 AM | 0 | 13 | 0 | 2 | 0 | 0 | 15 |
| 11:15 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 11:30 AM | 0 | 20 | 0 | 1 | 0 | 0 | 21 |
| 11:45 AM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 12:00 PM | 0 | 18 | 0 | 1 | 0 | 2 | 21 |
| 12:15 PM | 0 | 12 | 0 | 0 | 1 | 0 | 13 |
| 12:30 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 12:45 PM | 0 | 15 | 0 | 1 | 0 | 0 | 16 |
| 1:00 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 1:15 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 1:30 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 1:45 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 2:00 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 2:15 PM | 0 | 13 | 0 | 1 | 0 | 0 | 14 |
| 2:30 PM | 0 | 24 | 1 | 0 | 0 | 0 | 25 |
| 2:45 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 3:00 PM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 3:15 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 3:30 PM | 1 | 32 | 2 | 1 | 0 | 0 | 36 |
| 3:45 PM | 0 | 39 | 1 | 1 | 0 | 0 | 41 |
| 4:00 PM | 0 | 36 | 1 | 1 | 0 | 1 | 39 |
| 4:15 PM | 0 | 22 | 0 | 1 | 1 | 0 | 24 |
| 4:30 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 44 | 0 | 0 | 0 | 0 | 44 |
| 5:00 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 5:15 PM | 0 | 32 | 0 | 0 | 0 | 2 | 34 |
| 5:30 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 5:45 PM | 0 | 45 | 0 | 0 | 0 | 0 | 45 |
| Total | 1 | 1113 | 14 | 16 | 4 | 5 | 1153 |
| Total % | 0.1 | 96.5 | 1.2 | 1.4 | 0.3 | 0.4 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 8:00 AM | 10:30 AM | 10:00 AM | 7:00 AM | 7:30 AM |
| AM Peaks | 0 | 155 | 3 | 4 | 1 | 0 | 161 |
| PM Times | 2:45 PM | 4:45 PM | 3:00 PM | 3:30 PM | 12:00 PM | 4:30 PM | 4:45 PM |
| PM Peaks | 1 | 138 | 4 | 4 | 1 | 2 | 140 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Doon South Drive to Thomas Slee Drive)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Forest Creek Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Westbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 7:15 AM | 0 | 11 | 2 | 0 | 0 | 0 | 13 |
| 7:30 AM | 0 | 26 | 6 | 0 | 0 | 0 | 32 |
| 7:45 AM | 0 | 25 | 0 | 2 | 0 | 0 | 27 |
| 8:00 AM | 0 | 21 | 4 | 0 | 0 | 0 | 25 |
| 8:15 AM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 8:30 AM | 0 | 24 | 2 | 1 | 0 | 0 | 27 |
| 8:45 AM | 0 | 35 | 2 | 0 | 0 | 0 | 37 |
| 9:00 AM | 0 | 38 | 3 | 0 | 0 | 0 | 41 |
| 9:15 AM | 0 | 26 | 1 | 0 | 0 | 0 | 27 |
| 9:30 AM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 9:45 AM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 10:00 AM | 0 | 15 | 1 | 2 | 0 | 0 | 18 |
| 10:15 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 10:30 AM | 0 | 13 | 1 | 1 | 0 | 0 | 15 |
| 10:45 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 11:00 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 11:15 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 11:30 AM | 0 | 5 | 1 | 0 | 0 | 0 | 6 |
| 11:45 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 12:00 PM | 0 | 14 | 1 | 3 | 0 | 0 | 18 |
| 12:15 PM | 0 | 13 | 0 | 1 | 0 | 0 | 14 |
| 12:30 PM | 0 | 15 | 1 | 1 | 0 | 0 | 17 |
| 12:45 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 1:00 PM | 0 | 20 | 1 | 0 | 0 | 1 | 22 |
| 1:15 PM | 0 | 7 | 0 | 1 | 0 | 0 | 8 |
| 1:30 PM | 0 | 14 | 1 | 1 | 0 | 0 | 16 |
| 1:45 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 2:00 PM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 2:15 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 2:30 PM | 0 | 20 | 1 | 0 | 0 | 0 | 21 |
| 2:45 PM | 0 | 23 | 2 | 0 | 0 | 0 | 25 |
| 3:00 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 3:15 PM | 0 | 34 | 6 | 0 | 0 | 0 | 40 |
| 3:30 PM | 0 | 34 | 2 | 0 | 0 | 0 | 36 |
| 3:45 PM | 0 | 26 | 1 | 0 | 0 | 0 | 27 |
| 4:00 PM | 0 | 34 | 3 | 0 | 0 | 0 | 37 |
| 4:15 PM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 4:30 PM | 0 | 31 | 1 | 0 | 0 | 0 | 32 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 5:00 PM | 0 | 39 | 1 | 0 | 0 | 0 | 40 |
| 5:15 PM | 1 | 37 | 0 | 0 | 0 | 0 | 38 |
| 5:30 PM | 0 | 33 | 1 | 0 | 1 | 0 | 35 |
| 5:45 PM | 0 | 28 | 0 | 1 | 0 | 0 | 29 |
| Total | 1 | 942 | 49 | 17 | 1 | 1 | 1011 |
| Total % | 0.1 | 93.2 | 4.8 | 1.7 | 0.1 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 7:15 AM | 9:45 AM | 8:30 AM | 10:45 AM | 8:15 AM |
| AM Peaks | 0 | 126 | 12 | 4 | 0 | 0 | 135 |
| PM Times | 4:30 PM | 4:45 PM | 2:45 PM | 12:00 PM | 5:00 PM | 12:15 PM | 4:45 PM |
| PM Peaks | 1 | 144 | 10 | 5 | 1 | 1 | 148 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Forest Creek Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Eastbound)

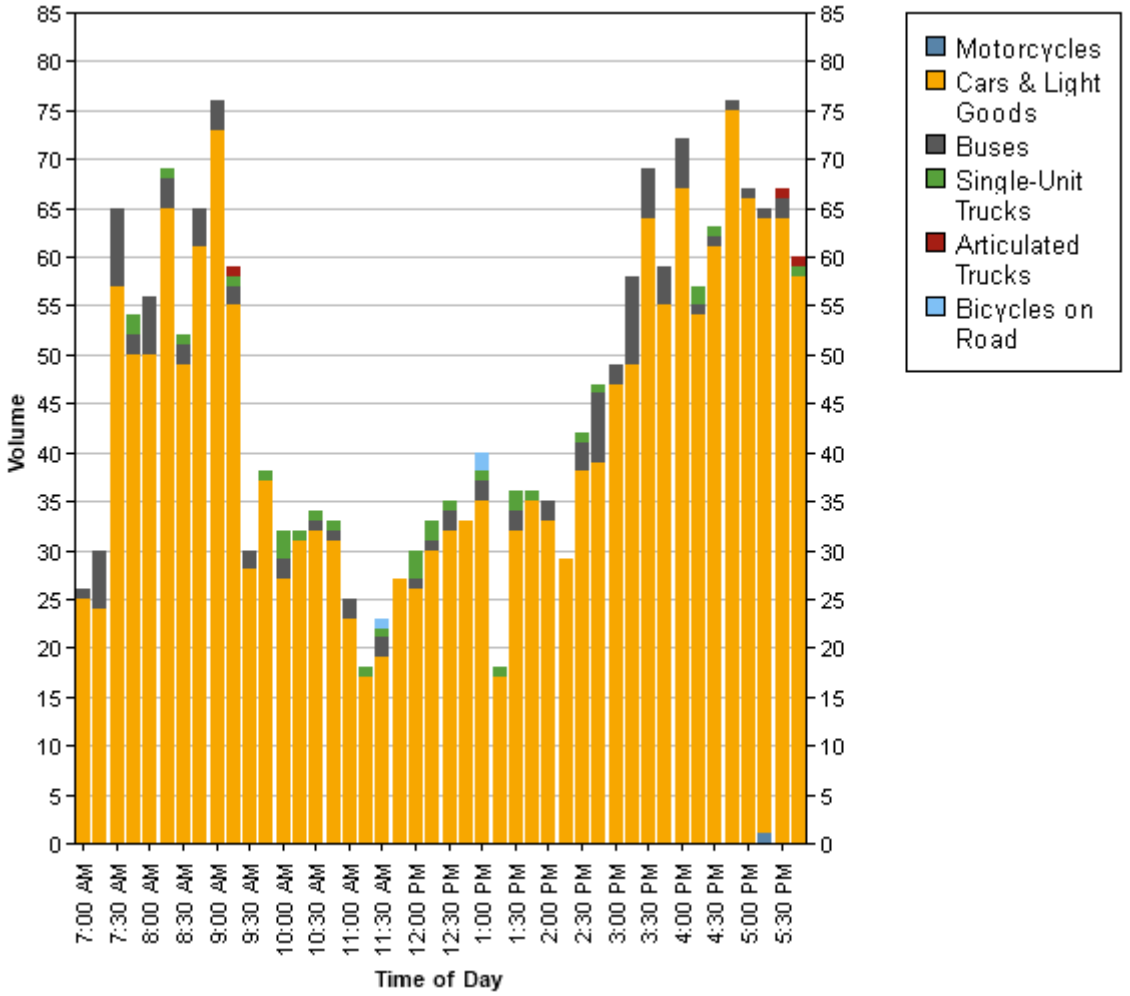
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 7:15 AM | 0 | 13 | 4 | 0 | 0 | 0 | 17 |
| 7:30 AM | 0 | 31 | 2 | 0 | 0 | 0 | 33 |
| 7:45 AM | 0 | 25 | 2 | 0 | 0 | 0 | 27 |
| 8:00 AM | 0 | 29 | 2 | 0 | 0 | 0 | 31 |
| 8:15 AM | 0 | 36 | 3 | 0 | 0 | 0 | 39 |
| 8:30 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 8:45 AM | 0 | 26 | 2 | 0 | 0 | 0 | 28 |
| 9:00 AM | 0 | 35 | 0 | 0 | 0 | 0 | 35 |
| 9:15 AM | 0 | 29 | 1 | 1 | 1 | 0 | 32 |
| 9:30 AM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 9:45 AM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 10:00 AM | 0 | 12 | 1 | 1 | 0 | 0 | 14 |
| 10:15 AM | 0 | 15 | 0 | 1 | 0 | 0 | 16 |
| 10:30 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 10:45 AM | 0 | 15 | 1 | 1 | 0 | 0 | 17 |
| 11:00 AM | 0 | 15 | 1 | 0 | 0 | 0 | 16 |
| 11:15 AM | 0 | 8 | 0 | 1 | 0 | 0 | 9 |
| 11:30 AM | 0 | 14 | 1 | 1 | 0 | 1 | 17 |
| 11:45 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 12:00 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 12:15 PM | 0 | 17 | 1 | 1 | 0 | 0 | 19 |
| 12:30 PM | 0 | 17 | 1 | 0 | 0 | 0 | 18 |
| 12:45 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 1:00 PM | 0 | 15 | 1 | 1 | 0 | 1 | 18 |
| 1:15 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 1:30 PM | 0 | 18 | 1 | 1 | 0 | 0 | 20 |
| 1:45 PM | 0 | 17 | 0 | 1 | 0 | 0 | 18 |
| 2:00 PM | 0 | 17 | 1 | 0 | 0 | 0 | 18 |
| 2:15 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 2:30 PM | 0 | 18 | 2 | 1 | 0 | 0 | 21 |
| 2:45 PM | 0 | 16 | 5 | 1 | 0 | 0 | 22 |
| 3:00 PM | 0 | 17 | 2 | 0 | 0 | 0 | 19 |
| 3:15 PM | 0 | 15 | 3 | 0 | 0 | 0 | 18 |
| 3:30 PM | 0 | 30 | 3 | 0 | 0 | 0 | 33 |
| 3:45 PM | 0 | 29 | 3 | 0 | 0 | 0 | 32 |
| 4:00 PM | 0 | 33 | 2 | 0 | 0 | 0 | 35 |
| 4:15 PM | 0 | 25 | 1 | 1 | 0 | 0 | 27 |
| 4:30 PM | 0 | 30 | 0 | 1 | 0 | 0 | 31 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 40 | 1 | 0 | 0 | 0 | 41 |
| 5:00 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 5:15 PM | 0 | 26 | 1 | 0 | 0 | 0 | 27 |
| 5:30 PM | 0 | 31 | 1 | 0 | 0 | 0 | 32 |
| 5:45 PM | 0 | 30 | 0 | 0 | 1 | 0 | 31 |
| Total | 0 | 941 | 50 | 14 | 2 | 2 | 1009 |
| Total % | 0.0 | 93.3 | 5.0 | 1.4 | 0.2 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 7:15 AM | 9:45 AM | 8:30 AM | 10:45 AM | 8:15 AM |
| AM Peaks | 0 | 122 | 10 | 2 | 1 | 1 | 127 |
| PM Times | 4:30 PM | 4:45 PM | 2:45 PM | 12:00 PM | 5:00 PM | 12:15 PM | 4:45 PM |
| PM Peaks | 0 | 124 | 13 | 1 | 1 | 1 | 127 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (Forest Creek Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/11/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (South Creek Drive to Forest Creek Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Westbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 14 | 2 | 0 | 0 | 0 | 16 |
| 7:15 AM | 0 | 14 | 2 | 0 | 0 | 2 | 18 |
| 7:30 AM | 0 | 26 | 7 | 0 | 0 | 0 | 33 |
| 7:45 AM | 0 | 33 | 1 | 1 | 0 | 0 | 35 |
| 8:00 AM | 0 | 25 | 2 | 1 | 0 | 0 | 28 |
| 8:15 AM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 8:30 AM | 0 | 30 | 1 | 1 | 0 | 0 | 32 |
| 8:45 AM | 0 | 37 | 2 | 1 | 0 | 0 | 40 |
| 9:00 AM | 0 | 32 | 3 | 0 | 0 | 0 | 35 |
| 9:15 AM | 0 | 30 | 3 | 0 | 0 | 0 | 33 |
| 9:30 AM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 9:45 AM | 0 | 20 | 0 | 1 | 0 | 0 | 21 |
| 10:00 AM | 0 | 17 | 1 | 1 | 0 | 0 | 19 |
| 10:15 AM | 0 | 24 | 0 | 3 | 0 | 0 | 27 |
| 10:30 AM | 0 | 19 | 1 | 1 | 0 | 0 | 21 |
| 10:45 AM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 11:00 AM | 0 | 15 | 1 | 0 | 0 | 0 | 16 |
| 11:15 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 11:30 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 11:45 AM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 12:00 PM | 0 | 22 | 1 | 3 | 0 | 0 | 26 |
| 12:15 PM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 12:30 PM | 0 | 18 | 1 | 2 | 0 | 0 | 21 |
| 12:45 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 1:00 PM | 0 | 24 | 1 | 0 | 0 | 1 | 26 |
| 1:15 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 1:30 PM | 0 | 14 | 1 | 0 | 0 | 0 | 15 |
| 1:45 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 2:00 PM | 0 | 24 | 1 | 0 | 0 | 0 | 25 |
| 2:15 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 2:30 PM | 0 | 24 | 1 | 0 | 0 | 0 | 25 |
| 2:45 PM | 0 | 36 | 2 | 0 | 0 | 0 | 38 |
| 3:00 PM | 0 | 31 | 2 | 0 | 0 | 0 | 33 |
| 3:15 PM | 0 | 32 | 3 | 0 | 0 | 0 | 35 |
| 3:30 PM | 0 | 31 | 4 | 0 | 0 | 0 | 35 |
| 3:45 PM | 0 | 33 | 1 | 0 | 1 | 0 | 35 |
| 4:00 PM | 0 | 38 | 2 | 0 | 0 | 0 | 40 |
| 4:15 PM | 0 | 36 | 1 | 1 | 0 | 0 | 38 |
| 4:30 PM | 0 | 42 | 0 | 1 | 0 | 0 | 43 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 43 | 1 | 0 | 0 | 0 | 44 |
| 5:00 PM | 0 | 56 | 0 | 0 | 0 | 1 | 57 |
| 5:15 PM | 0 | 50 | 1 | 0 | 0 | 0 | 51 |
| 5:30 PM | 0 | 47 | 1 | 2 | 1 | 0 | 51 |
| 5:45 PM | 0 | 50 | 0 | 1 | 0 | 0 | 51 |
| Total | 0 | 1216 | 52 | 20 | 2 | 4 | 1294 |
| Total % | 0.0 | 94.0 | 4.0 | 1.5 | 0.2 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 7:00 AM | 10:00 AM | 8:30 AM | 7:00 AM | 8:30 AM |
| AM Peaks | 0 | 126 | 12 | 5 | 0 | 2 | 140 |
| PM Times | 12:00 PM | 4:45 PM | 2:45 PM | 12:00 PM | 5:00 PM | 12:15 PM | 4:45 PM |
| PM Peaks | 0 | 196 | 11 | 5 | 1 | 1 | 203 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (South Creek Drive to Forest Creek Drive)
Site Code: 230376
Start Date: 10/11/2023


## Direction (Eastbound)

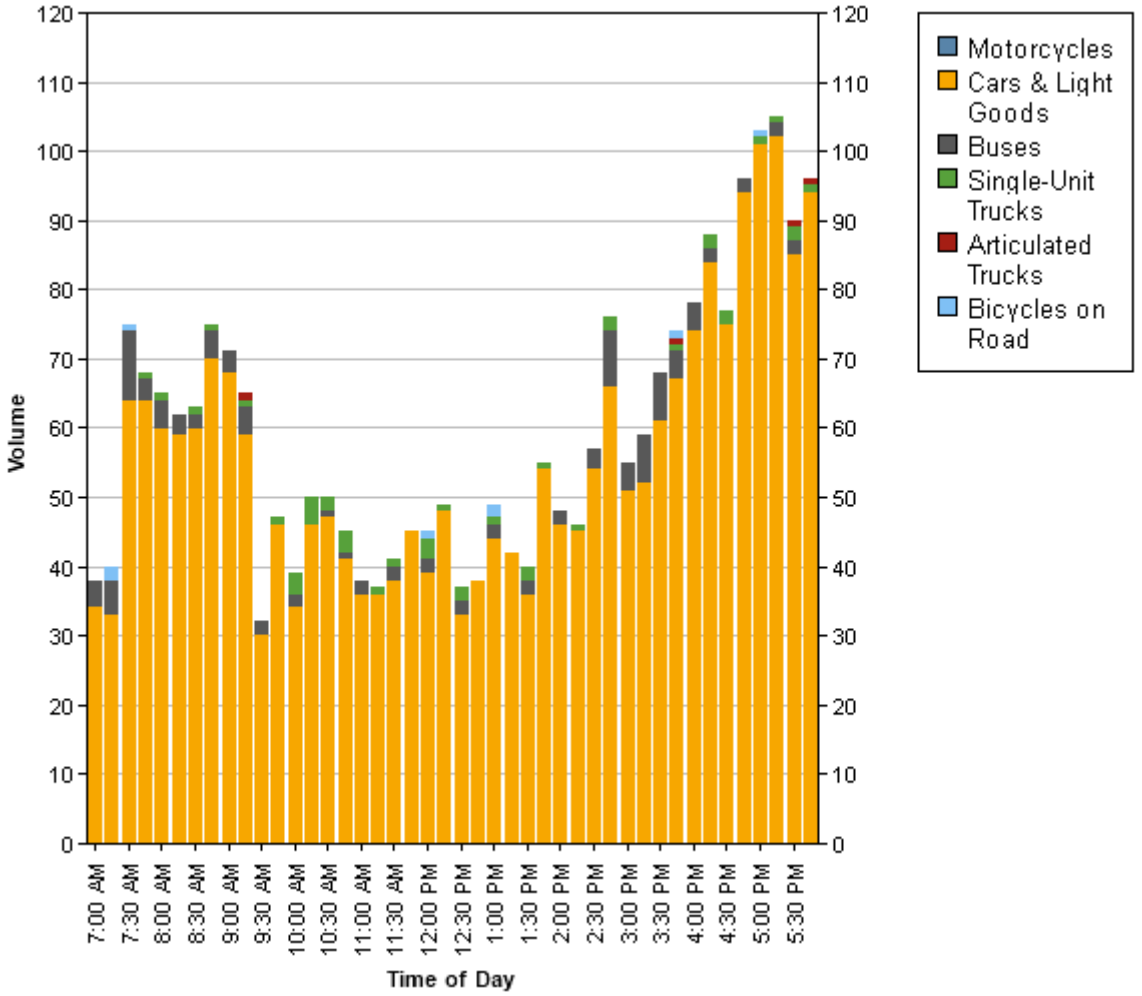
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 20 | 2 | 0 | 0 | 0 | 22 |
| 7:15 AM | 0 | 19 | 3 | 0 | 0 | 0 | 22 |
| 7:30 AM | 0 | 38 | 3 | 0 | 0 | 1 | 42 |
| 7:45 AM | 0 | 31 | 2 | 0 | 0 | 0 | 33 |
| 8:00 AM | 0 | 35 | 2 | 0 | 0 | 0 | 37 |
| 8:15 AM | 0 | 32 | 3 | 0 | 0 | 0 | 35 |
| 8:30 AM | 0 | 30 | 1 | 0 | 0 | 0 | 31 |
| 8:45 AM | 0 | 33 | 2 | 0 | 0 | 0 | 35 |
| 9:00 AM | 0 | 36 | 0 | 0 | 0 | 0 | 36 |
| 9:15 AM | 0 | 29 | 1 | 1 | 1 | 0 | 32 |
| 9:30 AM | 0 | 21 | 1 | 0 | 0 | 0 | 22 |
| 9:45 AM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 10:00 AM | 0 | 17 | 1 | 2 | 0 | 0 | 20 |
| 10:15 AM | 0 | 22 | 0 | 1 | 0 | 0 | 23 |
| 10:30 AM | 0 | 28 | 0 | 1 | 0 | 0 | 29 |
| 10:45 AM | 0 | 20 | 1 | 3 | 0 | 0 | 24 |
| 11:00 AM | 0 | 21 | 1 | 0 | 0 | 0 | 22 |
| 11:15 AM | 0 | 17 | 0 | 1 | 0 | 0 | 18 |
| 11:30 AM | 0 | 25 | 1 | 1 | 0 | 0 | 27 |
| 11:45 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 12:00 PM | 0 | 17 | 1 | 0 | 0 | 1 | 19 |
| 12:15 PM | 0 | 25 | 0 | 1 | 0 | 0 | 26 |
| 12:30 PM | 0 | 15 | 1 | 0 | 0 | 0 | 16 |
| 12:45 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 1:00 PM | 0 | 20 | 1 | 1 | 0 | 1 | 23 |
| 1:15 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 1:30 PM | 0 | 22 | 1 | 2 | 0 | 0 | 25 |
| 1:45 PM | 0 | 24 | 0 | 1 | 0 | 0 | 25 |
| 2:00 PM | 0 | 22 | 1 | 0 | 0 | 0 | 23 |
| 2:15 PM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 2:30 PM | 0 | 30 | 2 | 0 | 0 | 0 | 32 |
| 2:45 PM | 0 | 30 | 6 | 2 | 0 | 0 | 38 |
| 3:00 PM | 0 | 20 | 2 | 0 | 0 | 0 | 22 |
| 3:15 PM | 0 | 20 | 4 | 0 | 0 | 0 | 24 |
| 3:30 PM | 0 | 30 | 3 | 0 | 0 | 0 | 33 |
| 3:45 PM | 0 | 34 | 3 | 1 | 0 | 1 | 39 |
| 4:00 PM | 0 | 36 | 2 | 0 | 0 | 0 | 38 |
| 4:15 PM | 0 | 48 | 1 | 1 | 0 | 0 | 50 |
| 4:30 PM | 0 | 33 | 0 | 1 | 0 | 0 | 34 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 51 | 1 | 0 | 0 | 0 | 52 |
| 5:00 PM | 0 | 45 | 0 | 1 | 0 | 0 | 46 |
| 5:15 PM | 0 | 52 | 1 | 1 | 0 | 0 | 54 |
| 5:30 PM | 0 | 38 | 1 | 0 | 0 | 0 | 39 |
| 5:45 PM | 0 | 44 | 0 | 0 | 1 | 0 | 45 |
| Total | 0 | 1239 | 55 | 23 | 2 | 4 | 1323 |
| Total % | 0.0 | 93.7 | 4.2 | 1.7 | 0.2 | 0.3 | 100.0 |
| AM Times | 7:00 AM | 8:15 AM | 7:00 AM | 10:00 AM | 8:30 AM | 7:00 AM | 8:30 AM |
| AM Peaks | 0 | 131 | 10 | 7 | 1 | 1 | 134 |
| PM Times | 12:00 PM | 4:45 PM | 2:45 PM | 12:00 PM | 5:00 PM | 12:15 PM | 4:45 PM |
| PM Peaks | 0 | 186 | 15 | 1 | 1 | 1 | 191 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Robert Ferrie Drive (South Creek Drive to Forest Creek Drive)
Site Code: 230376
Start Date: 10/11/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: South Creek Drive (Robert Ferrie Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 3 | 2 | 0 | 0 | 0 | 5 |
| 7:15 AM | 0 | 9 | 2 | 0 | 0 | 0 | 11 |
| 7:30 AM | 0 | 10 | 1 | 1 | 0 | 0 | 12 |
| 7:45 AM | 0 | 10 | 0 | 0 | 0 | 1 | 11 |
| 8:00 AM | 0 | 25 | 1 | 1 | 0 | 0 | 27 |
| 8:15 AM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 8:30 AM | 0 | 15 | 1 | 1 | 0 | 0 | 17 |
| 8:45 AM | 0 | 23 | 1 | 1 | 0 | 0 | 25 |
| 9:00 AM | 1 | 43 | 0 | 0 | 0 | 0 | 44 |
| 9:15 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 9:30 AM | 0 | 8 | 0 | 1 | 0 | 0 | 9 |
| 9:45 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 10:00 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 10:15 AM | 0 | 15 | 0 | 1 | 0 | 0 | 16 |
| 10:30 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 10:45 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 11:00 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:15 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 11:30 AM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 11:45 AM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 12:00 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:15 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 12:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:45 PM | 0 | 14 | 0 | 1 | 0 | 0 | 15 |
| 1:00 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 1:15 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 1:30 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 1:45 PM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 2:00 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 2:15 PM | 1 | 17 | 0 | 1 | 0 | 0 | 19 |
| 2:30 PM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 2:45 PM | 0 | 29 | 4 | 0 | 0 | 0 | 33 |
| 3:00 PM | 0 | 26 | 1 | 0 | 0 | 0 | 27 |
| 3:15 PM | 0 | 42 | 1 | 0 | 0 | 0 | 43 |
| 3:30 PM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 3:45 PM | 0 | 20 | 3 | 0 | 0 | 0 | 23 |
| 4:00 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 4:15 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 4:30 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 5:00 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 5:15 PM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 5:30 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 5:45 PM | 0 | 35 | 0 | 1 | 0 | 0 | 36 |
| Total | 2 | 788 | 18 | 11 | 0 | 1 | 820 |
| Total % | 0.2 | 96.1 | 2.2 | 1.3 | 0.0 | 0.1 | 100.0 |
| AM Times | 8:15 AM | 8:15 AM | 7:00 AM | 8:30 AM | 10:15 AM | 7:00 AM | 8:15 AM |
| AM Peaks | 1 | 103 | 5 | 2 | 0 | 1 | 108 |
| PM Times | 1:30 PM | 3:15 PM | 2:30 PM | 1:30 PM | 2:15 PM | 12:00 PM | 3:15 PM |
| PM Peaks | 1 | 108 | 7 | 2 | 0 | 0 | 112 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: South Creek Drive (Robert Ferrie Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Northbound)

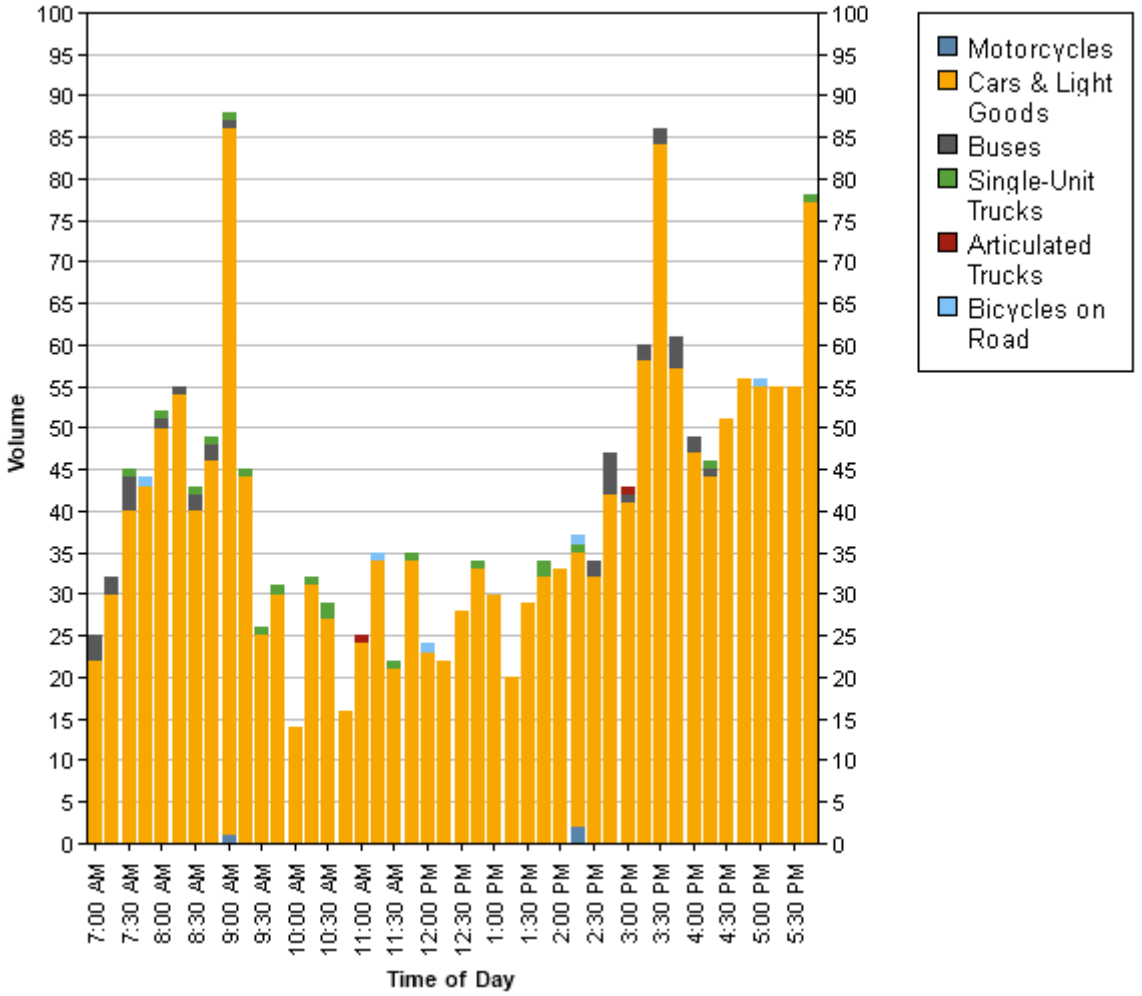
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 7:15 AM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 7:30 AM | 0 | 30 | 3 | 0 | 0 | 0 | 33 |
| 7:45 AM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 8:00 AM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 8:15 AM | 0 | 32 | 1 | 0 | 0 | 0 | 33 |
| 8:30 AM | 0 | 25 | 1 | 0 | 0 | 0 | 26 |
| 8:45 AM | 0 | 23 | 1 | 0 | 0 | 0 | 24 |
| 9:00 AM | 0 | 42 | 1 | 1 | 0 | 0 | 44 |
| 9:15 AM | 0 | 34 | 0 | 1 | 0 | 0 | 35 |
| 9:30 AM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 9:45 AM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 10:00 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 10:15 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 10:30 AM | 0 | 17 | 0 | 2 | 0 | 0 | 19 |
| 10:45 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:00 AM | 0 | 17 | 0 | 0 | 1 | 0 | 18 |
| 11:15 AM | 0 | 20 | 0 | 0 | 0 | 1 | 21 |
| 11:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:45 AM | 0 | 22 | 0 | 1 | 0 | 0 | 23 |
| 12:00 PM | 0 | 14 | 0 | 0 | 0 | 1 | 15 |
| 12:15 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:30 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 12:45 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 1:00 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 1:15 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 1:30 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 1:45 PM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 2:00 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 2:15 PM | 1 | 16 | 0 | 0 | 0 | 1 | 18 |
| 2:30 PM | 0 | 14 | 1 | 0 | 0 | 0 | 15 |
| 2:45 PM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 3:00 PM | 0 | 15 | 0 | 0 | 1 | 0 | 16 |
| 3:15 PM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 3:30 PM | 0 | 58 | 2 | 0 | 0 | 0 | 60 |
| 3:45 PM | 0 | 37 | 1 | 0 | 0 | 0 | 38 |
| 4:00 PM | 0 | 27 | 2 | 0 | 0 | 0 | 29 |
| 4:15 PM | 0 | 17 | 1 | 1 | 0 | 0 | 19 |
| 4:30 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 26 | 0 | 0 | 0 | 0 | 26 |
| 5:00 PM | 0 | 28 | 0 | 0 | 0 | 1 | 29 |
| 5:15 PM | 0 | 23 | 0 | 0 | 0 | 0 | 23 |
| 5:30 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| 5:45 PM | 0 | 42 | 0 | 0 | 0 | 0 | 42 |
| Total | 1 | 959 | 17 | 8 | 2 | 4 | 991 |
| Total % | 0.1 | 96.8 | 1.7 | 0.8 | 0.2 | 0.4 | 100.0 |
| AM Times | 8:15 AM | 8:15 AM | 7:00 AM | 8:30 AM | 10:15 AM | 7:00 AM | 8:15 AM |
| AM Peaks | 0 | 122 | 4 | 2 | 1 | 0 | 127 |
| PM Times | 1:30 PM | 3:15 PM | 2:30 PM | 1:30 PM | 2:15 PM | 12:00 PM | 3:15 PM |
| PM Peaks | 1 | 138 | 3 | 1 | 1 | 1 | 144 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: South Creek Drive (Robert Ferrie Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Thomas Slee Drive (Doon South Drive to Robert Ferrie Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Westbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 7:15 AM | 0 | 10 | 0 | 1 | 0 | 0 | 11 |
| 7:30 AM | 0 | 10 | 5 | 1 | 0 | 0 | 16 |
| 7:45 AM | 0 | 18 | 0 | 1 | 0 | 0 | 19 |
| 8:00 AM | 0 | 10 | 1 | 1 | 0 | 0 | 12 |
| 8:15 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 8:30 AM | 0 | 17 | 2 | 0 | 0 | 0 | 19 |
| 8:45 AM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 9:00 AM | 0 | 17 | 1 | 2 | 0 | 1 | 21 |
| 9:15 AM | 0 | 15 | 0 | 1 | 0 | 0 | 16 |
| 9:30 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 9:45 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 10:00 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 10:15 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 10:30 AM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 10:45 AM | 0 | 12 | 0 | 1 | 1 | 0 | 14 |
| 11:00 AM | 0 | 11 | 1 | 1 | 0 | 0 | 13 |
| 11:15 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 11:30 AM | 0 | 12 | 1 | 0 | 0 | 0 | 13 |
| 11:45 AM | 0 | 10 | 0 | 1 | 0 | 1 | 12 |
| 12:00 PM | 0 | 10 | 1 | 1 | 0 | 0 | 12 |
| 12:15 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:30 PM | 0 | 5 | 0 | 1 | 0 | 0 | 6 |
| 12:45 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 1:00 PM | 0 | 11 | 1 | 0 | 0 | 0 | 12 |
| 1:15 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 1:30 PM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 1:45 PM | 0 | 8 | 0 | 1 | 0 | 0 | 9 |
| 2:00 PM | 0 | 17 | 1 | 1 | 0 | 1 | 20 |
| 2:15 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 2:30 PM | 0 | 15 | 1 | 0 | 0 | 0 | 16 |
| 2:45 PM | 0 | 18 | 0 | 1 | 0 | 0 | 19 |
| 3:00 PM | 0 | 29 | 1 | 1 | 0 | 0 | 31 |
| 3:15 PM | 0 | 32 | 0 | 0 | 0 | 0 | 32 |
| 3:30 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 3:45 PM | 0 | 19 | 2 | 0 | 0 | 0 | 21 |
| 4:00 PM | 0 | 37 | 1 | 0 | 0 | 1 | 39 |
| 4:15 PM | 0 | 40 | 0 | 0 | 0 | 0 | 40 |
| 4:30 PM | 0 | 30 | 1 | 0 | 0 | 0 | 31 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 31 | 0 | 0 | 0 | 1 | 32 |
| 5:00 PM | 0 | 31 | 1 | 0 | 0 | 0 | 32 |
| 5:15 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 5:30 PM | 0 | 36 | 0 | 0 | 0 | 0 | 36 |
| 5:45 PM | 0 | 22 | 1 | 0 | 0 | 0 | 23 |
| Total | 0 | 767 | 27 | 16 | 1 | 5 | 816 |
| Total % | 0.0 | 94.0 | 3.3 | 2.0 | 0.1 | 0.6 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 7:15 AM | 7:15 AM | 7:15 AM | 8:15 AM | 7:30 AM |
| AM Peaks | 0 | 54 | 6 | 4 | 0 | 1 | 63 |
| PM Times | 12:00 PM | 3:30 PM | 3:00 PM | 12:15 PM | 12:00 PM | 4:00 PM | 3:30 PM |
| PM Peaks | 0 | 118 | 3 | 1 | 0 | 2 | 122 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Thomas Slee Drive (Doon South Drive to Robert Ferrie Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Eastbound)

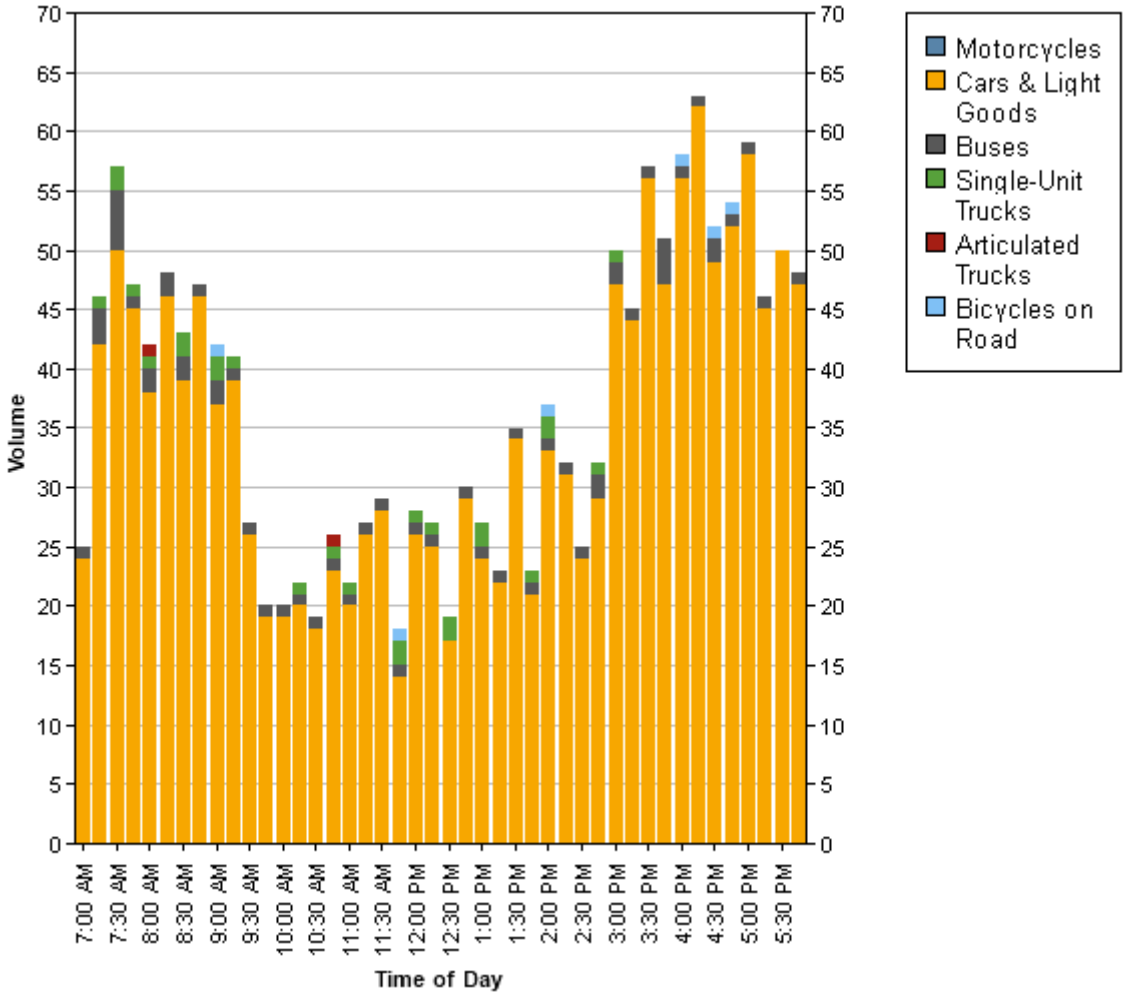
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 7:15 AM | 0 | 32 | 3 | 0 | 0 | 0 | 35 |
| 7:30 AM | 0 | 40 | 0 | 1 | 0 | 0 | 41 |
| 7:45 AM | 0 | 27 | 1 | 0 | 0 | 0 | 28 |
| 8:00 AM | 0 | 28 | 1 | 0 | 1 | 0 | 30 |
| 8:15 AM | 0 | 30 | 2 | 0 | 0 | 0 | 32 |
| 8:30 AM | 0 | 22 | 0 | 2 | 0 | 0 | 24 |
| 8:45 AM | 0 | 19 | 1 | 0 | 0 | 0 | 20 |
| 9:00 AM | 0 | 20 | 1 | 0 | 0 | 0 | 21 |
| 9:15 AM | 0 | 24 | 1 | 0 | 0 | 0 | 25 |
| 9:30 AM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 9:45 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 10:00 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 10:15 AM | 0 | 14 | 1 | 1 | 0 | 0 | 16 |
| 10:30 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 10:45 AM | 0 | 11 | 1 | 0 | 0 | 0 | 12 |
| 11:00 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 11:15 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 11:30 AM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 11:45 AM | 0 | 4 | 1 | 1 | 0 | 0 | 6 |
| 12:00 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 12:15 PM | 0 | 16 | 1 | 1 | 0 | 0 | 18 |
| 12:30 PM | 0 | 12 | 0 | 1 | 0 | 0 | 13 |
| 12:45 PM | 0 | 16 | 1 | 0 | 0 | 0 | 17 |
| 1:00 PM | 0 | 13 | 0 | 2 | 0 | 0 | 15 |
| 1:15 PM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 1:30 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 1:45 PM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 2:00 PM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 2:15 PM | 0 | 11 | 1 | 0 | 0 | 0 | 12 |
| 2:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 2:45 PM | 0 | 11 | 2 | 0 | 0 | 0 | 13 |
| 3:00 PM | 0 | 18 | 1 | 0 | 0 | 0 | 19 |
| 3:15 PM | 0 | 12 | 1 | 0 | 0 | 0 | 13 |
| 3:30 PM | 0 | 34 | 1 | 0 | 0 | 0 | 35 |
| 3:45 PM | 0 | 28 | 2 | 0 | 0 | 0 | 30 |
| 4:00 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 4:15 PM | 0 | 22 | 1 | 0 | 0 | 0 | 23 |
| 4:30 PM | 0 | 19 | 1 | 0 | 0 | 1 | 21 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 21 | 1 | 0 | 0 | 0 | 22 |
| 5:00 PM | 0 | 27 | 0 | 0 | 0 | 0 | 27 |
| 5:15 PM | 0 | 12 | 1 | 0 | 0 | 0 | 13 |
| 5:30 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 5:45 PM | 0 | 25 | 0 | 0 | 0 | 0 | 25 |
| Total | 0 | 780 | 31 | 10 | 1 | 1 | 823 |
| Total % | 0.0 | 94.8 | 3.8 | 1.2 | 0.1 | 0.1 | 100.0 |
| AM Times | 7:00 AM | 7:30 AM | 7:15 AM | 7:15 AM | 7:15 AM | 8:15 AM | 7:30 AM |
| AM Peaks | 0 | 125 | 5 | 1 | 1 | 0 | 131 |
| PM Times | 12:00 PM | 3:30 PM | 3:00 PM | 12:15 PM | 12:00 PM | 4:00 PM | 3:30 PM |
| PM Peaks | 0 | 103 | 5 | 4 | 0 | 1 | 107 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Thomas Slee Drive (Doon South Drive to Robert Ferrie Drive)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Thomas Slee Drive (South Creek Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Westbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 7:15 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 7:30 AM | 0 | 16 | 1 | 2 | 0 | 0 | 19 |
| 7:45 AM | 0 | 21 | 0 | 0 | 1 | 0 | 22 |
| 8:00 AM | 0 | 24 | 0 | 1 | 0 | 0 | 25 |
| 8:15 AM | 0 | 24 | 2 | 0 | 0 | 0 | 26 |
| 8:30 AM | 0 | 20 | 2 | 0 | 0 | 0 | 22 |
| 8:45 AM | 0 | 36 | 0 | 0 | 0 | 0 | 36 |
| 9:00 AM | 0 | 49 | 2 | 2 | 0 | 0 | 53 |
| 9:15 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 9:30 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 9:45 AM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 10:00 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 10:15 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 10:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 10:45 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 11:00 AM | 0 | 14 | 0 | 1 | 1 | 0 | 16 |
| 11:15 AM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 11:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:45 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 12:00 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 12:15 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:30 PM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 12:45 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 1:00 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 1:15 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 1:30 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 1:45 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 2:00 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 2:15 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 2:30 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| 2:45 PM | 0 | 8 | 1 | 1 | 0 | 0 | 10 |
| 3:00 PM | 0 | 29 | 0 | 1 | 0 | 0 | 30 |
| 3:15 PM | 0 | 45 | 2 | 0 | 0 | 1 | 48 |
| 3:30 PM | 0 | 28 | 1 | 0 | 0 | 0 | 29 |
| 3:45 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 4:00 PM | 0 | 28 | 0 | 0 | 0 | 1 | 29 |
| 4:15 PM | 0 | 32 | 1 | 0 | 0 | 0 | 33 |
| 4:30 PM | 0 | 23 | 0 | 0 | 0 | 1 | 24 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 33 | 0 | 0 | 0 | 0 | 33 |
| 5:00 PM | 0 | 36 | 0 | 0 | 0 | 1 | 37 |
| 5:15 PM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 5:30 PM | 0 | 21 | 0 | 2 | 0 | 0 | 23 |
| 5:45 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| Total | 0 | 816 | 14 | 10 | 2 | 4 | 846 |
| Total % | 0.0 | 96.5 | 1.7 | 1.2 | 0.2 | 0.5 | 100.0 |
| AM Times | 7:00 AM | 8:30 AM | 8:15 AM | 7:15 AM | 7:15 AM | 7:00 AM | 8:30 AM |
| AM Peaks | 0 | 114 | 6 | 3 | 1 | 0 | 120 |
| PM Times | 12:00 PM | 3:15 PM | 2:45 PM | 2:00 PM | 12:00 PM | 3:45 PM | 3:15 PM |
| PM Peaks | 0 | 117 | 4 | 1 | 0 | 2 | 122 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Thomas Slee Drive (South Creek Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Eastbound)

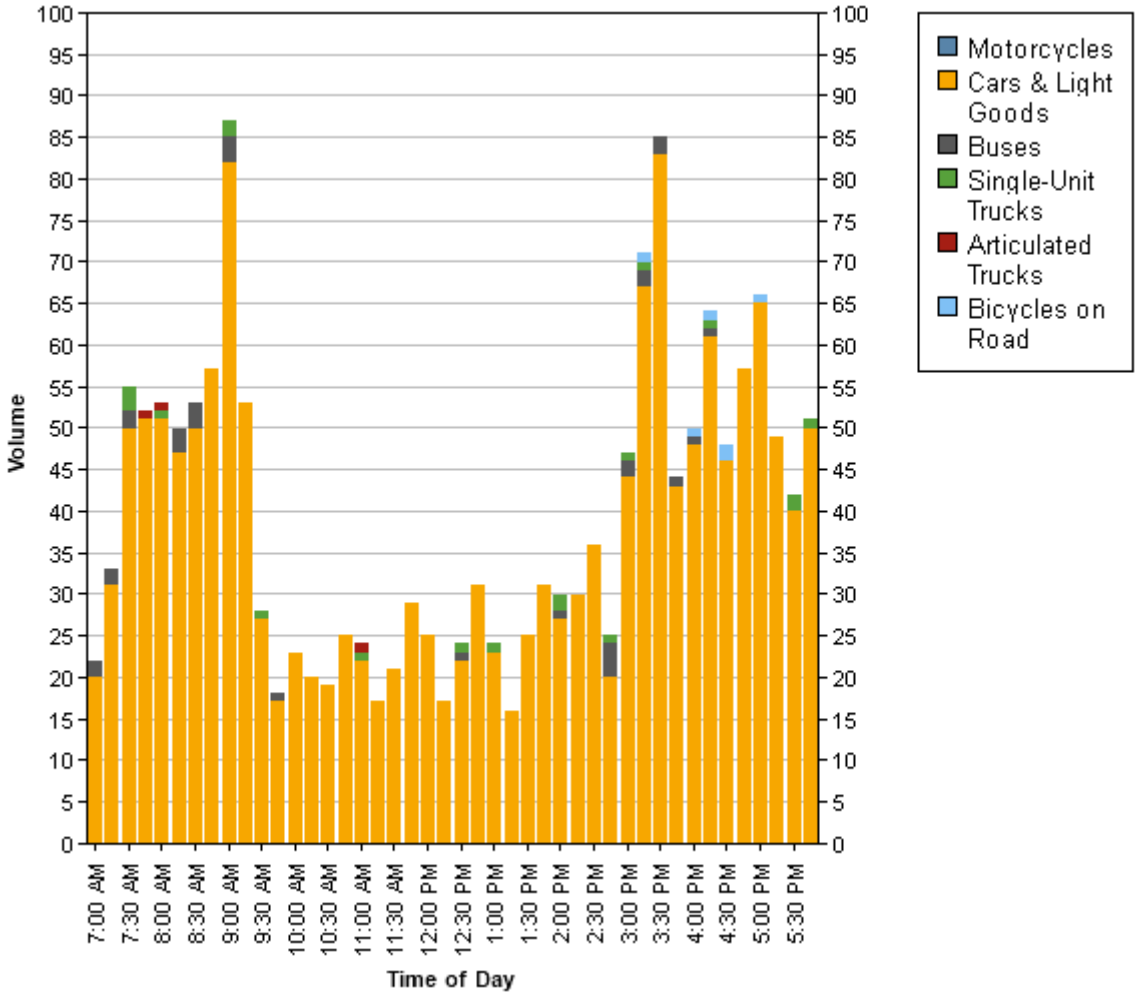
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 7:15 AM | 0 | 21 | 2 | 0 | 0 | 0 | 23 |
| 7:30 AM | 0 | 34 | 1 | 1 | 0 | 0 | 36 |
| 7:45 AM | 0 | 30 | 0 | 0 | 0 | 0 | 30 |
| 8:00 AM | 0 | 27 | 0 | 0 | 1 | 0 | 28 |
| 8:15 AM | 0 | 23 | 1 | 0 | 0 | 0 | 24 |
| 8:30 AM | 0 | 30 | 1 | 0 | 0 | 0 | 31 |
| 8:45 AM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 9:00 AM | 0 | 33 | 1 | 0 | 0 | 0 | 34 |
| 9:15 AM | 0 | 44 | 0 | 0 | 0 | 0 | 44 |
| 9:30 AM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 9:45 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 10:00 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 10:15 AM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 10:30 AM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 10:45 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 11:00 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 11:15 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 11:30 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 11:45 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 12:00 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 12:15 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 12:30 PM | 0 | 16 | 1 | 1 | 0 | 0 | 18 |
| 12:45 PM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 1:00 PM | 0 | 10 | 0 | 1 | 0 | 0 | 11 |
| 1:15 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 1:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 1:45 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 2:00 PM | 0 | 12 | 1 | 2 | 0 | 0 | 15 |
| 2:15 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 2:30 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 2:45 PM | 0 | 12 | 3 | 0 | 0 | 0 | 15 |
| 3:00 PM | 0 | 15 | 2 | 0 | 0 | 0 | 17 |
| 3:15 PM | 0 | 22 | 0 | 1 | 0 | 0 | 23 |
| 3:30 PM | 0 | 55 | 1 | 0 | 0 | 0 | 56 |
| 3:45 PM | 0 | 27 | 1 | 0 | 0 | 0 | 28 |
| 4:00 PM | 0 | 20 | 1 | 0 | 0 | 0 | 21 |
| 4:15 PM | 0 | 29 | 0 | 1 | 0 | 1 | 31 |
| 4:30 PM | 0 | 23 | 0 | 0 | 0 | 1 | 24 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 5:00 PM | 0 | 29 | 0 | 0 | 0 | 0 | 29 |
| 5:15 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 5:30 PM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 5:45 PM | 0 | 28 | 0 | 1 | 0 | 0 | 29 |
| Total | 0 | 852 | 17 | 9 | 1 | 2 | 881 |
| Total % | 0.0 | 96.7 | 1.9 | 1.0 | 0.1 | 0.2 | 100.0 |
| AM Times | 7:00 AM | 8:30 AM | 8:15 AM | 7:15 AM | 7:15 AM | 7:00 AM | 8:30 AM |
| AM Peaks | 0 | 128 | 3 | 1 | 1 | 0 | 130 |
| PM Times | 12:00 PM | 3:15 PM | 2:45 PM | 2:00 PM | 12:00 PM | 3:45 PM | 3:15 PM |
| PM Peaks | 0 | 124 | 6 | 2 | 0 | 2 | 128 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Thomas Slee Drive (South Creek Drive to Doon South Drive)
Site Code: 230376
Start Date: 10/19/2023

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Windrush Trail (Doon South Drive to Forest Edge Trail)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Southbound)

| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 7:15 AM | 0 | 4 | 1 | 0 | 0 | 0 | 5 |
| 7:30 AM | 0 | 5 | 1 | 0 | 0 | 0 | 6 |
| 7:45 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 8:00 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 8:15 AM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 8:30 AM | 0 | 6 | 2 | 0 | 0 | 0 | 8 |
| 8:45 AM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 9:00 AM | 0 | 9 | 1 | 0 | 0 | 0 | 10 |
| 9:15 AM | 0 | 4 | 0 | 1 | 0 | 0 | 5 |
| 9:30 AM | 0 | 6 | 0 | 2 | 0 | 0 | 8 |
| 9:45 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 10:00 AM | 0 | 3 | 0 | 0 | 0 | 0 | 3 |
| 10:15 AM | 0 | 6 | 0 | 0 | 0 | 0 | 6 |
| 10:30 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 10:45 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 11:00 AM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 11:15 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 11:30 AM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 11:45 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 12:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 12:15 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 12:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 12:45 PM | 0 | 10 | 1 | 1 | 0 | 0 | 12 |
| 1:00 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 1:15 PM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 1:30 PM | 0 | 12 | 0 | 0 | 0 | 1 | 13 |
| 1:45 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 2:00 PM | 0 | 7 | 0 | 0 | 0 | 0 | 7 |
| 2:15 PM | 1 | 11 | 0 | 0 | 0 | 0 | 12 |
| 2:30 PM | 0 | 9 | 0 | 0 | 0 | 0 | 9 |
| 2:45 PM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 3:00 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 3:15 PM | 0 | 7 | 1 | 0 | 0 | 0 | 8 |
| 3:30 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 3:45 PM | 0 | 26 | 2 | 0 | 0 | 0 | 28 |
| 4:00 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 4:15 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 4:30 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 5:00 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 5:15 PM | 0 | 22 | 0 | 0 | 0 | 0 | 22 |
| 5:30 PM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 5:45 PM | 0 | 20 | 0 | 0 | 0 | 0 | 20 |
| Total | 1 | 446 | 12 | 4 | 0 | 1 | 464 |
| Total % | 0.2 | 96.1 | 2.6 | 0.9 | 0.0 | 0.2 | 100.0 |
| AM Times | 10:15 AM | 7:30 AM | 7:00 AM | 8:45 AM | 7:00 AM | 7:30 AM | 7:30 AM |
| AM Peaks | 0 | 20 | 2 | 3 | 0 | 0 | 21 |
| PM Times | 1:30 PM | 4:45 PM | 3:00 PM | 12:00 PM | 12:00 PM | 12:45 PM | 4:45 PM |
| PM Peaks | 1 | 86 | 3 | 1 | 0 | 1 | 86 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Windrush Trail (Doon South Drive to Forest Edge Trail)
Site Code: 230376
Start Date: 10/19/2023


## Direction (Northbound)

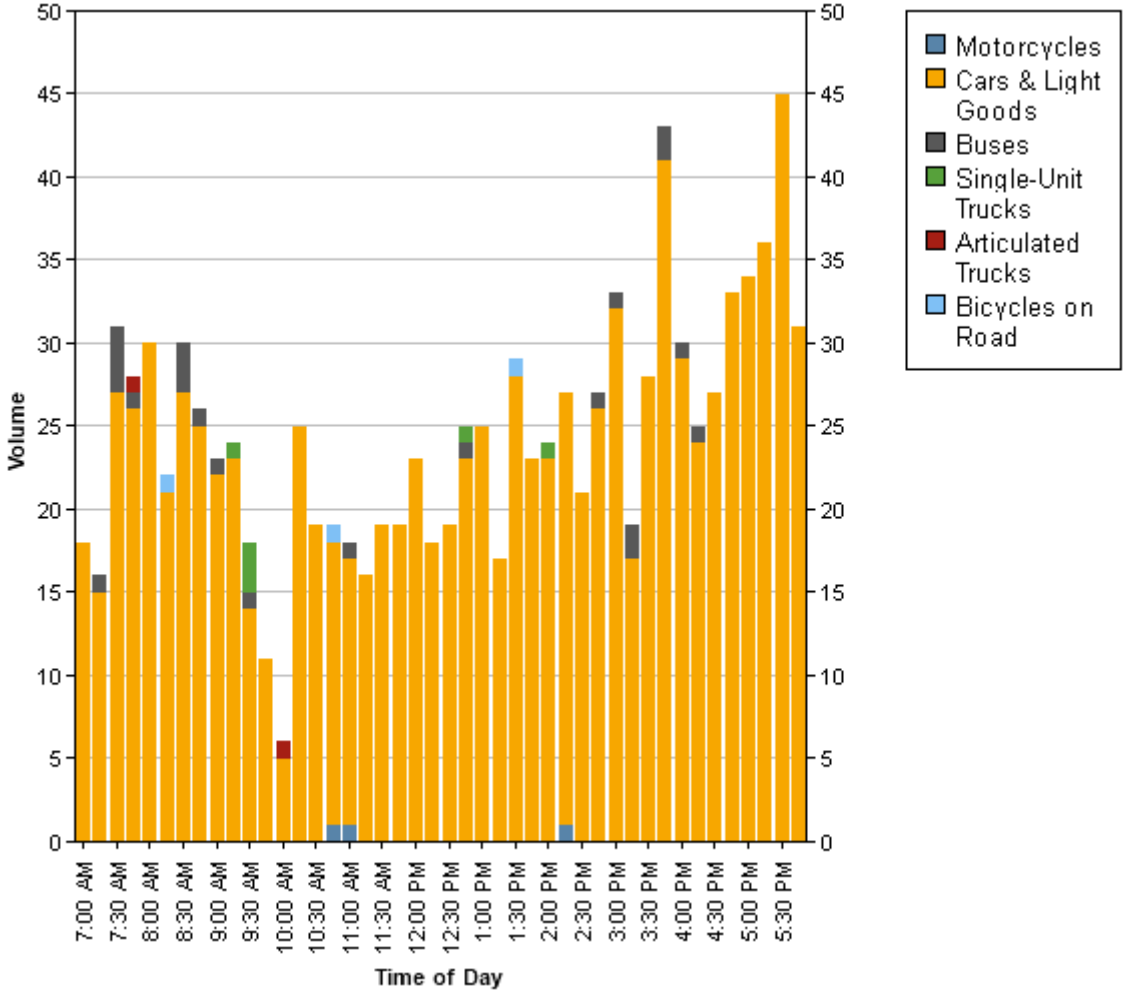
| Start Time | Motorcycles | Cars & Light Goods | Buses | Single-Unit Trucks | Articulated Trucks | Bicycles on Road | Total |
|---|---|---|---|---|---|---|---|
| 7:00 AM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 7:15 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 7:30 AM | 0 | 22 | 3 | 0 | 0 | 0 | 25 |
| 7:45 AM | 0 | 21 | 1 | 0 | 1 | 0 | 23 |
| 8:00 AM | 0 | 24 | 0 | 0 | 0 | 0 | 24 |
| 8:15 AM | 0 | 17 | 0 | 0 | 0 | 1 | 18 |
| 8:30 AM | 0 | 21 | 1 | 0 | 0 | 0 | 22 |
| 8:45 AM | 0 | 17 | 0 | 0 | 0 | 0 | 17 |
| 9:00 AM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 9:15 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 9:30 AM | 0 | 8 | 1 | 1 | 0 | 0 | 10 |
| 9:45 AM | 0 | 5 | 0 | 0 | 0 | 0 | 5 |
| 10:00 AM | 0 | 2 | 0 | 0 | 1 | 0 | 3 |
| 10:15 AM | 0 | 19 | 0 | 0 | 0 | 0 | 19 |
| 10:30 AM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 10:45 AM | 1 | 12 | 0 | 0 | 0 | 1 | 14 |
| 11:00 AM | 1 | 6 | 0 | 0 | 0 | 0 | 7 |
| 11:15 AM | 0 | 8 | 0 | 0 | 0 | 0 | 8 |
| 11:30 AM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 11:45 AM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 12:00 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 12:15 PM | 0 | 4 | 0 | 0 | 0 | 0 | 4 |
| 12:30 PM | 0 | 10 | 0 | 0 | 0 | 0 | 10 |
| 12:45 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 1:00 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 1:15 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 1:30 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 1:45 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 2:00 PM | 0 | 16 | 0 | 1 | 0 | 0 | 17 |
| 2:15 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 2:30 PM | 0 | 12 | 0 | 0 | 0 | 0 | 12 |
| 2:45 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |
| 3:00 PM | 0 | 17 | 1 | 0 | 0 | 0 | 18 |
| 3:15 PM | 0 | 10 | 1 | 0 | 0 | 0 | 11 |
| 3:30 PM | 0 | 18 | 0 | 0 | 0 | 0 | 18 |
| 3:45 PM | 0 | 15 | 0 | 0 | 0 | 0 | 15 |
| 4:00 PM | 0 | 13 | 1 | 0 | 0 | 0 | 14 |
| 4:15 PM | 0 | 8 | 1 | 0 | 0 | 0 | 9 |
| 4:30 PM | 0 | 13 | 0 | 0 | 0 | 0 | 13 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 4:45 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| 5:00 PM | 0 | 16 | 0 | 0 | 0 | 0 | 16 |
| 5:15 PM | 0 | 14 | 0 | 0 | 0 | 0 | 14 |
| 5:30 PM | 0 | 21 | 0 | 0 | 0 | 0 | 21 |
| 5:45 PM | 0 | 11 | 0 | 0 | 0 | 0 | 11 |
| Total | 2 | 598 | 10 | 2 | 2 | 2 | 616 |
| Total % | 0.3 | 97.1 | 1.6 | 0.3 | 0.3 | 0.3 | 100.0 |
| AM Times | 10:15 AM | 7:30 AM | 7:00 AM | 8:45 AM | 7:00 AM | 7:30 AM | 7:30 AM |
| AM Peaks | 2 | 84 | 4 | 1 | 1 | 1 | 90 |
| PM Times | 1:30 PM | 4:45 PM | 3:00 PM | 12:00 PM | 12:00 PM | 12:45 PM | 4:45 PM |
| PM Peaks | 0 | 62 | 2 | 0 | 0 | 0 | 62 |

Paradigm Transportation Solutions Limited
5A-150 Pinebush Rd

Cambridge, Ontario, Canada  N1R 8J8
519-896-3163 cbowness@ptsl.com

Count Name: Windrush Trail (Doon South Drive to Forest Edge Trail)
Site Code: 230376
Start Date: 10/19/2023

# Appendix C

## Existing Traffic Operations Reports

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 333 | 15 | 280 | 144 | 117 |
| Future Volume (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 333 | 15 | 280 | 144 | 117 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.96 | 1.00 | | 0.98 | 0.99 | 1.00 | | 0.98 | | 0.98 |
| Frt | | | 0.850 | | | 0.850 | | 0.994 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1547 | 3374 | 1390 | 1561 | 3438 | 1390 | 1653 | 3254 | 0 | 2895 | 1759 | 1417 |
| Flt Permitted | 0.086 | | | 0.300 | | | 0.581 | | | 0.950 | | |
| Satd. Flow (perm) | 140 | 3374 | 1337 | 491 | 3438 | 1361 | 1005 | 3254 | 0 | 2836 | 1759 | 1389 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 194 | | | 450 | | 3 | | | | 118 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Adj. Flow (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 333 | 15 | 280 | 144 | 117 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 348 | 0 | 280 | 144 | 117 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

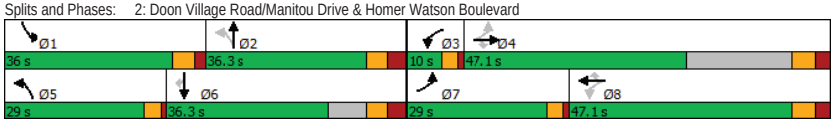




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 65.1 | 65.1 | 48.9 | 40.0 | 40.0 | 58.1 | 30.9 | | 20.6 | 29.6 | 29.6 |
| Actuated g/C Ratio | 0.51 | 0.46 | 0.46 | 0.35 | 0.28 | 0.28 | 0.41 | 0.22 | | 0.15 | 0.21 | 0.21 |
| v/c Ratio | 0.93 | 0.61 | 0.30 | 0.06 | 1.04 | 0.80 | 0.70 | 0.49 | | 0.66 | 0.39 | 0.30 |
| Control Delay | 76.9 | 31.6 | 6.0 | 20.3 | 87.8 | 19.8 | 38.1 | 51.0 | | 64.6 | 51.8 | 9.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 76.9 | 31.6 | 6.0 | 20.3 | 87.8 | 19.8 | 38.1 | 51.0 | | 64.6 | 51.8 | 9.6 |
| LOS | E | C | A | C | F | B | D | D | | E | D | A |
| Approach Delay | | 37.1 | | | 63.0 | | | 44.4 | | | 49.3 | |
| Approach LOS | | D | | | E | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 141 | | | |
| Natural Cycle: 125 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.04 | | | |
| Intersection Signal Delay: 49.4 | | Intersection LOS: D | |
| Intersection Capacity Utilization 111.6% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

Base Conditions - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 348 | 280 | 144 | 117 |
| v/c Ratio | 0.93 | 0.61 | 0.30 | 0.06 | 1.04 | 0.80 | 0.70 | 0.49 | 0.66 | 0.39 | 0.30 |
| Control Delay | 76.9 | 31.6 | 6.0 | 20.3 | 87.8 | 19.8 | 38.1 | 51.0 | 64.6 | 51.8 | 9.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 76.9 | 31.6 | 6.0 | 20.3 | 87.8 | 19.8 | 38.1 | 51.0 | 64.6 | 51.8 | 9.6 |
| Queue Length 50th (m) | 73.2 | 102.2 | 3.6 | 1.9 | ~169.0 | 32.7 | 77.4 | 47.0 | 40.7 | 37.1 | 0.0 |
| Queue Length 95th (m) | #136.9 | 147.7 | 22.1 | 5.9 | #220.3 | 93.3 | 108.5 | 66.5 | 55.4 | 59.2 | 16.6 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 321 | 1557 | 721 | 216 | 975 | 708 | 531 | 715 | 616 | 449 | 442 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.93 | 0.61 | 0.30 | 0.06 | 1.04 | 0.80 | 0.69 | 0.49 | 0.45 | 0.32 | 0.26 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

Base Conditions - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 333 | 15 | 280 | 144 | 117 |
| Future Volume (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 333 | 15 | 280 | 144 | 117 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1547 | 3374 | 1338 | 1559 | 3438 | 1362 | 1648 | 3253 | | 2895 | 1759 | 1389 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.30 | 1.00 | 1.00 | 0.58 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 140 | 3374 | 1338 | 493 | 3438 | 1362 | 1008 | 3253 | | 2895 | 1759 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 300 | 947 | 218 | 13 | 1012 | 568 | 366 | 333 | 15 | 280 | 144 | 117 |
| RTOR Reduction (vph) | 0 | 0 | 106 | 0 | 0 | 317 | 0 | 2 | 0 | 0 | 0 | 93 |
| Lane Group Flow (vph) | 300 | 947 | 112 | 13 | 1012 | 251 | 366 | 346 | 0 | 280 | 144 | 24 |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 54.8 | 30.9 | | 20.6 | 29.6 | 29.6 |
| Effective Green, g (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 54.8 | 30.9 | | 20.6 | 29.6 | 29.6 |
| Actuated g/C Ratio | 0.50 | 0.45 | 0.45 | 0.31 | 0.30 | 0.30 | 0.38 | 0.22 | | 0.14 | 0.21 | 0.21 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 315 | 1531 | 607 | 172 | 1018 | 403 | 491 | 700 | | 415 | 363 | 286 |
| v/s Ratio Prot | c0.17 | 0.28 | | 0.00 | 0.29 | | c0.12 | 0.11 | | 0.10 | 0.08 | |
| v/s Ratio Perm | c0.31 | | 0.08 | 0.02 | | 0.18 | c0.16 | | | | | 0.02 |
| v/c Ratio | 0.95 | 0.62 | 0.18 | 0.08 | 0.99 | 0.62 | 0.75 | 0.49 | | 0.67 | 0.40 | 0.08 |
| Uniform Delay, d1 | 45.3 | 29.7 | 23.3 | 34.1 | 50.3 | 43.5 | 35.5 | 49.4 | | 58.2 | 49.2 | 46.0 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 37.9 | 0.8 | 0.1 | 0.2 | 26.6 | 3.0 | 6.1 | 2.5 | | 5.6 | 3.2 | 0.6 |
| Delay (s) | 83.2 | 30.5 | 23.5 | 34.3 | 76.9 | 46.5 | 41.5 | 51.9 | | 63.8 | 52.4 | 46.5 |
| Level of Service | F | C | C | C | E | D | D | D | | E | D | D |
| Approach Delay (s) | | 40.2 | | | 65.7 | | | 46.6 | | | 57.0 | |
| Approach LOS | | D | | | E | | | D | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 52.8 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 0.90 | | | |
| Actuated Cycle Length (s) | 143.4 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 111.6% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1480 | 2 | 0 | 1305 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1480 | 2 | 0 | 1305 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 1.00 | 0.99 | | 0.99 | | 1.00 | | | | 1.00 | |
| Frt | | | 0.850 | | 0.865 | | | | | | 0.991 | |
| Flt Protected | | 0.950 | | | | | 0.950 | | | | | |
| Satd. Flow (prot) | 0 | 1537 | 1444 | 0 | 1323 | 0 | 1637 | 3094 | 0 | 1775 | 3067 | 0 |
| Flt Permitted | | 0.757 | | | | | 0.950 | | | | | |
| Satd. Flow (perm) | 0 | 1223 | 1425 | 0 | 1323 | 0 | 1632 | 3094 | 0 | 1775 | 3067 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 213 | | 80 | | | | | | 6 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1480 | 2 | 0 | 1305 | 81 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 238 | 213 | 0 | 2 | 0 | 76 | 1482 | 0 | 0 | 1386 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

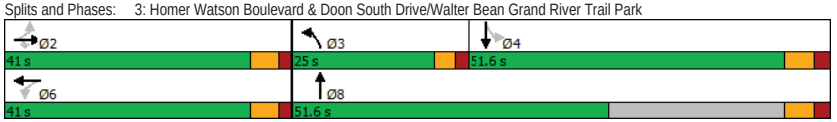




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 23.2 | 23.2 | | 23.2 | | 11.4 | 58.6 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.12 | 0.62 | | | 0.49 | |
| v/c Ratio | | 0.80 | 0.42 | | 0.01 | | 0.39 | 0.77 | | | 0.93 | |
| Control Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 18.1 | | | 37.9 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | | 0.0 | |
| Total Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 18.1 | | | 37.9 | |
| LOS | | D | A | | A | | D | B | | | D | |
| Approach Delay | | 31.5 | | | | | | 19.6 | | | 37.9 | |
| Approach LOS | | C | | | | | | B | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 94.8 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 0.93 | | | |
| Intersection Signal Delay: 28.6 | | Intersection LOS: C | |
| Intersection Capacity Utilization 98.4% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Lane Group | EBT | EBR | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 238 | 213 | 2 | 76 | 1482 | 1386 |
| v/c Ratio | 0.80 | 0.42 | 0.01 | 0.39 | 0.77 | 0.93 |
| Control Delay | 53.8 | 6.7 | 0.0 | 48.8 | 18.1 | 37.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.8 | 6.7 | 0.0 | 48.8 | 18.1 | 37.9 |
| Queue Length 50th (m) | 43.8 | 0.0 | 0.0 | 14.2 | 100.9 | 133.4 |
| Queue Length 95th (m) | 75.9 | 17.2 | 0.0 | 31.4 | 173.7 | #240.2 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | |
| Base Capacity (vph) | 463 | 672 | 550 | 354 | 2343 | 1496 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.51 | 0.32 | 0.00 | 0.21 | 0.63 | 0.93 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1480 | 2 | 0 | 1305 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1480 | 2 | 0 | 1305 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | | 0.99 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | | 1.00 | 0.85 | | 0.86 | | 1.00 | 1.00 | | | 0.99 | |
| Flt Protected | | 0.95 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | 1535 | 1425 | | 1323 | | 1637 | 3094 | | | 3069 | |
| Flt Permitted | | 0.76 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | 1222 | 1425 | | 1323 | | 1637 | 3094 | | | 3069 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1480 | 2 | 0 | 1305 | 81 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 0 | 238 | 52 | 0 | 0 | 0 | 76 | 1482 | 0 | 0 | 1383 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Effective Green, g (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.09 | 0.63 | | | 0.48 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | | 5.0 | |
| Lane Grp Cap (vph) | | 296 | 345 | | 320 | | 148 | 1936 | | | 1481 | |
| v/s Ratio Prot | | | | | 0.00 | | 0.05 | c0.48 | | | c0.45 | |
| v/s Ratio Perm | | c0.19 | 0.04 | | | | | | | | | |
| v/c Ratio | | 0.80 | 0.15 | | 0.00 | | 0.51 | 0.77 | | | 0.93 | |
| Uniform Delay, d1 | | 34.1 | 28.5 | | 27.5 | | 41.5 | 12.9 | | | 23.3 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 14.6 | 0.2 | | 0.0 | | 3.0 | 3.0 | | | 12.2 | |
| Delay (s) | | 48.7 | 28.7 | | 27.5 | | 44.5 | 15.8 | | | 35.5 | |
| Level of Service | | D | C | | C | | D | B | | | D | |
| Approach Delay (s) | | 39.2 | | | 27.5 | | | 17.2 | | | 35.5 | |
| Approach LOS | | D | | | C | | | B | | | D | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 27.6 | HCM 2000 Level of Service | | C | |
| HCM 2000 Volume to Capacity ratio | 0.90 | | | | |
| Actuated Cycle Length (s) | 95.7 | Sum of lost time (s) | | 17.6 | |
| Intersection Capacity Utilization | 98.4% | ICU Level of Service | | F | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 126 | 27 | 53 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| Future Volume (vph) | 126 | 27 | 53 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.98 | | | 0.98 | 1.00 | | 0.99 |
| Frt | | 0.901 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1576 | 2300 | 0 | 1492 | 1743 | 1219 | 1429 | 4848 | 1417 | 2749 | 3312 | 1229 |
| Flt Permitted | 0.583 | | | 0.702 | | | 0.088 | | | 0.950 | | |
| Satd. Flow (perm) | 960 | 2300 | 0 | 1094 | 1743 | 1196 | 132 | 4848 | 1393 | 2747 | 3312 | 1213 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 53 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Adj. Flow (vph) | 126 | 27 | 53 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 126 | 80 | 0 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

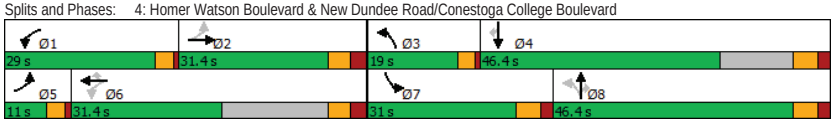




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 15.1 | 7.3 | | 14.8 | 7.5 | 7.5 | 60.5 | 46.5 | 46.5 | 10.1 | 40.2 | 40.2 |
| Actuated g/C Ratio | 0.17 | 0.08 | | 0.17 | 0.09 | 0.09 | 0.69 | 0.53 | 0.53 | 0.12 | 0.46 | 0.46 |
| v/c Ratio | 0.58 | 0.33 | | 0.36 | 0.16 | 0.33 | 0.63 | 0.53 | 0.23 | 0.25 | 0.93 | 0.04 |
| Control Delay | 41.7 | 22.2 | | 33.1 | 40.4 | 4.6 | 27.7 | 16.6 | 3.9 | 39.8 | 36.5 | 0.1 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 41.7 | 22.2 | | 33.1 | 40.4 | 4.6 | 27.7 | 16.6 | 3.9 | 39.8 | 36.5 | 0.1 |
| LOS | D | C | | C | D | A | C | B | A | D | D | A |
| Approach Delay | | 34.1 | | | 21.8 | | | 16.5 | | | 36.1 | |
| Approach LOS | | C | | | C | | | B | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 87.7 | | | |
| Natural Cycle: 120 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 0.93 | | | |
| Intersection Signal Delay: 25.9 | | Intersection LOS: C | |
| Intersection Capacity Utilization 82.0% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
### 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

Base Conditions - AM Peak Hour

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 126 | 80 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| v/c Ratio | 0.58 | 0.33 | 0.36 | 0.16 | 0.33 | 0.63 | 0.53 | 0.23 | 0.25 | 0.93 | 0.04 |
| Control Delay | 41.7 | 22.2 | 33.1 | 40.4 | 4.6 | 27.7 | 16.6 | 3.9 | 39.8 | 36.5 | 0.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 41.7 | 22.2 | 33.1 | 40.4 | 4.6 | 27.7 | 16.6 | 3.9 | 39.8 | 36.5 | 0.1 |
| Queue Length 50th (m) | 19.3 | 2.4 | 11.6 | 4.0 | 0.0 | 18.5 | 61.9 | 1.5 | 6.7 | 125.6 | 0.0 |
| Queue Length 95th (m) | 35.3 | 9.7 | 23.7 | 11.6 | 1.9 | #49.4 | 84.8 | 13.5 | 14.3 | #193.8 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 216 | 697 | 427 | 859 | 659 | 314 | 2569 | 817 | 788 | 1975 | 772 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.58 | 0.11 | 0.18 | 0.03 | 0.12 | 0.61 | 0.53 | 0.23 | 0.10 | 0.72 | 0.03 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

Base Conditions - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 126 | 27 | 53 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| Future Volume (vph) | 126 | 27 | 53 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.90 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1572 | 2304 | | 1486 | 1743 | 1199 | 1429 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Flt Permitted | 0.58 | 1.00 | | 0.70 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 964 | 2304 | | 1099 | 1743 | 1199 | 132 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 126 | 27 | 53 | 78 | 23 | 76 | 193 | 1356 | 185 | 78 | 1416 | 24 |
| RTOR Reduction (vph) | 0 | 48 | 0 | 0 | 0 | 71 | 0 | 0 | 82 | 0 | 0 | 13 |
| Lane Group Flow (vph) | 126 | 32 | 0 | 78 | 23 | 5 | 193 | 1356 | 103 | 78 | 1416 | 11 |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 15.2 | 7.9 | | 11.8 | 6.2 | 6.2 | 60.2 | 46.5 | 46.5 | 7.7 | 41.6 | 41.6 |
| Effective Green, g (s) | 15.2 | 7.9 | | 11.8 | 6.2 | 6.2 | 60.2 | 46.5 | 46.5 | 7.7 | 41.6 | 41.6 |
| Actuated g/C Ratio | 0.17 | 0.09 | | 0.13 | 0.07 | 0.07 | 0.67 | 0.51 | 0.51 | 0.09 | 0.46 | 0.46 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 210 | 201 | | 167 | 119 | 82 | 297 | 2490 | 716 | 233 | 1522 | 557 |
| v/s Ratio Prot | c0.05 | 0.01 | | 0.03 | 0.01 | | c0.10 | 0.28 | | 0.03 | c0.43 | |
| v/s Ratio Perm | c0.05 | | | 0.03 | | 0.00 | 0.33 | | 0.07 | | | 0.01 |
| v/c Ratio | 0.60 | 0.16 | | 0.47 | 0.19 | 0.06 | 0.65 | 0.54 | 0.14 | 0.33 | 0.93 | 0.02 |
| Uniform Delay, d1 | 34.1 | 38.2 | | 36.1 | 39.8 | 39.4 | 20.8 | 14.9 | 11.5 | 39.0 | 23.1 | 13.3 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 4.6 | 0.4 | | 0.8 | 0.8 | 0.3 | 4.8 | 0.9 | 0.4 | 0.9 | 11.5 | 0.1 |
| Delay (s) | 38.6 | 38.6 | | 36.9 | 40.6 | 39.8 | 25.6 | 15.7 | 12.0 | 39.8 | 34.6 | 13.4 |
| Level of Service | D | D | | D | D | D | C | B | B | D | C | B |
| Approach Delay (s) | | 38.6 | | | 38.6 | | | 16.4 | | | 34.6 | |
| Approach LOS | | D | | | D | | | B | | | C | |

Intersection Summary

| | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 26.3 | HCM 2000 Level of Service | | C | |
| HCM 2000 Volume to Capacity ratio | 0.85 | | | | |
| Actuated Cycle Length (s) | 90.5 | Sum of lost time (s) | | 22.8 | |
| Intersection Capacity Utilization | 82.0% | ICU Level of Service | | E | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp Base Conditions - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 54 | 0 | 546 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 28 |
| Future Volume (vph) | 54 | 0 | 546 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 28 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1591 | 0 | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | 0 | 0 | 4803 | 1261 |
| Flt Permitted | 0.626 | | | 0.950 | | | 0.115 | | | | | |
| Satd. Flow (perm) | 1048 | 0 | 1458 | 1441 | 1776 | 1365 | 189 | 3406 | 0 | 0 | 4803 | 1261 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 227 | | | 424 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Adj. Flow (vph) | 54 | 0 | 546 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 28 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 54 | 0 | 546 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 28 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

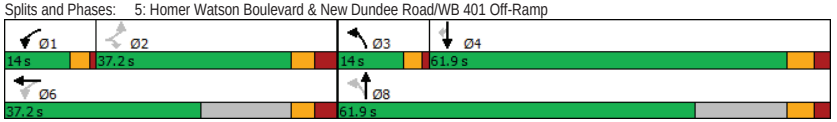


Lanes, Volumes, Timings
5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp Base Conditions - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.5 | | 30.5 | 48.0 | 44.7 | 112.3 | 56.2 | 53.3 | | | 42.8 | 42.8 |
| Actuated g/C Ratio | 0.27 | | 0.27 | 0.43 | 0.40 | 1.00 | 0.50 | 0.47 | | | 0.38 | 0.38 |
| v/c Ratio | 0.19 | | 0.97 | 0.37 | 0.30 | 0.62 | 0.36 | 0.52 | | | 0.69 | 0.05 |
| Control Delay | 38.5 | | 57.8 | 27.3 | 27.6 | 2.1 | 18.2 | 21.0 | | | 31.3 | 0.2 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 38.5 | | 57.8 | 27.3 | 27.6 | 2.1 | 18.2 | 21.0 | | | 31.3 | 0.2 |
| LOS | D | | E | C | C | A | B | C | | | C | A |
| Approach Delay | | 56.1 | | | 10.8 | | | 20.8 | | | 30.6 | |
| Approach LOS | | E | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 112.3 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.97 | | | |
| Intersection Signal Delay: 25.9 | | Intersection LOS: C | |
| Intersection Capacity Utilization 89.5% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

Base Conditions - AM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 54 | 546 | 227 | 210 | 843 | 75 | 837 | 1254 | 28 |
| v/c Ratio | 0.19 | 0.97 | 0.37 | 0.30 | 0.62 | 0.36 | 0.52 | 0.69 | 0.05 |
| Control Delay | 38.5 | 57.8 | 27.3 | 27.6 | 2.1 | 18.2 | 21.0 | 31.3 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 38.5 | 57.8 | 27.3 | 27.6 | 2.1 | 18.2 | 21.0 | 31.3 | 0.2 |
| Queue Length 50th (m) | 10.1 | ~85.9 | 37.6 | 34.9 | 0.0 | 8.6 | 67.6 | 91.3 | 0.0 |
| Queue Length 95th (m) | 23.9 | #180.8 | 68.4 | 62.6 | 0.0 | 16.3 | 84.0 | 107.2 | 0.0 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 284 | 561 | 615 | 707 | 1365 | 218 | 2126 | 2390 | 680 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.19 | 0.97 | 0.37 | 0.30 | 0.62 | 0.34 | 0.39 | 0.52 | 0.04 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



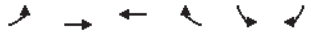
## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

Base Conditions - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 54 | 0 | 546 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 28 |
| Future Volume (vph) | 54 | 0 | 546 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 28 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1591 | | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | | | 4803 | 1261 |
| Flt Permitted | 0.63 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.12 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 1049 | | 1458 | 1441 | 1776 | 1365 | 189 | 3406 | | | 4803 | 1261 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 54 | 0 | 546 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 28 |
| RTOR Reduction (vph) | 0 | 0 | 166 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| Lane Group Flow (vph) | 54 | 0 | 380 | 227 | 210 | 843 | 75 | 837 | 0 | 0 | 1254 | 11 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.5 | | 30.5 | 44.7 | 44.7 | 113.1 | 54.3 | 54.3 | | | 42.8 | 42.8 |
| Effective Green, g (s) | 30.5 | | 30.5 | 44.7 | 44.7 | 113.1 | 54.3 | 54.3 | | | 42.8 | 42.8 |
| Actuated g/C Ratio | 0.27 | | 0.27 | 0.40 | 0.40 | 1.00 | 0.48 | 0.48 | | | 0.38 | 0.38 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 282 | | 393 | 569 | 701 | 1365 | 181 | 1635 | | | 1817 | 477 |
| v/s Ratio Prot | | | | 0.04 | 0.12 | | 0.03 | 0.25 | | | 0.26 | |
| v/s Ratio Perm | 0.05 | | c0.26 | 0.12 | | c0.62 | 0.17 | | | | | 0.01 |
| v/c Ratio | 0.19 | | 0.97 | 0.40 | 0.30 | 0.62 | 0.41 | 0.51 | | | 0.69 | 0.02 |
| Uniform Delay, d1 | 31.8 | | 40.8 | 24.5 | 23.5 | 0.0 | 18.6 | 20.3 | | | 29.6 | 22.0 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.5 | | 37.9 | 1.0 | 1.1 | 2.1 | 3.2 | 0.5 | | | 1.5 | 0.0 |
| Delay (s) | 33.3 | | 78.7 | 25.5 | 24.6 | 2.1 | 21.8 | 20.8 | | | 31.0 | 22.1 |
| Level of Service | C | | E | C | C | A | C | C | | | C | C |
| Approach Delay (s) | | 74.7 | | | 9.9 | | | 20.9 | | | 30.8 | |
| Approach LOS | | E | | | A | | | C | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 28.5 | HCM 2000 Level of Service | C | | |
| HCM 2000 Volume to Capacity ratio | 0.84 | | | | |
| Actuated Cycle Length (s) | 113.1 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 89.5% | ICU Level of Service | E | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

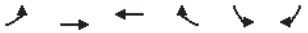


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 590 | 231 | 19 | 64 | 8 |
| Future Volume (vph) | 4 | 590 | 231 | 19 | 64 | 8 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.990 | | 0.985 | |
| Flt Protected | | | | | 0.957 | |
| Satd. Flow (prot) | 0 | 1615 | 1522 | 0 | 1664 | 0 |
| Flt Permitted | | | | | 0.957 | |
| Satd. Flow (perm) | 0 | 1615 | 1522 | 0 | 1664 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 25% | 2% | 7% | 11% | 0% | 0% |
| Adj. Flow (vph) | 4 | 590 | 231 | 19 | 64 | 8 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 594 | 250 | 0 | 72 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 50.4% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |







| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 590 | 231 | 19 | 64 | 8 |
| Future Volume (Veh/h) | 4 | 590 | 231 | 19 | 64 | 8 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 590 | 231 | 19 | 64 | 8 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 250 | | | | 838 | 240 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 250 | | | | 838 | 240 |
| tC, single (s) | 4.3 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.4 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 81 | 99 |
| cM capacity (veh/h) | 1192 | | | | 338 | 803 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 594 | 250 | 72 |
| Volume Left | 4 | 0 | 64 |
| Volume Right | 0 | 19 | 8 |
| cSH | 1192 | 1700 | 361 |
| Volume to Capacity | 0.00 | 0.15 | 0.20 |
| Queue Length 95th (m) | 0.1 | 0.0 | 5.9 |
| Control Delay (s) | 0.1 | 0.0 | 17.4 |
| Lane LOS | A | | C |
| Approach Delay (s) | 0.1 | 0.0 | 17.4 |
| Approach LOS | | | C |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 1.4 | | | |
| Intersection Capacity Utilization | 50.4% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 64 | 346 | 190 | 96 | 331 | 131 |
| Future Volume (vph) | 64 | 346 | 190 | 96 | 331 | 131 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.962 | |
| Flt Protected | 0.950 | | | | 0.965 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1613 | 0 |
| Flt Permitted | 0.494 | | | | 0.965 | |
| Satd. Flow (perm) | 851 | 1845 | 1528 | 1311 | 1613 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 96 | 21 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Adj. Flow (vph) | 64 | 346 | 190 | 96 | 331 | 131 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 64 | 346 | 190 | 96 | 462 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |

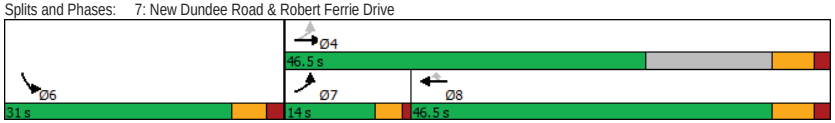




| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 22.9 | 20.3 | 13.7 | 13.7 | 25.5 | |
| Actuated g/C Ratio | 0.39 | 0.35 | 0.23 | 0.23 | 0.44 | |
| v/c Ratio | 0.15 | 0.54 | 0.53 | 0.25 | 0.65 | |
| Control Delay | 10.9 | 17.9 | 27.1 | 7.1 | 20.7 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 10.9 | 17.9 | 27.1 | 7.1 | 20.7 | |
| LOS | B | B | C | A | C | |
| Approach Delay | | 16.8 | 20.4 | | 20.7 | |
| Approach LOS | | B | C | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 91.5 | | | |
| Actuated Cycle Length: 58.6 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.65 | | | |
| Intersection Signal Delay: 19.2 | | Intersection LOS: B | |
| Intersection Capacity Utilization 57.8% | | ICU Level of Service B | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
## 7: New Dundee Road & Robert Ferrie Drive

Base Conditions - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 64 | 346 | 190 | 96 | 462 |
| v/c Ratio | 0.15 | 0.54 | 0.53 | 0.25 | 0.65 |
| Control Delay | 10.9 | 17.9 | 27.1 | 7.1 | 20.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 10.9 | 17.9 | 27.1 | 7.1 | 20.7 |
| Queue Length 50th (m) | 4.3 | 29.8 | 20.7 | 0.0 | 41.5 |
| Queue Length 95th (m) | 10.1 | 49.4 | 40.2 | 10.2 | #98.7 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 469 | 1660 | 1064 | 942 | 714 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.14 | 0.21 | 0.18 | 0.10 | 0.65 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 7: New Dundee Road & Robert Ferrie Drive

Base Conditions - AM Peak Hour

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 64 | 346 | 190 | 96 | 331 | 131 |
| Future Volume (vph) | 64 | 346 | 190 | 96 | 331 | 131 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1613 | |
| Flt Permitted | 0.49 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 851 | 1845 | 1528 | 1311 | 1613 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 64 | 346 | 190 | 96 | 331 | 131 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 74 | 12 | 0 |
| Lane Group Flow (vph) | 64 | 346 | 190 | 22 | 450 | 0 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 22.1 | 22.1 | 13.7 | 13.7 | 25.5 | |
| Effective Green, g (s) | 22.1 | 22.1 | 13.7 | 13.7 | 25.5 | |
| Actuated g/C Ratio | 0.37 | 0.37 | 0.23 | 0.23 | 0.42 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 370 | 678 | 348 | 298 | 684 | |
| v/s Ratio Prot | 0.01 | c0.19 | 0.12 | | c0.28 | |
| v/s Ratio Perm | 0.05 | | | 0.02 | | |
| v/c Ratio | 0.17 | 0.51 | 0.55 | 0.07 | 0.66 | |
| Uniform Delay, d1 | 12.6 | 14.8 | 20.5 | 18.2 | 13.8 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.2 | 0.7 | 1.8 | 0.1 | 4.9 | |
| Delay (s) | 12.9 | 15.4 | 22.2 | 18.3 | 18.7 | |
| Level of Service | B | B | C | B | B | |
| Approach Delay (s) | | 15.0 | 20.9 | | 18.7 | |
| Approach LOS | | B | C | | B | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 18.0 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.64 | | |
| Actuated Cycle Length (s) | 60.1 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 57.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## Lanes, Volumes, Timings
## 8: New Dundee Road

Base Conditions - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 310 | 82 | 13 | 209 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (vph) | 11 | 310 | 82 | 13 | 209 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.973 | | | 0.994 | | | 0.965 | | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.997 | | | 0.976 | | | 0.991 | |
| Satd. Flow (prot) | 0 | 1414 | 0 | 0 | 1422 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Flt Permitted | | 0.999 | | | 0.997 | | | 0.976 | | | 0.991 | |
| Satd. Flow (perm) | 0 | 1414 | 0 | 0 | 1422 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 18% | 6% | 7% | 23% | 7% | 10% | 0% | 4% | 33% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 310 | 82 | 13 | 209 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 403 | 0 | 0 | 232 | 0 | 0 | 92 | 0 | 0 | 65 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 50.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

Base Conditions - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 11 | 310 | 82 | 13 | 209 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (Veh/h) | 11 | 310 | 82 | 13 | 209 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 310 | 82 | 13 | 209 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 219 | | | 392 | | | 646 | 618 | 351 | 648 | 654 | 214 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 219 | | | 392 | | | 646 | 618 | 351 | 648 | 654 | 214 |
| tC, single (s) | 4.3 | | | 4.3 | | | 7.1 | 6.5 | 6.5 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.4 | | | 3.5 | 4.0 | 3.6 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 99 | | | 87 | 94 | 96 | 97 | 89 | 99 |
| cM capacity (veh/h) | 1261 | | | 1061 | | | 345 | 394 | 628 | 349 | 381 | 831 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 403 | 232 | 92 | 65 |
| Volume Left | 11 | 13 | 45 | 12 |
| Volume Right | 82 | 10 | 24 | 12 |
| cSH | 1261 | 1061 | 405 | 415 |
| Volume to Capacity | 0.01 | 0.01 | 0.23 | 0.16 |
| Queue Length 95th (m) | 0.2 | 0.3 | 6.9 | 4.4 |
| Control Delay (s) | 0.3 | 0.6 | 16.5 | 15.3 |
| Lane LOS | A | A | C | C |
| Approach Delay (s) | 0.3 | 0.6 | 16.5 | 15.3 |
| Approach LOS | | | C | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.5 | | |
| Intersection Capacity Utilization | 50.0% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

Lanes, Volumes, Timings
10: Doon Mills Road & Apple Ridge Drive

Base Conditions - AM Peak Hour

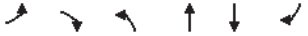
| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.973 | | | | 0.932 | |
| Flt Protected | 0.962 | | | 0.994 | | |
| Satd. Flow (prot) | 1613 | 0 | 0 | 1585 | 1458 | 0 |
| Flt Permitted | 0.962 | | | 0.994 | | |
| Satd. Flow (perm) | 1613 | 0 | 0 | 1585 | 1458 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 0% | 0% | 4% | 9% | 2% |
| Adj. Flow (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 277 | 0 | 0 | 333 | 293 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
10: Doon Mills Road & Apple Ridge Drive

Base Conditions - AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 221 | 56 | 41 | 292 | 146 | 147 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 277 | 333 | 293 |
| Volume Left (vph) | 221 | 41 | 0 |
| Volume Right (vph) | 56 | 0 | 147 |
| Hadj (s) | 0.08 | 0.08 | -0.21 |
| Departure Headway (s) | 5.6 | 5.2 | 5.0 |
| Degree Utilization, x | 0.43 | 0.48 | 0.41 |
| Capacity (veh/h) | 603 | 650 | 681 |
| Control Delay (s) | 12.7 | 13.0 | 11.4 |
| Approach Delay (s) | 12.7 | 13.0 | 11.4 |
| Approach LOS | B | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 12.4 | | |
| Level of Service | B | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

Lanes, Volumes, Timings
11: Biehn Drive & Carnydale Drive

Base Conditions - AM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.867 | | 0.970 | | | |
| Flt Protected | 0.999 | | | | | 0.954 |
| Satd. Flow (prot) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Flt Permitted | 0.999 | | | | | 0.954 |
| Satd. Flow (perm) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 7% | 25% | 5% | 20% |
| Adj. Flow (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 309 | 0 | 18 | 0 | 0 | 169 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
11: Biehn Drive & Carnydale Drive

Base Conditions - AM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (Veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 349 | 16 | | | 18 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 349 | 16 | | | 18 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 99 | 71 | | | 90 | |
| cM capacity (veh/h) | 584 | 1069 | | | 1579 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 309 | 18 | 169 |
| Volume Left | 4 | 0 | 164 |
| Volume Right | 305 | 4 | 0 |
| cSH | 1058 | 1700 | 1579 |
| Volume to Capacity | 0.29 | 0.01 | 0.10 |
| Queue Length 95th (m) | 9.8 | 0.0 | 2.8 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.6 | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 0.99 | |
| Frt | | 0.965 | | | | 0.850 | | 0.999 | | | 0.962 | |
| Flt Protected | 0.950 | | | | 0.994 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 1498 | 0 | 0 | 1500 | 1365 | 1519 | 1616 | 0 | 1519 | 1454 | 0 |
| Flt Permitted | 0.728 | | | | 0.974 | | 0.560 | | | 0.486 | | |
| Satd. Flow (perm) | 1224 | 1498 | 0 | 0 | 1467 | 1317 | 887 | 1616 | 0 | 775 | 1454 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 23 | | | | 74 | | 1 | | | 38 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 89 | 98 | 0 | 0 | 44 | 74 | 44 | 385 | 0 | 56 | 309 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

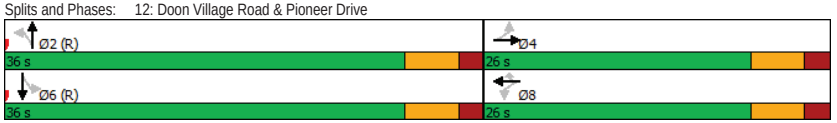




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.23 | 0.20 | | | 0.09 | 0.16 | 0.10 | 0.49 | | 0.15 | 0.43 | |
| Control Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.5 | 13.5 | | 10.2 | 11.3 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.5 | 13.5 | | 10.2 | 11.3 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.3 | | | 9.1 | | | 13.1 | | | 11.1 | |
| Approach LOS | | B | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.49 | | | |
| Intersection Signal Delay: 12.4 | | Intersection LOS: B | |
| Intersection Capacity Utilization 73.3% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

Base Conditions - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 89 | 98 | 44 | 74 | 44 | 385 | 56 | 309 |
| v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.10 | 0.49 | 0.15 | 0.43 |
| Control Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.5 | 13.5 | 10.2 | 11.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.5 | 13.5 | 10.2 | 11.3 |
| Queue Length 50th (m) | 7.7 | 6.3 | 3.6 | 0.0 | 2.7 | 29.2 | 3.5 | 19.2 |
| Queue Length 95th (m) | 17.5 | 16.1 | 9.9 | 7.7 | 7.6 | 50.6 | 9.5 | 36.9 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 394 | 498 | 473 | 474 | 429 | 782 | 375 | 723 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.10 | 0.49 | 0.15 | 0.43 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

Base Conditions - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1598 | 1498 | | | 1498 | 1317 | 1504 | 1616 | | 1515 | 1454 | |
| Flt Permitted | 0.73 | 1.00 | | | 0.97 | 1.00 | 0.56 | 1.00 | | 0.49 | 1.00 | |
| Satd. Flow (perm) | 1225 | 1498 | | | 1466 | 1317 | 887 | 1616 | | 774 | 1454 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 50 | 0 | 1 | 0 | 0 | 20 | 0 |
| Lane Group Flow (vph) | 89 | 82 | 0 | 0 | 44 | 24 | 44 | 384 | 0 | 56 | 289 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 395 | 483 | | | 472 | 424 | 429 | 781 | | 374 | 703 | |
| v/s Ratio Prot | | 0.06 | | | | | | c0.24 | | | 0.20 | |
| v/s Ratio Perm | c0.07 | | | | 0.03 | 0.02 | 0.05 | | | 0.07 | | |
| v/c Ratio | 0.23 | 0.17 | | | 0.09 | 0.06 | 0.10 | 0.49 | | 0.15 | 0.41 | |
| Uniform Delay, d1 | 15.3 | 15.1 | | | 14.7 | 14.5 | 8.7 | 10.8 | | 8.9 | 10.3 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.8 | | | 0.4 | 0.3 | 0.5 | 2.2 | | 0.8 | 1.8 | |
| Delay (s) | 16.7 | 15.8 | | | 15.1 | 14.7 | 9.2 | 13.1 | | 9.7 | 12.1 | |
| Level of Service | B | B | | | B | B | A | B | | A | B | |
| Approach Delay (s) | | 16.2 | | | 14.9 | | | 12.7 | | | 11.7 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 13.2 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.39 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 73.3% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and South Creek.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:35:05 PM

### Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - Existing | | | | | | |
| **Leg North** | 0.03 | -1 | 3.67 | 0.03 | A | 3.80 | A |
| **Leg West** | 0.12 | -1 | 3.48 | 0.11 | A | | |
| **Leg South** | 0.17 | -1 | 3.69 | 0.14 | A | | |
| **Leg East** | 0.26 | -1 | 4.08 | 0.20 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM " model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:35:05 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - Existing, AM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Existing, AM | Existing | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 3.80 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Evens Pond Crescent | |
| **West** | West | Robert Ferrie Drive | |
| **South** | South | South Creek Drive | |
| **East** | East | Robert Ferrie Drive | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **South** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |
| **West** | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |
| **South** | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |
| **East** | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |

### Slope / Intercept / Capacity

#### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | ROW 10-Year+ | | 90.00 |
| West | Percentage | ROW 10-Year+ | | 90.00 |
| South | Percentage | ROW 10-Year+ | | 90.00 |
| East | Percentage | ROW 10-Year+ | | 90.00 |

#### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.579 | 1221.701 |
| West | | (calculated) | (calculated) | 0.579 | 1221.701 |
| South | | (calculated) | (calculated) | 0.579 | 1221.701 |
| East | | (calculated) | (calculated) | 0.579 | 1221.701 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 24.00 | 100.000 |
| West | ONE HOUR | ✓ | 114.00 | 100.000 |
| South | ONE HOUR | ✓ | 147.00 | 100.000 |
| East | ONE HOUR | ✓ | 208.00 | 100.000 |

# Turning Proportions

#### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.000 | 3.000 | 8.000 | 13.000 |
| | West | 1.000 | 0.000 | 48.000 | 65.000 |
| | South | 8.000 | 87.000 | 0.000 | 52.000 |
| | East | 9.000 | 151.000 | 48.000 | 0.000 |

#### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.00 | 0.13 | 0.33 | 0.54 |
| | West | 0.01 | 0.00 | 0.42 | 0.57 |
| | South | 0.05 | 0.59 | 0.00 | 0.35 |
| | East | 0.04 | 0.73 | 0.23 | 0.00 |





# Vehicle Mix

#### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.330 | 1.000 | 1.000 |
| | West | 1.000 | 1.000 | 1.040 | 1.000 |
| | South | 1.000 | 1.050 | 1.000 | 1.020 |
| | East | 1.000 | 1.070 | 1.020 | 1.000 |

#### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 33.0 | 0.0 | 0.0 |
| | West | 0.0 | 0.0 | 4.0 | 0.0 |
| | South | 0.0 | 5.0 | 0.0 | 2.0 |
| | East | 0.0 | 7.0 | 2.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.03 | 3.67 | 0.03 | −1 | A | 22.02 | 33.03 | 1.95 | 3.55 | 0.02 | 1.95 | 3.55 |
| West | 0.11 | 3.48 | 0.12 | −1 | A | 104.61 | 156.91 | 8.85 | 3.38 | 0.10 | 8.85 | 3.38 |
| South | 0.14 | 3.69 | 0.17 | −1 | A | 134.89 | 202.33 | 12.04 | 3.57 | 0.13 | 12.04 | 3.57 |
| East | 0.20 | 4.08 | 0.26 | −1 | A | 190.86 | 286.30 | 18.53 | 3.88 | 0.21 | 18.53 | 3.88 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 18.07 | 4.52 | 18.00 | 13.50 | 214.45 | 0.00 | 1097.59 | 440.67 | 0.016 | 0.00 | 0.02 | 3.440 | A |
| West | 85.83 | 21.46 | 85.51 | 180.71 | 51.74 | 0.00 | 1191.76 | 875.44 | 0.072 | 0.00 | 0.08 | 3.307 | A |
| South | 110.67 | 27.67 | 110.25 | 77.99 | 59.26 | 0.00 | 1187.41 | 790.22 | 0.093 | 0.00 | 0.11 | 3.461 | A |
| East | 156.59 | 39.15 | 155.95 | 97.50 | 72.00 | 0.00 | 1180.03 | 921.69 | 0.133 | 0.00 | 0.16 | 3.706 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 21.58 | 5.39 | 21.56 | 16.17 | 256.90 | 0.00 | 1073.02 | 440.67 | 0.020 | 0.02 | 0.02 | 3.532 | A |
| West | 102.48 | 25.62 | 102.41 | 216.48 | 61.98 | 0.00 | 1185.83 | 875.44 | 0.086 | 0.08 | 0.10 | 3.376 | A |
| South | 132.15 | 33.04 | 132.05 | 93.42 | 70.97 | 0.00 | 1180.63 | 790.22 | 0.112 | 0.11 | 0.13 | 3.557 | A |
| East | 186.99 | 46.75 | 186.83 | 116.79 | 86.24 | 0.00 | 1171.79 | 921.69 | 0.160 | 0.16 | 0.20 | 3.855 | A |

#### Main results: (08:30-08:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 26.42 | 6.61 | 26.40 | 19.80 | 314.58 | 0.00 | 1039.63 | 440.67 | 0.025 | 0.02 | 0.03 | 3.665 | A |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 125.52 | 31.38 | 125.42 | 265.09 | 75.90 | 0.00 | 1177.77 | 875.44 | 0.107 | 0.10 | 0.12 | 3.476 | A |
| South | 161.85 | 40.46 | 161.71 | 114.40 | 86.91 | 0.00 | 1171.40 | 790.22 | 0.138 | 0.13 | 0.17 | 3.694 | A |
| East | 229.01 | 57.25 | 228.78 | 143.01 | 105.61 | 0.00 | 1160.58 | 921.69 | 0.197 | 0.20 | 0.26 | 4.074 | A |

### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 26.42 | 6.61 | 26.42 | 19.82 | 314.89 | 0.00 | 1039.46 | 440.67 | 0.025 | 0.03 | 0.03 | 3.666 | A |
| West | 125.52 | 31.38 | 125.52 | 265.34 | 75.97 | 0.00 | 1177.73 | 875.44 | 0.107 | 0.12 | 0.12 | 3.476 | A |
| South | 161.85 | 40.46 | 161.85 | 114.50 | 86.98 | 0.00 | 1171.36 | 790.22 | 0.138 | 0.17 | 0.17 | 3.694 | A |
| East | 229.01 | 57.25 | 229.01 | 143.13 | 105.70 | 0.00 | 1160.53 | 921.69 | 0.197 | 0.26 | 0.26 | 4.076 | A |

### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 21.58 | 5.39 | 21.60 | 16.20 | 257.41 | 0.00 | 1072.72 | 440.67 | 0.020 | 0.03 | 0.02 | 3.533 | A |
| West | 102.48 | 25.62 | 102.58 | 216.91 | 62.10 | 0.00 | 1185.76 | 875.44 | 0.086 | 0.12 | 0.10 | 3.380 | A |
| South | 132.15 | 33.04 | 132.29 | 93.60 | 71.09 | 0.00 | 1180.56 | 790.22 | 0.112 | 0.17 | 0.13 | 3.558 | A |
| East | 186.99 | 46.75 | 187.22 | 116.98 | 86.39 | 0.00 | 1171.70 | 921.69 | 0.160 | 0.26 | 0.20 | 3.859 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 18.07 | 4.52 | 18.08 | 13.56 | 215.52 | 0.00 | 1096.96 | 440.67 | 0.016 | 0.02 | 0.02 | 3.442 | A |
| West | 85.83 | 21.46 | 85.89 | 181.61 | 52.00 | 0.00 | 1191.61 | 875.44 | 0.072 | 0.10 | 0.08 | 3.308 | A |
| South | 110.67 | 27.67 | 110.77 | 78.37 | 59.52 | 0.00 | 1187.25 | 790.22 | 0.093 | 0.13 | 0.11 | 3.465 | A |
| East | 156.59 | 39.15 | 156.75 | 97.95 | 72.34 | 0.00 | 1179.83 | 921.69 | 0.133 | 0.20 | 0.16 | 3.711 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.25 | 0.02 | 3.440 | A | A |
| West | 1.16 | 0.08 | 3.307 | A | A |
| South | 1.56 | 0.10 | 3.461 | A | A |
| East | 2.36 | 0.16 | 3.706 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.31 | 0.02 | 3.532 | A | A |
| West | 1.42 | 0.09 | 3.376 | A | A |
| South | 1.93 | 0.13 | 3.557 | A | A |
| East | 2.95 | 0.20 | 3.855 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.40 | 0.03 | 3.665 | A | A |
| West | 1.79 | 0.12 | 3.476 | A | A |
| South | 2.45 | 0.16 | 3.694 | A | A |
| East | 3.81 | 0.25 | 4.074 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.40 | 0.03 | 3.666 | A | A |
| West | 1.81 | 0.12 | 3.476 | A | A |
| South | 2.48 | 0.17 | 3.694 | A | A |
| | | | | | |





| | | | | | |
|---|---|---|---|---|---|
| East | 3.88 | 0.26 | 4.076 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.32 | 0.02 | 3.533 | A | A |
| West | 1.47 | 0.10 | 3.380 | A | A |
| South | 2.00 | 0.13 | 3.558 | A | A |
| East | 3.07 | 0.20 | 3.859 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.26 | 0.02 | 3.442 | A | A |
| West | 1.20 | 0.08 | 3.308 | A | A |
| South | 1.63 | 0.11 | 3.465 | A | A |
| East | 2.47 | 0.16 | 3.711 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.02 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.02 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.03 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.12 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.26 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.03 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.12 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.26 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.02 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.02 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and South Creek.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:36:43 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - Existing | | | | | | |
| **Leg North** | 0.01 | −1 | 3.53 | 0.01 | A | 3.84 | A |
| **Leg West** | 0.16 | −1 | 3.64 | 0.14 | A | | |
| **Leg South** | 0.14 | −1 | 3.56 | 0.12 | A | | |
| **Leg East** | 0.33 | −1 | 4.10 | 0.25 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM " model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:36:43 PM*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - Existing, PM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Existing, PM | Existing | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 3.84 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Evens Pond Crescent | |
| West | West | Robert Ferrie Drive | |
| South | South | South Creek Drive | |
| East | East | Robert Ferrie Drive | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| South | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |
| West | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |
| South | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |
| East | 3.50 | 4.50 | 30.00 | 20.00 | 40.00 | 25.00 | |





## Slope / Intercept / Capacity

### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | ROW 10-Year+ | | 90.00 |
| West | Percentage | ROW 10-Year+ | | 90.00 |
| South | Percentage | ROW 10-Year+ | | 90.00 |
| East | Percentage | ROW 10-Year+ | | 90.00 |

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.579 | 1221.701 |
| West | | (calculated) | (calculated) | 0.579 | 1221.701 |
| South | | (calculated) | (calculated) | 0.579 | 1221.701 |
| East | | (calculated) | (calculated) | 0.579 | 1221.701 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 12.00 | 100.000 |
| West | ONE HOUR | ✓ | 144.00 | 100.000 |
| South | ONE HOUR | ✓ | 128.00 | 100.000 |
| East | ONE HOUR | ✓ | 264.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.000 | 1.000 | 2.000 | 9.000 |
| | West | 0.000 | 0.000 | 52.000 | 92.000 |
| | South | 3.000 | 55.000 | 0.000 | 70.000 |
| | East | 22.000 | 144.000 | 98.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.00 | 0.08 | 0.17 | 0.75 |
| | West | 0.00 | 0.00 | 0.36 | 0.64 |
| | South | 0.02 | 0.43 | 0.00 | 0.55 |
| | East | 0.08 | 0.55 | 0.37 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.000 | 1.000 | 1.000 |
| | West | 1.000 | 1.000 | 1.000 | 1.010 |
| | South | 1.000 | 1.010 | 1.000 | 1.000 |
| | East | 1.000 | 1.020 | 1.020 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 0.0 | 0.0 | 0.0 |
| | West | 0.0 | 0.0 | 0.0 | 1.0 |
| | South | 0.0 | 1.0 | 0.0 | 0.0 |
| | East | 0.0 | 2.0 | 2.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.01 | 3.53 | 0.01 | −1 | A | 11.01 | 16.52 | 0.94 | 3.42 | 0.01 | 0.94 | 3.42 |
| West | 0.14 | 3.64 | 0.16 | −1 | A | 132.14 | 198.21 | 11.60 | 3.51 | 0.13 | 11.60 | 3.51 |
| South | 0.12 | 3.56 | 0.14 | −1 | A | 117.46 | 176.18 | 10.10 | 3.44 | 0.11 | 10.10 | 3.44 |
| East | 0.25 | 4.10 | 0.33 | −1 | A | 242.25 | 363.38 | 23.47 | 3.88 | 0.26 | 23.47 | 3.88 |

### Main Results for each time segment

#### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 9.03 | 2.26 | 9.00 | 18.75 | 222.70 | 0.00 | 1092.81 | 493.09 | 0.008 | 0.00 | 0.01 | 3.320 | A |
| West | 108.41 | 27.10 | 108.00 | 149.97 | 81.73 | 0.00 | 1174.40 | 739.01 | 0.092 | 0.00 | 0.10 | 3.397 | A |
| South | 96.37 | 24.09 | 96.01 | 113.98 | 75.75 | 0.00 | 1177.86 | 734.41 | 0.082 | 0.00 | 0.09 | 3.342 | A |
| East | 198.75 | 49.69 | 197.95 | 128.26 | 43.50 | 0.00 | 1196.52 | 1029.10 | 0.166 | 0.00 | 0.20 | 3.667 | A |

#### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 10.79 | 2.70 | 10.78 | 22.46 | 266.78 | 0.00 | 1067.30 | 493.09 | 0.010 | 0.01 | 0.01 | 3.406 | A |
| West | 129.45 | 32.36 | 129.36 | 179.65 | 97.91 | 0.00 | 1165.04 | 739.01 | 0.111 | 0.10 | 0.13 | 3.497 | A |
| South | 115.07 | 28.77 | 114.99 | 136.54 | 90.73 | 0.00 | 1169.19 | 734.41 | 0.098 | 0.09 | 0.11 | 3.428 | A |
| East | 237.33 | 59.33 | 237.13 | 153.62 | 52.10 | 0.00 | 1191.54 | 1029.10 | 0.199 | 0.20 | 0.25 | 3.840 | A |

#### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 13.21 | 3.30 | 13.20 | 27.50 | 326.67 | 0.00 | 1032.64 | 493.09 | 0.013 | 0.01 | 0.01 | 3.530 | A |
| West | 158.55 | 39.64 | 158.41 | 219.98 | 119.89 | 0.00 | 1152.32 | 739.01 | 0.138 | 0.13 | 0.16 | 3.644 | A |
| South | 140.93 | 35.23 | 140.81 | 167.19 | 111.11 | 0.00 | 1157.40 | 734.41 | 0.122 | 0.11 | 0.14 | 3.555 | A |
| East | 290.67 | 72.67 | 290.36 | 188.11 | 63.81 | 0.00 | 1184.77 | 1029.10 | 0.245 | 0.25 | 0.33 | 4.098 | A |





#### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 13.21 | 3.30 | 13.21 | 27.53 | 327.00 | 0.00 | 1032.45 | 493.09 | 0.013 | 0.01 | 0.01 | 3.531 | A |
| West | 158.55 | 39.64 | 158.55 | 220.20 | 120.01 | 0.00 | 1152.24 | 739.01 | 0.138 | 0.16 | 0.16 | 3.644 | A |
| South | 140.93 | 35.23 | 140.93 | 167.35 | 111.20 | 0.00 | 1157.34 | 734.41 | 0.122 | 0.14 | 0.14 | 3.556 | A |
| East | 290.67 | 72.67 | 290.67 | 188.27 | 63.86 | 0.00 | 1184.74 | 1029.10 | 0.245 | 0.33 | 0.33 | 4.099 | A |

#### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 10.79 | 2.70 | 10.80 | 22.50 | 267.32 | 0.00 | 1066.98 | 493.09 | 0.010 | 0.01 | 0.01 | 3.410 | A |
| West | 129.45 | 32.36 | 129.59 | 180.01 | 98.11 | 0.00 | 1164.92 | 739.01 | 0.111 | 0.16 | 0.13 | 3.501 | A |
| South | 115.07 | 28.77 | 115.18 | 136.81 | 90.89 | 0.00 | 1169.10 | 734.41 | 0.098 | 0.14 | 0.11 | 3.429 | A |
| East | 237.33 | 59.33 | 237.63 | 153.88 | 52.19 | 0.00 | 1191.49 | 1029.10 | 0.199 | 0.33 | 0.25 | 3.845 | A |

#### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 9.03 | 2.26 | 9.04 | 18.84 | 223.82 | 0.00 | 1092.16 | 493.09 | 0.008 | 0.01 | 0.01 | 3.325 | A |
| West | 108.41 | 27.10 | 108.51 | 150.72 | 82.14 | 0.00 | 1174.16 | 739.01 | 0.092 | 0.13 | 0.10 | 3.401 | A |
| South | 96.37 | 24.09 | 96.45 | 114.54 | 76.10 | 0.00 | 1177.65 | 734.41 | 0.082 | 0.11 | 0.09 | 3.345 | A |
| East | 198.75 | 49.69 | 198.96 | 128.85 | 43.70 | 0.00 | 1196.41 | 1029.10 | 0.166 | 0.25 | 0.20 | 3.675 | A |

### Queueing Delay Results for each time segment

#### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.12 | 0.01 | 3.320 | A | A |
| West | 1.50 | 0.10 | 3.397 | A | A |
| South | 1.31 | 0.09 | 3.342 | A | A |
| East | 2.96 | 0.20 | 3.667 | A | A |

#### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.15 | 0.01 | 3.406 | A | A |
| West | 1.86 | 0.12 | 3.497 | A | A |
| South | 1.62 | 0.11 | 3.428 | A | A |
| East | 3.72 | 0.25 | 3.840 | A | A |

#### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.19 | 0.01 | 3.530 | A | A |
| West | 2.36 | 0.16 | 3.644 | A | A |
| South | 2.05 | 0.14 | 3.555 | A | A |
| East | 4.85 | 0.32 | 4.098 | A | A |

#### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.19 | 0.01 | 3.531 | A | A |
| West | 2.40 | 0.16 | 3.644 | A | A |
| South | 2.08 | 0.14 | 3.556 | A | A |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| East | 4.95 | 0.33 | 4.099 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.16 | 0.01 | 3.410 | A | A |
| West | 1.92 | 0.13 | 3.501 | A | A |
| South | 1.67 | 0.11 | 3.429 | A | A |
| East | 3.88 | 0.26 | 3.845 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.13 | 0.01 | 3.325 | A | A |
| West | 1.56 | 0.10 | 3.401 | A | A |
| South | 1.36 | 0.09 | 3.345 | A | A |
| East | 3.10 | 0.21 | 3.675 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.01 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.01 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.01 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.33 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|





| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.01 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.33 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.01 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.01 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 308 | 22 | 655 | 350 | 268 |
| Future Volume (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 308 | 22 | 655 | 350 | 268 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.97 | 1.00 | | 0.98 | 0.99 | 1.00 | | 1.00 | | 0.97 |
| Frt | | | 0.850 | | | 0.850 | | 0.990 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1670 | 3471 | 1488 | 1686 | 3438 | 1417 | 1670 | 3304 | 0 | 3146 | 1863 | 1458 |
| Flt Permitted | 0.089 | | | 0.190 | | | 0.353 | | | 0.950 | | |
| Satd. Flow (perm) | 156 | 3471 | 1447 | 337 | 3438 | 1387 | 614 | 3304 | 0 | 3130 | 1863 | 1410 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 451 | | | 461 | | 4 | | | | 224 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Adj. Flow (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 308 | 22 | 655 | 350 | 268 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 330 | 0 | 655 | 350 | 268 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

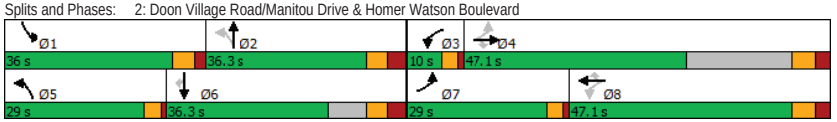




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 61.0 | 61.0 | 49.0 | 40.0 | 40.0 | 55.2 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Actuated g/C Ratio | 0.49 | 0.41 | 0.41 | 0.33 | 0.27 | 0.27 | 0.37 | 0.20 | | 0.20 | 0.26 | 0.26 |
| v/c Ratio | 0.95 | 0.74 | 0.66 | 0.24 | 1.07 | 0.79 | 0.82 | 0.51 | | 1.03 | 0.73 | 0.51 |
| Control Delay | 80.1 | 41.4 | 11.2 | 25.8 | 100.6 | 18.6 | 46.1 | 55.9 | | 100.8 | 61.3 | 13.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 80.1 | 41.4 | 11.2 | 25.8 | 100.6 | 18.6 | 46.1 | 55.9 | | 100.8 | 61.3 | 13.2 |
| LOS | F | D | B | C | F | B | D | E | | F | E | B |
| Approach Delay | | 38.8 | | | 69.8 | | | 51.1 | | | 71.5 | |
| Approach LOS | | D | | | E | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 148.4 | | | |
| Natural Cycle: 145 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.07 | | | |
| Intersection Signal Delay: 57.0 | | Intersection LOS: E | |
| Intersection Capacity Utilization 111.8% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

Base Conditions - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 330 | 655 | 350 | 268 |
| v/c Ratio | 0.95 | 0.74 | 0.66 | 0.24 | 1.07 | 0.79 | 0.82 | 0.51 | 1.03 | 0.73 | 0.51 |
| Control Delay | 80.1 | 41.4 | 11.2 | 25.8 | 100.6 | 18.6 | 46.1 | 55.9 | 100.8 | 61.3 | 13.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 80.1 | 41.4 | 11.2 | 25.8 | 100.6 | 18.6 | 46.1 | 55.9 | 100.8 | 61.3 | 13.2 |
| Queue Length 50th (m) | 80.0 | 148.3 | 25.2 | 6.3 | ~177.9 | 28.4 | 65.2 | 48.0 | ~111.5 | 101.9 | 10.7 |
| Queue Length 95th (m) | #141.4 | 176.2 | 70.2 | 13.3 | #222.2 | 85.2 | #93.8 | 64.7 | #151.5 | #141.2 | 39.6 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 330 | 1426 | 860 | 166 | 926 | 710 | 414 | 648 | 635 | 478 | 528 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.95 | 0.74 | 0.66 | 0.23 | 1.07 | 0.79 | 0.77 | 0.51 | 1.03 | 0.73 | 0.51 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

Base Conditions - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 308 | 22 | 655 | 350 | 268 |
| Future Volume (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 308 | 22 | 655 | 350 | 268 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1670 | 3471 | 1447 | 1686 | 3438 | 1387 | 1664 | 3304 | | 3146 | 1863 | 1410 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.19 | 1.00 | 1.00 | 0.35 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 157 | 3471 | 1447 | 337 | 3438 | 1387 | 619 | 3304 | | 3146 | 1863 | 1410 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 312 | 1057 | 566 | 39 | 990 | 562 | 320 | 308 | 22 | 655 | 350 | 268 |
| RTOR Reduction (vph) | 0 | 0 | 267 | 0 | 0 | 335 | 0 | 3 | 0 | 0 | 0 | 167 |
| Lane Group Flow (vph) | 312 | 1057 | 299 | 39 | 990 | 227 | 320 | 327 | 0 | 655 | 350 | 101 |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 51.9 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Effective Green, g (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 51.9 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Actuated g/C Ratio | 0.47 | 0.41 | 0.41 | 0.31 | 0.27 | 0.27 | 0.35 | 0.19 | | 0.20 | 0.26 | 0.26 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 326 | 1419 | 591 | 146 | 940 | 379 | 375 | 642 | | 632 | 475 | 360 |
| v/s Ratio Prot | c0.16 | 0.30 | | 0.01 | c0.29 | | 0.13 | 0.10 | | c0.21 | 0.19 | |
| v/s Ratio Perm | 0.29 | | 0.21 | 0.07 | | 0.16 | c0.17 | | | | | 0.07 |
| v/c Ratio | 0.96 | 0.74 | 0.51 | 0.27 | 1.05 | 0.60 | 0.85 | 0.51 | | 1.04 | 0.74 | 0.28 |
| Uniform Delay, d1 | 47.4 | 37.5 | 32.9 | 37.4 | 54.2 | 47.1 | 39.9 | 53.7 | | 59.6 | 51.0 | 44.6 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 38.1 | 2.2 | 0.7 | 1.0 | 44.4 | 2.5 | 16.9 | 2.9 | | 45.5 | 9.8 | 1.9 |
| Delay (s) | 85.5 | 39.7 | 33.6 | 38.3 | 98.6 | 49.6 | 56.8 | 56.6 | | 105.1 | 60.8 | 46.5 |
| Level of Service | F | D | C | D | F | D | E | E | | F | E | D |
| Approach Delay (s) | | 45.3 | | | 79.8 | | | 56.7 | | | 80.6 | |
| Approach LOS | | D | | | E | | | E | | | F | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 65.0 | HCM 2000 Level of Service | E | |
| HCM 2000 Volume to Capacity ratio | 0.98 | | | |
| Actuated Cycle Length (s) | 149.2 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 111.8% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1619 | 6 | 2 | 1425 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1619 | 6 | 2 | 1425 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 0.99 | | | | | | | | | | |
| Frt | | | 0.850 | | | | | 0.999 | | | 0.983 | |
| Flt Protected | | 0.953 | | | 0.979 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1493 | 1417 | 0 | 1517 | 0 | 1670 | 3179 | 0 | 1686 | 3168 | 0 |
| Flt Permitted | | 0.726 | | | 0.896 | | 0.950 | | | 0.144 | | |
| Satd. Flow (perm) | 0 | 1131 | 1417 | 0 | 1389 | 0 | 1670 | 3179 | 0 | 256 | 3168 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 125 | | | | | 1 | | | 14 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1619 | 6 | 2 | 1425 | 187 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 144 | 125 | 0 | 7 | 0 | 127 | 1625 | 0 | 2 | 1612 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

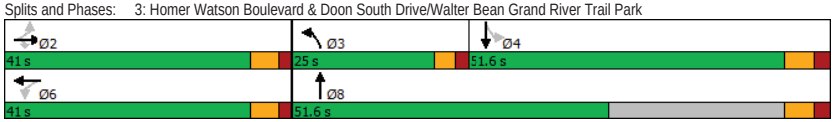




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.4 | 45.4 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| v/c Ratio | | 0.69 | 0.35 | | 0.03 | | 0.55 | 0.75 | | 0.02 | 1.04 | |
| Control Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 13.7 | | 17.5 | 60.0 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 13.7 | | 17.5 | 60.0 | |
| LOS | | D | A | | C | | D | B | | B | E | |
| Approach Delay | | 32.8 | | | 31.1 | | | 16.2 | | | 60.0 | |
| Approach LOS | | C | | | C | | | B | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 93.3 | | | |
| Natural Cycle: 100 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.04 | | | |
| Intersection Signal Delay: 36.8 | | Intersection LOS: D | |
| Intersection Capacity Utilization 96.6% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Lane Group | EBT | EBR | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 144 | 125 | 7 | 127 | 1625 | 2 | 1612 |
| v/c Ratio | 0.69 | 0.35 | 0.03 | 0.55 | 0.75 | 0.02 | 1.04 |
| Control Delay | 53.5 | 8.9 | 31.1 | 48.1 | 13.7 | 17.5 | 60.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.5 | 8.9 | 31.1 | 48.1 | 13.7 | 17.5 | 60.0 |
| Queue Length 50th (m) | 25.3 | 0.0 | 1.1 | 22.5 | 91.4 | 0.2 | ~170.4 |
| Queue Length 95th (m) | 48.8 | 14.7 | 5.0 | 44.9 | 164.4 | 1.9 | #276.5 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | 35.0 | |
| Base Capacity (vph) | 428 | 614 | 525 | 361 | 2407 | 124 | 1549 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.20 | 0.01 | 0.35 | 0.68 | 0.02 | 1.04 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1619 | 6 | 2 | 1425 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1619 | 6 | 2 | 1425 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | | 0.95 | 1.00 | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1487 | 1417 | | 1517 | | 1670 | 3181 | | 1686 | 3167 | |
| Flt Permitted | | 0.73 | 1.00 | | 0.90 | | 0.95 | 1.00 | | 0.14 | 1.00 | |
| Satd. Flow (perm) | | 1132 | 1417 | | 1389 | | 1670 | 3181 | | 256 | 3167 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1619 | 6 | 2 | 1425 | 187 |
| RTOR Reduction (vph) | 0 | 0 | 102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 0 | 144 | 23 | 0 | 7 | 0 | 127 | 1625 | 0 | 2 | 1605 | 0 |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Effective Green, g (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Grp Cap (vph) | | 208 | 261 | | 256 | | 231 | 2163 | | 124 | 1546 | |
| v/s Ratio Prot | | | | | | | 0.08 | c0.51 | | | c0.51 | |
| v/s Ratio Perm | | c0.13 | 0.02 | | 0.01 | | | | | 0.01 | | |
| v/c Ratio | | 0.69 | 0.09 | | 0.03 | | 0.55 | 0.75 | | 0.02 | 1.04 | |
| Uniform Delay, d1 | | 35.5 | 31.5 | | 31.1 | | 37.4 | 9.7 | | 12.3 | 23.9 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 9.5 | 0.1 | | 0.0 | | 2.7 | 2.5 | | 0.2 | 33.4 | |
| Delay (s) | | 45.1 | 31.6 | | 31.2 | | 40.1 | 12.2 | | 12.5 | 57.3 | |
| Level of Service | | D | C | | C | | D | B | | B | E | |
| Approach Delay (s) | | 38.8 | | | 31.2 | | | 14.2 | | | 57.2 | |
| Approach LOS | | D | | | C | | | B | | | E | |

Intersection Summary

| | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 35.1 | HCM 2000 Level of Service | | D | |
| HCM 2000 Volume to Capacity ratio | 0.93 | | | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | | 17.6 | |
| Intersection Capacity Utilization | 96.6% | ICU Level of Service | | F | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 217 | 28 | 86 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| Future Volume (vph) | 217 | 28 | 86 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.98 | | 0.99 | | 0.97 | | | 0.99 | 1.00 | | 0.98 |
| Frt | | 0.887 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 2574 | 0 | 1576 | 1827 | 1340 | 1547 | 4940 | 1377 | 2870 | 3471 | 1458 |
| Flt Permitted | 0.724 | | | 0.530 | | | 0.091 | | | 0.950 | | |
| Satd. Flow (perm) | 1220 | 2574 | 0 | 868 | 1827 | 1306 | 148 | 4940 | 1359 | 2869 | 3471 | 1425 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 86 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Adj. Flow (vph) | 217 | 28 | 86 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 217 | 114 | 0 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

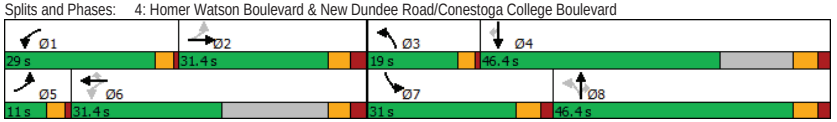




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 16.8 | 7.4 | | 20.6 | 9.5 | 9.5 | 56.4 | 43.9 | 43.9 | 10.2 | 40.6 | 40.6 |
| Actuated g/C Ratio | 0.19 | 0.08 | | 0.23 | 0.11 | 0.11 | 0.63 | 0.49 | 0.49 | 0.11 | 0.45 | 0.45 |
| v/c Ratio | 0.84 | 0.39 | | 0.50 | 0.26 | 0.41 | 0.65 | 0.59 | 0.11 | 0.30 | 0.90 | 0.08 |
| Control Delay | 60.7 | 18.9 | | 34.5 | 40.5 | 8.3 | 28.0 | 19.4 | 0.3 | 40.9 | 33.2 | 0.2 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 60.7 | 18.9 | | 34.5 | 40.5 | 8.3 | 28.0 | 19.4 | 0.3 | 40.9 | 33.2 | 0.2 |
| LOS | E | B | | C | D | A | C | B | A | D | C | A |
| Approach Delay | | 46.3 | | | 26.0 | | | 19.4 | | | 32.5 | |
| Approach LOS | | D | | | C | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 90 | | | |
| Natural Cycle: 110 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 0.90 | | | |
| Intersection Signal Delay: 27.5 | | Intersection LOS: C | |
| Intersection Capacity Utilization 86.1% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

Base Conditions - PM Peak Hour

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 217 | 114 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| v/c Ratio | 0.84 | 0.39 | 0.50 | 0.26 | 0.41 | 0.65 | 0.59 | 0.11 | 0.30 | 0.90 | 0.08 |
| Control Delay | 60.7 | 18.9 | 34.5 | 40.5 | 8.3 | 28.0 | 19.4 | 0.3 | 40.9 | 33.2 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 60.7 | 18.9 | 34.5 | 40.5 | 8.3 | 28.0 | 19.4 | 0.3 | 40.9 | 33.2 | 0.2 |
| Queue Length 50th (m) | 33.7 | 2.5 | 20.0 | 8.5 | 0.0 | 16.1 | 69.5 | 0.0 | 8.2 | 117.7 | 0.0 |
| Queue Length 95th (m) | #74.6 | 11.4 | 37.4 | 19.6 | 9.1 | 41.6 | 99.3 | 0.0 | 17.3 | #197.5 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 259 | 779 | 446 | 875 | 698 | 329 | 2409 | 749 | 799 | 2012 | 877 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.84 | 0.15 | 0.30 | 0.06 | 0.15 | 0.55 | 0.59 | 0.11 | 0.12 | 0.70 | 0.06 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

Base Conditions - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 217 | 28 | 86 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| Future Volume (vph) | 217 | 28 | 86 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.89 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1612 | 2584 | | 1569 | 1827 | 1312 | 1547 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Flt Permitted | 0.72 | 1.00 | | 0.53 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1229 | 2584 | | 875 | 1827 | 1312 | 148 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 217 | 28 | 86 | 136 | 50 | 107 | 180 | 1428 | 85 | 96 | 1403 | 54 |
| RTOR Reduction (vph) | 0 | 79 | 0 | 0 | 0 | 96 | 0 | 0 | 44 | 0 | 0 | 29 |
| Lane Group Flow (vph) | 217 | 35 | 0 | 136 | 50 | 11 | 180 | 1428 | 41 | 96 | 1403 | 25 |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 14.4 | 7.4 | | 18.6 | 9.5 | 9.5 | 55.9 | 43.9 | 43.9 | 8.0 | 41.9 | 41.9 |
| Effective Green, g (s) | 14.4 | 7.4 | | 18.6 | 9.5 | 9.5 | 55.9 | 43.9 | 43.9 | 8.0 | 41.9 | 41.9 |
| Actuated g/C Ratio | 0.16 | 0.08 | | 0.20 | 0.10 | 0.10 | 0.61 | 0.48 | 0.48 | 0.09 | 0.46 | 0.46 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 223 | 209 | | 247 | 190 | 136 | 274 | 2377 | 654 | 251 | 1594 | 656 |
| v/s Ratio Prot | c0.07 | 0.01 | | c0.05 | 0.03 | | c0.09 | 0.29 | | 0.03 | c0.40 | |
| v/s Ratio Perm | c0.08 | | | 0.06 | | 0.01 | 0.31 | | 0.03 | | | 0.02 |
| v/c Ratio | 0.97 | 0.17 | | 0.55 | 0.26 | 0.08 | 0.66 | 0.60 | 0.06 | 0.38 | 0.88 | 0.04 |
| Uniform Delay, d1 | 37.7 | 39.0 | | 31.7 | 37.6 | 36.9 | 18.9 | 17.3 | 12.6 | 39.3 | 22.4 | 13.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 52.3 | 0.4 | | 1.5 | 0.7 | 0.3 | 5.6 | 1.1 | 0.2 | 1.0 | 7.3 | 0.1 |
| Delay (s) | 90.0 | 39.4 | | 33.2 | 38.4 | 37.2 | 24.5 | 18.4 | 12.8 | 40.2 | 29.7 | 13.7 |
| Level of Service | F | D | | C | D | D | C | B | B | D | C | B |
| Approach Delay (s) | | 72.6 | | | 35.5 | | | 18.8 | | | 29.8 | |
| Approach LOS | | E | | | D | | | B | | | C | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 29.0 | HCM 2000 Level of Service | C | |
| HCM 2000 Volume to Capacity ratio | 0.86 | | | |
| Actuated Cycle Length (s) | 91.2 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 86.1% | ICU Level of Service | E | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 46 | 0 | 339 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 50 |
| Future Volume (vph) | 46 | 0 | 339 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 50 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1621 | 0 | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | 0 | 0 | 5036 | 1458 |
| Flt Permitted | 0.317 | | | 0.950 | | | 0.130 | | | | | |
| Satd. Flow (perm) | 541 | 0 | 1458 | 1637 | 1881 | 1390 | 224 | 3438 | 0 | 0 | 5036 | 1458 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 232 | | | 460 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Adj. Flow (vph) | 46 | 0 | 339 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 50 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 46 | 0 | 339 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 50 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

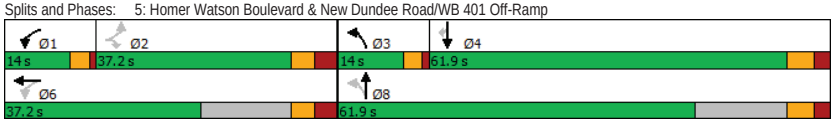




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.1 | | 30.1 | 47.4 | 44.2 | 109.8 | 54.4 | 51.5 | | | 37.4 | 37.4 |
| Actuated g/C Ratio | 0.27 | | 0.27 | 0.43 | 0.40 | 1.00 | 0.50 | 0.47 | | | 0.34 | 0.34 |
| v/c Ratio | 0.31 | | 0.60 | 0.34 | 0.75 | 0.66 | 0.91 | 0.46 | | | 0.66 | 0.09 |
| Control Delay | 41.6 | | 16.8 | 24.0 | 37.0 | 2.4 | 59.9 | 20.4 | | | 32.5 | 0.3 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 41.6 | | 16.8 | 24.0 | 37.0 | 2.4 | 59.9 | 20.4 | | | 32.5 | 0.3 |
| LOS | D | | B | C | D | A | E | C | | | C | A |
| Approach Delay | | 19.8 | | | 16.8 | | | 29.5 | | | 31.2 | |
| Approach LOS | | B | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 109.8 | | | |
| Natural Cycle: 80 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.91 | | | |
| Intersection Signal Delay: 23.9 | | Intersection LOS: C | |
| Intersection Capacity Utilization 86.5% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

Base Conditions - PM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 46 | 339 | 239 | 567 | 913 | 218 | 734 | 1137 | 50 |
| v/c Ratio | 0.31 | 0.60 | 0.34 | 0.75 | 0.66 | 0.91 | 0.46 | 0.66 | 0.09 |
| Control Delay | 41.6 | 16.8 | 24.0 | 37.0 | 2.4 | 59.9 | 20.4 | 32.5 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 41.6 | 16.8 | 24.0 | 37.0 | 2.4 | 59.9 | 20.4 | 32.5 | 0.3 |
| Queue Length 50th (m) | 8.2 | 18.8 | 34.9 | 107.0 | 0.0 | 27.5 | 56.8 | 79.0 | 0.0 |
| Queue Length 95th (m) | 22.1 | 56.6 | 65.0 | #188.2 | 0.0 | #74.8 | 72.0 | 93.7 | 0.0 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 148 | 568 | 706 | 756 | 1390 | 240 | 2169 | 2532 | 785 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.31 | 0.60 | 0.34 | 0.75 | 0.66 | 0.91 | 0.34 | 0.45 | 0.06 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

Base Conditions - PM Peak Hour

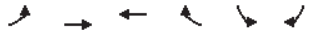
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 46 | 0 | 339 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 50 |
| Future Volume (vph) | 46 | 0 | 339 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 50 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1621 | | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | | | 5036 | 1458 |
| Flt Permitted | 0.32 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.13 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 542 | | 1458 | 1637 | 1881 | 1390 | 224 | 3438 | | | 5036 | 1458 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 46 | 0 | 339 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 50 |
| RTOR Reduction (vph) | 0 | 0 | 168 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |
| Lane Group Flow (vph) | 46 | 0 | 171 | 239 | 567 | 913 | 218 | 734 | 0 | 0 | 1137 | 17 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 109.8 | 51.5 | 51.5 | | | 37.5 | 37.5 |
| Effective Green, g (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 109.8 | 51.5 | 51.5 | | | 37.5 | 37.5 |
| Actuated g/C Ratio | 0.28 | | 0.28 | 0.40 | 0.40 | 1.00 | 0.47 | 0.47 | | | 0.34 | 0.34 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 149 | | 401 | 658 | 757 | 1390 | 233 | 1612 | | | 1719 | 497 |
| v/s Ratio Prot | | | | 0.03 | 0.30 | | c0.08 | 0.21 | | | 0.23 | |
| v/s Ratio Perm | 0.08 | | 0.12 | 0.11 | | c0.66 | c0.35 | | | | | 0.01 |
| v/c Ratio | 0.31 | | 0.43 | 0.36 | 0.75 | 0.66 | 0.94 | 0.46 | | | 0.66 | 0.03 |
| Uniform Delay, d1 | 31.5 | | 32.7 | 22.9 | 28.1 | 0.0 | 21.3 | 19.7 | | | 30.8 | 24.1 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.3 | | 3.3 | 0.7 | 6.7 | 2.4 | 42.4 | 0.4 | | | 1.3 | 0.1 |
| Delay (s) | 36.8 | | 36.0 | 23.7 | 34.8 | 2.4 | 63.7 | 20.1 | | | 32.0 | 24.1 |
| Level of Service | D | | D | C | C | A | E | C | | | C | C |
| Approach Delay (s) | | 36.1 | | | 16.0 | | | 30.1 | | | 31.7 | |
| Approach LOS | | D | | | B | | | C | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 25.4 | HCM 2000 Level of Service | C | | |
| HCM 2000 Volume to Capacity ratio | 0.92 | | | | |
| Actuated Cycle Length (s) | 109.8 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 86.5% | ICU Level of Service | E | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: New Dundee Road & Pinnacle Drive

Base Conditions - PM Peak Hour



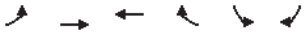
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 11 | 455 | 810 | 97 | 52 | 12 |
| Future Volume (vph) | 11 | 455 | 810 | 97 | 52 | 12 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.986 | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.961 | |
| Satd. Flow (prot) | 0 | 1601 | 1597 | 0 | 1654 | 0 |
| Flt Permitted | | 0.999 | | | 0.961 | |
| Satd. Flow (perm) | 0 | 1601 | 1597 | 0 | 1654 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 3% | 2% | 1% | 0% | 0% |
| Adj. Flow (vph) | 11 | 455 | 810 | 97 | 52 | 12 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 466 | 907 | 0 | 64 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
6: New Dundee Road & Pinnacle Drive

Base Conditions - PM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 11 | 455 | 810 | 97 | 52 | 12 |
| Future Volume (Veh/h) | 11 | 455 | 810 | 97 | 52 | 12 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 455 | 810 | 97 | 52 | 12 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 907 | | | | 1336 | 858 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 907 | | | | 1336 | 858 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 99 | | | | 69 | 97 |
| cM capacity (veh/h) | 759 | | | | 169 | 359 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 466 | 907 | 64 |
| Volume Left | 11 | 0 | 52 |
| Volume Right | 0 | 97 | 12 |
| cSH | 759 | 1700 | 187 |
| Volume to Capacity | 0.01 | 0.53 | 0.34 |
| Queue Length 95th (m) | 0.4 | 0.0 | 11.4 |
| Control Delay (s) | 0.4 | 0.0 | 33.9 |
| Lane LOS | A | | D |
| Approach Delay (s) | 0.4 | 0.0 | 33.9 |
| Approach LOS | | | D |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 1.6 | | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C | |
| Analysis Period (min) | 15 | | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 105 | 214 | 449 | 296 | 162 | 91 |
| Future Volume (vph) | 105 | 214 | 449 | 296 | 162 | 91 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.951 | |
| Flt Protected | 0.950 | | | | 0.969 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1595 | 0 |
| Flt Permitted | 0.267 | | | | 0.969 | |
| Satd. Flow (perm) | 469 | 1845 | 1618 | 1389 | 1595 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 190 | 30 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Adj. Flow (vph) | 105 | 214 | 449 | 296 | 162 | 91 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 105 | 214 | 449 | 296 | 253 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |



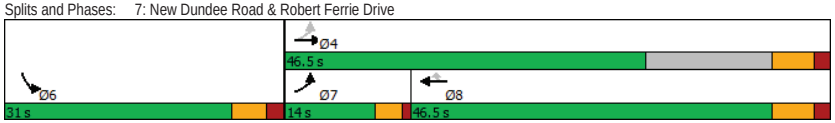


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 38.4 | 35.8 | 25.8 | 25.8 | 26.0 | |
| Actuated g/C Ratio | 0.51 | 0.48 | 0.34 | 0.34 | 0.35 | |
| v/c Ratio | 0.28 | 0.24 | 0.81 | 0.49 | 0.44 | |
| Control Delay | 9.9 | 10.8 | 34.4 | 10.0 | 23.3 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 9.9 | 10.8 | 34.4 | 10.0 | 23.3 | |
| LOS | A | B | C | B | C | |
| Approach Delay | | 10.5 | 24.7 | | 23.3 | |
| Approach LOS | | B | C | | C | |

**Intersection Summary**

Area Type: Other
Cycle Length: 91.5
Actuated Cycle Length: 74.8
Natural Cycle: 80
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.81
Intersection Signal Delay: 21.0 Intersection LOS: C
Intersection Capacity Utilization 62.8% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
### 7: New Dundee Road & Robert Ferrie Drive

Base Conditions - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 105 | 214 | 449 | 296 | 253 |
| v/c Ratio | 0.28 | 0.24 | 0.81 | 0.49 | 0.44 |
| Control Delay | 9.9 | 10.8 | 34.4 | 10.0 | 23.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 9.9 | 10.8 | 34.4 | 10.0 | 23.3 |
| Queue Length 50th (m) | 7.2 | 17.0 | 62.4 | 11.5 | 27.0 |
| Queue Length 95th (m) | 13.8 | 28.0 | 96.8 | 31.0 | 60.2 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 407 | 1366 | 900 | 857 | 574 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.26 | 0.16 | 0.50 | 0.35 | 0.44 |

| Intersection Summary |
|---|



## HCM Signalized Intersection Capacity Analysis
### 7: New Dundee Road & Robert Ferrie Drive

Base Conditions - PM Peak Hour

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 105 | 214 | 449 | 296 | 162 | 91 |
| Future Volume (vph) | 105 | 214 | 449 | 296 | 162 | 91 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1595 | |
| Flt Permitted | 0.27 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 469 | 1845 | 1618 | 1389 | 1595 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 105 | 214 | 449 | 296 | 162 | 91 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 125 | 20 | 0 |
| Lane Group Flow (vph) | 105 | 214 | 449 | 171 | 233 | 0 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 36.7 | 36.7 | 25.7 | 25.7 | 26.0 | |
| Effective Green, g (s) | 36.7 | 36.7 | 25.7 | 25.7 | 26.0 | |
| Actuated g/C Ratio | 0.49 | 0.49 | 0.34 | 0.34 | 0.35 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 340 | 900 | 552 | 474 | 551 | |
| v/s Ratio Prot | c0.03 | 0.12 | c0.28 | | c0.15 | |
| v/s Ratio Perm | 0.12 | | | 0.12 | | |
| v/c Ratio | 0.31 | 0.24 | 0.81 | 0.36 | 0.42 | |
| Uniform Delay, d1 | 12.0 | 11.1 | 22.6 | 18.6 | 18.9 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.5 | 0.1 | 8.9 | 0.5 | 2.4 | |
| Delay (s) | 12.5 | 11.3 | 31.5 | 19.1 | 21.2 | |
| Level of Service | B | B | C | B | C | |
| Approach Delay (s) | | 11.7 | 26.6 | | 21.2 | |
| Approach LOS | | B | C | | C | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 21.9 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.58 | | |
| Actuated Cycle Length (s) | 75.2 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 62.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## Lanes, Volumes, Timings
## 8: New Dundee Road

Base Conditions - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 322 | 89 | 20 | 368 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (vph) | 26 | 322 | 89 | 20 | 368 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.973 | | | 0.994 | | | 0.984 | | | 0.955 | |
| Flt Protected | | 0.997 | | | 0.998 | | | 0.979 | | | 0.997 | |
| Satd. Flow (prot) | 0 | 1487 | 0 | 0 | 1490 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Flt Permitted | | 0.997 | | | 0.998 | | | 0.979 | | | 0.997 | |
| Satd. Flow (perm) | 0 | 1487 | 0 | 0 | 1490 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 1% | 2% | 10% | 3% | 0% | 3% | 0% | 0% | 0% | 3% | 0% |
| Adj. Flow (vph) | 26 | 322 | 89 | 20 | 368 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 437 | 0 | 0 | 406 | 0 | 0 | 162 | 0 | 0 | 57 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 62.8% | | ICU Level of Service B | |
| Analysis Period (min) 15 | | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

Base Conditions - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 26 | 322 | 89 | 20 | 368 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (Veh/h) | 26 | 322 | 89 | 20 | 368 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 26 | 322 | 89 | 20 | 368 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 386 | | | 411 | | | 872 | 844 | 366 | 892 | 880 | 377 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 386 | | | 411 | | | 872 | 844 | 366 | 892 | 880 | 377 |
| tC, single (s) | 4.1 | | | 4.2 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.3 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 98 | | | 98 | | | 70 | 74 | 97 | 98 | 88 | 97 |
| cM capacity (veh/h) | 1184 | | | 1106 | | | 230 | 290 | 683 | 200 | 273 | 674 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 437 | 406 | 162 | 57 |
| Volume Left | 26 | 20 | 68 | 4 |
| Volume Right | 89 | 18 | 19 | 19 |
| cSH | 1184 | 1106 | 279 | 330 |
| Volume to Capacity | 0.02 | 0.02 | 0.58 | 0.17 |
| Queue Length 95th (m) | 0.5 | 0.4 | 27.1 | 4.9 |
| Control Delay (s) | 0.7 | 0.6 | 34.4 | 18.2 |
| Lane LOS | A | A | D | C |
| Approach Delay (s) | 0.7 | 0.6 | 34.4 | 18.2 |
| Approach LOS | | | D | C |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | | 6.7 | | |
| Intersection Capacity Utilization | | 62.8% | ICU Level of Service | B |
| Analysis Period (min) | | 15 | | |

| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.983 | | | | 0.935 | |
| Flt Protected | 0.958 | | | 0.991 | | |
| Satd. Flow (prot) | 1662 | 0 | 0 | 1603 | 1520 | 0 |
| Flt Permitted | 0.958 | | | 0.991 | | |
| Satd. Flow (perm) | 1662 | 0 | 0 | 1603 | 1520 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | 2 | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 245 | 0 | 0 | 276 | 603 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 81.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 215 | 30 | 50 | 226 | 312 | 291 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 245 | 276 | 603 |
| Volume Left (vph) | 215 | 50 | 0 |
| Volume Right (vph) | 30 | 0 | 291 |
| Hadj (s) | 0.10 | 0.07 | -0.26 |
| Departure Headway (s) | 6.2 | 5.6 | 4.9 |
| Degree Utilization, x | 0.42 | 0.43 | 0.82 |
| Capacity (veh/h) | 546 | 602 | 725 |
| Control Delay (s) | 13.6 | 12.8 | 25.9 |
| Approach Delay (s) | 13.6 | 12.8 | 25.9 |
| Approach LOS | B | B | D |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 20.0 | | |
| Level of Service | C | | |
| Intersection Capacity Utilization | 81.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

## Lanes, Volumes, Timings
## 11: Biehn Drive & Carnydale Drive

Base Conditions - PM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.868 | | 0.983 | | | |
| Flt Protected | 0.999 | | | | | 0.955 |
| Satd. Flow (prot) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Flt Permitted | 0.999 | | | | | 0.955 |
| Satd. Flow (perm) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Confl. Peds. (#/hr) | 49 | | | 7 | 7 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 5% | 0% |
| Adj. Flow (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 276 | 0 | 16 | 0 | 0 | 221 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 11: Biehn Drive & Carnydale Drive

Base Conditions - PM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (Veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Pedestrians | 7 | | 49 | | | |
| Lane Width (m) | 3.6 | | 3.6 | | | |
| Walking Speed (m/s) | 1.2 | | 1.2 | | | |
| Percent Blockage | 1 | | 4 | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 500 | 22 | | | 23 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 500 | 22 | | | 23 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 98 | 74 | | | 87 | |
| cM capacity (veh/h) | 441 | 1055 | | | 1564 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 276 | 16 | 221 |
| Volume Left | 7 | 0 | 208 |
| Volume Right | 269 | 2 | 0 |
| cSH | 1019 | 1700 | 1564 |
| Volume to Capacity | 0.27 | 0.01 | 0.13 |
| Queue Length 95th (m) | 8.8 | 0.0 | 3.7 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.4 | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.976 | | | | 0.850 | | 0.995 | | | 0.980 | |
| Flt Protected | 0.950 | | | | 0.990 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1653 | 1587 | 0 | 0 | 1621 | 1430 | 1686 | 1579 | 0 | 1621 | 1574 | 0 |
| Flt Permitted | 0.678 | | | | 0.935 | | 0.372 | | | 0.529 | | |
| Satd. Flow (perm) | 1164 | 1587 | 0 | 0 | 1526 | 1380 | 656 | 1579 | 0 | 900 | 1574 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 14 | | | | 101 | | 4 | | | 18 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 63 | 86 | 0 | 0 | 123 | 101 | 13 | 340 | 0 | 135 | 508 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |



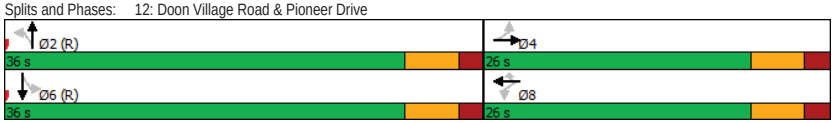


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.17 | 0.17 | | | 0.25 | 0.20 | 0.04 | 0.44 | | 0.31 | 0.66 | |
| Control Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.0 | 12.7 | | 12.2 | 16.8 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.0 | 12.7 | | 12.2 | 16.8 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.1 | | | 11.7 | | | 12.6 | | | 15.8 | |
| Approach LOS | | B | | | B | | | B | | | B | |

**Intersection Summary**

Area Type: Other
Cycle Length: 62
Actuated Cycle Length: 62
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Pretimed
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 14.2 — Intersection LOS: B
Intersection Capacity Utilization 73.3% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

Base Conditions - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 63 | 86 | 123 | 101 | 13 | 340 | 135 | 508 |
| v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.04 | 0.44 | 0.31 | 0.66 |
| Control Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.0 | 12.7 | 12.2 | 16.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.0 | 12.7 | 12.2 | 16.8 |
| Queue Length 50th (m) | 5.3 | 6.1 | 10.7 | 0.0 | 0.8 | 24.7 | 9.2 | 41.6 |
| Queue Length 95th (m) | 13.4 | 15.0 | 22.3 | 8.9 | 3.3 | 43.8 | 20.4 | 72.9 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 375 | 521 | 492 | 513 | 317 | 766 | 435 | 770 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.04 | 0.44 | 0.31 | 0.66 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

Base Conditions - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1632 | 1587 | | | 1616 | 1380 | 1675 | 1579 | | 1616 | 1573 | |
| Flt Permitted | 0.68 | 1.00 | | | 0.93 | 1.00 | 0.37 | 1.00 | | 0.53 | 1.00 | |
| Satd. Flow (perm) | 1164 | 1587 | | | 1526 | 1380 | 656 | 1579 | | 901 | 1573 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 0 | 68 | 0 | 2 | 0 | 0 | 9 | 0 |
| Lane Group Flow (vph) | 63 | 77 | 0 | 0 | 123 | 33 | 13 | 338 | 0 | 135 | 499 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 375 | 511 | | | 492 | 445 | 317 | 764 | | 435 | 761 | |
| v/s Ratio Prot | | 0.05 | | | | | | 0.21 | | | c0.32 | |
| v/s Ratio Perm | 0.05 | | | | c0.08 | 0.02 | 0.02 | | | 0.15 | | |
| v/c Ratio | 0.17 | 0.15 | | | 0.25 | 0.07 | 0.04 | 0.44 | | 0.31 | 0.66 | |
| Uniform Delay, d1 | 15.0 | 14.9 | | | 15.5 | 14.6 | 8.4 | 10.5 | | 9.7 | 12.1 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.6 | | | 1.2 | 0.3 | 0.2 | 1.9 | | 1.9 | 4.4 | |
| Delay (s) | 16.0 | 15.6 | | | 16.7 | 14.9 | 8.7 | 12.4 | | 11.6 | 16.5 | |
| Level of Service | B | B | | | B | B | A | B | | B | B | |
| Approach Delay (s) | | 15.8 | | | 15.9 | | | 12.2 | | | 15.4 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 14.7 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.49 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 73.3% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:54:12 PM

## Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - Existing | | | | | | |
| Leg North | 0.08 | -1 | 2.43 | 0.06 | A | 2.65 | A |
| Leg West | 0.58 | 1.06 | 2.76 | 0.36 | A | | |
| Leg South | 0.15 | -1 | 2.62 | 0.12 | A | | |
| Leg East | 0.22 | -1 | 2.52 | 0.16 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM " model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:54:11 PM*

## File summary

| | |
|---|---|
| Title | (untitled) |
| Location | |
| Site Number | |
| Date | 2023-12-13 |
| Version | |
| Status | (new file) |
| Identifier | |
| Client | |
| Jobnumber | |
| Analyst | AdamMorrison |
| Description | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - Existing, AM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Existing, AM | Existing | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 2.65 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Strasburg Road | |
| West | West | Huron Road | |
| South | South | Strasburg Road | |
| East | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| South | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| South | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| East | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

#### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | ROW Standard | | 90.00 |
| West | Percentage | ROW Standard | | 90.00 |
| South | Percentage | ROW Standard | | 90.00 |
| East | Percentage | ROW Standard | | 90.00 |

#### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.723 | 2192.710 |
| West | | (calculated) | (calculated) | 0.723 | 2192.710 |
| South | | (calculated) | (calculated) | 0.723 | 2192.710 |
| East | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 108.00 | 100.000 |
| West | ONE HOUR | ✓ | 691.00 | 100.000 |
| South | ONE HOUR | ✓ | 186.00 | 100.000 |
| East | ONE HOUR | ✓ | 289.00 | 100.000 |

# Turning Proportions

#### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.000 | 64.000 | 17.000 | 27.000 |
| | West | 190.000 | 0.000 | 28.000 | 473.000 |
| | South | 52.000 | 47.000 | 0.000 | 87.000 |
| | East | 63.000 | 203.000 | 23.000 | 0.000 |

#### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.00 | 0.59 | 0.16 | 0.25 |
| | West | 0.27 | 0.00 | 0.04 | 0.68 |
| | South | 0.28 | 0.25 | 0.00 | 0.47 |
| | East | 0.22 | 0.70 | 0.08 | 0.00 |





# Vehicle Mix

#### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.190 | 1.350 | 1.370 |
| | West | 1.050 | 1.000 | 1.210 | 1.050 |
| | South | 1.150 | 1.040 | 1.000 | 1.000 |
| | East | 1.250 | 1.130 | 1.090 | 1.000 |

#### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 19.0 | 35.0 | 37.0 |
| | West | 5.0 | 0.0 | 21.0 | 5.0 |
| | South | 15.0 | 4.0 | 0.0 | 0.0 |
| | East | 25.0 | 13.0 | 9.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | 2.43 | 0.08 | −1 | A | 99.10 | 148.65 | 5.86 | 2.36 | 0.07 | 5.86 | 2.36 |
| West | 0.36 | 2.76 | 0.58 | 1.06 | A | 634.07 | 951.11 | 40.22 | 2.54 | 0.45 | 40.22 | 2.54 |
| South | 0.12 | 2.62 | 0.15 | −1 | A | 170.68 | 256.02 | 10.40 | 2.44 | 0.12 | 10.40 | 2.44 |
| East | 0.16 | 2.52 | 0.22 | −1 | A | 265.19 | 397.79 | 15.89 | 2.40 | 0.18 | 15.89 | 2.40 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 81.31 | 20.33 | 81.10 | 229.03 | 205.01 | 0.00 | 2044.50 | 1177.04 | 0.040 | 0.00 | 0.05 | 2.300 | A |
| West | 520.22 | 130.06 | 518.88 | 235.80 | 50.31 | 0.00 | 2156.34 | 1756.82 | 0.241 | 0.00 | 0.33 | 2.318 | A |
| South | 140.03 | 35.01 | 139.68 | 51.06 | 518.13 | 0.00 | 1818.13 | 761.35 | 0.077 | 0.00 | 0.09 | 2.248 | A |
| East | 217.57 | 54.39 | 217.03 | 440.79 | 217.02 | 0.00 | 2035.82 | 1550.52 | 0.107 | 0.00 | 0.14 | 2.277 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 97.09 | 24.27 | 97.04 | 274.03 | 245.29 | 0.00 | 2015.38 | 1177.04 | 0.048 | 0.05 | 0.06 | 2.354 | A |
| West | 621.19 | 155.30 | 620.82 | 282.13 | 60.20 | 0.00 | 2149.19 | 1756.82 | 0.289 | 0.33 | 0.43 | 2.486 | A |
| South | 167.21 | 41.80 | 167.12 | 61.10 | 619.93 | 0.00 | 1744.53 | 761.35 | 0.096 | 0.09 | 0.11 | 2.392 | A |
| East | 259.81 | 64.95 | 259.67 | 527.39 | 259.65 | 0.00 | 2004.99 | 1550.52 | 0.130 | 0.14 | 0.17 | 2.373 | A |

#### Main results: (08:30-08:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 118.91 | 29.73 | 118.84 | 335.56 | 300.38 | 0.00 | 1975.55 | 1177.04 | 0.060 | 0.06 | 0.08 | 2.432 | A |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 760.81 | 190.20 | 760.20 | 345.50 | 73.72 | 0.00 | 2139.41 | 1756.82 | 0.356 | 0.43 | 0.58 | 2.753 | A |
| South | 204.79 | 51.20 | 204.64 | 74.82 | 759.10 | 0.00 | 1643.92 | 761.35 | 0.125 | 0.11 | 0.15 | 2.622 | A |
| East | 318.19 | 79.55 | 317.99 | 645.79 | 317.95 | 0.00 | 1962.85 | 1550.52 | 0.162 | 0.17 | 0.22 | 2.518 | A |

### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 118.91 | 29.73 | 118.91 | 335.81 | 300.58 | 0.00 | 1975.41 | 1177.04 | 0.060 | 0.08 | 0.08 | 2.432 | A |
| West | 760.81 | 190.20 | 760.80 | 345.72 | 73.77 | 0.00 | 2139.38 | 1756.82 | 0.356 | 0.58 | 0.58 | 2.756 | A |
| South | 204.79 | 51.20 | 204.79 | 74.87 | 759.70 | 0.00 | 1643.49 | 761.35 | 0.125 | 0.15 | 0.15 | 2.622 | A |
| East | 318.19 | 79.55 | 318.19 | 646.29 | 318.19 | 0.00 | 1962.67 | 1550.52 | 0.162 | 0.22 | 0.22 | 2.518 | A |

### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 97.09 | 24.27 | 97.16 | 274.44 | 245.62 | 0.00 | 2015.14 | 1177.04 | 0.048 | 0.08 | 0.06 | 2.354 | A |
| West | 621.19 | 155.30 | 621.80 | 282.50 | 60.27 | 0.00 | 2149.13 | 1756.82 | 0.289 | 0.58 | 0.43 | 2.490 | A |
| South | 167.21 | 41.80 | 167.36 | 61.18 | 620.89 | 0.00 | 1743.84 | 761.35 | 0.096 | 0.15 | 0.11 | 2.395 | A |
| East | 259.81 | 64.95 | 260.01 | 528.20 | 260.05 | 0.00 | 2004.71 | 1550.52 | 0.130 | 0.22 | 0.17 | 2.376 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 81.31 | 20.33 | 81.35 | 229.78 | 205.66 | 0.00 | 2044.03 | 1177.04 | 0.040 | 0.06 | 0.05 | 2.300 | A |
| West | 520.22 | 130.06 | 520.60 | 236.54 | 50.47 | 0.00 | 2156.22 | 1756.82 | 0.241 | 0.43 | 0.34 | 2.323 | A |
| South | 140.03 | 35.01 | 140.13 | 51.23 | 519.84 | 0.00 | 1816.89 | 761.35 | 0.077 | 0.11 | 0.09 | 2.252 | A |
| East | 217.57 | 54.39 | 217.71 | 442.24 | 217.73 | 0.00 | 2035.30 | 1550.52 | 0.107 | 0.17 | 0.14 | 2.278 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.77 | 0.05 | 2.300 | A | A |
| West | 4.94 | 0.33 | 2.318 | A | A |
| South | 1.29 | 0.09 | 2.248 | A | A |
| East | 2.03 | 0.14 | 2.277 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.94 | 0.06 | 2.354 | A | A |
| West | 6.34 | 0.42 | 2.486 | A | A |
| South | 1.65 | 0.11 | 2.392 | A | A |
| East | 2.54 | 0.17 | 2.373 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.19 | 0.08 | 2.432 | A | A |
| West | 8.57 | 0.57 | 2.753 | A | A |
| South | 2.21 | 0.15 | 2.622 | A | A |
| East | 3.29 | 0.22 | 2.518 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.20 | 0.08 | 2.432 | A | A |
| West | 8.71 | 0.58 | 2.756 | A | A |
| South | 2.23 | 0.15 | 2.622 | A | A |
| | | | | | |





| | | | | | |
|---|---|---|---|---|---|
| East | 3.33 | 0.22 | 2.518 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.96 | 0.06 | 2.354 | A | A |
| West | 6.55 | 0.44 | 2.490 | A | A |
| South | 1.69 | 0.11 | 2.395 | A | A |
| East | 2.61 | 0.17 | 2.376 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.79 | 0.05 | 2.300 | A | A |
| West | 5.11 | 0.34 | 2.323 | A | A |
| South | 1.33 | 0.09 | 2.252 | A | A |
| East | 2.09 | 0.14 | 2.278 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.05 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.33 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.43 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.58 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.58 | 0.00 | 0.00 | 0.00 | 1.06 | | | N/A | N/A |
| **South** | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.43 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.05 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.34 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:53:53 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - Existing | | | | | | |
| **Leg North** | 0.28 | −1 | 2.96 | 0.21 | A | 2.79 | A |
| **Leg West** | 0.44 | −1 | 2.57 | 0.30 | A | | |
| **Leg South** | 0.12 | −1 | 2.30 | 0.11 | A | | |
| **Leg East** | 0.66 | 1.03 | 3.01 | 0.39 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM " model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:53:53 PM*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - Existing, PM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Existing, PM | Existing | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 2.79 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Strasburg Road | |
| **West** | West | Huron Road | |
| **South** | South | Strasburg Road | |
| **East** | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **South** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **South** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |





## Slope / Intercept / Capacity

### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| **North** | Percentage | ROW Standard | | 90.00 |
| **West** | Percentage | ROW Standard | | 90.00 |
| **South** | Percentage | ROW Standard | | 90.00 |
| **East** | Percentage | ROW Standard | | 90.00 |

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| **North** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **West** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **South** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **East** | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| **North** | ONE HOUR | ✓ | 308.00 | 100.000 |
| **West** | ONE HOUR | ✓ | 555.00 | 100.000 |
| **South** | ONE HOUR | ✓ | 175.00 | 100.000 |
| **East** | ONE HOUR | ✓ | 723.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.000 | 207.000 | 65.000 | 36.000 |
| | **West** | 113.000 | 0.000 | 52.000 | 390.000 |
| | **South** | 54.000 | 44.000 | 0.000 | 77.000 |
| | **East** | 25.000 | 609.000 | 89.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.00 | 0.67 | 0.21 | 0.12 |
| | **West** | 0.20 | 0.00 | 0.09 | 0.70 |
| | **South** | 0.31 | 0.25 | 0.00 | 0.44 |
| | **East** | 0.03 | 0.84 | 0.12 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.020 | 1.020 | 1.190 |
| | West | 1.040 | 1.000 | 1.000 | 1.020 |
| | South | 1.000 | 1.020 | 1.000 | 1.000 |
| | East | 1.520 | 1.020 | 1.000 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 2.0 | 2.0 | 19.0 |
| | West | 4.0 | 0.0 | 0.0 | 2.0 |
| | South | 0.0 | 2.0 | 0.0 | 0.0 |
| | East | 52.0 | 2.0 | 0.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.21 | 2.96 | 0.28 | −1 | A | 282.63 | 423.94 | 18.91 | 2.68 | 0.21 | 18.91 | 2.68 |
| West | 0.30 | 2.57 | 0.44 | −1 | A | 509.28 | 763.92 | 30.37 | 2.39 | 0.34 | 30.37 | 2.39 |
| South | 0.11 | 2.30 | 0.12 | −1 | A | 160.58 | 240.87 | 8.73 | 2.17 | 0.10 | 8.73 | 2.17 |
| East | 0.39 | 3.01 | 0.66 | 1.03 | A | 663.44 | 995.16 | 44.97 | 2.71 | 0.50 | 44.98 | 2.71 |

### Main Results for each time segment

#### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 231.88 | 57.97 | 231.26 | 144.20 | 557.14 | 0.00 | 1789.93 | 942.48 | 0.130 | 0.00 | 0.15 | 2.394 | A |
| West | 417.83 | 104.46 | 416.81 | 645.74 | 142.66 | 0.00 | 2089.57 | 1831.03 | 0.200 | 0.00 | 0.25 | 2.198 | A |
| South | 131.75 | 32.94 | 131.45 | 154.68 | 404.79 | 0.00 | 1900.07 | 913.35 | 0.069 | 0.00 | 0.07 | 2.045 | A |
| East | 544.31 | 136.08 | 542.86 | 377.77 | 158.48 | 0.00 | 2078.14 | 1553.42 | 0.262 | 0.00 | 0.36 | 2.411 | A |

#### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 276.89 | 69.22 | 276.70 | 172.51 | 666.60 | 0.00 | 1710.79 | 942.48 | 0.162 | 0.15 | 0.20 | 2.603 | A |
| West | 498.93 | 124.73 | 498.66 | 772.61 | 170.69 | 0.00 | 2069.31 | 1831.03 | 0.241 | 0.25 | 0.32 | 2.342 | A |
| South | 157.32 | 39.33 | 157.25 | 185.07 | 484.28 | 0.00 | 1842.60 | 913.35 | 0.085 | 0.07 | 0.09 | 2.146 | A |
| East | 649.96 | 162.49 | 649.52 | 451.94 | 189.59 | 0.00 | 2055.65 | 1553.42 | 0.316 | 0.36 | 0.47 | 2.635 | A |

#### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 339.11 | 84.78 | 338.80 | 211.24 | 816.20 | 0.00 | 1602.64 | 942.48 | 0.212 | 0.20 | 0.28 | 2.954 | A |





| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 611.07 | 152.77 | 610.62 | 946.00 | 209.00 | 0.00 | 2041.61 | 1831.03 | 0.299 | 0.32 | 0.43 | 2.571 | A |
| South | 192.68 | 48.17 | 192.56 | 226.61 | 593.01 | 0.00 | 1763.99 | 913.35 | 0.109 | 0.09 | 0.12 | 2.302 | A |
| East | 796.04 | 199.01 | 795.28 | 553.41 | 232.16 | 0.00 | 2024.87 | 1553.42 | 0.393 | 0.47 | 0.66 | 3.012 | A |

#### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 339.11 | 84.78 | 339.11 | 211.39 | 816.95 | 0.00 | 1602.10 | 942.48 | 0.212 | 0.28 | 0.28 | 2.956 | A |
| West | 611.07 | 152.77 | 611.06 | 946.87 | 209.19 | 0.00 | 2041.47 | 1831.03 | 0.299 | 0.43 | 0.44 | 2.571 | A |
| South | 192.68 | 48.17 | 192.68 | 226.81 | 593.45 | 0.00 | 1763.68 | 913.35 | 0.109 | 0.12 | 0.12 | 2.302 | A |
| East | 796.04 | 199.01 | 796.03 | 553.81 | 232.31 | 0.00 | 2024.76 | 1553.42 | 0.393 | 0.66 | 0.66 | 3.014 | A |

#### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 276.89 | 69.22 | 277.19 | 172.76 | 667.79 | 0.00 | 1709.93 | 942.48 | 0.162 | 0.28 | 0.20 | 2.606 | A |
| West | 498.93 | 124.73 | 499.37 | 773.99 | 171.00 | 0.00 | 2069.09 | 1831.03 | 0.241 | 0.44 | 0.33 | 2.344 | A |
| South | 157.32 | 39.33 | 157.44 | 185.39 | 484.98 | 0.00 | 1842.09 | 913.35 | 0.085 | 0.12 | 0.09 | 2.149 | A |
| East | 649.96 | 162.49 | 650.71 | 452.58 | 189.84 | 0.00 | 2055.47 | 1553.42 | 0.316 | 0.66 | 0.48 | 2.638 | A |

#### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 231.88 | 57.97 | 232.06 | 144.64 | 559.07 | 0.00 | 1788.53 | 942.48 | 0.130 | 0.20 | 0.15 | 2.400 | A |
| West | 417.83 | 104.46 | 418.11 | 647.97 | 143.16 | 0.00 | 2089.21 | 1831.03 | 0.200 | 0.33 | 0.26 | 2.201 | A |
| South | 131.75 | 32.94 | 131.83 | 155.21 | 406.06 | 0.00 | 1899.15 | 913.35 | 0.069 | 0.09 | 0.08 | 2.048 | A |
| East | 544.31 | 136.08 | 544.76 | 378.94 | 158.95 | 0.00 | 2077.80 | 1553.42 | 0.262 | 0.48 | 0.37 | 2.418 | A |

### Queueing Delay Results for each time segment

#### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.28 | 0.15 | 2.394 | A | A |
| West | 3.77 | 0.25 | 2.198 | A | A |
| South | 1.11 | 0.07 | 2.045 | A | A |
| East | 5.37 | 0.36 | 2.411 | A | A |

#### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.96 | 0.20 | 2.603 | A | A |
| West | 4.80 | 0.32 | 2.342 | A | A |
| South | 1.39 | 0.09 | 2.146 | A | A |
| East | 7.02 | 0.47 | 2.635 | A | A |

#### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.10 | 0.27 | 2.954 | A | A |
| West | 6.44 | 0.43 | 2.571 | A | A |
| South | 1.82 | 0.12 | 2.302 | A | A |
| East | 9.78 | 0.65 | 3.012 | A | A |

#### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.17 | 0.28 | 2.956 | A | A |
| West | 6.53 | 0.44 | 2.571 | A | A |
| South | 1.84 | 0.12 | 2.302 | A | A |
| | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| East | 9.96 | 0.66 | 3.014 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.06 | 0.20 | 2.606 | A | A |
| West | 4.95 | 0.33 | 2.344 | A | A |
| South | 1.43 | 0.10 | 2.149 | A | A |
| East | 7.28 | 0.49 | 2.638 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.35 | 0.16 | 2.400 | A | A |
| West | 3.89 | 0.26 | 2.201 | A | A |
| South | 1.14 | 0.08 | 2.048 | A | A |
| East | 5.57 | 0.37 | 2.418 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.32 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.47 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.43 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.12 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.66 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|





| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.44 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.12 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.66 | 0.00 | 0.00 | 0.00 | 1.03 | | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.33 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.48 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.26 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.37 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

# Appendix D

## 2028 Background Traffic Operations Reports

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 333 | 15 | 294 | 144 | 123 |
| Future Volume (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 333 | 15 | 294 | 144 | 123 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.96 | 1.00 | | 0.98 | 0.99 | 1.00 | | 0.98 | | 0.98 |
| Frt | | | 0.850 | | | 0.850 | | 0.994 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1547 | 3374 | 1390 | 1561 | 3438 | 1390 | 1653 | 3254 | 0 | 2895 | 1759 | 1417 |
| Flt Permitted | 0.086 | | | 0.271 | | | 0.596 | | | 0.950 | | |
| Satd. Flow (perm) | 140 | 3374 | 1337 | 444 | 3438 | 1361 | 1031 | 3254 | 0 | 2836 | 1759 | 1389 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 194 | | | 450 | | 3 | | | | 123 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Adj. Flow (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 333 | 15 | 294 | 144 | 123 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 348 | 0 | 294 | 144 | 123 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

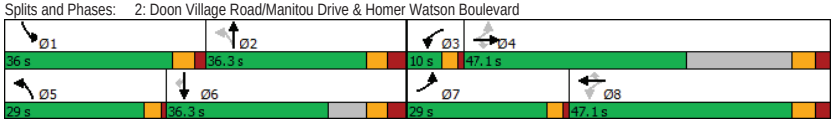




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 65.1 | 65.1 | 48.9 | 40.0 | 40.0 | 57.7 | 30.5 | | 21.3 | 29.9 | 29.9 |
| Actuated g/C Ratio | 0.51 | 0.46 | 0.46 | 0.35 | 0.28 | 0.28 | 0.41 | 0.22 | | 0.15 | 0.21 | 0.21 |
| v/c Ratio | 0.94 | 0.64 | 0.32 | 0.07 | 1.09 | 0.80 | 0.70 | 0.49 | | 0.67 | 0.39 | 0.32 |
| Control Delay | 77.4 | 32.6 | 6.8 | 20.7 | 104.3 | 19.8 | 38.0 | 51.6 | | 64.6 | 51.6 | 9.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 77.4 | 32.6 | 6.8 | 20.7 | 104.3 | 19.8 | 38.0 | 51.6 | | 64.6 | 51.6 | 9.6 |
| LOS | E | C | A | C | F | B | D | D | | E | D | A |
| Approach Delay | | 37.5 | | | 74.4 | | | 44.6 | | | 49.2 | |
| Approach LOS | | D | | | E | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 141.2 | | | |
| Natural Cycle: 115 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.09 | | | |
| Intersection Signal Delay: 53.8 | | Intersection LOS: D | |
| Intersection Capacity Utilization 112.7% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Background - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 348 | 294 | 144 | 123 |
| v/c Ratio | 0.94 | 0.64 | 0.32 | 0.07 | 1.09 | 0.80 | 0.70 | 0.49 | 0.67 | 0.39 | 0.32 |
| Control Delay | 77.4 | 32.6 | 6.8 | 20.7 | 104.3 | 19.8 | 38.0 | 51.6 | 64.6 | 51.6 | 9.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 77.4 | 32.6 | 6.8 | 20.7 | 104.3 | 19.8 | 38.0 | 51.6 | 64.6 | 51.6 | 9.6 |
| Queue Length 50th (m) | 73.2 | 109.5 | 5.3 | 2.0 | ~185.7 | 32.7 | 77.4 | 47.3 | 42.7 | 37.1 | 0.0 |
| Queue Length 95th (m) | #138.3 | 159.1 | 25.7 | 6.3 | #239.6 | 93.6 | 108.5 | 67.1 | 58.1 | 58.9 | 17.4 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 320 | 1555 | 720 | 202 | 974 | 707 | 534 | 704 | 615 | 448 | 446 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.94 | 0.64 | 0.32 | 0.07 | 1.09 | 0.80 | 0.69 | 0.49 | 0.48 | 0.32 | 0.28 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Background - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 333 | 15 | 294 | 144 | 123 |
| Future Volume (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 333 | 15 | 294 | 144 | 123 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1547 | 3374 | 1338 | 1560 | 3438 | 1362 | 1648 | 3253 | | 2895 | 1759 | 1389 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.27 | 1.00 | 1.00 | 0.60 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 140 | 3374 | 1338 | 445 | 3438 | 1362 | 1033 | 3253 | | 2895 | 1759 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 300 | 995 | 229 | 14 | 1064 | 568 | 366 | 333 | 15 | 294 | 144 | 123 |
| RTOR Reduction (vph) | 0 | 0 | 106 | 0 | 0 | 317 | 0 | 2 | 0 | 0 | 0 | 97 |
| Lane Group Flow (vph) | 300 | 995 | 123 | 14 | 1064 | 251 | 366 | 346 | 0 | 294 | 144 | 26 |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 54.4 | 30.5 | | 21.3 | 29.9 | 29.9 |
| Effective Green, g (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 54.4 | 30.5 | | 21.3 | 29.9 | 29.9 |
| Actuated g/C Ratio | 0.50 | 0.45 | 0.45 | 0.31 | 0.30 | 0.30 | 0.38 | 0.21 | | 0.15 | 0.21 | 0.21 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 314 | 1528 | 606 | 157 | 1016 | 402 | 493 | 690 | | 429 | 365 | 289 |
| v/s Ratio Prot | c0.17 | 0.29 | | 0.00 | c0.31 | | c0.12 | 0.11 | | 0.10 | 0.08 | |
| v/s Ratio Perm | 0.31 | | 0.09 | 0.03 | | 0.18 | c0.16 | | | | | 0.02 |
| v/c Ratio | 0.96 | 0.65 | 0.20 | 0.09 | 1.05 | 0.62 | 0.74 | 0.50 | | 0.69 | 0.39 | 0.09 |
| Uniform Delay, d1 | 45.7 | 30.5 | 23.7 | 34.3 | 50.6 | 43.7 | 35.9 | 49.9 | | 58.0 | 49.1 | 45.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 38.6 | 1.0 | 0.2 | 0.2 | 41.4 | 3.0 | 6.0 | 2.6 | | 5.8 | 3.2 | 0.6 |
| Delay (s) | 84.3 | 31.5 | 23.8 | 34.5 | 92.0 | 46.7 | 41.9 | 52.5 | | 63.8 | 52.3 | 46.5 |
| Level of Service | F | C | C | C | F | D | D | D | | E | D | D |
| Approach Delay (s) | | 40.7 | | | 75.9 | | | 47.1 | | | 57.0 | |
| Approach LOS | | D | | | E | | | D | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 56.8 | HCM 2000 Level of Service | E | |
| HCM 2000 Volume to Capacity ratio | 0.91 | | | |
| Actuated Cycle Length (s) | 143.7 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 112.7% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1555 | 2 | 0 | 1372 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1555 | 2 | 0 | 1372 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 1.00 | 0.99 | | 0.99 | | 1.00 | | | | 1.00 | |
| Frt | | | 0.850 | | 0.865 | | | | | | 0.992 | |
| Flt Protected | | 0.950 | | | | | 0.950 | | | | | |
| Satd. Flow (prot) | 0 | 1537 | 1444 | 0 | 1323 | 0 | 1637 | 3094 | 0 | 1775 | 3070 | 0 |
| Flt Permitted | | 0.757 | | | | | 0.950 | | | | | |
| Satd. Flow (perm) | 0 | 1223 | 1425 | 0 | 1323 | 0 | 1632 | 3094 | 0 | 1775 | 3070 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 213 | | 80 | | | | | | 6 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1555 | 2 | 0 | 1372 | 81 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 238 | 213 | 0 | 2 | 0 | 76 | 1557 | 0 | 0 | 1453 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

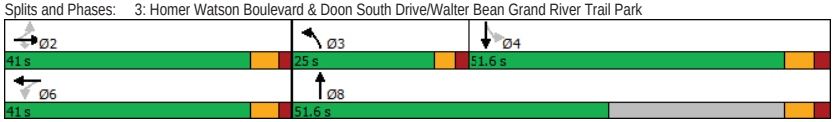




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 23.2 | 23.2 | | 23.2 | | 11.4 | 58.6 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.12 | 0.62 | | | 0.49 | |
| v/c Ratio | | 0.80 | 0.42 | | 0.01 | | 0.39 | 0.81 | | | 0.97 | |
| Control Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 19.7 | | | 44.6 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | | 0.0 | |
| Total Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 19.7 | | | 44.6 | |
| LOS | | D | A | | A | | D | B | | | D | |
| Approach Delay | | 31.5 | | | | | | 21.0 | | | 44.6 | |
| Approach LOS | | C | | | | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 94.8 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 0.97 | | | |
| Intersection Signal Delay: 32.0 | | Intersection LOS: C | |
| Intersection Capacity Utilization 100.0% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

| Lane Group | EBT | EBR | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 238 | 213 | 2 | 76 | 1557 | 1453 |
| v/c Ratio | 0.80 | 0.42 | 0.01 | 0.39 | 0.81 | 0.97 |
| Control Delay | 53.8 | 6.7 | 0.0 | 48.8 | 19.7 | 44.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.8 | 6.7 | 0.0 | 48.8 | 19.7 | 44.6 |
| Queue Length 50th (m) | 43.8 | 0.0 | 0.0 | 14.2 | 111.1 | ~148.9 |
| Queue Length 95th (m) | 75.9 | 17.2 | 0.0 | 31.4 | 191.8 | #257.3 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | |
| Base Capacity (vph) | 463 | 672 | 550 | 354 | 2343 | 1498 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.51 | 0.32 | 0.00 | 0.21 | 0.66 | 0.97 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1555 | 2 | 0 | 1372 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1555 | 2 | 0 | 1372 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | | 0.99 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | | 1.00 | 0.85 | | 0.86 | | 1.00 | 1.00 | | | 0.99 | |
| Flt Protected | | 0.95 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | 1535 | 1425 | | 1323 | | 1637 | 3094 | | | 3070 | |
| Flt Permitted | | 0.76 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | 1222 | 1425 | | 1323 | | 1637 | 3094 | | | 3070 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1555 | 2 | 0 | 1372 | 81 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 0 | 238 | 52 | 0 | 0 | 0 | 76 | 1557 | 0 | 0 | 1450 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Effective Green, g (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.09 | 0.63 | | | 0.48 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | | 5.0 | |
| Lane Grp Cap (vph) | | 296 | 345 | | 320 | | 148 | 1936 | | | 1482 | |
| v/s Ratio Prot | | | | | 0.00 | | 0.05 | c0.50 | | | c0.47 | |
| v/s Ratio Perm | | c0.19 | 0.04 | | | | | | | | | |
| v/c Ratio | | 0.80 | 0.15 | | 0.00 | | 0.51 | 0.80 | | | 0.98 | |
| Uniform Delay, d1 | | 34.1 | 28.5 | | 27.5 | | 41.5 | 13.5 | | | 24.3 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 14.6 | 0.2 | | 0.0 | | 3.0 | 3.7 | | | 18.8 | |
| Delay (s) | | 48.7 | 28.7 | | 27.5 | | 44.5 | 17.2 | | | 43.0 | |
| Level of Service | | D | C | | C | | D | B | | | D | |
| Approach Delay (s) | | 39.2 | | | 27.5 | | | 18.4 | | | 43.0 | |
| Approach LOS | | D | | | C | | | B | | | D | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 31.2 | HCM 2000 Level of Service | C | | |
| HCM 2000 Volume to Capacity ratio | 0.93 | | | | |
| Actuated Cycle Length (s) | 95.7 | Sum of lost time (s) | 17.6 | | |
| Intersection Capacity Utilization | 100.0% | ICU Level of Service | F | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 132 | 28 | 56 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| Future Volume (vph) | 132 | 28 | 56 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.98 | | | 0.98 | 1.00 | | 0.99 |
| Frt | | 0.900 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1576 | 2295 | 0 | 1492 | 1743 | 1219 | 1429 | 4848 | 1417 | 2749 | 3312 | 1229 |
| Flt Permitted | 0.609 | | | 0.700 | | | 0.088 | | | 0.950 | | |
| Satd. Flow (perm) | 1003 | 2295 | 0 | 1091 | 1743 | 1196 | 132 | 4848 | 1393 | 2747 | 3312 | 1213 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 56 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Adj. Flow (vph) | 132 | 28 | 56 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 132 | 84 | 0 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

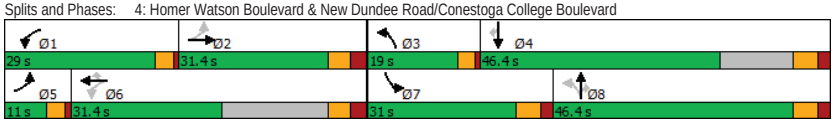




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 15.1 | 7.3 | | 15.2 | 7.7 | 7.7 | 60.9 | 46.8 | 46.8 | 10.1 | 40.2 | 40.2 |
| Actuated g/C Ratio | 0.17 | 0.08 | | 0.17 | 0.09 | 0.09 | 0.69 | 0.53 | 0.53 | 0.11 | 0.46 | 0.46 |
| v/c Ratio | 0.61 | 0.35 | | 0.37 | 0.16 | 0.35 | 0.65 | 0.55 | 0.24 | 0.26 | 0.99 | 0.04 |
| Control Delay | 42.7 | 22.0 | | 33.3 | 40.3 | 5.4 | 29.4 | 17.2 | 4.3 | 40.0 | 46.5 | 0.1 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 42.7 | 22.0 | | 33.3 | 40.3 | 5.4 | 29.4 | 17.2 | 4.3 | 40.0 | 46.5 | 0.1 |
| LOS | D | C | | C | D | A | C | B | A | D | D | A |
| Approach Delay | | 34.7 | | | 22.2 | | | 17.2 | | | 45.5 | |
| Approach LOS | | C | | | C | | | B | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 88.3 | | | |
| Natural Cycle: 130 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 0.99 | | | |
| Intersection Signal Delay: 30.2 | | Intersection LOS: C | |
| Intersection Capacity Utilization 84.9% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
### 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 132 | 84 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| v/c Ratio | 0.61 | 0.35 | 0.37 | 0.16 | 0.35 | 0.65 | 0.55 | 0.24 | 0.26 | 0.99 | 0.04 |
| Control Delay | 42.7 | 22.0 | 33.3 | 40.3 | 5.4 | 29.4 | 17.2 | 4.3 | 40.0 | 46.5 | 0.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 42.7 | 22.0 | 33.3 | 40.3 | 5.4 | 29.4 | 17.2 | 4.3 | 40.0 | 46.5 | 0.1 |
| Queue Length 50th (m) | 20.3 | 2.5 | 12.2 | 4.2 | 0.0 | 20.4 | 66.4 | 2.3 | 7.1 | ~138.3 | 0.0 |
| Queue Length 95th (m) | 36.6 | 10.0 | 24.7 | 11.9 | 2.8 | #54.6 | 91.7 | 15.0 | 15.0 | #210.8 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 218 | 692 | 425 | 852 | 655 | 312 | 2569 | 817 | 781 | 1958 | 767 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.61 | 0.12 | 0.19 | 0.03 | 0.12 | 0.65 | 0.55 | 0.24 | 0.10 | 0.76 | 0.03 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 132 | 28 | 56 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| Future Volume (vph) | 132 | 28 | 56 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.90 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1572 | 2300 | | 1486 | 1743 | 1199 | 1429 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Flt Permitted | 0.61 | 1.00 | | 0.70 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1007 | 2300 | | 1095 | 1743 | 1199 | 132 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 132 | 28 | 56 | 82 | 24 | 80 | 203 | 1425 | 194 | 82 | 1488 | 25 |
| RTOR Reduction (vph) | 0 | 51 | 0 | 0 | 0 | 74 | 0 | 0 | 82 | 0 | 0 | 14 |
| Lane Group Flow (vph) | 132 | 33 | 0 | 82 | 24 | 6 | 203 | 1425 | 112 | 82 | 1488 | 11 |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 15.0 | 7.8 | | 12.2 | 6.4 | 6.4 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Effective Green, g (s) | 15.0 | 7.8 | | 12.2 | 6.4 | 6.4 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Actuated g/C Ratio | 0.16 | 0.09 | | 0.13 | 0.07 | 0.07 | 0.67 | 0.51 | 0.51 | 0.09 | 0.46 | 0.46 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 210 | 197 | | 171 | 122 | 84 | 303 | 2493 | 717 | 235 | 1510 | 553 |
| v/s Ratio Prot | c0.05 | 0.01 | | 0.03 | 0.01 | | c0.11 | 0.29 | | 0.03 | c0.45 | |
| v/s Ratio Perm | c0.05 | | | 0.03 | | 0.00 | 0.33 | | 0.08 | | | 0.01 |
| v/c Ratio | 0.63 | 0.17 | | 0.48 | 0.20 | 0.07 | 0.67 | 0.57 | 0.16 | 0.35 | 0.99 | 0.02 |
| Uniform Delay, d1 | 34.7 | 38.6 | | 36.1 | 39.9 | 39.5 | 22.1 | 15.2 | 11.7 | 39.2 | 24.5 | 13.6 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.8 | 0.4 | | 0.8 | 0.8 | 0.3 | 5.5 | 1.0 | 0.5 | 0.9 | 19.9 | 0.1 |
| Delay (s) | 40.4 | 39.0 | | 36.9 | 40.7 | 39.8 | 27.6 | 16.2 | 12.1 | 40.1 | 44.4 | 13.7 |
| Level of Service | D | D | | D | D | D | C | B | B | D | D | B |
| Approach Delay (s) | | 39.9 | | | 38.6 | | | 17.0 | | | 43.7 | |
| Approach LOS | | D | | | D | | | B | | | D | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 30.5 | HCM 2000 Level of Service | C | |
| HCM 2000 Volume to Capacity ratio | 0.89 | | | |
| Actuated Cycle Length (s) | 91.0 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 84.9% | ICU Level of Service | E | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 57 | 0 | 574 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 29 |
| Future Volume (vph) | 57 | 0 | 574 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 29 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1591 | 0 | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | 0 | 0 | 4803 | 1261 |
| Flt Permitted | 0.620 | | | 0.950 | | | 0.105 | | | | | |
| Satd. Flow (perm) | 1038 | 0 | 1458 | 1441 | 1776 | 1365 | 173 | 3406 | 0 | 0 | 4803 | 1261 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 222 | | | 412 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Adj. Flow (vph) | 57 | 0 | 574 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 29 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 57 | 0 | 574 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 29 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

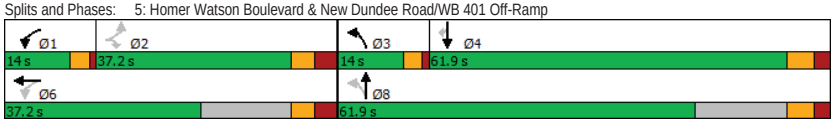




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.5 | | 30.5 | 48.0 | 44.7 | 114.5 | 58.4 | 55.4 | | | 44.9 | 44.9 |
| Actuated g/C Ratio | 0.27 | | 0.27 | 0.42 | 0.39 | 1.00 | 0.51 | 0.48 | | | 0.39 | 0.39 |
| v/c Ratio | 0.21 | | 1.04 | 0.40 | 0.32 | 0.65 | 0.39 | 0.53 | | | 0.70 | 0.05 |
| Control Delay | 39.9 | | 76.8 | 28.8 | 29.0 | 2.4 | 18.9 | 21.1 | | | 31.3 | 0.2 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 39.9 | | 76.8 | 28.8 | 29.0 | 2.4 | 18.9 | 21.1 | | | 31.3 | 0.2 |
| LOS | D | | E | C | C | A | B | C | | | C | A |
| Approach Delay | | 73.4 | | | 11.4 | | | 20.9 | | | 30.6 | |
| Approach LOS | | E | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 114.5 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 1.04 | | | |
| Intersection Signal Delay: 28.7 | | Intersection LOS: C | |
| Intersection Capacity Utilization 93.3% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Background - AM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 57 | 574 | 239 | 221 | 886 | 79 | 880 | 1318 | 29 |
| v/c Ratio | 0.21 | 1.04 | 0.40 | 0.32 | 0.65 | 0.39 | 0.53 | 0.70 | 0.05 |
| Control Delay | 39.9 | 76.8 | 28.8 | 29.0 | 2.4 | 18.9 | 21.1 | 31.3 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 39.9 | 76.8 | 28.8 | 29.0 | 2.4 | 18.9 | 21.1 | 31.3 | 0.2 |
| Queue Length 50th (m) | 11.1 | ~113.2 | 41.8 | 38.6 | 0.0 | 9.1 | 72.3 | 97.8 | 0.0 |
| Queue Length 95th (m) | 25.2 | #199.6 | 72.2 | 65.8 | 0.0 | 16.9 | 89.4 | 114.2 | 0.0 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 276 | 551 | 603 | 693 | 1365 | 211 | 2086 | 2345 | 669 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.21 | 1.04 | 0.40 | 0.32 | 0.65 | 0.37 | 0.42 | 0.56 | 0.04 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Background - AM Peak Hour

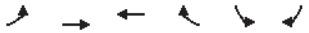
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 57 | 0 | 574 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 29 |
| Future Volume (vph) | 57 | 0 | 574 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 29 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1591 | | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | | | 4803 | 1261 |
| Flt Permitted | 0.62 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.10 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 1039 | | 1458 | 1441 | 1776 | 1365 | 172 | 3406 | | | 4803 | 1261 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 57 | 0 | 574 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 29 |
| RTOR Reduction (vph) | 0 | 0 | 163 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| Lane Group Flow (vph) | 57 | 0 | 411 | 239 | 221 | 886 | 79 | 880 | 0 | 0 | 1318 | 11 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.5 | | 30.5 | 44.7 | 44.7 | 115.3 | 56.5 | 56.5 | | | 45.0 | 45.0 |
| Effective Green, g (s) | 30.5 | | 30.5 | 44.7 | 44.7 | 115.3 | 56.5 | 56.5 | | | 45.0 | 45.0 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.39 | 0.39 | 1.00 | 0.49 | 0.49 | | | 0.39 | 0.39 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 274 | | 385 | 558 | 688 | 1365 | 174 | 1669 | | | 1874 | 492 |
| v/s Ratio Prot | | | | 0.04 | 0.12 | | 0.03 | 0.26 | | | 0.27 | |
| v/s Ratio Perm | 0.05 | | c0.28 | 0.13 | | c0.65 | 0.19 | | | | | 0.01 |
| v/c Ratio | 0.21 | | 1.07 | 0.43 | 0.32 | 0.65 | 0.45 | 0.53 | | | 0.70 | 0.02 |
| Uniform Delay, d1 | 33.0 | | 42.4 | 25.9 | 24.7 | 0.0 | 18.8 | 20.2 | | | 29.5 | 21.6 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 1.7 | | 64.7 | 1.1 | 1.2 | 2.4 | 3.9 | 0.6 | | | 1.5 | 0.0 |
| Delay (s) | 34.7 | | 107.1 | 27.0 | 25.9 | 2.4 | 22.7 | 20.8 | | | 31.1 | 21.7 |
| Level of Service | C | | F | C | C | A | C | C | | | C | C |
| Approach Delay (s) | | 100.6 | | | 10.6 | | | 20.9 | | | 30.9 | |
| Approach LOS | | F | | | B | | | C | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 32.6 | HCM 2000 Level of Service | C | | |
| HCM 2000 Volume to Capacity ratio | 0.89 | | | | |
| Actuated Cycle Length (s) | 115.3 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 93.3% | ICU Level of Service | F | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: New Dundee Road & Pinnacle Drive

2028 Background - AM Peak Hour



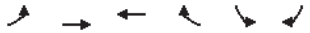
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 620 | 243 | 19 | 64 | 8 |
| Future Volume (vph) | 4 | 620 | 243 | 19 | 64 | 8 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.990 | | 0.985 | |
| Flt Protected | | | | | 0.957 | |
| Satd. Flow (prot) | 0 | 1615 | 1523 | 0 | 1664 | 0 |
| Flt Permitted | | | | | 0.957 | |
| Satd. Flow (perm) | 0 | 1615 | 1523 | 0 | 1664 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 25% | 2% | 7% | 11% | 0% | 0% |
| Adj. Flow (vph) | 4 | 620 | 243 | 19 | 64 | 8 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 624 | 262 | 0 | 72 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 52.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
6: New Dundee Road & Pinnacle Drive

2028 Background - AM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 620 | 243 | 19 | 64 | 8 |
| Future Volume (Veh/h) | 4 | 620 | 243 | 19 | 64 | 8 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 620 | 243 | 19 | 64 | 8 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 262 | | | | 880 | 252 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 262 | | | | 880 | 252 |
| tC, single (s) | 4.3 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.4 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 80 | 99 |
| cM capacity (veh/h) | 1180 | | | | 319 | 791 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 624 | 262 | 72 |
| Volume Left | 4 | 0 | 64 |
| Volume Right | 0 | 19 | 8 |
| cSH | 1180 | 1700 | 342 |
| Volume to Capacity | 0.00 | 0.15 | 0.21 |
| Queue Length 95th (m) | 0.1 | 0.0 | 6.3 |
| Control Delay (s) | 0.1 | 0.0 | 18.3 |
| Lane LOS | A | | C |
| Approach Delay (s) | 0.1 | 0.0 | 18.3 |
| Approach LOS | | | C |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 1.4 | | | |
| Intersection Capacity Utilization | 52.2% | ICU Level of Service | A | |
| Analysis Period (min) | 15 | | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 64 | 364 | 200 | 96 | 331 | 131 |
| Future Volume (vph) | 64 | 364 | 200 | 96 | 331 | 131 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.962 | |
| Flt Protected | 0.950 | | | | 0.965 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1613 | 0 |
| Flt Permitted | 0.493 | | | | 0.965 | |
| Satd. Flow (perm) | 850 | 1845 | 1528 | 1311 | 1613 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 96 | 21 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Adj. Flow (vph) | 64 | 364 | 200 | 96 | 331 | 131 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 64 | 364 | 200 | 96 | 462 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |

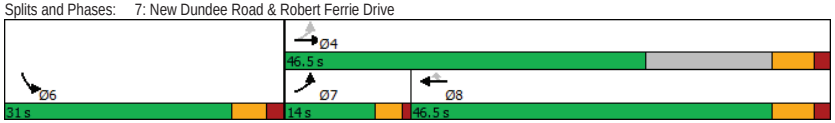




| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 23.4 | 20.8 | 14.2 | 14.2 | 25.5 | |
| Actuated g/C Ratio | 0.40 | 0.35 | 0.24 | 0.24 | 0.43 | |
| v/c Ratio | 0.15 | 0.56 | 0.54 | 0.25 | 0.65 | |
| Control Delay | 10.8 | 18.2 | 27.2 | 6.9 | 21.2 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 10.8 | 18.2 | 27.2 | 6.9 | 21.2 | |
| LOS | B | B | C | A | C | |
| Approach Delay | | 17.1 | 20.6 | | 21.2 | |
| Approach LOS | | B | C | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 91.5 | | | |
| Actuated Cycle Length: 59.1 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.65 | | | |
| Intersection Signal Delay: 19.5 | | Intersection LOS: B | |
| Intersection Capacity Utilization 58.4% | | ICU Level of Service B | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
## 7: New Dundee Road & Robert Ferrie Drive

2028 Background - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 64 | 364 | 200 | 96 | 462 |
| v/c Ratio | 0.15 | 0.56 | 0.54 | 0.25 | 0.65 |
| Control Delay | 10.8 | 18.2 | 27.2 | 6.9 | 21.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 10.8 | 18.2 | 27.2 | 6.9 | 21.2 |
| Queue Length 50th (m) | 4.3 | 31.8 | 21.8 | 0.0 | 41.9 |
| Queue Length 95th (m) | 10.1 | 52.1 | 41.9 | 10.2 | #100.3 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 471 | 1652 | 1056 | 935 | 709 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.14 | 0.22 | 0.19 | 0.10 | 0.65 |

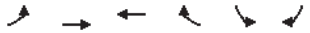
Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 7: New Dundee Road & Robert Ferrie Drive

2028 Background - AM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 64 | 364 | 200 | 96 | 331 | 131 |
| Future Volume (vph) | 64 | 364 | 200 | 96 | 331 | 131 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1613 | |
| Flt Permitted | 0.49 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 850 | 1845 | 1528 | 1311 | 1613 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 64 | 364 | 200 | 96 | 331 | 131 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 74 | 12 | 0 |
| Lane Group Flow (vph) | 64 | 364 | 200 | 22 | 450 | 0 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 22.6 | 22.6 | 14.2 | 14.2 | 25.5 | |
| Effective Green, g (s) | 22.6 | 22.6 | 14.2 | 14.2 | 25.5 | |
| Actuated g/C Ratio | 0.37 | 0.37 | 0.23 | 0.23 | 0.42 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 374 | 688 | 358 | 307 | 678 | |
| v/s Ratio Prot | 0.01 | c0.20 | 0.13 | | c0.28 | |
| v/s Ratio Perm | 0.05 | | | 0.02 | | |
| v/c Ratio | 0.17 | 0.53 | 0.56 | 0.07 | 0.66 | |
| Uniform Delay, d1 | 12.5 | 14.8 | 20.4 | 18.1 | 14.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.2 | 0.7 | 1.9 | 0.1 | 5.1 | |
| Delay (s) | 12.8 | 15.6 | 22.3 | 18.2 | 19.2 | |
| Level of Service | B | B | C | B | B | |
| Approach Delay (s) | | 15.2 | 21.0 | | 19.2 | |
| Approach LOS | | B | C | | B | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 18.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.65 | | |
| Actuated Cycle Length (s) | 60.6 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 58.4% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## Lanes, Volumes, Timings
## 8: New Dundee Road

2028 Background - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 326 | 82 | 13 | 220 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (vph) | 11 | 326 | 82 | 13 | 220 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.974 | | | 0.994 | | | 0.965 | | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.997 | | | 0.976 | | | 0.991 | |
| Satd. Flow (prot) | 0 | 1416 | 0 | 0 | 1423 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Flt Permitted | | 0.999 | | | 0.997 | | | 0.976 | | | 0.991 | |
| Satd. Flow (perm) | 0 | 1416 | 0 | 0 | 1423 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 18% | 6% | 7% | 23% | 7% | 10% | 0% | 4% | 33% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 326 | 82 | 13 | 220 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 419 | 0 | 0 | 243 | 0 | 0 | 92 | 0 | 0 | 65 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 51.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

2028 Background - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 11 | 326 | 82 | 13 | 220 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (Veh/h) | 11 | 326 | 82 | 13 | 220 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 326 | 82 | 13 | 220 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 230 | | | 408 | | | 672 | 645 | 367 | 676 | 681 | 225 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 230 | | | 408 | | | 672 | 645 | 367 | 676 | 681 | 225 |
| tC, single (s) | 4.3 | | | 4.3 | | | 7.1 | 6.5 | 6.5 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.4 | | | 3.5 | 4.0 | 3.6 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 99 | | | 86 | 94 | 96 | 96 | 89 | 99 |
| cM capacity (veh/h) | 1249 | | | 1046 | | | 330 | 380 | 614 | 334 | 367 | 819 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 419 | 243 | 92 | 65 |
| Volume Left | 11 | 13 | 45 | 12 |
| Volume Right | 82 | 10 | 24 | 12 |
| cSH | 1249 | 1046 | 390 | 401 |
| Volume to Capacity | 0.01 | 0.01 | 0.24 | 0.16 |
| Queue Length 95th (m) | 0.2 | 0.3 | 7.2 | 4.6 |
| Control Delay (s) | 0.3 | 0.6 | 17.1 | 15.7 |
| Lane LOS | A | A | C | C |
| Approach Delay (s) | 0.3 | 0.6 | 17.1 | 15.7 |
| Approach LOS | | | C | C |

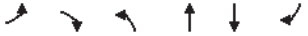
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.5 | | | |
| Intersection Capacity Utilization | 51.2% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.973 | | | | 0.932 | |
| Flt Protected | 0.962 | | | 0.994 | | |
| Satd. Flow (prot) | 1613 | 0 | 0 | 1585 | 1458 | 0 |
| Flt Permitted | 0.962 | | | 0.994 | | |
| Satd. Flow (perm) | 1613 | 0 | 0 | 1585 | 1458 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 0% | 0% | 4% | 9% | 2% |
| Adj. Flow (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 277 | 0 | 0 | 333 | 293 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |







| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 221 | 56 | 41 | 292 | 146 | 147 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 277 | 333 | 293 |
| Volume Left (vph) | 221 | 41 | 0 |
| Volume Right (vph) | 56 | 0 | 147 |
| Hadj (s) | 0.08 | 0.08 | -0.21 |
| Departure Headway (s) | 5.6 | 5.2 | 5.0 |
| Degree Utilization, x | 0.43 | 0.48 | 0.41 |
| Capacity (veh/h) | 603 | 650 | 681 |
| Control Delay (s) | 12.7 | 13.0 | 11.4 |
| Approach Delay (s) | 12.7 | 13.0 | 11.4 |
| Approach LOS | B | B | B |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Delay | 12.4 | | | |
| Level of Service | B | | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C | |
| Analysis Period (min) | 15 | | | |

Lanes, Volumes, Timings
11: Biehn Drive & Carnydale Drive

2028 Background - AM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.867 | | 0.970 | | | |
| Flt Protected | 0.999 | | | | | 0.954 |
| Satd. Flow (prot) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Flt Permitted | 0.999 | | | | | 0.954 |
| Satd. Flow (perm) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 7% | 25% | 5% | 20% |
| Adj. Flow (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 309 | 0 | 18 | 0 | 0 | 169 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
11: Biehn Drive & Carnydale Drive

2028 Background - AM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (Veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 349 | 16 | | | 18 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 349 | 16 | | | 18 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 99 | 71 | | | 90 | |
| cM capacity (veh/h) | 584 | 1069 | | | 1579 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 309 | 18 | 169 |
| Volume Left | 4 | 0 | 164 |
| Volume Right | 305 | 4 | 0 |
| cSH | 1058 | 1700 | 1579 |
| Volume to Capacity | 0.29 | 0.01 | 0.10 |
| Queue Length 95th (m) | 9.8 | 0.0 | 2.8 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| Average Delay | | 8.6 | | | |
| Intersection Capacity Utilization | | 44.7% | ICU Level of Service | | A |
| Analysis Period (min) | | 15 | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 0.99 | |
| Frt | | 0.965 | | | | 0.850 | | 0.999 | | | 0.962 | |
| Flt Protected | 0.950 | | | | 0.994 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 1498 | 0 | 0 | 1500 | 1365 | 1519 | 1616 | 0 | 1519 | 1454 | 0 |
| Flt Permitted | 0.728 | | | | 0.974 | | 0.560 | | | 0.486 | | |
| Satd. Flow (perm) | 1224 | 1498 | 0 | 0 | 1467 | 1317 | 887 | 1616 | 0 | 775 | 1454 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 23 | | | | 74 | | 1 | | | 38 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 89 | 98 | 0 | 0 | 44 | 74 | 44 | 385 | 0 | 56 | 309 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

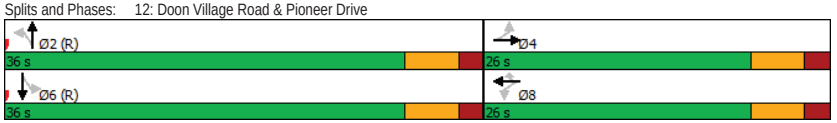




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.23 | 0.20 | | | 0.09 | 0.16 | 0.10 | 0.49 | | 0.15 | 0.43 | |
| Control Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.5 | 13.5 | | 10.2 | 11.3 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.5 | 13.5 | | 10.2 | 11.3 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.3 | | | 9.1 | | | 13.1 | | | 11.1 | |
| Approach LOS | | B | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.49 | | | |
| Intersection Signal Delay: 12.4 | | Intersection LOS: B | |
| Intersection Capacity Utilization 73.3% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2028 Background - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 89 | 98 | 44 | 74 | 44 | 385 | 56 | 309 |
| v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.10 | 0.49 | 0.15 | 0.43 |
| Control Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.5 | 13.5 | 10.2 | 11.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.5 | 13.5 | 10.2 | 11.3 |
| Queue Length 50th (m) | 7.7 | 6.3 | 3.6 | 0.0 | 2.7 | 29.2 | 3.5 | 19.2 |
| Queue Length 95th (m) | 17.5 | 16.1 | 9.9 | 7.7 | 7.6 | 50.6 | 9.5 | 36.9 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 394 | 498 | 473 | 474 | 429 | 782 | 375 | 723 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.10 | 0.49 | 0.15 | 0.43 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2028 Background - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1598 | 1498 | | | 1498 | 1317 | 1504 | 1616 | | 1515 | 1454 | |
| Flt Permitted | 0.73 | 1.00 | | | 0.97 | 1.00 | 0.56 | 1.00 | | 0.49 | 1.00 | |
| Satd. Flow (perm) | 1225 | 1498 | | | 1466 | 1317 | 887 | 1616 | | 774 | 1454 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 50 | 0 | 1 | 0 | 0 | 20 | 0 |
| Lane Group Flow (vph) | 89 | 82 | 0 | 0 | 44 | 24 | 44 | 384 | 0 | 56 | 289 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 395 | 483 | | | 472 | 424 | 429 | 781 | | 374 | 703 | |
| v/s Ratio Prot | | 0.06 | | | | | | c0.24 | | | 0.20 | |
| v/s Ratio Perm | c0.07 | | | | 0.03 | 0.02 | 0.05 | | | 0.07 | | |
| v/c Ratio | 0.23 | 0.17 | | | 0.09 | 0.06 | 0.10 | 0.49 | | 0.15 | 0.41 | |
| Uniform Delay, d1 | 15.3 | 15.1 | | | 14.7 | 14.5 | 8.7 | 10.8 | | 8.9 | 10.3 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.8 | | | 0.4 | 0.3 | 0.5 | 2.2 | | 0.8 | 1.8 | |
| Delay (s) | 16.7 | 15.8 | | | 15.1 | 14.7 | 9.2 | 13.1 | | 9.7 | 12.1 | |
| Level of Service | B | B | | | B | B | A | B | | A | B | |
| Approach Delay (s) | | 16.2 | | | 14.9 | | | 12.7 | | | 11.7 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 13.2 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.39 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 73.3% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and New Dundee.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:45:32 PM

### Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2028 | | | | | | |
| **Leg North** | 0.48 | 1.02 | 3.37 | 0.32 | A | 2.85 | A |
| **Leg West** | 0.35 | ~1 | 2.69 | 0.26 | A | | |
| **Leg East** | 0.21 | ~1 | 2.28 | 0.16 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM " model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:45:30 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FB 2028, AM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2028, AM | FB 2028 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 2.85 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Robert Ferrie Drive | |
| **West** | West | New Dundee Road | |
| **East** | East | New Dundee Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 462.00 | 100.000 |
| West | ONE HOUR | ✓ | 428.00 | 100.000 |
| East | ONE HOUR | ✓ | 296.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 131.000 | 331.000 |
| | West | 64.000 | 0.000 | 364.000 |
| | East | 96.000 | 200.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.28 | 0.72 |
| | West | 0.15 | 0.00 | 0.85 |
| | East | 0.32 | 0.68 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 1.000 | 1.030 | 1.010 |
| | West | 1.030 | 1.000 | 1.030 |
| | East | 1.070 | 1.080 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 3.0 | 1.0 |
| | West | 3.0 | 0.0 | 3.0 |
| | East | 7.0 | 8.0 | 0.0 |





# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.32 | 3.37 | 0.48 | 1.02 | A | 423.94 | 635.91 | 32.91 | 3.11 | 0.37 | 32.92 | 3.11 |
| West | 0.26 | 2.69 | 0.35 | −1 | A | 392.74 | 589.11 | 24.62 | 2.51 | 0.27 | 24.62 | 2.51 |
| East | 0.16 | 2.28 | 0.21 | −1 | A | 271.61 | 407.42 | 14.95 | 2.20 | 0.17 | 14.95 | 2.20 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 347.82 | 86.95 | 346.72 | 120.16 | 150.21 | 0.00 | 1631.19 | 1000.36 | 0.213 | 0.00 | 0.27 | 2.843 | A |
| West | 322.22 | 80.56 | 321.39 | 248.53 | 248.41 | 0.00 | 1918.24 | 1630.47 | 0.168 | 0.00 | 0.21 | 2.321 | A |
| East | 222.84 | 55.71 | 222.32 | 521.74 | 48.06 | 0.00 | 2041.36 | 1921.07 | 0.109 | 0.00 | 0.13 | 2.131 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 415.33 | 103.83 | 415.02 | 143.76 | 179.72 | 0.00 | 1614.97 | 1000.36 | 0.257 | 0.27 | 0.35 | 3.046 | A |
| West | 384.76 | 96.19 | 384.54 | 297.40 | 297.34 | 0.00 | 1888.17 | 1630.47 | 0.204 | 0.21 | 0.26 | 2.465 | A |
| East | 266.10 | 66.52 | 265.98 | 624.38 | 57.50 | 0.00 | 2035.56 | 1921.07 | 0.131 | 0.13 | 0.16 | 2.190 | A |

#### Main results: (08:30-08:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 508.67 | 127.17 | 508.18 | 176.05 | 220.08 | 0.00 | 1592.79 | 1000.35 | 0.319 | 0.35 | 0.47 | 3.369 | A |
| West | 471.24 | 117.81 | 470.88 | 364.18 | 364.08 | 0.00 | 1847.16 | 1630.47 | 0.255 | 0.26 | 0.35 | 2.694 | A |
| East | 325.90 | 81.48 | 325.73 | 764.55 | 70.41 | 0.00 | 2027.62 | 1921.07 | 0.161 | 0.16 | 0.21 | 2.277 | A |

#### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 508.67 | 127.17 | 508.67 | 176.16 | 220.20 | 0.00 | 1592.72 | 1000.35 | 0.319 | 0.47 | 0.48 | 3.371 | A |
| West | 471.24 | 117.81 | 471.23 | 364.44 | 364.43 | 0.00 | 1846.95 | 1630.47 | 0.255 | 0.35 | 0.35 | 2.694 | A |
| East | 325.90 | 81.48 | 325.90 | 765.20 | 70.46 | 0.00 | 2027.59 | 1921.07 | 0.161 | 0.21 | 0.21 | 2.277 | A |

#### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 415.33 | 103.83 | 415.82 | 143.95 | 179.91 | 0.00 | 1614.86 | 1000.36 | 0.257 | 0.48 | 0.35 | 3.052 | A |
| West | 384.76 | 96.19 | 385.11 | 297.82 | 297.91 | 0.00 | 1887.82 | 1630.47 | 0.204 | 0.35 | 0.26 | 2.467 | A |
| East | 266.10 | 66.52 | 266.27 | 625.44 | 57.59 | 0.00 | 2035.51 | 1921.07 | 0.131 | 0.21 | 0.16 | 2.192 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 347.82 | 86.95 | 348.13 | 120.53 | 150.65 | 0.00 | 1630.95 | 1000.36 | 0.213 | 0.35 | 0.28 | 2.850 | A |
| West | 322.22 | 80.56 | 322.44 | 249.36 | 249.41 | 0.00 | 1917.63 | 1630.47 | 0.168 | 0.26 | 0.21 | 2.324 | A |
| East | 222.84 | 55.71 | 222.96 | 523.64 | 48.22 | 0.00 | 2041.26 | 1921.07 | 0.109 | 0.16 | 0.13 | 2.133 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.04 | 0.27 | 2.843 | A | A |
| West | 3.06 | 0.20 | 2.321 | A | A |
| East | 1.95 | 0.13 | 2.131 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.18 | 0.35 | 3.046 | A | A |
| West | 3.90 | 0.26 | 2.465 | A | A |
| East | 2.40 | 0.16 | 2.190 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 6.99 | 0.47 | 3.369 | A | A |
| West | 5.20 | 0.35 | 2.694 | A | A |
| East | 3.05 | 0.20 | 2.277 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 7.12 | 0.47 | 3.371 | A | A |
| West | 5.28 | 0.35 | 2.694 | A | A |
| East | 3.09 | 0.21 | 2.277 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.38 | 0.36 | 3.052 | A | A |
| West | 4.02 | 0.27 | 2.467 | A | A |
| East | 2.46 | 0.16 | 2.192 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.20 | 0.28 | 2.850 | A | A |
| West | 3.16 | 0.21 | 2.324 | A | A |
| East | 2.00 | 0.13 | 2.133 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)





| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.27 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.26 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.47 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.48 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| West | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.26 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and New Dundee.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:45:01 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2028 | | | | | | |
| **Leg North** | 0.25 | -1 | 3.19 | 0.20 | A | 2.96 | A |
| **Leg West** | 0.23 | -1 | 2.31 | 0.19 | A | | |
| **Leg East** | 0.74 | 1.02 | 3.17 | 0.42 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM " model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:45:00 PM*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - FB 2028, PM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2028, PM | FB 2028 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 2.96 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Robert Ferrie Drive | |
| West | West | New Dundee Road | |
| East | East | New Dundee Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| East | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

## Slope / Intercept / Capacity





### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 253.00 | 100.000 |
| West | ONE HOUR | ✓ | 330.00 | 100.000 |
| East | ONE HOUR | ✓ | 768.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 91.000 | 162.000 |
| | West | 105.000 | 0.000 | 225.000 |
| | East | 296.000 | 472.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.36 | 0.64 |
| | West | 0.32 | 0.00 | 0.68 |
| | East | 0.39 | 0.61 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | To | | | |
|---|---|---|---|---|
| | | North | West | East |

| | | | | |
|---|---|---|---|---|
| From | North | 1.000 | 1.020 | 1.020 |
| | West | 1.010 | 1.000 | 1.030 |
| | East | 1.010 | 1.020 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 2.0 | 2.0 |
| | West | 1.0 | 0.0 | 3.0 |
| | East | 1.0 | 2.0 | 0.0 |

# Results

## Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.20 | 3.19 | 0.25 | −1 | A | 232.16 | 348.24 | 17.27 | 2.98 | 0.19 | 17.27 | 2.98 |
| West | 0.19 | 2.31 | 0.23 | −1 | A | 302.81 | 454.22 | 16.69 | 2.21 | 0.19 | 16.69 | 2.21 |
| East | 0.42 | 3.17 | 0.74 | 1.02 | A | 704.73 | 1057.10 | 50.13 | 2.85 | 0.56 | 50.14 | 2.85 |

## Main Results for each time segment

### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 190.47 | 47.62 | 189.89 | 301.08 | 354.35 | 0.00 | 1518.99 | 1121.86 | 0.125 | 0.00 | 0.15 | 2.761 | A |
| West | 248.44 | 62.11 | 247.86 | 422.65 | 121.59 | 0.00 | 1996.18 | 1629.46 | 0.124 | 0.00 | 0.15 | 2.108 | A |
| East | 578.19 | 144.55 | 576.57 | 290.58 | 78.86 | 0.00 | 2022.43 | 1752.29 | 0.286 | 0.00 | 0.41 | 2.528 | A |

### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 227.44 | 56.86 | 227.29 | 360.26 | 424.02 | 0.00 | 1480.71 | 1121.86 | 0.154 | 0.15 | 0.18 | 2.929 | A |
| West | 296.66 | 74.17 | 296.52 | 505.77 | 145.54 | 0.00 | 1981.46 | 1629.46 | 0.150 | 0.15 | 0.18 | 2.186 | A |
| East | 690.42 | 172.60 | 689.92 | 347.71 | 94.35 | 0.00 | 2012.92 | 1752.29 | 0.343 | 0.41 | 0.53 | 2.765 | A |

### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 278.56 | 69.64 | 278.31 | 441.12 | 519.16 | 0.00 | 1428.42 | 1121.86 | 0.195 | 0.18 | 0.25 | 3.192 | A |
| West | 363.34 | 90.83 | 363.13 | 619.27 | 178.21 | 0.00 | 1961.38 | 1629.46 | 0.185 | 0.18 | 0.23 | 2.305 | A |
| East | 845.58 | 211.40 | 844.74 | 425.79 | 115.54 | 0.00 | 1999.89 | 1752.29 | 0.423 | 0.53 | 0.74 | 3.165 | A |

### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 278.56 | 69.64 | 278.56 | 441.51 | 519.68 | 0.00 | 1428.13 | 1121.86 | 0.195 | 0.25 | 0.25 | 3.193 | A |
| West | 363.34 | 90.83 | 363.34 | 619.87 | 178.36 | 0.00 | 1961.29 | 1629.46 | 0.185 | 0.23 | 0.23 | 2.305 | A |
| East | 845.58 | 211.40 | 845.57 | 426.09 | 115.61 | 0.00 | 1999.85 | 1752.29 | 0.423 | 0.74 | 0.74 | 3.168 | A |

### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 227.44 | 56.86 | 227.68 | 360.88 | 424.83 | 0.00 | 1480.26 | 1121.86 | 0.154 | 0.25 | 0.19 | 2.933 | A |
| West | 296.66 | 74.17 | 296.87 | 506.73 | 145.79 | 0.00 | 1981.30 | 1629.46 | 0.150 | 0.23 | 0.18 | 2.189 | A |
| East | 690.42 | 172.60 | 691.25 | 348.20 | 94.46 | 0.00 | 2012.85 | 1752.29 | 0.343 | 0.74 | 0.53 | 2.771 | A |





### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 190.47 | 47.62 | 190.63 | 302.13 | 355.65 | 0.00 | 1518.28 | 1121.86 | 0.125 | 0.19 | 0.15 | 2.767 | A |
| West | 248.44 | 62.11 | 248.58 | 424.22 | 122.06 | 0.00 | 1995.89 | 1629.46 | 0.124 | 0.18 | 0.15 | 2.110 | A |
| East | 578.19 | 144.55 | 578.69 | 291.55 | 79.09 | 0.00 | 2022.29 | 1752.29 | 0.286 | 0.53 | 0.41 | 2.536 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.15 | 0.14 | 2.761 | A | A |
| West | 2.15 | 0.14 | 2.108 | A | A |
| East | 5.97 | 0.40 | 2.528 | A | A |

### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.73 | 0.18 | 2.929 | A | A |
| West | 2.67 | 0.18 | 2.186 | A | A |
| East | 7.81 | 0.52 | 2.765 | A | A |

### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.64 | 0.24 | 3.192 | A | A |
| West | 3.44 | 0.23 | 2.305 | A | A |
| East | 10.90 | 0.73 | 3.165 | A | A |

### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.70 | 0.25 | 3.193 | A | A |
| West | 3.48 | 0.23 | 2.305 | A | A |
| East | 11.12 | 0.74 | 3.168 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.83 | 0.19 | 2.933 | A | A |
| West | 2.74 | 0.18 | 2.189 | A | A |
| East | 8.12 | 0.54 | 2.771 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.23 | 0.15 | 2.767 | A | A |
| West | 2.21 | 0.15 | 2.110 | A | A |
| East | 6.21 | 0.41 | 2.536 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.41 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.53 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.23 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.74 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.23 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.74 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.19 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.53 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.41 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 308 | 22 | 688 | 350 | 282 |
| Future Volume (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 308 | 22 | 688 | 350 | 282 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.97 | 1.00 | | 0.98 | 0.99 | 1.00 | | 1.00 | | 0.97 |
| Frt | | | 0.850 | | | 0.850 | | 0.990 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1670 | 3471 | 1488 | 1686 | 3438 | 1417 | 1670 | 3304 | 0 | 3146 | 1863 | 1458 |
| Flt Permitted | 0.089 | | | 0.161 | | | 0.353 | | | 0.950 | | |
| Satd. Flow (perm) | 156 | 3471 | 1447 | 285 | 3438 | 1387 | 614 | 3304 | 0 | 3130 | 1863 | 1410 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 451 | | | 461 | | 4 | | | | 235 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Adj. Flow (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 308 | 22 | 688 | 350 | 282 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 330 | 0 | 688 | 350 | 282 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

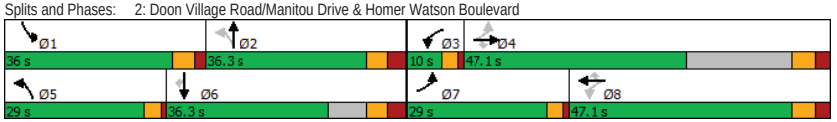




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 61.0 | 61.0 | 49.0 | 40.0 | 40.0 | 55.2 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Actuated g/C Ratio | 0.49 | 0.41 | 0.41 | 0.33 | 0.27 | 0.27 | 0.37 | 0.20 | | 0.20 | 0.26 | 0.26 |
| v/c Ratio | 0.95 | 0.78 | 0.69 | 0.28 | 1.12 | 0.79 | 0.82 | 0.51 | | 1.08 | 0.73 | 0.53 |
| Control Delay | 80.1 | 43.1 | 13.1 | 27.1 | 118.1 | 18.6 | 46.1 | 55.9 | | 114.7 | 61.3 | 13.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 80.1 | 43.1 | 13.1 | 27.1 | 118.1 | 18.6 | 46.1 | 55.9 | | 114.7 | 61.3 | 13.5 |
| LOS | F | D | B | C | F | B | D | E | | F | E | B |
| Approach Delay | | 40.0 | | | 81.8 | | | 51.1 | | | 78.9 | |
| Approach LOS | | D | | | F | | | D | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 148.4 | | | |
| Natural Cycle: 145 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.12 | | | |
| Intersection Signal Delay: 62.6 | | Intersection LOS: E | |
| Intersection Capacity Utilization 113.8% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Background - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 330 | 688 | 350 | 282 |
| v/c Ratio | 0.95 | 0.78 | 0.69 | 0.28 | 1.12 | 0.79 | 0.82 | 0.51 | 1.08 | 0.73 | 0.53 |
| Control Delay | 80.1 | 43.1 | 13.1 | 27.1 | 118.1 | 18.6 | 46.1 | 55.9 | 114.7 | 61.3 | 13.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 80.1 | 43.1 | 13.1 | 27.1 | 118.1 | 18.6 | 46.1 | 55.9 | 114.7 | 61.3 | 13.5 |
| Queue Length 50th (m) | 80.0 | 159.3 | 35.3 | 6.6 | ~194.8 | 28.4 | 65.2 | 48.0 | ~122.4 | 101.9 | 11.5 |
| Queue Length 95th (m) | #141.4 | 188.9 | 84.4 | 13.8 | #239.1 | 85.2 | #93.8 | 64.7 | #163.1 | #141.2 | 41.2 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 330 | 1426 | 860 | 150 | 926 | 710 | 414 | 648 | 635 | 478 | 537 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.95 | 0.78 | 0.69 | 0.27 | 1.12 | 0.79 | 0.77 | 0.51 | 1.08 | 0.73 | 0.53 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Background - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 308 | 22 | 688 | 350 | 282 |
| Future Volume (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 308 | 22 | 688 | 350 | 282 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1670 | 3471 | 1447 | 1686 | 3438 | 1387 | 1664 | 3304 | | 3146 | 1863 | 1410 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.16 | 1.00 | 1.00 | 0.35 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 157 | 3471 | 1447 | 286 | 3438 | 1387 | 619 | 3304 | | 3146 | 1863 | 1410 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 312 | 1111 | 595 | 41 | 1040 | 562 | 320 | 308 | 22 | 688 | 350 | 282 |
| RTOR Reduction (vph) | 0 | 0 | 267 | 0 | 0 | 335 | 0 | 3 | 0 | 0 | 0 | 175 |
| Lane Group Flow (vph) | 312 | 1111 | 328 | 41 | 1040 | 227 | 320 | 327 | 0 | 688 | 350 | 107 |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 51.9 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Effective Green, g (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 51.9 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Actuated g/C Ratio | 0.47 | 0.41 | 0.41 | 0.31 | 0.27 | 0.27 | 0.35 | 0.19 | | 0.20 | 0.26 | 0.26 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 326 | 1419 | 591 | 132 | 940 | 379 | 375 | 642 | | 632 | 475 | 360 |
| v/s Ratio Prot | c0.16 | 0.32 | | 0.01 | c0.30 | | 0.13 | 0.10 | | c0.22 | 0.19 | |
| v/s Ratio Perm | 0.29 | | 0.23 | 0.08 | | 0.16 | c0.17 | | | | | 0.08 |
| v/c Ratio | 0.96 | 0.78 | 0.56 | 0.31 | 1.11 | 0.60 | 0.85 | 0.51 | | 1.09 | 0.74 | 0.30 |
| Uniform Delay, d1 | 47.4 | 38.3 | 33.7 | 37.7 | 54.2 | 47.1 | 39.9 | 53.7 | | 59.6 | 51.0 | 44.8 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 38.1 | 2.9 | 1.1 | 1.3 | 63.0 | 2.5 | 16.9 | 2.9 | | 62.3 | 9.8 | 2.1 |
| Delay (s) | 85.5 | 41.2 | 34.9 | 39.1 | 117.2 | 49.6 | 56.8 | 56.6 | | 121.9 | 60.8 | 46.9 |
| Level of Service | F | D | C | D | F | D | E | E | | F | E | D |
| Approach Delay (s) | | 46.2 | | | 92.1 | | | 56.7 | | | 89.6 | |
| Approach LOS | | D | | | F | | | E | | | F | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 71.0 | HCM 2000 Level of Service | E | |
| HCM 2000 Volume to Capacity ratio | 1.01 | | | |
| Actuated Cycle Length (s) | 149.2 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 113.8% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1702 | 6 | 2 | 1498 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1702 | 6 | 2 | 1498 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 0.99 | | | | | | | | | | |
| Frt | | | 0.850 | | | | | 0.999 | | | 0.983 | |
| Flt Protected | | 0.953 | | | 0.979 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1493 | 1417 | 0 | 1517 | 0 | 1670 | 3179 | 0 | 1686 | 3167 | 0 |
| Flt Permitted | | 0.726 | | | 0.896 | | 0.950 | | | 0.124 | | |
| Satd. Flow (perm) | 0 | 1131 | 1417 | 0 | 1389 | 0 | 1670 | 3179 | 0 | 220 | 3167 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 125 | | | | | 1 | | | 13 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1702 | 6 | 2 | 1498 | 187 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 144 | 125 | 0 | 7 | 0 | 127 | 1708 | 0 | 2 | 1685 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

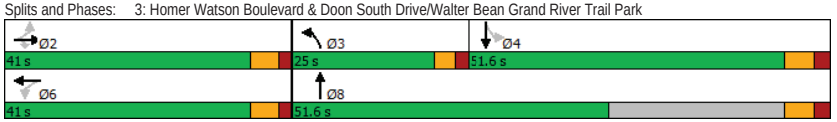




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.4 | 45.4 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| v/c Ratio | | 0.69 | 0.35 | | 0.03 | | 0.55 | 0.79 | | 0.02 | 1.09 | |
| Control Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 15.0 | | 17.5 | 76.6 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 15.0 | | 17.5 | 76.6 | |
| LOS | | D | A | | C | | D | B | | B | E | |
| Approach Delay | | 32.8 | | | 31.1 | | | 17.3 | | | 76.5 | |
| Approach LOS | | C | | | C | | | B | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 93.3 | | | |
| Natural Cycle: 100 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.09 | | | |
| Intersection Signal Delay: 44.7 | | Intersection LOS: D | |
| Intersection Capacity Utilization 99.1% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues

### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Lane Group | EBT | EBR | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 144 | 125 | 7 | 127 | 1708 | 2 | 1685 |
| v/c Ratio | 0.69 | 0.35 | 0.03 | 0.55 | 0.79 | 0.02 | 1.09 |
| Control Delay | 53.5 | 8.9 | 31.1 | 48.1 | 15.0 | 17.5 | 76.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.5 | 8.9 | 31.1 | 48.1 | 15.0 | 17.5 | 76.6 |
| Queue Length 50th (m) | 25.3 | 0.0 | 1.1 | 22.5 | 101.5 | 0.2 | ~185.9 |
| Queue Length 95th (m) | 48.8 | 14.7 | 5.0 | 44.9 | 183.3 | 1.9 | #295.1 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | 35.0 | |
| Base Capacity (vph) | 428 | 614 | 525 | 361 | 2407 | 107 | 1548 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.20 | 0.01 | 0.35 | 0.71 | 0.02 | 1.09 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis

### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1702 | 6 | 2 | 1498 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1702 | 6 | 2 | 1498 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | | 0.95 | 1.00 | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1487 | 1417 | | 1517 | | 1670 | 3181 | | 1686 | 3168 | |
| Flt Permitted | | 0.73 | 1.00 | | 0.90 | | 0.95 | 1.00 | | 0.12 | 1.00 | |
| Satd. Flow (perm) | | 1132 | 1417 | | 1389 | | 1670 | 3181 | | 220 | 3168 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1702 | 6 | 2 | 1498 | 187 |
| RTOR Reduction (vph) | 0 | 0 | 102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 0 | 144 | 23 | 0 | 7 | 0 | 127 | 1708 | 0 | 2 | 1678 | 0 |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Effective Green, g (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Grp Cap (vph) | | 208 | 261 | | 256 | | 231 | 2163 | | 107 | 1546 | |
| v/s Ratio Prot | | | | | | | 0.08 | c0.54 | | | c0.53 | |
| v/s Ratio Perm | | c0.13 | 0.02 | | 0.01 | | | | | 0.01 | | |
| v/c Ratio | | 0.69 | 0.09 | | 0.03 | | 0.55 | 0.79 | | 0.02 | 1.09 | |
| Uniform Delay, d1 | | 35.5 | 31.5 | | 31.1 | | 37.4 | 10.3 | | 12.3 | 23.9 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 9.5 | 0.1 | | 0.0 | | 2.7 | 3.0 | | 0.3 | 49.9 | |
| Delay (s) | | 45.1 | 31.6 | | 31.2 | | 40.1 | 13.3 | | 12.6 | 73.8 | |
| Level of Service | | D | C | | C | | D | B | | B | E | |
| Approach Delay (s) | | 38.8 | | | 31.2 | | | 15.2 | | | 73.7 | |
| Approach LOS | | D | | | C | | | B | | | E | |

Intersection Summary

| | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 42.9 | HCM 2000 Level of Service | | D | |
| HCM 2000 Volume to Capacity ratio | 0.97 | | | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | | 17.6 | |
| Intersection Capacity Utilization | 99.1% | ICU Level of Service | | F | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 228 | 29 | 90 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| Future Volume (vph) | 228 | 29 | 90 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.98 | | 0.99 | | 0.97 | | | 0.99 | 1.00 | | 0.98 |
| Frt | | 0.887 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 2574 | 0 | 1576 | 1827 | 1340 | 1547 | 4940 | 1377 | 2870 | 3471 | 1458 |
| Flt Permitted | 0.722 | | | 0.504 | | | 0.097 | | | 0.950 | | |
| Satd. Flow (perm) | 1217 | 2574 | 0 | 826 | 1827 | 1306 | 158 | 4940 | 1359 | 2869 | 3471 | 1425 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 90 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Adj. Flow (vph) | 228 | 29 | 90 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 228 | 119 | 0 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

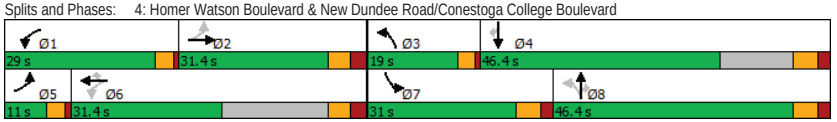




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 16.8 | 7.3 | | 21.2 | 9.8 | 9.8 | 56.5 | 41.4 | 41.4 | 10.2 | 40.9 | 40.9 |
| Actuated g/C Ratio | 0.18 | 0.08 | | 0.23 | 0.11 | 0.11 | 0.62 | 0.45 | 0.45 | 0.11 | 0.45 | 0.45 |
| v/c Ratio | 0.90 | 0.41 | | 0.53 | 0.27 | 0.43 | 0.65 | 0.67 | 0.13 | 0.31 | 0.95 | 0.08 |
| Control Delay | 70.4 | 18.9 | | 35.5 | 40.6 | 9.2 | 27.3 | 22.0 | 0.4 | 41.6 | 39.9 | 0.2 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 70.4 | 18.9 | | 35.5 | 40.6 | 9.2 | 27.3 | 22.0 | 0.4 | 41.6 | 39.9 | 0.2 |
| LOS | E | B | | D | D | A | C | C | A | D | D | A |
| Approach Delay | | 52.8 | | | 26.8 | | | 21.5 | | | 38.6 | |
| Approach LOS | | D | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 91.3 | | | |
| Natural Cycle: 120 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 0.95 | | | |
| Intersection Signal Delay: 31.4 | | Intersection LOS: C | |
| Intersection Capacity Utilization 89.0% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 228 | 119 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| v/c Ratio | 0.90 | 0.41 | 0.53 | 0.27 | 0.43 | 0.65 | 0.67 | 0.13 | 0.31 | 0.95 | 0.08 |
| Control Delay | 70.4 | 18.9 | 35.5 | 40.6 | 9.2 | 27.3 | 22.0 | 0.4 | 41.6 | 39.9 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 70.4 | 18.9 | 35.5 | 40.6 | 9.2 | 27.3 | 22.0 | 0.4 | 41.6 | 39.9 | 0.2 |
| Queue Length 50th (m) | 36.6 | 2.6 | 21.7 | 9.2 | 0.0 | 16.3 | 75.3 | 0.0 | 8.9 | 133.6 | 0.0 |
| Queue Length 95th (m) | #81.2 | 11.6 | 39.1 | 20.6 | 10.2 | 43.6 | 107.9 | 0.0 | 18.1 | #216.1 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 254 | 772 | 441 | 862 | 689 | 330 | 2237 | 708 | 787 | 1982 | 866 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.90 | 0.15 | 0.32 | 0.06 | 0.16 | 0.57 | 0.67 | 0.13 | 0.13 | 0.74 | 0.07 |

Intersection Summary

\# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 228 | 29 | 90 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| Future Volume (vph) | 228 | 29 | 90 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.89 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1612 | 2583 | | 1570 | 1827 | 1312 | 1547 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Flt Permitted | 0.72 | 1.00 | | 0.50 | 1.00 | 1.00 | 0.10 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1226 | 2583 | | 833 | 1827 | 1312 | 157 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 228 | 29 | 90 | 143 | 53 | 112 | 189 | 1501 | 89 | 101 | 1475 | 57 |
| RTOR Reduction (vph) | 0 | 83 | 0 | 0 | 0 | 100 | 0 | 0 | 49 | 0 | 0 | 31 |
| Lane Group Flow (vph) | 228 | 36 | 0 | 143 | 53 | 12 | 189 | 1501 | 40 | 101 | 1475 | 26 |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 14.3 | 7.3 | | 19.3 | 9.8 | 9.8 | 54.1 | 41.4 | 41.4 | 10.2 | 40.9 | 40.9 |
| Effective Green, g (s) | 14.3 | 7.3 | | 19.3 | 9.8 | 9.8 | 54.1 | 41.4 | 41.4 | 10.2 | 40.9 | 40.9 |
| Actuated g/C Ratio | 0.16 | 0.08 | | 0.21 | 0.11 | 0.11 | 0.59 | 0.45 | 0.45 | 0.11 | 0.45 | 0.45 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 221 | 206 | | 253 | 196 | 140 | 286 | 2242 | 616 | 320 | 1556 | 641 |
| v/s Ratio Prot | c0.08 | 0.01 | | c0.06 | 0.03 | | c0.09 | 0.30 | | 0.04 | c0.42 | |
| v/s Ratio Perm | c0.08 | | | 0.06 | | 0.01 | 0.30 | | 0.03 | | | 0.02 |
| v/c Ratio | 1.03 | 0.18 | | 0.57 | 0.27 | 0.09 | 0.66 | 0.67 | 0.07 | 0.32 | 0.95 | 0.04 |
| Uniform Delay, d1 | 37.9 | 39.1 | | 31.2 | 37.4 | 36.7 | 19.5 | 19.5 | 14.0 | 37.3 | 24.1 | 14.1 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 69.0 | 0.4 | | 1.7 | 0.7 | 0.3 | 5.6 | 1.6 | 0.2 | 0.6 | 13.4 | 0.1 |
| Delay (s) | 107.0 | 39.6 | | 32.9 | 38.2 | 36.9 | 25.1 | 21.1 | 14.2 | 37.9 | 37.5 | 14.2 |
| Level of Service | F | D | | C | D | D | C | C | B | D | D | B |
| Approach Delay (s) | | 83.8 | | | 35.3 | | | 21.2 | | | 36.7 | |
| Approach LOS | | F | | | D | | | C | | | D | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 33.9 | HCM 2000 Level of Service | C | | |
| HCM 2000 Volume to Capacity ratio | 0.91 | | | | |
| Actuated Cycle Length (s) | 91.2 | Sum of lost time (s) | 22.8 | | |
| Intersection Capacity Utilization | 89.0% | ICU Level of Service | E | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 48 | 0 | 356 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 53 |
| Future Volume (vph) | 48 | 0 | 356 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 53 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1621 | 0 | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | 0 | 0 | 5036 | 1458 |
| Flt Permitted | 0.254 | | | 0.950 | | | 0.121 | | | | | |
| Satd. Flow (perm) | 434 | 0 | 1458 | 1637 | 1881 | 1390 | 209 | 3438 | 0 | 0 | 5036 | 1458 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 225 | | | 448 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Adj. Flow (vph) | 48 | 0 | 356 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 53 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 48 | 0 | 356 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 53 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

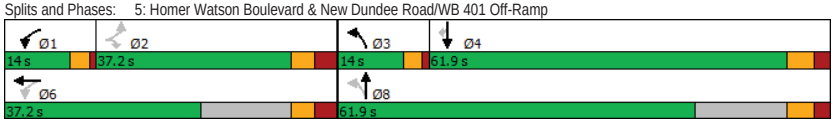




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.2 | | 30.2 | 47.5 | 44.2 | 112.8 | 57.3 | 54.4 | | | 40.3 | 40.3 |
| Actuated g/C Ratio | 0.27 | | 0.27 | 0.42 | 0.39 | 1.00 | 0.51 | 0.48 | | | 0.36 | 0.36 |
| v/c Ratio | 0.42 | | 0.64 | 0.36 | 0.81 | 0.69 | 0.98 | 0.47 | | | 0.66 | 0.09 |
| Control Delay | 50.4 | | 20.2 | 25.9 | 42.0 | 2.8 | 78.3 | 20.2 | | | 32.1 | 0.3 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 50.4 | | 20.2 | 25.9 | 42.0 | 2.8 | 78.3 | 20.2 | | | 32.1 | 0.3 |
| LOS | D | | C | C | D | A | E | C | | | C | A |
| Approach Delay | | 23.8 | | | 19.0 | | | 33.5 | | | 30.8 | |
| Approach LOS | | C | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 112.8 | | | |
| Natural Cycle: 80 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.98 | | | |
| Intersection Signal Delay: 26.0 | | Intersection LOS: C | |
| Intersection Capacity Utilization 89.8% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Background - PM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 48 | 356 | 251 | 596 | 960 | 229 | 771 | 1195 | 53 |
| v/c Ratio | 0.42 | 0.64 | 0.36 | 0.81 | 0.69 | 0.98 | 0.47 | 0.66 | 0.09 |
| Control Delay | 50.4 | 20.2 | 25.9 | 42.0 | 2.8 | 78.3 | 20.2 | 32.1 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 50.4 | 20.2 | 25.9 | 42.0 | 2.8 | 78.3 | 20.2 | 32.1 | 0.3 |
| Queue Length 50th (m) | 9.1 | 25.3 | 38.6 | 119.8 | 0.0 | 31.5 | 60.5 | 84.3 | 0.0 |
| Queue Length 95th (m) | 25.1 | 67.3 | 71.8 | #215.3 | 0.0 | #86.4 | 75.9 | 99.3 | 0.0 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 115 | 554 | 688 | 737 | 1390 | 233 | 2114 | 2468 | 768 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.42 | 0.64 | 0.36 | 0.81 | 0.69 | 0.98 | 0.36 | 0.48 | 0.07 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



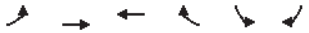
## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Background - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 48 | 0 | 356 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 53 |
| Future Volume (vph) | 48 | 0 | 356 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 53 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1621 | | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | | | 5036 | 1458 |
| Flt Permitted | 0.25 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.12 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 434 | | 1458 | 1637 | 1881 | 1390 | 209 | 3438 | | | 5036 | 1458 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 48 | 0 | 356 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 53 |
| RTOR Reduction (vph) | 0 | 0 | 165 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| Lane Group Flow (vph) | 48 | 0 | 191 | 251 | 596 | 960 | 229 | 771 | 0 | 0 | 1195 | 19 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 112.7 | 54.4 | 54.4 | | | 40.4 | 40.4 |
| Effective Green, g (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 112.7 | 54.4 | 54.4 | | | 40.4 | 40.4 |
| Actuated g/C Ratio | 0.27 | | 0.27 | 0.39 | 0.39 | 1.00 | 0.48 | 0.48 | | | 0.36 | 0.36 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 116 | | 390 | 642 | 737 | 1390 | 227 | 1659 | | | 1805 | 522 |
| v/s Ratio Prot | | | | 0.03 | c0.32 | | c0.09 | 0.22 | | | 0.24 | |
| v/s Ratio Perm | 0.11 | | 0.13 | 0.12 | | c0.69 | c0.40 | | | | | 0.01 |
| v/c Ratio | 0.41 | | 0.49 | 0.39 | 0.81 | 0.69 | 1.01 | 0.46 | | | 0.66 | 0.04 |
| Uniform Delay, d1 | 34.0 | | 34.8 | 24.6 | 30.5 | 0.0 | 24.0 | 19.4 | | | 30.4 | 23.5 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 10.5 | | 4.4 | 0.8 | 9.3 | 2.8 | 62.0 | 0.4 | | | 1.2 | 0.1 |
| Delay (s) | 44.5 | | 39.1 | 25.4 | 39.8 | 2.8 | 86.0 | 19.9 | | | 31.6 | 23.6 |
| Level of Service | D | | D | C | D | A | F | B | | | C | C |
| Approach Delay (s) | | 39.8 | | | 18.2 | | | 35.0 | | | 31.3 | |
| Approach LOS | | D | | | B | | | D | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 27.6 | HCM 2000 Level of Service | C | | |
| HCM 2000 Volume to Capacity ratio | 0.99 | | | | |
| Actuated Cycle Length (s) | 112.7 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 89.8% | ICU Level of Service | E | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

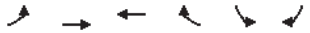


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 11 | 478 | 851 | 97 | 52 | 12 |
| Future Volume (vph) | 11 | 478 | 851 | 97 | 52 | 12 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.986 | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.961 | |
| Satd. Flow (prot) | 0 | 1601 | 1597 | 0 | 1654 | 0 |
| Flt Permitted | | 0.999 | | | 0.961 | |
| Satd. Flow (perm) | 0 | 1601 | 1597 | 0 | 1654 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 3% | 2% | 1% | 0% | 0% |
| Adj. Flow (vph) | 11 | 478 | 851 | 97 | 52 | 12 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 489 | 948 | 0 | 64 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 68.9% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |







| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 11 | 478 | 851 | 97 | 52 | 12 |
| Future Volume (Veh/h) | 11 | 478 | 851 | 97 | 52 | 12 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 478 | 851 | 97 | 52 | 12 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 948 | | | | 1400 | 900 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 948 | | | | 1400 | 900 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 98 | | | | 66 | 96 |
| cM capacity (veh/h) | 732 | | | | 154 | 340 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 489 | 948 | 64 |
| Volume Left | 11 | 0 | 52 |
| Volume Right | 0 | 97 | 12 |
| cSH | 732 | 1700 | 172 |
| Volume to Capacity | 0.02 | 0.56 | 0.37 |
| Queue Length 95th (m) | 0.4 | 0.0 | 12.8 |
| Control Delay (s) | 0.4 | 0.0 | 37.9 |
| Lane LOS | A | | E |
| Approach Delay (s) | 0.4 | 0.0 | 37.9 |
| Approach LOS | | | E |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| Average Delay | | 1.8 | | | |
| Intersection Capacity Utilization | | 68.9% | ICU Level of Service | | C |
| Analysis Period (min) | | 15 | | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 105 | 225 | 472 | 296 | 162 | 91 |
| Future Volume (vph) | 105 | 225 | 472 | 296 | 162 | 91 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.951 | |
| Flt Protected | 0.950 | | | | 0.969 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1595 | 0 |
| Flt Permitted | 0.251 | | | | 0.969 | |
| Satd. Flow (perm) | 441 | 1845 | 1618 | 1389 | 1595 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 181 | 30 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Adj. Flow (vph) | 105 | 225 | 472 | 296 | 162 | 91 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 105 | 225 | 472 | 296 | 253 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |

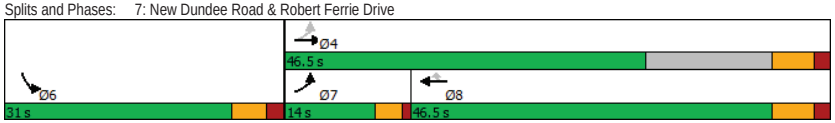




| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 39.4 | 36.8 | 26.8 | 26.8 | 26.0 | |
| Actuated g/C Ratio | 0.52 | 0.49 | 0.35 | 0.35 | 0.34 | |
| v/c Ratio | 0.28 | 0.25 | 0.83 | 0.49 | 0.45 | |
| Control Delay | 9.9 | 10.8 | 35.6 | 10.4 | 23.9 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 9.9 | 10.8 | 35.6 | 10.4 | 23.9 | |
| LOS | A | B | D | B | C | |
| Approach Delay | | 10.5 | 25.9 | | 23.9 | |
| Approach LOS | | B | C | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 91.5 | | | |
| Actuated Cycle Length: 75.8 | | | |
| Natural Cycle: 80 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.83 | | | |
| Intersection Signal Delay: 21.8 | | Intersection LOS: C | |
| Intersection Capacity Utilization 64.2% | | ICU Level of Service C | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
### 7: New Dundee Road & Robert Ferrie Drive

2028 Background - PM Peak Hour

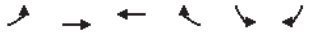
| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 105 | 225 | 472 | 296 | 253 |
| v/c Ratio | 0.28 | 0.25 | 0.83 | 0.49 | 0.45 |
| Control Delay | 9.9 | 10.8 | 35.6 | 10.4 | 23.9 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 9.9 | 10.8 | 35.6 | 10.4 | 23.9 |
| Queue Length 50th (m) | 7.2 | 18.0 | 67.2 | 12.6 | 27.9 |
| Queue Length 95th (m) | 13.8 | 29.4 | 103.3 | 32.5 | 60.2 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 397 | 1351 | 888 | 843 | 566 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.26 | 0.17 | 0.53 | 0.35 | 0.45 |

| Intersection Summary |
|---|



## HCM Signalized Intersection Capacity Analysis
### 7: New Dundee Road & Robert Ferrie Drive

2028 Background - PM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 105 | 225 | 472 | 296 | 162 | 91 |
| Future Volume (vph) | 105 | 225 | 472 | 296 | 162 | 91 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1595 | |
| Flt Permitted | 0.25 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 442 | 1845 | 1618 | 1389 | 1595 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 105 | 225 | 472 | 296 | 162 | 91 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 117 | 20 | 0 |
| Lane Group Flow (vph) | 105 | 225 | 472 | 179 | 233 | 0 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 37.8 | 37.8 | 26.8 | 26.8 | 26.0 | |
| Effective Green, g (s) | 37.8 | 37.8 | 26.8 | 26.8 | 26.0 | |
| Actuated g/C Ratio | 0.50 | 0.50 | 0.35 | 0.35 | 0.34 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 331 | 914 | 568 | 487 | 543 | |
| v/s Ratio Prot | c0.03 | 0.12 | c0.29 | | c0.15 | |
| v/s Ratio Perm | 0.13 | | | 0.13 | | |
| v/c Ratio | 0.32 | 0.25 | 0.83 | 0.37 | 0.43 | |
| Uniform Delay, d1 | 12.1 | 11.1 | 22.7 | 18.4 | 19.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.6 | 0.1 | 10.0 | 0.5 | 2.5 | |
| Delay (s) | 12.6 | 11.2 | 32.7 | 18.9 | 21.9 | |
| Level of Service | B | B | C | B | C | |
| Approach Delay (s) | | 11.7 | 27.4 | | 21.9 | |
| Approach LOS | | B | C | | C | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 22.5 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.60 | | |
| Actuated Cycle Length (s) | 76.3 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 64.2% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

## Lanes, Volumes, Timings
## 8: New Dundee Road

2028 Background - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 338 | 89 | 20 | 387 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (vph) | 26 | 338 | 89 | 20 | 387 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.973 | | | 0.994 | | | 0.984 | | | 0.955 | |
| Flt Protected | | 0.997 | | | 0.998 | | | 0.979 | | | 0.997 | |
| Satd. Flow (prot) | 0 | 1487 | 0 | 0 | 1490 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Flt Permitted | | 0.997 | | | 0.998 | | | 0.979 | | | 0.997 | |
| Satd. Flow (perm) | 0 | 1487 | 0 | 0 | 1490 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 1% | 2% | 10% | 3% | 0% | 3% | 0% | 0% | 0% | 3% | 0% |
| Adj. Flow (vph) | 26 | 338 | 89 | 20 | 387 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 453 | 0 | 0 | 425 | 0 | 0 | 162 | 0 | 0 | 57 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 64.1% | | ICU Level of Service C | |
| Analysis Period (min) 15 | | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

2028 Background - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 26 | 338 | 89 | 20 | 387 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (Veh/h) | 26 | 338 | 89 | 20 | 387 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 26 | 338 | 89 | 20 | 387 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 405 | | | 427 | | | 906 | 880 | 382 | 927 | 915 | 396 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 405 | | | 427 | | | 906 | 880 | 382 | 927 | 915 | 396 |
| tC, single (s) | 4.1 | | | 4.2 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.3 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 98 | | | 98 | | | 69 | 73 | 97 | 98 | 87 | 97 |
| cM capacity (veh/h) | 1165 | | | 1091 | | | 217 | 277 | 669 | 187 | 261 | 658 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 453 | 425 | 162 | 57 |
| Volume Left | 26 | 20 | 68 | 4 |
| Volume Right | 89 | 18 | 19 | 19 |
| cSH | 1165 | 1091 | 264 | 315 |
| Volume to Capacity | 0.02 | 0.02 | 0.61 | 0.18 |
| Queue Length 95th (m) | 0.5 | 0.4 | 29.5 | 5.2 |
| Control Delay (s) | 0.7 | 0.6 | 38.1 | 18.9 |
| Lane LOS | A | A | E | C |
| Approach Delay (s) | 0.7 | 0.6 | 38.1 | 18.9 |
| Approach LOS | | | E | C |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | | 7.1 | | |
| Intersection Capacity Utilization | | 64.1% | ICU Level of Service | C |
| Analysis Period (min) | | 15 | | |

## Lanes, Volumes, Timings
## 10: Doon Mills Road & Apple Ridge Drive

2028 Background - PM Peak Hour

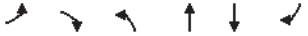
| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.983 | | | | 0.935 | |
| Flt Protected | 0.958 | | | 0.991 | | |
| Satd. Flow (prot) | 1662 | 0 | 0 | 1603 | 1520 | 0 |
| Flt Permitted | 0.958 | | | 0.991 | | |
| Satd. Flow (perm) | 1662 | 0 | 0 | 1603 | 1520 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | 2 | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 245 | 0 | 0 | 276 | 603 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 81.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 10: Doon Mills Road & Apple Ridge Drive

2028 Background - PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 215 | 30 | 50 | 226 | 312 | 291 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 245 | 276 | 603 |
| Volume Left (vph) | 215 | 50 | 0 |
| Volume Right (vph) | 30 | 0 | 291 |
| Hadj (s) | 0.10 | 0.07 | -0.26 |
| Departure Headway (s) | 6.2 | 5.6 | 4.9 |
| Degree Utilization, x | 0.42 | 0.43 | 0.82 |
| Capacity (veh/h) | 546 | 602 | 725 |
| Control Delay (s) | 13.6 | 12.8 | 25.9 |
| Approach Delay (s) | 13.6 | 12.8 | 25.9 |
| Approach LOS | B | B | D |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 20.0 | | |
| Level of Service | C | | |
| Intersection Capacity Utilization | 81.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

Lanes, Volumes, Timings
11: Biehn Drive & Carnydale Drive

2028 Background - PM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.868 | | 0.983 | | | |
| Flt Protected | 0.999 | | | | | 0.955 |
| Satd. Flow (prot) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Flt Permitted | 0.999 | | | | | 0.955 |
| Satd. Flow (perm) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Confl. Peds. (#/hr) | 49 | | | 7 | 7 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 5% | 0% |
| Adj. Flow (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 276 | 0 | 16 | 0 | 0 | 221 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
11: Biehn Drive & Carnydale Drive

2028 Background - PM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (Veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Pedestrians | 7 | | 49 | | | |
| Lane Width (m) | 3.6 | | 3.6 | | | |
| Walking Speed (m/s) | 1.2 | | 1.2 | | | |
| Percent Blockage | 1 | | 4 | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 500 | 22 | | | 23 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 500 | 22 | | | 23 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 98 | 74 | | | 87 | |
| cM capacity (veh/h) | 441 | 1055 | | | 1564 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 276 | 16 | 221 |
| Volume Left | 7 | 0 | 208 |
| Volume Right | 269 | 2 | 0 |
| cSH | 1019 | 1700 | 1564 |
| Volume to Capacity | 0.27 | 0.01 | 0.13 |
| Queue Length 95th (m) | 8.8 | 0.0 | 3.7 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | | 8.4 | | |
| Intersection Capacity Utilization | | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.976 | | | | 0.850 | | 0.995 | | | 0.980 | |
| Flt Protected | 0.950 | | | | 0.990 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1653 | 1587 | 0 | 0 | 1621 | 1430 | 1686 | 1579 | 0 | 1621 | 1574 | 0 |
| Flt Permitted | 0.678 | | | | 0.935 | | 0.372 | | | 0.529 | | |
| Satd. Flow (perm) | 1164 | 1587 | 0 | 0 | 1526 | 1380 | 656 | 1579 | 0 | 900 | 1574 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 14 | | | | 101 | | 4 | | | 18 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 63 | 86 | 0 | 0 | 123 | 101 | 13 | 340 | 0 | 135 | 508 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

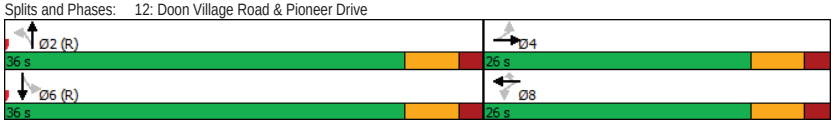




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.17 | 0.17 | | | 0.25 | 0.20 | 0.04 | 0.44 | | 0.31 | 0.66 | |
| Control Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.0 | 12.7 | | 12.2 | 16.8 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.0 | 12.7 | | 12.2 | 16.8 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.1 | | | 11.7 | | | 12.6 | | | 15.8 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.66 | | | |
| Intersection Signal Delay: 14.2 | | Intersection LOS: B | |
| Intersection Capacity Utilization 73.3% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2028 Background - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 63 | 86 | 123 | 101 | 13 | 340 | 135 | 508 |
| v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.04 | 0.44 | 0.31 | 0.66 |
| Control Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.0 | 12.7 | 12.2 | 16.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.0 | 12.7 | 12.2 | 16.8 |
| Queue Length 50th (m) | 5.3 | 6.1 | 10.7 | 0.0 | 0.8 | 24.7 | 9.2 | 41.6 |
| Queue Length 95th (m) | 13.4 | 15.0 | 22.3 | 8.9 | 3.3 | 43.8 | 20.4 | 72.9 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 375 | 521 | 492 | 513 | 317 | 766 | 435 | 770 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.04 | 0.44 | 0.31 | 0.66 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2028 Background - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1632 | 1587 | | | 1616 | 1380 | 1675 | 1579 | | 1616 | 1573 | |
| Flt Permitted | 0.68 | 1.00 | | | 0.93 | 1.00 | 0.37 | 1.00 | | 0.53 | 1.00 | |
| Satd. Flow (perm) | 1164 | 1587 | | | 1526 | 1380 | 656 | 1579 | | 901 | 1573 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 0 | 68 | 0 | 2 | 0 | 0 | 9 | 0 |
| Lane Group Flow (vph) | 63 | 77 | 0 | 0 | 123 | 33 | 13 | 338 | 0 | 135 | 499 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 375 | 511 | | | 492 | 445 | 317 | 764 | | 435 | 761 | |
| v/s Ratio Prot | | 0.05 | | | | | | 0.21 | | | c0.32 | |
| v/s Ratio Perm | 0.05 | | | | c0.08 | 0.02 | 0.02 | | | 0.15 | | |
| v/c Ratio | 0.17 | 0.15 | | | 0.25 | 0.07 | 0.04 | 0.44 | | 0.31 | 0.66 | |
| Uniform Delay, d1 | 15.0 | 14.9 | | | 15.5 | 14.6 | 8.4 | 10.5 | | 9.7 | 12.1 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.6 | | | 1.2 | 0.3 | 0.2 | 1.9 | | 1.9 | 4.4 | |
| Delay (s) | 16.0 | 15.6 | | | 16.7 | 14.9 | 8.7 | 12.4 | | 11.6 | 16.5 | |
| Level of Service | B | B | | | B | B | A | B | | B | B | |
| Approach Delay (s) | | 15.8 | | | 15.9 | | | 12.2 | | | 15.4 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 14.7 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.49 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 73.3% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:53:31 PM

## Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2028 | | | | | | |
| **Leg North** | 0.08 | ~1 | 2.45 | 0.06 | A | 2.72 | A |
| **Leg West** | 0.63 | 1.06 | 2.84 | 0.37 | A | | |
| **Leg South** | 0.16 | ~1 | 2.69 | 0.13 | A | | |
| **Leg East** | 0.24 | ~1 | 2.56 | 0.17 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM " model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:53:30 PM*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FB 2028, AM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2028, AM | FB 2028 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 2.72 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Strasburg Road | |
| **West** | West | Huron Road | |
| **South** | South | Strasburg Road | |
| **East** | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **South** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **South** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

#### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| **North** | Percentage | ROW Standard | | 90.00 |
| **West** | Percentage | ROW Standard | | 90.00 |
| **South** | Percentage | ROW Standard | | 90.00 |
| **East** | Percentage | ROW Standard | | 90.00 |

#### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| **North** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **West** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **South** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **East** | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| **North** | ONE HOUR | ✓ | 113.00 | 100.000 |
| **West** | ONE HOUR | ✓ | 726.00 | 100.000 |
| **South** | ONE HOUR | ✓ | 195.00 | 100.000 |
| **East** | ONE HOUR | ✓ | 303.00 | 100.000 |

# Turning Proportions

#### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.000 | 67.000 | 18.000 | 28.000 |
| | **West** | 200.000 | 0.000 | 29.000 | 497.000 |
| | **South** | 55.000 | 49.000 | 0.000 | 91.000 |
| | **East** | 66.000 | 213.000 | 24.000 | 0.000 |

#### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.00 | 0.59 | 0.16 | 0.25 |
| | **West** | 0.28 | 0.00 | 0.04 | 0.68 |
| | **South** | 0.28 | 0.25 | 0.00 | 0.47 |
| | **East** | 0.22 | 0.70 | 0.08 | 0.00 |





# Vehicle Mix

#### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 1.000 | 1.190 | 1.350 | 1.370 |
| | **West** | 1.050 | 1.000 | 1.210 | 1.050 |
| | **South** | 1.150 | 1.040 | 1.000 | 1.000 |
| | **East** | 1.250 | 1.130 | 1.090 | 1.000 |

#### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.0 | 19.0 | 35.0 | 37.0 |
| | **West** | 5.0 | 0.0 | 21.0 | 5.0 |
| | **South** | 15.0 | 4.0 | 0.0 | 0.0 |
| | **East** | 25.0 | 13.0 | 9.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.06 | 2.45 | 0.08 | −1 | A | 103.69 | 155.54 | 6.17 | 2.38 | 0.07 | 6.17 | 2.38 |
| **West** | 0.37 | 2.84 | 0.63 | 1.06 | A | 666.19 | 999.29 | 43.28 | 2.60 | 0.48 | 43.29 | 2.60 |
| **South** | 0.13 | 2.69 | 0.16 | −1 | A | 178.94 | 268.40 | 11.14 | 2.49 | 0.12 | 11.14 | 2.49 |
| **East** | 0.17 | 2.56 | 0.24 | −1 | A | 278.04 | 417.06 | 16.89 | 2.43 | 0.19 | 16.89 | 2.43 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 85.07 | 21.27 | 84.85 | 241.04 | 214.77 | 0.00 | 2037.44 | 1178.40 | 0.042 | 0.00 | 0.05 | 2.312 | A |
| **West** | 546.57 | 136.64 | 545.14 | 247.06 | 52.56 | 0.00 | 2154.71 | 1757.21 | 0.254 | 0.00 | 0.36 | 2.358 | A |
| **South** | 146.81 | 36.70 | 146.43 | 53.31 | 544.39 | 0.00 | 1799.14 | 761.98 | 0.082 | 0.00 | 0.09 | 2.284 | A |
| **East** | 228.11 | 57.03 | 227.53 | 462.55 | 228.27 | 0.00 | 2027.68 | 1548.94 | 0.113 | 0.00 | 0.15 | 2.301 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 101.58 | 25.40 | 101.54 | 288.40 | 256.97 | 0.00 | 2006.93 | 1178.40 | 0.051 | 0.05 | 0.07 | 2.369 | A |
| **West** | 652.66 | 163.16 | 652.25 | 295.61 | 62.90 | 0.00 | 2147.24 | 1757.21 | 0.304 | 0.36 | 0.46 | 2.542 | A |
| **South** | 175.30 | 43.83 | 175.20 | 63.79 | 651.36 | 0.00 | 1721.81 | 761.98 | 0.102 | 0.09 | 0.12 | 2.440 | A |
| **East** | 272.39 | 68.10 | 272.25 | 553.43 | 273.12 | 0.00 | 1995.26 | 1548.94 | 0.137 | 0.15 | 0.18 | 2.404 | A |

#### Main results: (08:30-08:45)

| | Total | Intersection | Entry | Exit Flow | Circulating | Pedestrian | Capacity | Saturation | V/C | Start | End | Delay | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Leg | Demand (PCE/hr) | Arrivals (PCE) | Flow (PCE/hr) | (PCE/hr) | Flow (PCE/hr) | Demand (Ped/hr) | (PCE/hr) | Capacity (PCE/hr) | Ratio | Queue (PCE) | Queue (PCE) | (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 124.42 | 31.10 | 124.34 | 353.15 | 314.68 | 0.00 | 1965.21 | 1178.40 | 0.063 | 0.07 | 0.08 | 2.452 | A |
| West | 799.34 | 199.84 | 798.67 | 362.00 | 77.02 | 0.00 | 2137.03 | 1757.21 | 0.374 | 0.46 | 0.63 | 2.837 | A |
| South | 214.70 | 53.67 | 214.53 | 78.12 | 797.58 | 0.00 | 1616.10 | 761.98 | 0.133 | 0.12 | 0.16 | 2.693 | A |
| East | 333.61 | 83.40 | 333.39 | 677.67 | 334.44 | 0.00 | 1950.93 | 1548.94 | 0.171 | 0.18 | 0.24 | 2.560 | A |

### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 124.42 | 31.10 | 124.41 | 353.43 | 314.89 | 0.00 | 1965.06 | 1178.40 | 0.063 | 0.08 | 0.08 | 2.453 | A |
| West | 799.34 | 199.84 | 799.33 | 362.23 | 77.07 | 0.00 | 2136.99 | 1757.21 | 0.374 | 0.63 | 0.63 | 2.840 | A |
| South | 214.70 | 53.67 | 214.70 | 78.17 | 798.23 | 0.00 | 1615.63 | 761.98 | 0.133 | 0.16 | 0.16 | 2.694 | A |
| East | 333.61 | 83.40 | 333.61 | 678.22 | 334.71 | 0.00 | 1950.73 | 1548.94 | 0.171 | 0.24 | 0.24 | 2.561 | A |

### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 101.58 | 25.40 | 101.66 | 288.85 | 257.32 | 0.00 | 2006.68 | 1178.40 | 0.051 | 0.08 | 0.07 | 2.372 | A |
| West | 652.66 | 163.16 | 653.32 | 296.00 | 62.97 | 0.00 | 2147.18 | 1757.21 | 0.304 | 0.63 | 0.46 | 2.546 | A |
| South | 175.30 | 43.83 | 175.47 | 63.88 | 652.42 | 0.00 | 1721.05 | 761.98 | 0.102 | 0.16 | 0.12 | 2.442 | A |
| East | 272.39 | 68.10 | 272.61 | 554.32 | 273.56 | 0.00 | 1994.94 | 1548.94 | 0.137 | 0.24 | 0.18 | 2.405 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 85.07 | 21.27 | 85.12 | 241.84 | 215.45 | 0.00 | 2036.95 | 1178.40 | 0.042 | 0.07 | 0.05 | 2.313 | A |
| West | 546.57 | 136.64 | 546.98 | 247.85 | 52.73 | 0.00 | 2154.59 | 1757.21 | 0.254 | 0.46 | 0.36 | 2.363 | A |
| South | 146.81 | 36.70 | 146.91 | 53.49 | 546.22 | 0.00 | 1797.82 | 761.98 | 0.082 | 0.12 | 0.09 | 2.288 | A |
| East | 228.11 | 57.03 | 228.26 | 464.10 | 229.04 | 0.00 | 2027.13 | 1548.94 | 0.113 | 0.18 | 0.15 | 2.304 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.81 | 0.05 | 2.312 | A | A |
| West | 5.28 | 0.35 | 2.358 | A | A |
| South | 1.38 | 0.09 | 2.284 | A | A |
| East | 2.15 | 0.14 | 2.301 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.99 | 0.07 | 2.369 | A | A |
| West | 6.80 | 0.45 | 2.542 | A | A |
| South | 1.76 | 0.12 | 2.440 | A | A |
| East | 2.69 | 0.18 | 2.404 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.26 | 0.08 | 2.452 | A | A |
| West | 9.27 | 0.62 | 2.837 | A | A |
| South | 2.37 | 0.16 | 2.693 | A | A |
| East | 3.51 | 0.23 | 2.560 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|





| North | 1.27 | 0.08 | 2.453 | A | A |
|---|---|---|---|---|---|
| West | 9.43 | 0.63 | 2.840 | A | A |
| South | 2.40 | 0.16 | 2.694 | A | A |
| East | 3.55 | 0.24 | 2.561 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.02 | 0.07 | 2.372 | A | A |
| West | 7.04 | 0.47 | 2.546 | A | A |
| South | 1.81 | 0.12 | 2.442 | A | A |
| East | 2.77 | 0.18 | 2.405 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.83 | 0.06 | 2.313 | A | A |
| West | 5.47 | 0.36 | 2.363 | A | A |
| South | 1.42 | 0.09 | 2.288 | A | A |
| East | 2.22 | 0.15 | 2.304 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.05 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.46 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.12 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.63 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.63 | 0.00 | 0.00 | 0.00 | 1.06 | | | N/A | N/A |
| South | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.46 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.12 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.05 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:52:48 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2028 | | | | | | |
| Leg North | 0.30 | −1 | 3.07 | 0.23 | A | 2.89 | A |
| Leg West | 0.47 | 1.02 | 2.65 | 0.32 | A | | |
| Leg South | 0.13 | −1 | 2.35 | 0.12 | A | | |
| Leg East | 0.73 | 1.03 | 3.14 | 0.42 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM " model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:52:48 PM*

## File summary

| | |
|---|---|
| Title | (untitled) |
| Location | |
| Site Number | |
| Date | 2023-12-13 |
| Version | |
| Status | (new file) |
| Identifier | |
| Client | |
| Jobnumber | |
| Analyst | AdamMorrison |
| Description | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - FB 2028, PM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2028, PM | FB 2028 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 2.89 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Strasburg Road | |
| West | West | Huron Road | |
| South | South | Strasburg Road | |
| East | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| South | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| South | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| East | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |





## Slope / Intercept / Capacity

### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | ROW Standard | | 90.00 |
| West | Percentage | ROW Standard | | 90.00 |
| South | Percentage | ROW Standard | | 90.00 |
| East | Percentage | ROW Standard | | 90.00 |

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.723 | 2192.710 |
| West | | (calculated) | (calculated) | 0.723 | 2192.710 |
| South | | (calculated) | (calculated) | 0.723 | 2192.710 |
| East | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 324.00 | 100.000 |
| West | ONE HOUR | ✓ | 584.00 | 100.000 |
| South | ONE HOUR | ✓ | 184.00 | 100.000 |
| East | ONE HOUR | ✓ | 760.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.000 | 218.000 | 68.000 | 38.000 |
| | West | 119.000 | 0.000 | 55.000 | 410.000 |
| | South | 57.000 | 46.000 | 0.000 | 81.000 |
| | East | 26.000 | 640.000 | 94.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.00 | 0.67 | 0.21 | 0.12 |
| | West | 0.20 | 0.00 | 0.09 | 0.70 |
| | South | 0.31 | 0.25 | 0.00 | 0.44 |

| | | | | | |
|---|---|---|---|---|---|
| | East | 0.03 | 0.84 | 0.12 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.020 | 1.020 | 1.190 |
| | West | 1.040 | 1.000 | 1.000 | 1.020 |
| | South | 1.000 | 1.020 | 1.000 | 1.000 |
| | East | 1.520 | 1.020 | 1.000 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 2.0 | 2.0 | 19.0 |
| | West | 4.0 | 0.0 | 0.0 | 2.0 |
| | South | 0.0 | 2.0 | 0.0 | 0.0 |
| | East | 52.0 | 2.0 | 0.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.23 | 3.07 | 0.30 | −1 | A | 297.31 | 445.96 | 20.51 | 2.76 | 0.23 | 20.51 | 2.76 |
| West | 0.32 | 2.65 | 0.47 | 1.02 | A | 535.89 | 803.83 | 32.69 | 2.44 | 0.36 | 32.69 | 2.44 |
| South | 0.12 | 2.35 | 0.13 | −1 | A | 168.84 | 253.26 | 9.33 | 2.21 | 0.10 | 9.33 | 2.21 |
| East | 0.42 | 3.14 | 0.73 | 1.03 | A | 697.39 | 1046.08 | 48.83 | 2.80 | 0.54 | 48.83 | 2.80 |

### Main Results for each time segment

#### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 243.92 | 60.98 | 243.26 | 151.70 | 585.63 | 0.00 | 1769.33 | 943.08 | 0.138 | 0.00 | 0.17 | 2.445 | A |
| West | 439.67 | 109.92 | 438.58 | 678.74 | 150.16 | 0.00 | 2084.15 | 1830.77 | 0.211 | 0.00 | 0.27 | 2.235 | A |
| South | 138.52 | 34.63 | 138.21 | 162.93 | 425.80 | 0.00 | 1884.88 | 913.84 | 0.073 | 0.00 | 0.08 | 2.071 | A |
| East | 572.17 | 143.04 | 570.60 | 397.28 | 166.73 | 0.00 | 2072.17 | 1553.19 | 0.276 | 0.00 | 0.39 | 2.465 | A |

#### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 291.27 | 72.82 | 291.07 | 181.49 | 700.71 | 0.00 | 1686.13 | 943.08 | 0.173 | 0.17 | 0.22 | 2.676 | A |
| West | 525.00 | 131.25 | 524.70 | 812.11 | 179.67 | 0.00 | 2062.82 | 1830.77 | 0.255 | 0.27 | 0.35 | 2.392 | A |
| South | 165.41 | 41.35 | 165.33 | 194.95 | 509.42 | 0.00 | 1824.42 | 913.84 | 0.091 | 0.08 | 0.10 | 2.180 | A |
| East | 683.22 | 170.81 | 682.74 | 475.29 | 199.47 | 0.00 | 2048.51 | 1553.19 | 0.334 | 0.39 | 0.51 | 2.712 | A |

#### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 356.73 | 89.18 | 356.38 | 222.24 | 857.94 | 0.00 | 1572.46 | 943.08 | 0.227 | 0.22 | 0.30 | 3.071 | A |
| West | 643.00 | 160.75 | 642.50 | 994.34 | 219.98 | 0.00 | 2033.67 | 1830.77 | 0.316 | 0.35 | 0.47 | 2.645 | A |
| South | 202.59 | 50.65 | 202.46 | 238.70 | 623.79 | 0.00 | 1741.74 | 913.84 | 0.116 | 0.10 | 0.13 | 2.350 | A |
| East | 836.78 | 209.19 | 835.92 | 582.00 | 244.25 | 0.00 | 2016.13 | 1553.19 | 0.415 | 0.51 | 0.73 | 3.137 | A |





#### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 356.73 | 89.18 | 356.73 | 222.40 | 858.79 | 0.00 | 1571.85 | 943.08 | 0.227 | 0.30 | 0.30 | 3.072 | A |
| West | 643.00 | 160.75 | 642.99 | 995.31 | 220.20 | 0.00 | 2033.52 | 1830.77 | 0.316 | 0.47 | 0.47 | 2.645 | A |
| South | 202.59 | 50.65 | 202.59 | 238.92 | 624.27 | 0.00 | 1741.39 | 913.84 | 0.116 | 0.13 | 0.13 | 2.350 | A |
| East | 836.78 | 209.19 | 836.77 | 582.44 | 244.43 | 0.00 | 2016.00 | 1553.19 | 0.415 | 0.73 | 0.73 | 3.140 | A |

#### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 291.27 | 72.82 | 291.61 | 181.76 | 702.05 | 0.00 | 1685.16 | 943.08 | 0.173 | 0.30 | 0.22 | 2.682 | A |
| West | 525.00 | 131.25 | 525.49 | 813.65 | 180.01 | 0.00 | 2062.57 | 1830.77 | 0.255 | 0.47 | 0.35 | 2.396 | A |
| South | 165.41 | 41.35 | 165.54 | 195.30 | 510.20 | 0.00 | 1823.86 | 913.84 | 0.091 | 0.13 | 0.10 | 2.183 | A |
| East | 683.22 | 170.81 | 684.07 | 476.00 | 199.74 | 0.00 | 2048.31 | 1553.19 | 0.334 | 0.73 | 0.52 | 2.718 | A |

#### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 243.92 | 60.98 | 244.13 | 152.18 | 587.72 | 0.00 | 1767.82 | 943.08 | 0.138 | 0.22 | 0.17 | 2.452 | A |
| West | 439.67 | 109.92 | 439.97 | 681.15 | 150.70 | 0.00 | 2083.76 | 1830.77 | 0.211 | 0.35 | 0.27 | 2.240 | A |
| South | 138.52 | 34.63 | 138.61 | 163.50 | 427.17 | 0.00 | 1883.89 | 913.84 | 0.074 | 0.10 | 0.08 | 2.072 | A |
| East | 572.17 | 143.04 | 572.66 | 398.53 | 167.24 | 0.00 | 2071.80 | 1553.19 | 0.276 | 0.52 | 0.39 | 2.471 | A |

### Queueing Delay Results for each time segment

#### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.44 | 0.16 | 2.445 | A | A |
| West | 4.03 | 0.27 | 2.235 | A | A |
| South | 1.18 | 0.08 | 2.071 | A | A |
| East | 5.77 | 0.38 | 2.465 | A | A |

#### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.20 | 0.21 | 2.676 | A | A |
| West | 5.16 | 0.34 | 2.392 | A | A |
| South | 1.49 | 0.10 | 2.180 | A | A |
| East | 7.59 | 0.51 | 2.712 | A | A |

#### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.48 | 0.30 | 3.071 | A | A |
| West | 6.96 | 0.46 | 2.645 | A | A |
| South | 1.96 | 0.13 | 2.350 | A | A |
| East | 10.70 | 0.71 | 3.137 | A | A |

#### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| North | 4.55 | 0.30 | 3.072 | A | A |
| West | 7.07 | 0.47 | 2.645 | A | A |
| South | 1.98 | 0.13 | 2.350 | A | A |
| East | 10.91 | 0.73 | 3.140 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.31 | 0.22 | 2.682 | A | A |
| West | 5.32 | 0.35 | 2.396 | A | A |
| South | 1.52 | 0.10 | 2.183 | A | A |
| East | 7.88 | 0.53 | 2.718 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.53 | 0.17 | 2.452 | A | A |
| West | 4.16 | 0.28 | 2.240 | A | A |
| South | 1.21 | 0.08 | 2.072 | A | A |
| East | 5.99 | 0.40 | 2.471 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.27 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.51 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.30 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.47 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.73 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.30 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.47 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| South | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.73 | 0.00 | 0.00 | 0.00 | 1.03 | | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.52 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.27 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

# Appendix E

## 2033 Background Traffic Operations Reports

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 333 | 15 | 309 | 144 | 129 |
| Future Volume (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 333 | 15 | 309 | 144 | 129 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.96 | 1.00 | | 0.98 | 0.99 | 1.00 | | 0.98 | | 0.98 |
| Frt | | | 0.850 | | | 0.850 | | 0.994 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1547 | 3374 | 1390 | 1561 | 3438 | 1390 | 1653 | 3254 | 0 | 2895 | 1759 | 1417 |
| Flt Permitted | 0.086 | | | 0.241 | | | 0.610 | | | 0.950 | | |
| Satd. Flow (perm) | 140 | 3374 | 1337 | 395 | 3438 | 1361 | 1055 | 3254 | 0 | 2836 | 1759 | 1389 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 194 | | | 450 | | 3 | | | | 129 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Adj. Flow (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 333 | 15 | 309 | 144 | 129 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 348 | 0 | 309 | 144 | 129 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

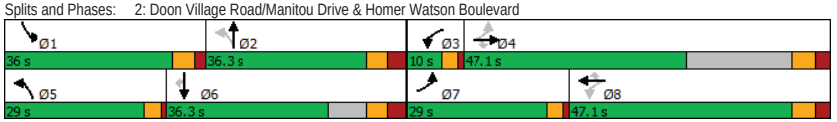




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.2 | 65.1 | 65.1 | 49.0 | 40.0 | 40.0 | 57.3 | 30.1 | | 22.0 | 30.2 | 30.2 |
| Actuated g/C Ratio | 0.51 | 0.46 | 0.46 | 0.35 | 0.28 | 0.28 | 0.40 | 0.21 | | 0.16 | 0.21 | 0.21 |
| v/c Ratio | 0.94 | 0.67 | 0.34 | 0.08 | 1.15 | 0.80 | 0.69 | 0.50 | | 0.69 | 0.38 | 0.32 |
| Control Delay | 78.1 | 33.9 | 7.7 | 21.1 | 124.9 | 20.0 | 37.9 | 52.3 | | 64.6 | 51.3 | 9.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 78.1 | 33.9 | 7.7 | 21.1 | 124.9 | 20.0 | 37.9 | 52.3 | | 64.6 | 51.3 | 9.4 |
| LOS | E | C | A | C | F | B | D | D | | E | D | A |
| Approach Delay | | 38.3 | | | 89.0 | | | 44.9 | | | 49.1 | |
| Approach LOS | | D | | | F | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 141.6 | | | |
| Natural Cycle: 125 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.15 | | | |
| Intersection Signal Delay: 59.5 | | Intersection LOS: E | |
| Intersection Capacity Utilization 113.8% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Background - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 348 | 309 | 144 | 129 |
| v/c Ratio | 0.94 | 0.67 | 0.34 | 0.08 | 1.15 | 0.80 | 0.69 | 0.50 | 0.69 | 0.38 | 0.32 |
| Control Delay | 78.1 | 33.9 | 7.7 | 21.1 | 124.9 | 20.0 | 37.9 | 52.3 | 64.6 | 51.3 | 9.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 78.1 | 33.9 | 7.7 | 21.1 | 124.9 | 20.0 | 37.9 | 52.3 | 64.6 | 51.3 | 9.4 |
| Queue Length 50th (m) | 73.2 | 117.7 | 7.2 | 2.0 | ~203.1 | 32.7 | 77.4 | 47.6 | 44.9 | 37.1 | 0.0 |
| Queue Length 95th (m) | #139.6 | 172.5 | 29.6 | 6.4 | #260.6 | 94.3 | 108.2 | 67.5 | 60.9 | 58.9 | 17.7 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 320 | 1551 | 719 | 186 | 971 | 707 | 536 | 693 | 613 | 447 | 449 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.94 | 0.67 | 0.34 | 0.08 | 1.15 | 0.80 | 0.68 | 0.50 | 0.50 | 0.32 | 0.29 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Background - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 333 | 15 | 309 | 144 | 129 |
| Future Volume (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 333 | 15 | 309 | 144 | 129 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1547 | 3374 | 1338 | 1560 | 3438 | 1362 | 1647 | 3253 | | 2895 | 1759 | 1389 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.24 | 1.00 | 1.00 | 0.61 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 140 | 3374 | 1338 | 396 | 3438 | 1362 | 1058 | 3253 | | 2895 | 1759 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 300 | 1046 | 241 | 14 | 1118 | 568 | 366 | 333 | 15 | 309 | 144 | 129 |
| RTOR Reduction (vph) | 0 | 0 | 106 | 0 | 0 | 317 | 0 | 2 | 0 | 0 | 0 | 102 |
| Lane Group Flow (vph) | 300 | 1046 | 135 | 14 | 1118 | 251 | 366 | 346 | 0 | 309 | 144 | 27 |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 54.0 | 30.1 | | 22.0 | 30.2 | 30.2 |
| Effective Green, g (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 54.0 | 30.1 | | 22.0 | 30.2 | 30.2 |
| Actuated g/C Ratio | 0.50 | 0.45 | 0.45 | 0.31 | 0.30 | 0.30 | 0.38 | 0.21 | | 0.15 | 0.21 | 0.21 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 313 | 1525 | 604 | 142 | 1014 | 401 | 494 | 679 | | 442 | 368 | 291 |
| v/s Ratio Prot | c0.17 | 0.31 | | 0.00 | c0.33 | | c0.12 | 0.11 | | 0.11 | 0.08 | |
| v/s Ratio Perm | 0.31 | | 0.10 | 0.03 | | 0.18 | c0.15 | | | | | 0.02 |
| v/c Ratio | 0.96 | 0.69 | 0.22 | 0.10 | 1.10 | 0.63 | 0.74 | 0.51 | | 0.70 | 0.39 | 0.09 |
| Uniform Delay, d1 | 45.8 | 31.3 | 24.0 | 34.5 | 50.8 | 43.9 | 36.4 | 50.4 | | 57.9 | 49.0 | 45.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 39.3 | 1.3 | 0.2 | 0.3 | 60.7 | 3.0 | 5.9 | 2.7 | | 6.0 | 3.1 | 0.6 |
| Delay (s) | 85.2 | 32.6 | 24.2 | 34.8 | 111.4 | 46.9 | 42.3 | 53.1 | | 63.9 | 52.1 | 46.5 |
| Level of Service | F | C | C | C | F | D | D | D | | E | D | D |
| Approach Delay (s) | | 41.3 | | | 89.2 | | | 47.6 | | | 57.1 | |
| Approach LOS | | D | | | F | | | D | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 62.1 | HCM 2000 Level of Service | E | |
| HCM 2000 Volume to Capacity ratio | 0.93 | | | |
| Actuated Cycle Length (s) | 144.0 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 113.8% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1635 | 2 | 0 | 1442 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1635 | 2 | 0 | 1442 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 1.00 | 0.99 | | 0.99 | | 1.00 | | | | 1.00 | |
| Frt | | | 0.850 | | 0.865 | | | | | | 0.992 | |
| Flt Protected | | 0.950 | | | | | 0.950 | | | | | |
| Satd. Flow (prot) | 0 | 1537 | 1444 | 0 | 1323 | 0 | 1637 | 3094 | 0 | 1775 | 3070 | 0 |
| Flt Permitted | | 0.757 | | | | | 0.950 | | | | | |
| Satd. Flow (perm) | 0 | 1223 | 1425 | 0 | 1323 | 0 | 1633 | 3094 | 0 | 1775 | 3070 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 213 | | 80 | | | | | | 6 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1635 | 2 | 0 | 1442 | 81 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 238 | 213 | 0 | 2 | 0 | 76 | 1637 | 0 | 0 | 1523 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

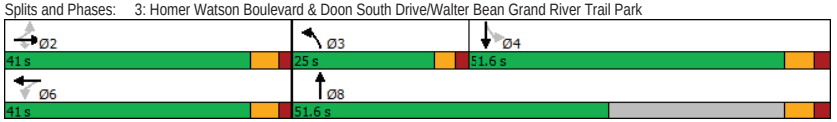




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 23.2 | 23.2 | | 23.2 | | 11.4 | 58.6 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.12 | 0.62 | | | 0.49 | |
| v/c Ratio | | 0.80 | 0.42 | | 0.01 | | 0.39 | 0.86 | | | 1.02 | |
| Control Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 21.8 | | | 55.4 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | | 0.0 | |
| Total Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 21.8 | | | 55.4 | |
| LOS | | D | A | | A | | D | C | | | E | |
| Approach Delay | | 31.5 | | | | | | 23.0 | | | 55.4 | |
| Approach LOS | | C | | | | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 94.8 | | | |
| Natural Cycle: 100 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.02 | | | |
| Intersection Signal Delay: 37.4 | | Intersection LOS: D | |
| Intersection Capacity Utilization 100.0% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Lane Group | EBT | EBR | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 238 | 213 | 2 | 76 | 1637 | 1523 |
| v/c Ratio | 0.80 | 0.42 | 0.01 | 0.39 | 0.86 | 1.02 |
| Control Delay | 53.8 | 6.7 | 0.0 | 48.8 | 21.8 | 55.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.8 | 6.7 | 0.0 | 48.8 | 21.8 | 55.4 |
| Queue Length 50th (m) | 43.8 | 0.0 | 0.0 | 14.2 | 123.2 | ~173.7 |
| Queue Length 95th (m) | 75.9 | 17.2 | 0.0 | 31.4 | #222.1 | #275.4 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | |
| Base Capacity (vph) | 463 | 672 | 550 | 354 | 2343 | 1498 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.51 | 0.32 | 0.00 | 0.21 | 0.70 | 1.02 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1635 | 2 | 0 | 1442 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1635 | 2 | 0 | 1442 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | | 0.99 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | | 1.00 | 0.85 | | 0.86 | | 1.00 | 1.00 | | | 0.99 | |
| Flt Protected | | 0.95 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | 1535 | 1425 | | 1323 | | 1637 | 3094 | | | 3071 | |
| Flt Permitted | | 0.76 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | 1222 | 1425 | | 1323 | | 1637 | 3094 | | | 3071 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1635 | 2 | 0 | 1442 | 81 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 0 | 238 | 52 | 0 | 0 | 0 | 76 | 1637 | 0 | 0 | 1520 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Effective Green, g (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.09 | 0.63 | | | 0.48 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | | 5.0 | |
| Lane Grp Cap (vph) | | 296 | 345 | | 320 | | 148 | 1936 | | | 1482 | |
| v/s Ratio Prot | | | | | 0.00 | | 0.05 | c0.53 | | | c0.49 | |
| v/s Ratio Perm | | c0.19 | 0.04 | | | | | | | | | |
| v/c Ratio | | 0.80 | 0.15 | | 0.00 | | 0.51 | 0.85 | | | 1.03 | |
| Uniform Delay, d1 | | 34.1 | 28.5 | | 27.5 | | 41.5 | 14.2 | | | 24.8 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 14.6 | 0.2 | | 0.0 | | 3.0 | 4.8 | | | 30.1 | |
| Delay (s) | | 48.7 | 28.7 | | 27.5 | | 44.5 | 19.0 | | | 54.9 | |
| Level of Service | | D | C | | C | | D | B | | | D | |
| Approach Delay (s) | | 39.2 | | | 27.5 | | | 20.1 | | | 54.9 | |
| Approach LOS | | D | | | C | | | C | | | D | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 36.8 | HCM 2000 Level of Service | | D | |
| HCM 2000 Volume to Capacity ratio | 0.97 | | | | |
| Actuated Cycle Length (s) | 95.7 | Sum of lost time (s) | | 17.6 | |
| Intersection Capacity Utilization | 100.0% | ICU Level of Service | | F | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 139 | 30 | 59 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| Future Volume (vph) | 139 | 30 | 59 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | 0.99 | | 0.98 | | | 0.98 | 1.00 | | 0.99 |
| Frt | | 0.901 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1576 | 2300 | 0 | 1492 | 1743 | 1219 | 1429 | 4848 | 1417 | 2749 | 3312 | 1229 |
| Flt Permitted | 0.627 | | | 0.696 | | | 0.088 | | | 0.950 | | |
| Satd. Flow (perm) | 1033 | 2300 | 0 | 1084 | 1743 | 1196 | 132 | 4848 | 1393 | 2747 | 3312 | 1213 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 59 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Adj. Flow (vph) | 139 | 30 | 59 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 139 | 89 | 0 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

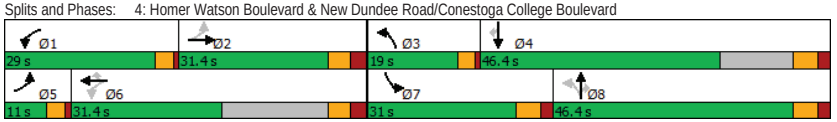




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 15.1 | 7.3 | | 15.5 | 7.8 | 7.8 | 60.8 | 46.8 | 46.8 | 10.1 | 40.2 | 40.2 |
| Actuated g/C Ratio | 0.17 | 0.08 | | 0.18 | 0.09 | 0.09 | 0.69 | 0.53 | 0.53 | 0.11 | 0.45 | 0.45 |
| v/c Ratio | 0.63 | 0.37 | | 0.39 | 0.16 | 0.36 | 0.68 | 0.58 | 0.25 | 0.27 | 1.04 | 0.04 |
| Control Delay | 44.1 | 22.1 | | 33.5 | 40.2 | 6.0 | 32.0 | 17.8 | 4.7 | 40.2 | 60.6 | 0.1 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 44.1 | 22.1 | | 33.5 | 40.2 | 6.0 | 32.0 | 17.8 | 4.7 | 40.2 | 60.6 | 0.1 |
| LOS | D | C | | C | D | A | C | B | A | D | E | A |
| Approach Delay | | 35.5 | | | 22.5 | | | 18.0 | | | 58.6 | |
| Approach LOS | | D | | | C | | | B | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 88.5 | | | |
| Natural Cycle: 140 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.04 | | | |
| Intersection Signal Delay: 36.2 | | Intersection LOS: D | |
| Intersection Capacity Utilization 87.9% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 139 | 89 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| v/c Ratio | 0.63 | 0.37 | 0.39 | 0.16 | 0.36 | 0.68 | 0.58 | 0.25 | 0.27 | 1.04 | 0.04 |
| Control Delay | 44.1 | 22.1 | 33.5 | 40.2 | 6.0 | 32.0 | 17.8 | 4.7 | 40.2 | 60.6 | 0.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 44.1 | 22.1 | 33.5 | 40.2 | 6.0 | 32.0 | 17.8 | 4.7 | 40.2 | 60.6 | 0.1 |
| Queue Length 50th (m) | 21.5 | 2.7 | 12.9 | 4.3 | 0.0 | 22.5 | 71.5 | 3.2 | 7.4 | ~164.8 | 0.0 |
| Queue Length 95th (m) | 38.3 | 10.5 | 25.6 | 12.1 | 3.6 | #60.8 | 99.5 | 16.7 | 15.5 | #229.2 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 221 | 694 | 425 | 851 | 654 | 311 | 2563 | 816 | 780 | 1955 | 765 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.63 | 0.13 | 0.20 | 0.03 | 0.13 | 0.68 | 0.58 | 0.25 | 0.11 | 0.80 | 0.04 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 139 | 30 | 59 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| Future Volume (vph) | 139 | 30 | 59 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.90 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1572 | 2304 | | 1486 | 1743 | 1199 | 1429 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Flt Permitted | 0.63 | 1.00 | | 0.70 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1037 | 2304 | | 1090 | 1743 | 1199 | 132 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 139 | 30 | 59 | 86 | 25 | 84 | 213 | 1498 | 204 | 86 | 1564 | 27 |
| RTOR Reduction (vph) | 0 | 54 | 0 | 0 | 0 | 78 | 0 | 0 | 82 | 0 | 0 | 15 |
| Lane Group Flow (vph) | 139 | 35 | 0 | 86 | 25 | 6 | 213 | 1498 | 122 | 86 | 1564 | 12 |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 15.0 | 7.8 | | 12.6 | 6.6 | 6.6 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Effective Green, g (s) | 15.0 | 7.8 | | 12.6 | 6.6 | 6.6 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Actuated g/C Ratio | 0.16 | 0.09 | | 0.14 | 0.07 | 0.07 | 0.66 | 0.51 | 0.51 | 0.09 | 0.46 | 0.46 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 212 | 197 | | 176 | 126 | 86 | 302 | 2487 | 715 | 235 | 1507 | 551 |
| v/s Ratio Prot | c0.05 | 0.02 | | 0.03 | 0.01 | | c0.12 | 0.31 | | 0.03 | c0.47 | |
| v/s Ratio Perm | c0.06 | | | 0.04 | | 0.01 | 0.35 | | 0.09 | | | 0.01 |
| v/c Ratio | 0.66 | 0.18 | | 0.49 | 0.20 | 0.07 | 0.71 | 0.60 | 0.17 | 0.37 | 1.04 | 0.02 |
| Uniform Delay, d1 | 35.0 | 38.7 | | 36.0 | 39.8 | 39.4 | 23.5 | 15.6 | 11.8 | 39.4 | 24.9 | 13.7 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 7.1 | 0.4 | | 0.8 | 0.8 | 0.3 | 7.3 | 1.1 | 0.5 | 1.0 | 33.6 | 0.1 |
| Delay (s) | 42.1 | 39.2 | | 36.7 | 40.6 | 39.8 | 30.8 | 16.7 | 12.4 | 40.3 | 58.5 | 13.8 |
| Level of Service | D | D | | D | D | D | C | B | B | D | E | B |
| Approach Delay (s) | | 40.9 | | | 38.5 | | | 17.8 | | | 56.8 | |
| Approach LOS | | D | | | D | | | B | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 36.4 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 0.93 | | | |
| Actuated Cycle Length (s) | 91.2 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 87.9% | ICU Level of Service | E | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 60 | 0 | 603 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 31 |
| Future Volume (vph) | 60 | 0 | 603 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 31 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1591 | 0 | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | 0 | 0 | 4803 | 1261 |
| Flt Permitted | 0.614 | | | 0.950 | | | 0.095 | | | | | |
| Satd. Flow (perm) | 1028 | 0 | 1458 | 1441 | 1776 | 1365 | 156 | 3406 | 0 | 0 | 4803 | 1261 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 216 | | | 399 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Adj. Flow (vph) | 60 | 0 | 603 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 31 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 60 | 0 | 603 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 31 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

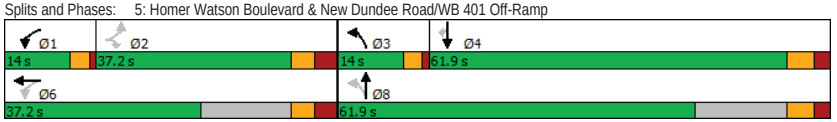




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.5 | | 30.5 | 48.0 | 44.7 | 116.9 | 60.8 | 57.9 | | | 47.3 | 47.3 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.41 | 0.38 | 1.00 | 0.52 | 0.50 | | | 0.40 | 0.40 |
| v/c Ratio | 0.22 | | 1.12 | 0.42 | 0.34 | 0.68 | 0.42 | 0.55 | | | 0.71 | 0.05 |
| Control Delay | 41.2 | | 102.7 | 30.4 | 30.3 | 2.8 | 19.8 | 21.1 | | | 31.4 | 0.2 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 41.2 | | 102.7 | 30.4 | 30.3 | 2.8 | 19.8 | 21.1 | | | 31.4 | 0.2 |
| LOS | D | | F | C | C | A | B | C | | | C | A |
| Approach Delay | | 97.1 | | | 12.2 | | | 21.0 | | | 30.7 | |
| Approach LOS | | F | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 116.9 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 1.12 | | | |
| Intersection Signal Delay: 32.5 | | Intersection LOS: C | |
| Intersection Capacity Utilization 97.3% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Background - AM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 60 | 603 | 251 | 232 | 931 | 83 | 925 | 1385 | 31 |
| v/c Ratio | 0.22 | 1.12 | 0.42 | 0.34 | 0.68 | 0.42 | 0.55 | 0.71 | 0.05 |
| Control Delay | 41.2 | 102.7 | 30.4 | 30.3 | 2.8 | 19.8 | 21.1 | 31.4 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 41.2 | 102.7 | 30.4 | 30.3 | 2.8 | 19.8 | 21.1 | 31.4 | 0.2 |
| Queue Length 50th (m) | 12.3 | ~137.5 | 47.1 | 43.2 | 0.0 | 9.6 | 77.4 | 104.7 | 0.0 |
| Queue Length 95th (m) | 26.2 | #218.9 | 76.3 | 69.2 | 0.0 | 17.8 | 95.3 | 122.0 | 0.0 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 268 | 539 | 591 | 679 | 1365 | 203 | 2042 | 2296 | 657 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.22 | 1.12 | 0.42 | 0.34 | 0.68 | 0.41 | 0.45 | 0.60 | 0.05 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Background - AM Peak Hour

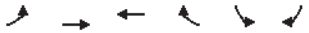
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 60 | 0 | 603 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 31 |
| Future Volume (vph) | 60 | 0 | 603 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 31 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1591 | | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | | | 4803 | 1261 |
| Flt Permitted | 0.61 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.10 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 1028 | | 1458 | 1441 | 1776 | 1365 | 156 | 3406 | | | 4803 | 1261 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 60 | 0 | 603 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 31 |
| RTOR Reduction (vph) | 0 | 0 | 160 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| Lane Group Flow (vph) | 60 | 0 | 443 | 251 | 232 | 931 | 83 | 925 | 0 | 0 | 1385 | 12 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.5 | | 30.5 | 44.7 | 44.7 | 117.6 | 58.8 | 58.8 | | | 47.3 | 47.3 |
| Effective Green, g (s) | 30.5 | | 30.5 | 44.7 | 44.7 | 117.6 | 58.8 | 58.8 | | | 47.3 | 47.3 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.38 | 0.38 | 1.00 | 0.50 | 0.50 | | | 0.40 | 0.40 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 266 | | 378 | 547 | 675 | 1365 | 167 | 1703 | | | 1931 | 507 |
| v/s Ratio Prot | | | | 0.04 | 0.13 | | 0.03 | 0.27 | | | 0.29 | |
| v/s Ratio Perm | 0.06 | | c0.30 | 0.13 | | c0.68 | 0.22 | | | | | 0.01 |
| v/c Ratio | 0.23 | | 1.17 | 0.46 | 0.34 | 0.68 | 0.50 | 0.54 | | | 0.72 | 0.02 |
| Uniform Delay, d1 | 34.3 | | 43.5 | 27.4 | 26.0 | 0.0 | 19.1 | 20.2 | | | 29.5 | 21.2 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 2.0 | | 102.0 | 1.3 | 1.4 | 2.8 | 4.8 | 0.6 | | | 1.6 | 0.0 |
| Delay (s) | 36.2 | | 145.6 | 28.6 | 27.4 | 2.8 | 23.9 | 20.8 | | | 31.1 | 21.3 |
| Level of Service | D | | F | C | C | A | C | C | | | C | C |
| Approach Delay (s) | | 135.7 | | | 11.4 | | | 21.1 | | | 30.9 | |
| Approach LOS | | F | | | B | | | C | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 38.0 | HCM 2000 Level of Service | D | | |
| HCM 2000 Volume to Capacity ratio | 0.94 | | | | |
| Actuated Cycle Length (s) | 117.6 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 97.3% | ICU Level of Service | F | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: New Dundee Road & Pinnacle Drive

2033 Background - AM Peak Hour



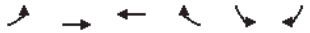
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 652 | 255 | 19 | 64 | 8 |
| Future Volume (vph) | 4 | 652 | 255 | 19 | 64 | 8 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.991 | | 0.985 | |
| Flt Protected | | | | | 0.957 | |
| Satd. Flow (prot) | 0 | 1615 | 1524 | 0 | 1664 | 0 |
| Flt Permitted | | | | | 0.957 | |
| Satd. Flow (perm) | 0 | 1615 | 1524 | 0 | 1664 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 25% | 2% | 7% | 11% | 0% | 0% |
| Adj. Flow (vph) | 4 | 652 | 255 | 19 | 64 | 8 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 656 | 274 | 0 | 72 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 54.2% | | ICU Level of Service A | |
| Analysis Period (min) 15 | | | |



HCM Unsignalized Intersection Capacity Analysis
6: New Dundee Road & Pinnacle Drive

2033 Background - AM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 652 | 255 | 19 | 64 | 8 |
| Future Volume (Veh/h) | 4 | 652 | 255 | 19 | 64 | 8 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 652 | 255 | 19 | 64 | 8 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 274 | | | | 924 | 264 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 274 | | | | 924 | 264 |
| tC, single (s) | 4.3 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.4 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 79 | 99 |
| cM capacity (veh/h) | 1168 | | | | 300 | 779 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 656 | 274 | 72 |
| Volume Left | 4 | 0 | 64 |
| Volume Right | 0 | 19 | 8 |
| cSH | 1168 | 1700 | 322 |
| Volume to Capacity | 0.00 | 0.16 | 0.22 |
| Queue Length 95th (m) | 0.1 | 0.0 | 6.7 |
| Control Delay (s) | 0.1 | 0.0 | 19.4 |
| Lane LOS | A | | C |
| Approach Delay (s) | 0.1 | 0.0 | 19.4 |
| Approach LOS | | | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.5 | | |
| Intersection Capacity Utilization | 54.2% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 64 | 382 | 210 | 96 | 331 | 131 |
| Future Volume (vph) | 64 | 382 | 210 | 96 | 331 | 131 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.962 | |
| Flt Protected | 0.950 | | | | 0.965 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1613 | 0 |
| Flt Permitted | 0.492 | | | | 0.965 | |
| Satd. Flow (perm) | 848 | 1845 | 1528 | 1311 | 1613 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 96 | 21 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Adj. Flow (vph) | 64 | 382 | 210 | 96 | 331 | 131 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 64 | 382 | 210 | 96 | 462 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |



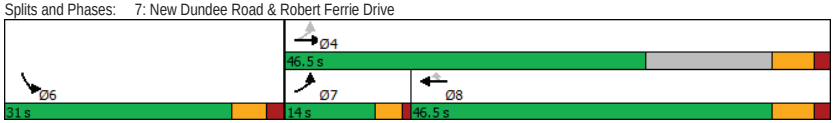


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 23.9 | 21.3 | 14.7 | 14.7 | 25.5 | |
| Actuated g/C Ratio | 0.40 | 0.36 | 0.25 | 0.25 | 0.43 | |
| v/c Ratio | 0.15 | 0.58 | 0.56 | 0.24 | 0.66 | |
| Control Delay | 10.7 | 18.4 | 27.2 | 6.8 | 21.7 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 10.7 | 18.4 | 27.2 | 6.8 | 21.7 | |
| LOS | B | B | C | A | C | |
| Approach Delay | | 17.3 | 20.8 | | 21.7 | |
| Approach LOS | | B | C | | C | |

**Intersection Summary**

Area Type: Other
Cycle Length: 91.5
Actuated Cycle Length: 59.6
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.66
Intersection Signal Delay: 19.9 Intersection LOS: B
Intersection Capacity Utilization 59.0% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
## 7: New Dundee Road & Robert Ferrie Drive

2033 Background - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 64 | 382 | 210 | 96 | 462 |
| v/c Ratio | 0.15 | 0.58 | 0.56 | 0.24 | 0.66 |
| Control Delay | 10.7 | 18.4 | 27.2 | 6.8 | 21.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 10.7 | 18.4 | 27.2 | 6.8 | 21.7 |
| Queue Length 50th (m) | 4.3 | 33.8 | 23.1 | 0.0 | 42.6 |
| Queue Length 95th (m) | 10.0 | 55.0 | 43.9 | 10.1 | #102.3 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 474 | 1645 | 1046 | 928 | 702 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.14 | 0.23 | 0.20 | 0.10 | 0.66 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 7: New Dundee Road & Robert Ferrie Drive

2033 Background - AM Peak Hour

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 64 | 382 | 210 | 96 | 331 | 131 |
| Future Volume (vph) | 64 | 382 | 210 | 96 | 331 | 131 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1613 | |
| Flt Permitted | 0.49 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 849 | 1845 | 1528 | 1311 | 1613 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 64 | 382 | 210 | 96 | 331 | 131 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 73 | 12 | 0 |
| Lane Group Flow (vph) | 64 | 382 | 210 | 23 | 450 | 0 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 23.1 | 23.1 | 14.7 | 14.7 | 25.5 | |
| Effective Green, g (s) | 23.1 | 23.1 | 14.7 | 14.7 | 25.5 | |
| Actuated g/C Ratio | 0.38 | 0.38 | 0.24 | 0.24 | 0.42 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 377 | 697 | 367 | 315 | 673 | |
| v/s Ratio Prot | 0.01 | c0.21 | 0.14 | | c0.28 | |
| v/s Ratio Perm | 0.05 | | | 0.02 | | |
| v/c Ratio | 0.17 | 0.55 | 0.57 | 0.07 | 0.67 | |
| Uniform Delay, d1 | 12.4 | 14.9 | 20.4 | 17.9 | 14.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.2 | 0.9 | 2.2 | 0.1 | 5.2 | |
| Delay (s) | 12.7 | 15.8 | 22.6 | 18.0 | 19.6 | |
| Level of Service | B | B | C | B | B | |
| Approach Delay (s) | | 15.3 | 21.2 | | 19.6 | |
| Approach LOS | | B | C | | B | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 18.4 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.67 | | |
| Actuated Cycle Length (s) | 61.1 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 59.0% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 342 | 82 | 13 | 231 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (vph) | 11 | 342 | 82 | 13 | 231 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.975 | | | 0.995 | | | 0.965 | | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.997 | | | 0.976 | | | 0.991 | |
| Satd. Flow (prot) | 0 | 1418 | 0 | 0 | 1425 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Flt Permitted | | 0.999 | | | 0.997 | | | 0.976 | | | 0.991 | |
| Satd. Flow (perm) | 0 | 1418 | 0 | 0 | 1425 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 18% | 6% | 7% | 23% | 7% | 10% | 0% | 4% | 33% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 342 | 82 | 13 | 231 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 435 | 0 | 0 | 254 | 0 | 0 | 92 | 0 | 0 | 65 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 52.3% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 11 | 342 | 82 | 13 | 231 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (Veh/h) | 11 | 342 | 82 | 13 | 231 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 342 | 82 | 13 | 231 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 241 | | | 424 | | | 700 | 672 | 383 | 702 | 708 | 236 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 241 | | | 424 | | | 700 | 672 | 383 | 702 | 708 | 236 |
| tC, single (s) | 4.3 | | | 4.3 | | | 7.1 | 6.5 | 6.5 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.4 | | | 3.5 | 4.0 | 3.6 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 99 | | | 86 | 94 | 96 | 96 | 88 | 99 |
| cM capacity (veh/h) | 1237 | | | 1031 | | | 315 | 367 | 601 | 319 | 354 | 808 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 435 | 254 | 92 | 65 |
| Volume Left | 11 | 13 | 45 | 12 |
| Volume Right | 82 | 10 | 24 | 12 |
| cSH | 1237 | 1031 | 375 | 387 |
| Volume to Capacity | 0.01 | 0.01 | 0.25 | 0.17 |
| Queue Length 95th (m) | 0.2 | 0.3 | 7.6 | 4.8 |
| Control Delay (s) | 0.3 | 0.6 | 17.7 | 16.2 |
| Lane LOS | A | A | C | C |
| Approach Delay (s) | 0.3 | 0.6 | 17.7 | 16.2 |
| Approach LOS | | | C | C |

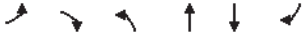
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 3.5 | | | |
| Intersection Capacity Utilization | 52.3% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.973 | | | | 0.932 | |
| Flt Protected | 0.962 | | | 0.994 | | |
| Satd. Flow (prot) | 1613 | 0 | 0 | 1585 | 1458 | 0 |
| Flt Permitted | 0.962 | | | 0.994 | | |
| Satd. Flow (perm) | 1613 | 0 | 0 | 1585 | 1458 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 0% | 0% | 4% | 9% | 2% |
| Adj. Flow (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 277 | 0 | 0 | 333 | 293 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |







| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 292 | 146 | 147 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 221 | 56 | 41 | 292 | 146 | 147 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 277 | 333 | 293 |
| Volume Left (vph) | 221 | 41 | 0 |
| Volume Right (vph) | 56 | 0 | 147 |
| Hadj (s) | 0.08 | 0.08 | -0.21 |
| Departure Headway (s) | 5.6 | 5.2 | 5.0 |
| Degree Utilization, x | 0.43 | 0.48 | 0.41 |
| Capacity (veh/h) | 603 | 650 | 681 |
| Control Delay (s) | 12.7 | 13.0 | 11.4 |
| Approach Delay (s) | 12.7 | 13.0 | 11.4 |
| Approach LOS | B | B | B |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 12.4 | | |
| Level of Service | B | | |
| Intersection Capacity Utilization | 66.4% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

## Lanes, Volumes, Timings
## 11: Biehn Drive & Carnydale Drive

2033 Background - AM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.867 | | 0.970 | | | |
| Flt Protected | 0.999 | | | | | 0.954 |
| Satd. Flow (prot) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Flt Permitted | 0.999 | | | | | 0.954 |
| Satd. Flow (perm) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 7% | 25% | 5% | 20% |
| Adj. Flow (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 309 | 0 | 18 | 0 | 0 | 169 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 11: Biehn Drive & Carnydale Drive

2033 Background - AM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (Veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 349 | 16 | | | 18 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 349 | 16 | | | 18 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 99 | 71 | | | 90 | |
| cM capacity (veh/h) | 584 | 1069 | | | 1579 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 309 | 18 | 169 |
| Volume Left | 4 | 0 | 164 |
| Volume Right | 305 | 4 | 0 |
| cSH | 1058 | 1700 | 1579 |
| Volume to Capacity | 0.29 | 0.01 | 0.10 |
| Queue Length 95th (m) | 9.8 | 0.0 | 2.8 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.6 | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 0.99 | |
| Frt | | 0.965 | | | | 0.850 | | 0.999 | | | 0.962 | |
| Flt Protected | 0.950 | | | | 0.994 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 1498 | 0 | 0 | 1500 | 1365 | 1519 | 1616 | 0 | 1519 | 1454 | 0 |
| Flt Permitted | 0.728 | | | | 0.974 | | 0.560 | | | 0.486 | | |
| Satd. Flow (perm) | 1224 | 1498 | 0 | 0 | 1467 | 1317 | 887 | 1616 | 0 | 775 | 1454 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 23 | | | | 74 | | 1 | | | 38 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 89 | 98 | 0 | 0 | 44 | 74 | 44 | 385 | 0 | 56 | 309 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |



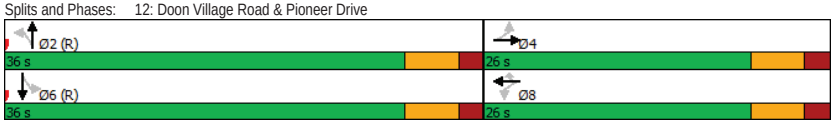


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.23 | 0.20 | | | 0.09 | 0.16 | 0.10 | 0.49 | | 0.15 | 0.43 | |
| Control Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.5 | 13.5 | | 10.2 | 11.3 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.5 | 13.5 | | 10.2 | 11.3 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.3 | | | 9.1 | | | 13.1 | | | 11.1 | |
| Approach LOS | | B | | | A | | | B | | | B | |

**Intersection Summary**

Area Type: Other
Cycle Length: 62
Actuated Cycle Length: 62
Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green
Natural Cycle: 65
Control Type: Pretimed
Maximum v/c Ratio: 0.49
Intersection Signal Delay: 12.4 — Intersection LOS: B
Intersection Capacity Utilization 73.3% — ICU Level of Service D
Analysis Period (min) 15

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2033 Background - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 89 | 98 | 44 | 74 | 44 | 385 | 56 | 309 |
| v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.10 | 0.49 | 0.15 | 0.43 |
| Control Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.5 | 13.5 | 10.2 | 11.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.5 | 13.5 | 10.2 | 11.3 |
| Queue Length 50th (m) | 7.7 | 6.3 | 3.6 | 0.0 | 2.7 | 29.2 | 3.5 | 19.2 |
| Queue Length 95th (m) | 17.5 | 16.1 | 9.9 | 7.7 | 7.6 | 50.6 | 9.5 | 36.9 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 394 | 498 | 473 | 474 | 429 | 782 | 375 | 723 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.10 | 0.49 | 0.15 | 0.43 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2033 Background - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1598 | 1498 | | | 1498 | 1317 | 1504 | 1616 | | 1515 | 1454 | |
| Flt Permitted | 0.73 | 1.00 | | | 0.97 | 1.00 | 0.56 | 1.00 | | 0.49 | 1.00 | |
| Satd. Flow (perm) | 1225 | 1498 | | | 1466 | 1317 | 887 | 1616 | | 774 | 1454 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 382 | 3 | 56 | 231 | 78 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 50 | 0 | 1 | 0 | 0 | 20 | 0 |
| Lane Group Flow (vph) | 89 | 82 | 0 | 0 | 44 | 24 | 44 | 384 | 0 | 56 | 289 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 395 | 483 | | | 472 | 424 | 429 | 781 | | 374 | 703 | |
| v/s Ratio Prot | | 0.06 | | | | | | c0.24 | | | 0.20 | |
| v/s Ratio Perm | c0.07 | | | | 0.03 | 0.02 | 0.05 | | | 0.07 | | |
| v/c Ratio | 0.23 | 0.17 | | | 0.09 | 0.06 | 0.10 | 0.49 | | 0.15 | 0.41 | |
| Uniform Delay, d1 | 15.3 | 15.1 | | | 14.7 | 14.5 | 8.7 | 10.8 | | 8.9 | 10.3 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.8 | | | 0.4 | 0.3 | 0.5 | 2.2 | | 0.8 | 1.8 | |
| Delay (s) | 16.7 | 15.8 | | | 15.1 | 14.7 | 9.2 | 13.1 | | 9.7 | 12.1 | |
| Level of Service | B | B | | | B | B | A | B | | A | B | |
| Approach Delay (s) | | 16.2 | | | 14.9 | | | 12.7 | | | 11.7 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 13.2 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.39 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 73.3% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and New Dundee.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:44:48 PM

### Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2033 | | | | | | |
| **Leg North** | 0.48 | 1.02 | 3.39 | 0.32 | A | 2.87 | A |
| **Leg West** | 0.37 | ~1 | 2.73 | 0.27 | A | | |
| **Leg East** | 0.21 | ~1 | 2.29 | 0.17 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM " model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:44:47 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FB 2033, AM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2033, AM | FB 2033 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 2.87 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Robert Ferrie Drive | |
| **West** | West | New Dundee Road | |
| **East** | East | New Dundee Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 462.00 | 100.000 |
| West | ONE HOUR | ✓ | 446.00 | 100.000 |
| East | ONE HOUR | ✓ | 306.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 131.000 | 331.000 |
| | West | 64.000 | 0.000 | 382.000 |
| | East | 96.000 | 210.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.28 | 0.72 |
| | West | 0.14 | 0.00 | 0.86 |
| | East | 0.31 | 0.69 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 1.000 | 1.030 | 1.010 |
| | West | 1.030 | 1.000 | 1.030 |
| | East | 1.070 | 1.080 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 3.0 | 1.0 |
| | West | 3.0 | 0.0 | 3.0 |
| | East | 7.0 | 8.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.32 | 3.39 | 0.48 | 1.02 | A | 423.94 | 635.91 | 33.06 | 3.12 | 0.37 | 33.06 | 3.12 |
| West | 0.27 | 2.73 | 0.37 | −1 | A | 409.26 | 613.89 | 25.96 | 2.54 | 0.29 | 25.96 | 2.54 |
| East | 0.17 | 2.29 | 0.21 | −1 | A | 280.79 | 421.19 | 15.54 | 2.21 | 0.17 | 15.54 | 2.21 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 347.82 | 86.95 | 346.72 | 120.16 | 157.72 | 0.00 | 1627.06 | 987.08 | 0.214 | 0.00 | 0.28 | 2.852 | A |
| West | 335.77 | 83.94 | 334.90 | 256.04 | 248.41 | 0.00 | 1918.25 | 1636.32 | 0.175 | 0.00 | 0.22 | 2.340 | A |
| East | 230.37 | 57.59 | 229.83 | 535.25 | 48.06 | 0.00 | 2041.36 | 1926.60 | 0.113 | 0.00 | 0.14 | 2.140 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 415.33 | 103.83 | 415.02 | 143.76 | 188.70 | 0.00 | 1610.03 | 987.08 | 0.258 | 0.28 | 0.35 | 3.059 | A |
| West | 400.94 | 100.24 | 400.71 | 306.38 | 297.34 | 0.00 | 1888.17 | 1636.32 | 0.212 | 0.22 | 0.28 | 2.492 | A |
| East | 275.09 | 68.77 | 274.96 | 640.55 | 57.50 | 0.00 | 2035.56 | 1926.60 | 0.135 | 0.14 | 0.17 | 2.201 | A |

#### Main results: (08:30-08:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 508.67 | 127.17 | 508.17 | 176.05 | 231.09 | 0.00 | 1586.74 | 987.08 | 0.321 | 0.35 | 0.48 | 3.387 | A |
| West | 491.06 | 122.76 | 490.68 | 375.18 | 364.08 | 0.00 | 1847.16 | 1636.32 | 0.266 | 0.28 | 0.37 | 2.733 | A |
| East | 336.91 | 84.23 | 336.73 | 784.34 | 70.41 | 0.00 | 2027.63 | 1926.60 | 0.166 | 0.17 | 0.21 | 2.292 | A |

#### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 508.67 | 127.17 | 508.67 | 176.16 | 231.21 | 0.00 | 1586.67 | 987.08 | 0.321 | 0.48 | 0.48 | 3.390 | A |
| West | 491.06 | 122.76 | 491.05 | 375.45 | 364.43 | 0.00 | 1846.95 | 1636.32 | 0.266 | 0.37 | 0.37 | 2.734 | A |
| East | 336.91 | 84.23 | 336.91 | 785.02 | 70.46 | 0.00 | 2027.59 | 1926.60 | 0.166 | 0.21 | 0.21 | 2.292 | A |

#### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 415.33 | 103.83 | 415.82 | 143.95 | 188.91 | 0.00 | 1609.92 | 987.08 | 0.258 | 0.48 | 0.35 | 3.062 | A |
| West | 400.94 | 100.24 | 401.32 | 306.82 | 297.92 | 0.00 | 1887.82 | 1636.32 | 0.212 | 0.37 | 0.28 | 2.494 | A |
| East | 275.09 | 68.77 | 275.27 | 641.65 | 57.59 | 0.00 | 2035.50 | 1926.60 | 0.135 | 0.21 | 0.17 | 2.203 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 347.82 | 86.95 | 348.13 | 120.53 | 158.19 | 0.00 | 1626.81 | 987.08 | 0.214 | 0.35 | 0.28 | 2.861 | A |
| West | 335.77 | 83.94 | 336.01 | 256.90 | 249.42 | 0.00 | 1917.63 | 1636.32 | 0.175 | 0.28 | 0.22 | 2.344 | A |
| East | 230.37 | 57.59 | 230.50 | 537.21 | 48.22 | 0.00 | 2041.26 | 1926.60 | 0.113 | 0.17 | 0.14 | 2.140 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.05 | 0.27 | 2.852 | A | A |
| West | 3.22 | 0.21 | 2.340 | A | A |
| East | 2.02 | 0.13 | 2.140 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.20 | 0.35 | 3.059 | A | A |
| West | 4.10 | 0.27 | 2.492 | A | A |
| East | 2.49 | 0.17 | 2.201 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 7.03 | 0.47 | 3.387 | A | A |
| West | 5.50 | 0.37 | 2.733 | A | A |
| East | 3.18 | 0.21 | 2.292 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 7.16 | 0.48 | 3.390 | A | A |
| West | 5.58 | 0.37 | 2.734 | A | A |
| East | 3.21 | 0.21 | 2.292 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.40 | 0.36 | 3.062 | A | A |
| West | 4.23 | 0.28 | 2.494 | A | A |
| East | 2.56 | 0.17 | 2.203 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.21 | 0.28 | 2.861 | A | A |
| West | 3.33 | 0.22 | 2.344 | A | A |
| East | 2.08 | 0.14 | 2.140 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)





| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.48 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.37 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.48 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| West | 0.37 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and New Dundee.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:44:34 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2033 | | | | | | |
| **Leg North** | 0.25 | -1 | 3.23 | 0.20 | A | 3.01 | A |
| **Leg West** | 0.24 | -1 | 2.32 | 0.19 | A | | |
| **Leg East** | 0.78 | 1.02 | 3.24 | 0.44 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM " model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:44:34 PM*

## File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - FB 2033, PM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2033, PM | FB 2033 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 3.01 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Robert Ferrie Drive | |
| West | West | New Dundee Road | |
| East | East | New Dundee Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| East | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity





#### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

#### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 253.00 | 100.000 |
| West | ONE HOUR | ✓ | 341.00 | 100.000 |
| East | ONE HOUR | ✓ | 792.00 | 100.000 |

# Turning Proportions

#### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 91.000 | 162.000 |
| | West | 105.000 | 0.000 | 236.000 |
| | East | 296.000 | 496.000 | 0.000 |

#### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.36 | 0.64 |
| | West | 0.31 | 0.00 | 0.69 |
| | East | 0.37 | 0.63 | 0.00 |

# Vehicle Mix

#### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | To | | | |
|---|---|---|---|---|
| | | North | West | East |

| | | | | |
|---|---|---|---|---|
| From | North | 1.000 | 1.020 | 1.020 |
| | West | 1.010 | 1.000 | 1.030 |
| | East | 1.010 | 1.020 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 2.0 | 2.0 |
| | West | 1.0 | 0.0 | 3.0 |
| | East | 1.0 | 2.0 | 0.0 |

# Results

## Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.20 | 3.23 | 0.25 | −1 | A | 232.16 | 348.24 | 17.45 | 3.01 | 0.19 | 17.45 | 3.01 |
| West | 0.19 | 2.32 | 0.24 | −1 | A | 312.91 | 469.36 | 17.36 | 2.22 | 0.19 | 17.36 | 2.22 |
| East | 0.44 | 3.24 | 0.78 | 1.02 | A | 726.75 | 1090.13 | 52.66 | 2.90 | 0.59 | 52.66 | 2.90 |

## Main Results for each time segment

### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 190.47 | 47.62 | 189.88 | 301.08 | 372.35 | 0.00 | 1509.10 | 1107.45 | 0.126 | 0.00 | 0.15 | 2.781 | A |
| West | 256.72 | 64.18 | 256.12 | 440.65 | 121.59 | 0.00 | 1996.18 | 1635.14 | 0.129 | 0.00 | 0.15 | 2.118 | A |
| East | 596.26 | 149.06 | 594.57 | 298.84 | 78.86 | 0.00 | 2022.43 | 1761.50 | 0.295 | 0.00 | 0.42 | 2.558 | A |

### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 227.44 | 56.86 | 227.28 | 360.25 | 445.57 | 0.00 | 1468.86 | 1107.44 | 0.155 | 0.15 | 0.19 | 2.957 | A |
| West | 306.55 | 76.64 | 306.41 | 527.32 | 145.53 | 0.00 | 1981.46 | 1635.14 | 0.155 | 0.15 | 0.19 | 2.200 | A |
| East | 711.99 | 178.00 | 711.47 | 357.59 | 94.35 | 0.00 | 2012.92 | 1761.50 | 0.354 | 0.42 | 0.55 | 2.809 | A |

### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 278.56 | 69.64 | 278.31 | 441.10 | 545.54 | 0.00 | 1413.92 | 1107.45 | 0.197 | 0.19 | 0.25 | 3.233 | A |
| West | 375.45 | 93.86 | 375.23 | 645.64 | 178.20 | 0.00 | 1961.39 | 1635.14 | 0.191 | 0.19 | 0.24 | 2.323 | A |
| East | 872.01 | 218.00 | 871.10 | 437.89 | 115.54 | 0.00 | 1999.89 | 1761.50 | 0.436 | 0.55 | 0.78 | 3.237 | A |

### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 278.56 | 69.64 | 278.56 | 441.51 | 546.10 | 0.00 | 1413.61 | 1107.45 | 0.197 | 0.25 | 0.25 | 3.234 | A |
| West | 375.45 | 93.86 | 375.45 | 646.29 | 178.36 | 0.00 | 1961.29 | 1635.14 | 0.191 | 0.24 | 0.24 | 2.323 | A |
| East | 872.01 | 218.00 | 872.00 | 438.20 | 115.61 | 0.00 | 1999.85 | 1761.50 | 0.436 | 0.78 | 0.78 | 3.243 | A |

### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 227.44 | 56.86 | 227.69 | 360.89 | 446.46 | 0.00 | 1468.37 | 1107.44 | 0.155 | 0.25 | 0.19 | 2.959 | A |
| West | 306.55 | 76.64 | 306.77 | 528.35 | 145.79 | 0.00 | 1981.30 | 1635.14 | 0.155 | 0.24 | 0.19 | 2.202 | A |
| East | 711.99 | 178.00 | 712.89 | 358.10 | 94.46 | 0.00 | 2012.85 | 1761.50 | 0.354 | 0.78 | 0.56 | 2.817 | A |





### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 190.47 | 47.62 | 190.63 | 302.14 | 373.75 | 0.00 | 1508.33 | 1107.45 | 0.126 | 0.19 | 0.15 | 2.788 | A |
| West | 256.72 | 64.18 | 256.87 | 442.31 | 122.06 | 0.00 | 1995.88 | 1635.14 | 0.129 | 0.19 | 0.15 | 2.120 | A |
| East | 596.26 | 149.06 | 596.79 | 299.84 | 79.09 | 0.00 | 2022.29 | 1761.50 | 0.295 | 0.56 | 0.43 | 2.566 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.17 | 0.14 | 2.781 | A | A |
| West | 2.23 | 0.15 | 2.118 | A | A |
| East | 6.23 | 0.42 | 2.558 | A | A |

### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.76 | 0.18 | 2.957 | A | A |
| West | 2.78 | 0.19 | 2.200 | A | A |
| East | 8.19 | 0.55 | 2.809 | A | A |

### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.69 | 0.25 | 3.233 | A | A |
| West | 3.59 | 0.24 | 2.323 | A | A |
| East | 11.50 | 0.77 | 3.237 | A | A |

### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.74 | 0.25 | 3.234 | A | A |
| West | 3.63 | 0.24 | 2.323 | A | A |
| East | 11.73 | 0.78 | 3.243 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.85 | 0.19 | 2.959 | A | A |
| West | 2.85 | 0.19 | 2.202 | A | A |
| East | 8.52 | 0.57 | 2.817 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.25 | 0.15 | 2.788 | A | A |
| West | 2.29 | 0.15 | 2.120 | A | A |
| East | 6.49 | 0.43 | 2.566 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.42 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.19 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.19 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.55 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.78 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.78 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.19 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.19 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.56 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.43 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 308 | 22 | 724 | 350 | 296 |
| Future Volume (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 308 | 22 | 724 | 350 | 296 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.97 | 1.00 | | 0.98 | 0.99 | 1.00 | | 1.00 | | 0.97 |
| Frt | | | 0.850 | | | 0.850 | | 0.990 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1670 | 3471 | 1488 | 1686 | 3438 | 1417 | 1670 | 3304 | 0 | 3146 | 1863 | 1458 |
| Flt Permitted | 0.089 | | | 0.133 | | | 0.353 | | | 0.950 | | |
| Satd. Flow (perm) | 156 | 3471 | 1447 | 236 | 3438 | 1387 | 614 | 3304 | 0 | 3130 | 1863 | 1410 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 450 | | | 461 | | 4 | | | | 247 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Adj. Flow (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 308 | 22 | 724 | 350 | 296 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 330 | 0 | 724 | 350 | 296 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

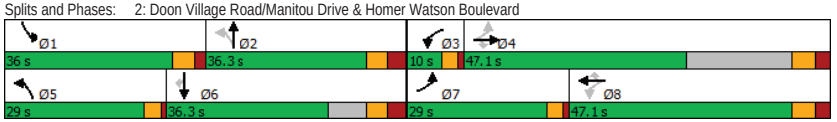




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 61.0 | 61.0 | 49.0 | 40.0 | 40.0 | 55.2 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Actuated g/C Ratio | 0.49 | 0.41 | 0.41 | 0.33 | 0.27 | 0.27 | 0.37 | 0.20 | | 0.20 | 0.26 | 0.26 |
| v/c Ratio | 0.95 | 0.82 | 0.73 | 0.32 | 1.18 | 0.79 | 0.82 | 0.51 | | 1.14 | 0.73 | 0.54 |
| Control Delay | 80.1 | 45.1 | 15.4 | 28.9 | 139.3 | 18.6 | 46.1 | 55.9 | | 132.8 | 61.3 | 13.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 80.1 | 45.1 | 15.4 | 28.9 | 139.3 | 18.6 | 46.1 | 55.9 | | 132.8 | 61.3 | 13.6 |
| LOS | F | D | B | C | F | B | D | E | | F | E | B |
| Approach Delay | | 41.5 | | | 96.6 | | | 51.1 | | | 88.8 | |
| Approach LOS | | D | | | F | | | D | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 148.4 | | | |
| Natural Cycle: 145 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.18 | | | |
| Intersection Signal Delay: 69.8 | | Intersection LOS: E | |
| Intersection Capacity Utilization 116.1% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Background - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 330 | 724 | 350 | 296 |
| v/c Ratio | 0.95 | 0.82 | 0.73 | 0.32 | 1.18 | 0.79 | 0.82 | 0.51 | 1.14 | 0.73 | 0.54 |
| Control Delay | 80.1 | 45.1 | 15.4 | 28.9 | 139.3 | 18.6 | 46.1 | 55.9 | 132.8 | 61.3 | 13.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 80.1 | 45.1 | 15.4 | 28.9 | 139.3 | 18.6 | 46.1 | 55.9 | 132.8 | 61.3 | 13.6 |
| Queue Length 50th (m) | 80.0 | 171.7 | 46.6 | 6.9 | ~213.1 | 28.4 | 65.2 | 48.0 | ~134.3 | 101.9 | 12.0 |
| Queue Length 95th (m) | #141.4 | 202.8 | 100.2 | 14.2 | #257.6 | 85.2 | #93.8 | 64.7 | #175.4 | #141.2 | 43.0 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 330 | 1426 | 859 | 136 | 926 | 710 | 414 | 648 | 635 | 478 | 545 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.95 | 0.82 | 0.73 | 0.32 | 1.18 | 0.79 | 0.77 | 0.51 | 1.14 | 0.73 | 0.54 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Background - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 308 | 22 | 724 | 350 | 296 |
| Future Volume (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 308 | 22 | 724 | 350 | 296 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1670 | 3471 | 1447 | 1686 | 3438 | 1387 | 1664 | 3304 | | 3146 | 1863 | 1410 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.13 | 1.00 | 1.00 | 0.35 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 157 | 3471 | 1447 | 236 | 3438 | 1387 | 619 | 3304 | | 3146 | 1863 | 1410 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 312 | 1168 | 625 | 43 | 1094 | 562 | 320 | 308 | 22 | 724 | 350 | 296 |
| RTOR Reduction (vph) | 0 | 0 | 266 | 0 | 0 | 335 | 0 | 3 | 0 | 0 | 0 | 184 |
| Lane Group Flow (vph) | 312 | 1168 | 359 | 43 | 1094 | 227 | 320 | 327 | 0 | 724 | 350 | 112 |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 51.9 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Effective Green, g (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 51.9 | 29.0 | | 30.0 | 38.1 | 38.1 |
| Actuated g/C Ratio | 0.47 | 0.41 | 0.41 | 0.31 | 0.27 | 0.27 | 0.35 | 0.19 | | 0.20 | 0.26 | 0.26 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 326 | 1419 | 591 | 118 | 940 | 379 | 375 | 642 | | 632 | 475 | 360 |
| v/s Ratio Prot | c0.16 | 0.34 | | 0.01 | c0.32 | | 0.13 | 0.10 | | c0.23 | 0.19 | |
| v/s Ratio Perm | 0.29 | | 0.25 | 0.10 | | 0.16 | c0.17 | | | | | 0.08 |
| v/c Ratio | 0.96 | 0.82 | 0.61 | 0.36 | 1.16 | 0.60 | 0.85 | 0.51 | | 1.15 | 0.74 | 0.31 |
| Uniform Delay, d1 | 47.4 | 39.3 | 34.7 | 38.2 | 54.2 | 47.1 | 39.9 | 53.7 | | 59.6 | 51.0 | 44.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 38.1 | 4.0 | 1.8 | 1.9 | 85.5 | 2.5 | 16.9 | 2.9 | | 83.2 | 9.8 | 2.2 |
| Delay (s) | 85.5 | 43.3 | 36.5 | 40.1 | 139.7 | 49.6 | 56.8 | 56.6 | | 142.8 | 60.8 | 47.2 |
| Level of Service | F | D | D | D | F | D | E | E | | F | E | D |
| Approach Delay (s) | | 47.5 | | | 107.4 | | | 56.7 | | | 101.2 | |
| Approach LOS | | D | | | F | | | E | | | F | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 78.6 | HCM 2000 Level of Service | E | |
| HCM 2000 Volume to Capacity ratio | 1.05 | | | |
| Actuated Cycle Length (s) | 149.2 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 116.1% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1788 | 6 | 2 | 1574 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1788 | 6 | 2 | 1574 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 0.99 | | | | | | | | | | |
| Frt | | | 0.850 | | | | | 0.999 | | | 0.984 | |
| Flt Protected | | 0.953 | | | 0.979 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1493 | 1417 | 0 | 1517 | 0 | 1670 | 3179 | 0 | 1686 | 3170 | 0 |
| Flt Permitted | | 0.726 | | | 0.896 | | 0.950 | | | 0.105 | | |
| Satd. Flow (perm) | 0 | 1131 | 1417 | 0 | 1389 | 0 | 1670 | 3179 | 0 | 186 | 3170 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 125 | | | | | | | | 13 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1788 | 6 | 2 | 1574 | 187 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 144 | 125 | 0 | 7 | 0 | 127 | 1794 | 0 | 2 | 1761 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

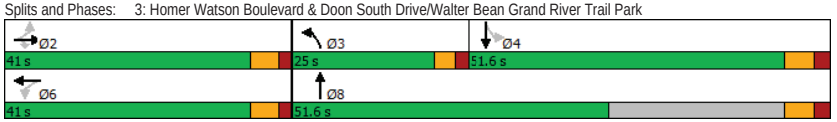




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.4 | 45.4 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| v/c Ratio | | 0.69 | 0.35 | | 0.03 | | 0.55 | 0.83 | | 0.02 | 1.14 | |
| Control Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 16.7 | | 18.0 | 95.2 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 16.7 | | 18.0 | 95.2 | |
| LOS | | D | A | | C | | D | B | | B | F | |
| Approach Delay | | 32.8 | | | 31.1 | | | 18.8 | | | 95.1 | |
| Approach LOS | | C | | | C | | | B | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 93.3 | | | |
| Natural Cycle: 110 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.14 | | | |
| Intersection Signal Delay: 53.7 | | Intersection LOS: D | |
| Intersection Capacity Utilization 101.6% | | ICU Level of Service G | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



| Lane Group | EBT | EBR | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 144 | 125 | 7 | 127 | 1794 | 2 | 1761 |
| v/c Ratio | 0.69 | 0.35 | 0.03 | 0.55 | 0.83 | 0.02 | 1.14 |
| Control Delay | 53.5 | 8.9 | 31.1 | 48.1 | 16.7 | 18.0 | 95.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.5 | 8.9 | 31.1 | 48.1 | 16.7 | 18.0 | 95.2 |
| Queue Length 50th (m) | 25.3 | 0.0 | 1.1 | 22.5 | 113.4 | 0.2 | ~201.7 |
| Queue Length 95th (m) | 48.8 | 14.7 | 5.0 | 44.9 | 205.5 | 1.9 | #313.5 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | 35.0 | |
| Base Capacity (vph) | 428 | 614 | 525 | 361 | 2407 | 90 | 1550 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.20 | 0.01 | 0.35 | 0.75 | 0.02 | 1.14 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1788 | 6 | 2 | 1574 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1788 | 6 | 2 | 1574 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | | 0.95 | 1.00 | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1487 | 1417 | | 1517 | | 1670 | 3181 | | 1686 | 3170 | |
| Flt Permitted | | 0.73 | 1.00 | | 0.90 | | 0.95 | 1.00 | | 0.10 | 1.00 | |
| Satd. Flow (perm) | | 1132 | 1417 | | 1389 | | 1670 | 3181 | | 186 | 3170 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1788 | 6 | 2 | 1574 | 187 |
| RTOR Reduction (vph) | 0 | 0 | 102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 0 | 144 | 23 | 0 | 7 | 0 | 127 | 1794 | 0 | 2 | 1754 | 0 |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Effective Green, g (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Grp Cap (vph) | | 208 | 261 | | 256 | | 231 | 2163 | | 90 | 1547 | |
| v/s Ratio Prot | | | | | | | 0.08 | c0.56 | | | c0.55 | |
| v/s Ratio Perm | | c0.13 | 0.02 | | 0.01 | | | | | 0.01 | | |
| v/c Ratio | | 0.69 | 0.09 | | 0.03 | | 0.55 | 0.83 | | 0.02 | 1.13 | |
| Uniform Delay, d1 | | 35.5 | 31.5 | | 31.1 | | 37.4 | 10.9 | | 12.3 | 23.9 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 9.5 | 0.1 | | 0.0 | | 2.7 | 3.9 | | 0.5 | 68.9 | |
| Delay (s) | | 45.1 | 31.6 | | 31.2 | | 40.1 | 14.8 | | 12.8 | 92.8 | |
| Level of Service | | D | C | | C | | D | B | | B | F | |
| Approach Delay (s) | | 38.8 | | | 31.2 | | | 16.5 | | | 92.7 | |
| Approach LOS | | D | | | C | | | B | | | F | |

Intersection Summary

| | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 51.9 | HCM 2000 Level of Service | D |
| HCM 2000 Volume to Capacity ratio | 1.01 | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | 17.6 |
| Intersection Capacity Utilization | 101.6% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 240 | 31 | 95 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| Future Volume (vph) | 240 | 31 | 95 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.98 | | 0.99 | | 0.97 | | | 0.99 | 1.00 | | 0.98 |
| Frt | | 0.887 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 2574 | 0 | 1576 | 1827 | 1340 | 1547 | 4940 | 1377 | 2870 | 3471 | 1458 |
| Flt Permitted | 0.721 | | | 0.481 | | | 0.096 | | | 0.950 | | |
| Satd. Flow (perm) | 1215 | 2574 | 0 | 788 | 1827 | 1306 | 156 | 4940 | 1359 | 2869 | 3471 | 1425 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 95 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Adj. Flow (vph) | 240 | 31 | 95 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 240 | 126 | 0 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

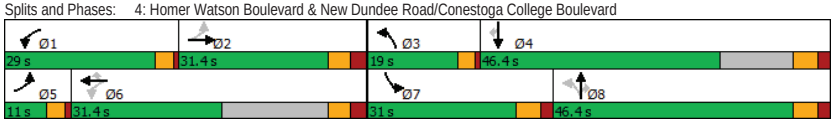




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 16.8 | 7.3 | | 21.8 | 10.2 | 10.2 | 57.9 | 41.8 | 41.8 | 10.3 | 40.4 | 40.4 |
| Actuated g/C Ratio | 0.18 | 0.08 | | 0.24 | 0.11 | 0.11 | 0.63 | 0.45 | 0.45 | 0.11 | 0.44 | 0.44 |
| v/c Ratio | 0.96 | 0.43 | | 0.56 | 0.27 | 0.44 | 0.65 | 0.70 | 0.13 | 0.33 | 1.02 | 0.09 |
| Control Delay | 82.5 | 19.1 | | 36.4 | 40.6 | 10.2 | 28.1 | 23.0 | 0.4 | 42.2 | 56.1 | 0.2 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 82.5 | 19.1 | | 36.4 | 40.6 | 10.2 | 28.1 | 23.0 | 0.4 | 42.2 | 56.1 | 0.2 |
| LOS | F | B | | D | D | B | C | C | A | D | E | A |
| Approach Delay | | 60.7 | | | 27.5 | | | 22.4 | | | 53.3 | |
| Approach LOS | | E | | | C | | | C | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 92.2 | | | |
| Natural Cycle: 130 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.02 | | | |
| Intersection Signal Delay: 38.5 | | Intersection LOS: D | |
| Intersection Capacity Utilization 97.8% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 240 | 126 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| v/c Ratio | 0.96 | 0.43 | 0.56 | 0.27 | 0.44 | 0.65 | 0.70 | 0.13 | 0.33 | 1.02 | 0.09 |
| Control Delay | 82.5 | 19.1 | 36.4 | 40.6 | 10.2 | 28.1 | 23.0 | 0.4 | 42.2 | 56.1 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 82.5 | 19.1 | 36.4 | 40.6 | 10.2 | 28.1 | 23.0 | 0.4 | 42.2 | 56.1 | 0.2 |
| Queue Length 50th (m) | 39.7 | 2.9 | 23.4 | 9.7 | 0.0 | 18.2 | 81.8 | 0.0 | 9.6 | ~165.2 | 0.0 |
| Queue Length 95th (m) | #88.4 | 12.2 | 40.7 | 20.9 | 11.7 | #48.2 | 117.7 | 0.3 | 18.9 | #235.6 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 251 | 769 | 439 | 854 | 684 | 327 | 2238 | 708 | 781 | 1964 | 859 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.96 | 0.16 | 0.34 | 0.06 | 0.17 | 0.61 | 0.70 | 0.13 | 0.14 | 0.79 | 0.07 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 240 | 31 | 95 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| Future Volume (vph) | 240 | 31 | 95 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.89 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1612 | 2584 | | 1570 | 1827 | 1312 | 1547 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Flt Permitted | 0.72 | 1.00 | | 0.48 | 1.00 | 1.00 | 0.10 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1224 | 2584 | | 795 | 1827 | 1312 | 156 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 240 | 31 | 95 | 150 | 55 | 118 | 199 | 1577 | 94 | 106 | 1550 | 60 |
| RTOR Reduction (vph) | 0 | 87 | 0 | 0 | 0 | 105 | 0 | 0 | 51 | 0 | 0 | 34 |
| Lane Group Flow (vph) | 240 | 39 | 0 | 150 | 55 | 13 | 199 | 1577 | 43 | 106 | 1550 | 26 |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 14.3 | 7.3 | | 20.1 | 10.2 | 10.2 | 55.5 | 41.8 | 41.8 | 10.3 | 40.4 | 40.4 |
| Effective Green, g (s) | 14.3 | 7.3 | | 20.1 | 10.2 | 10.2 | 55.5 | 41.8 | 41.8 | 10.3 | 40.4 | 40.4 |
| Actuated g/C Ratio | 0.16 | 0.08 | | 0.22 | 0.11 | 0.11 | 0.60 | 0.45 | 0.45 | 0.11 | 0.44 | 0.44 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 219 | 204 | | 256 | 202 | 145 | 300 | 2242 | 616 | 320 | 1522 | 627 |
| v/s Ratio Prot | c0.08 | 0.01 | | c0.06 | 0.03 | | c0.10 | 0.32 | | 0.04 | c0.45 | |
| v/s Ratio Perm | c0.09 | | | 0.06 | | 0.01 | 0.30 | | 0.03 | | | 0.02 |
| v/c Ratio | 1.10 | 0.19 | | 0.59 | 0.27 | 0.09 | 0.66 | 0.70 | 0.07 | 0.33 | 1.02 | 0.04 |
| Uniform Delay, d1 | 38.4 | 39.6 | | 31.2 | 37.5 | 36.8 | 21.3 | 20.2 | 14.2 | 37.7 | 25.8 | 14.8 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 88.8 | 0.5 | | 2.2 | 0.7 | 0.3 | 5.4 | 1.9 | 0.2 | 0.6 | 27.8 | 0.1 |
| Delay (s) | 127.2 | 40.1 | | 33.4 | 38.3 | 37.1 | 26.8 | 22.1 | 14.4 | 38.3 | 53.6 | 14.9 |
| Level of Service | F | D | | C | D | D | C | C | B | D | D | B |
| Approach Delay (s) | | 97.2 | | | 35.6 | | | 22.2 | | | 51.3 | |
| Approach LOS | | F | | | D | | | C | | | D | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 41.3 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 0.96 | | | |
| Actuated Cycle Length (s) | 92.1 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 97.8% | ICU Level of Service | F | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 51 | 0 | 374 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 55 |
| Future Volume (vph) | 51 | 0 | 374 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 55 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1621 | 0 | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | 0 | 0 | 5036 | 1458 |
| Flt Permitted | 0.193 | | | 0.950 | | | 0.111 | | | | | |
| Satd. Flow (perm) | 329 | 0 | 1458 | 1637 | 1881 | 1390 | 191 | 3438 | 0 | 0 | 5036 | 1458 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 219 | | | 434 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Adj. Flow (vph) | 51 | 0 | 374 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 55 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 51 | 0 | 374 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 55 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

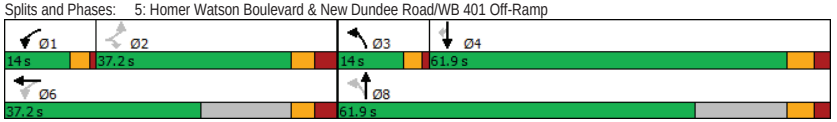




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.1 | | 30.1 | 47.4 | 44.2 | 115.1 | 59.7 | 56.7 | | | 42.7 | 42.7 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.41 | 0.38 | 1.00 | 0.52 | 0.49 | | | 0.37 | 0.37 |
| v/c Ratio | 0.59 | | 0.69 | 0.39 | 0.87 | 0.73 | 1.07 | 0.48 | | | 0.67 | 0.09 |
| Control Delay | 70.7 | | 23.8 | 27.5 | 48.1 | 3.3 | 105.2 | 20.1 | | | 32.0 | 0.4 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 70.7 | | 23.8 | 27.5 | 48.1 | 3.3 | 105.2 | 20.1 | | | 32.0 | 0.4 |
| LOS | E | | C | C | D | A | F | C | | | C | A |
| Approach Delay | | 29.4 | | | 21.4 | | | 39.6 | | | 30.7 | |
| Approach LOS | | C | | | C | | | D | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 115.1 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 1.07 | | | |
| Intersection Signal Delay: 28.8 | | Intersection LOS: C | |
| Intersection Capacity Utilization 93.3% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Background - PM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 51 | 374 | 264 | 626 | 1009 | 241 | 811 | 1256 | 55 |
| v/c Ratio | 0.59 | 0.69 | 0.39 | 0.87 | 0.73 | 1.07 | 0.48 | 0.67 | 0.09 |
| Control Delay | 70.7 | 23.8 | 27.5 | 48.1 | 3.3 | 105.2 | 20.1 | 32.0 | 0.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 70.7 | 23.8 | 27.5 | 48.1 | 3.3 | 105.2 | 20.1 | 32.0 | 0.4 |
| Queue Length 50th (m) | 10.5 | 32.3 | 42.8 | 134.0 | 0.0 | ~42.3 | 64.7 | 90.0 | 0.0 |
| Queue Length 95th (m) | #35.1 | 77.9 | 77.2 | #238.3 | 0.0 | #99.6 | 80.5 | 105.3 | 0.5 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 86 | 543 | 674 | 722 | 1390 | 225 | 2070 | 2417 | 754 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.59 | 0.69 | 0.39 | 0.87 | 0.73 | 1.07 | 0.39 | 0.52 | 0.07 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



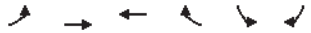
## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Background - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 51 | 0 | 374 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 55 |
| Future Volume (vph) | 51 | 0 | 374 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 55 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1621 | | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | | | 5036 | 1458 |
| Flt Permitted | 0.19 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.11 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 330 | | 1458 | 1637 | 1881 | 1390 | 192 | 3438 | | | 5036 | 1458 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 51 | 0 | 374 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 55 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| Lane Group Flow (vph) | 51 | 0 | 213 | 264 | 626 | 1009 | 241 | 811 | 0 | 0 | 1256 | 20 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 115.0 | 56.7 | 56.7 | | | 42.7 | 42.7 |
| Effective Green, g (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 115.0 | 56.7 | 56.7 | | | 42.7 | 42.7 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.38 | 0.38 | 1.00 | 0.49 | 0.49 | | | 0.37 | 0.37 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 86 | | 382 | 629 | 722 | 1390 | 220 | 1695 | | | 1869 | 541 |
| v/s Ratio Prot | | | | 0.04 | c0.33 | | c0.10 | 0.24 | | | 0.25 | |
| v/s Ratio Perm | 0.15 | | 0.15 | 0.12 | | c0.73 | c0.44 | | | | | 0.01 |
| v/c Ratio | 0.59 | | 0.56 | 0.42 | 0.87 | 0.73 | 1.10 | 0.48 | | | 0.67 | 0.04 |
| Uniform Delay, d1 | 37.0 | | 36.6 | 26.0 | 32.7 | 0.0 | 25.7 | 19.3 | | | 30.3 | 23.1 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 26.6 | | 5.7 | 0.9 | 13.3 | 3.3 | 88.5 | 0.4 | | | 1.3 | 0.1 |
| Delay (s) | 63.7 | | 42.4 | 26.9 | 46.0 | 3.3 | 114.2 | 19.8 | | | 31.5 | 23.1 |
| Level of Service | E | | D | C | D | A | F | B | | | C | C |
| Approach Delay (s) | | 44.9 | | | 20.7 | | | 41.4 | | | 31.2 | |
| Approach LOS | | D | | | C | | | D | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 30.5 | HCM 2000 Level of Service | C | | |
| HCM 2000 Volume to Capacity ratio | 1.07 | | | | |
| Actuated Cycle Length (s) | 115.0 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 93.3% | ICU Level of Service | F | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

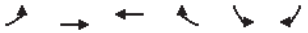


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 11 | 503 | 895 | 97 | 52 | 12 |
| Future Volume (vph) | 11 | 503 | 895 | 97 | 52 | 12 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.987 | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.961 | |
| Satd. Flow (prot) | 0 | 1601 | 1598 | 0 | 1654 | 0 |
| Flt Permitted | | 0.999 | | | 0.961 | |
| Satd. Flow (perm) | 0 | 1601 | 1598 | 0 | 1654 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 3% | 2% | 1% | 0% | 0% |
| Adj. Flow (vph) | 11 | 503 | 895 | 97 | 52 | 12 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 514 | 992 | 0 | 64 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 71.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |







| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 11 | 503 | 895 | 97 | 52 | 12 |
| Future Volume (Veh/h) | 11 | 503 | 895 | 97 | 52 | 12 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 503 | 895 | 97 | 52 | 12 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 992 | | | | 1468 | 944 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 992 | | | | 1468 | 944 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 98 | | | | 63 | 96 |
| cM capacity (veh/h) | 705 | | | | 140 | 321 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 514 | 992 | 64 |
| Volume Left | 11 | 0 | 52 |
| Volume Right | 0 | 97 | 12 |
| cSH | 705 | 1700 | 156 |
| Volume to Capacity | 0.02 | 0.58 | 0.41 |
| Queue Length 95th (m) | 0.4 | 0.0 | 14.4 |
| Control Delay (s) | 0.4 | 0.0 | 43.1 |
| Lane LOS | A | | E |
| Approach Delay (s) | 0.4 | 0.0 | 43.1 |
| Approach LOS | | | E |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 1.9 | | |
| Intersection Capacity Utilization | 71.6% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 105 | 236 | 496 | 296 | 162 | 91 |
| Future Volume (vph) | 105 | 236 | 496 | 296 | 162 | 91 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.951 | |
| Flt Protected | 0.950 | | | | 0.969 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1595 | 0 |
| Flt Permitted | 0.235 | | | | 0.969 | |
| Satd. Flow (perm) | 413 | 1845 | 1618 | 1389 | 1595 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 172 | 30 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Adj. Flow (vph) | 105 | 236 | 496 | 296 | 162 | 91 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 105 | 236 | 496 | 296 | 253 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |

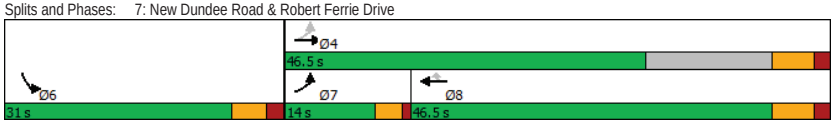




| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 40.5 | 37.9 | 27.9 | 27.9 | 26.0 | |
| Actuated g/C Ratio | 0.53 | 0.49 | 0.36 | 0.36 | 0.34 | |
| v/c Ratio | 0.29 | 0.26 | 0.84 | 0.48 | 0.45 | |
| Control Delay | 9.9 | 10.8 | 36.9 | 10.7 | 24.5 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 9.9 | 10.8 | 36.9 | 10.7 | 24.5 | |
| LOS | A | B | D | B | C | |
| Approach Delay | | 10.5 | 27.1 | | 24.5 | |
| Approach LOS | | B | C | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 91.5 | | | |
| Actuated Cycle Length: 76.9 | | | |
| Natural Cycle: 80 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.84 | | | |
| Intersection Signal Delay: 22.5 | | Intersection LOS: C | |
| Intersection Capacity Utilization 65.7% | | ICU Level of Service C | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
### 7: New Dundee Road & Robert Ferrie Drive



| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 105 | 236 | 496 | 296 | 253 |
| v/c Ratio | 0.29 | 0.26 | 0.84 | 0.48 | 0.45 |
| Control Delay | 9.9 | 10.8 | 36.9 | 10.7 | 24.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 9.9 | 10.8 | 36.9 | 10.7 | 24.5 |
| Queue Length 50th (m) | 7.2 | 19.0 | 72.3 | 13.8 | 28.8 |
| Queue Length 95th (m) | 13.8 | 30.9 | 110.8 | 34.0 | 60.2 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 387 | 1336 | 874 | 829 | 558 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.27 | 0.18 | 0.57 | 0.36 | 0.45 |

| Intersection Summary |
|---|



## HCM Signalized Intersection Capacity Analysis
### 7: New Dundee Road & Robert Ferrie Drive



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 105 | 236 | 496 | 296 | 162 | 91 |
| Future Volume (vph) | 105 | 236 | 496 | 296 | 162 | 91 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1595 | |
| Flt Permitted | 0.24 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 413 | 1845 | 1618 | 1389 | 1595 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 105 | 236 | 496 | 296 | 162 | 91 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 110 | 20 | 0 |
| Lane Group Flow (vph) | 105 | 236 | 496 | 186 | 233 | 0 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 38.9 | 38.9 | 27.9 | 27.9 | 26.0 | |
| Effective Green, g (s) | 38.9 | 38.9 | 27.9 | 27.9 | 26.0 | |
| Actuated g/C Ratio | 0.50 | 0.50 | 0.36 | 0.36 | 0.34 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 321 | 927 | 583 | 500 | 535 | |
| v/s Ratio Prot | c0.03 | 0.13 | c0.31 | | c0.15 | |
| v/s Ratio Perm | 0.13 | | | 0.13 | | |
| v/c Ratio | 0.33 | 0.25 | 0.85 | 0.37 | 0.44 | |
| Uniform Delay, d1 | 12.2 | 11.0 | 22.8 | 18.3 | 20.0 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.6 | 0.1 | 11.4 | 0.5 | 2.6 | |
| Delay (s) | 12.8 | 11.1 | 34.3 | 18.7 | 22.6 | |
| Level of Service | B | B | C | B | C | |
| Approach Delay (s) | | 11.6 | 28.5 | | 22.6 | |
| Approach LOS | | B | C | | C | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 23.2 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.61 | | |
| Actuated Cycle Length (s) | 77.4 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 65.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |
| c Critical Lane Group | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 356 | 89 | 20 | 407 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (vph) | 26 | 356 | 89 | 20 | 407 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.974 | | | 0.995 | | | 0.984 | | | 0.955 | |
| Flt Protected | | 0.997 | | | 0.998 | | | 0.979 | | | 0.997 | |
| Satd. Flow (prot) | 0 | 1488 | 0 | 0 | 1492 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Flt Permitted | | 0.997 | | | 0.998 | | | 0.979 | | | 0.997 | |
| Satd. Flow (perm) | 0 | 1488 | 0 | 0 | 1492 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 1% | 2% | 10% | 3% | 0% | 3% | 0% | 0% | 0% | 3% | 0% |
| Adj. Flow (vph) | 26 | 356 | 89 | 20 | 407 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 471 | 0 | 0 | 445 | 0 | 0 | 162 | 0 | 0 | 57 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 65.6% | | ICU Level of Service C | |
| Analysis Period (min) 15 | | | |





| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 26 | 356 | 89 | 20 | 407 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (Veh/h) | 26 | 356 | 89 | 20 | 407 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 26 | 356 | 89 | 20 | 407 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 425 | | | 445 | | | 944 | 918 | 400 | 965 | 953 | 416 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 425 | | | 445 | | | 944 | 918 | 400 | 965 | 953 | 416 |
| tC, single (s) | 4.1 | | | 4.2 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.3 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 98 | | | 98 | | | 66 | 71 | 97 | 98 | 86 | 97 |
| cM capacity (veh/h) | 1145 | | | 1074 | | | 203 | 263 | 654 | 174 | 247 | 641 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 471 | 445 | 162 | 57 |
| Volume Left | 26 | 20 | 68 | 4 |
| Volume Right | 89 | 18 | 19 | 19 |
| cSH | 1145 | 1074 | 249 | 300 |
| Volume to Capacity | 0.02 | 0.02 | 0.65 | 0.19 |
| Queue Length 95th (m) | 0.6 | 0.5 | 32.5 | 5.5 |
| Control Delay (s) | 0.7 | 0.6 | 42.8 | 19.8 |
| Lane LOS | A | A | E | C |
| Approach Delay (s) | 0.7 | 0.6 | 42.8 | 19.8 |
| Approach LOS | | | E | C |

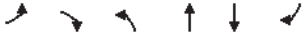
| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | | 7.6 | | |
| Intersection Capacity Utilization | | 65.6% | ICU Level of Service | C |
| Analysis Period (min) | | 15 | | |

| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.983 | | | | 0.935 | |
| Flt Protected | 0.958 | | | 0.991 | | |
| Satd. Flow (prot) | 1662 | 0 | 0 | 1603 | 1520 | 0 |
| Flt Permitted | 0.958 | | | 0.991 | | |
| Satd. Flow (perm) | 1662 | 0 | 0 | 1603 | 1520 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | 2 | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 245 | 0 | 0 | 276 | 603 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 81.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |







| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 226 | 312 | 291 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 215 | 30 | 50 | 226 | 312 | 291 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 245 | 276 | 603 |
| Volume Left (vph) | 215 | 50 | 0 |
| Volume Right (vph) | 30 | 0 | 291 |
| Hadj (s) | 0.10 | 0.07 | -0.26 |
| Departure Headway (s) | 6.2 | 5.6 | 4.9 |
| Degree Utilization, x | 0.42 | 0.43 | 0.82 |
| Capacity (veh/h) | 546 | 602 | 725 |
| Control Delay (s) | 13.6 | 12.8 | 25.9 |
| Approach Delay (s) | 13.6 | 12.8 | 25.9 |
| Approach LOS | B | B | D |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 20.0 | | |
| Level of Service | C | | |
| Intersection Capacity Utilization | 81.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

## Lanes, Volumes, Timings
## 11: Biehn Drive & Carnydale Drive

2033 Background - PM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.868 | | 0.983 | | | |
| Flt Protected | 0.999 | | | | | 0.955 |
| Satd. Flow (prot) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Flt Permitted | 0.999 | | | | | 0.955 |
| Satd. Flow (perm) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Confl. Peds. (#/hr) | 49 | | | 7 | 7 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 5% | 0% |
| Adj. Flow (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 276 | 0 | 16 | 0 | 0 | 221 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 11: Biehn Drive & Carnydale Drive

2033 Background - PM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (Veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Pedestrians | 7 | | 49 | | | |
| Lane Width (m) | 3.6 | | 3.6 | | | |
| Walking Speed (m/s) | 1.2 | | 1.2 | | | |
| Percent Blockage | 1 | | 4 | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 500 | 22 | | | 23 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 500 | 22 | | | 23 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 98 | 74 | | | 87 | |
| cM capacity (veh/h) | 441 | 1055 | | | 1564 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 276 | 16 | 221 |
| Volume Left | 7 | 0 | 208 |
| Volume Right | 269 | 2 | 0 |
| cSH | 1019 | 1700 | 1564 |
| Volume to Capacity | 0.27 | 0.01 | 0.13 |
| Queue Length 95th (m) | 8.8 | 0.0 | 3.7 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.4 | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.976 | | | | 0.850 | | 0.995 | | | 0.980 | |
| Flt Protected | 0.950 | | | | 0.990 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1653 | 1587 | 0 | 0 | 1621 | 1430 | 1686 | 1579 | 0 | 1621 | 1574 | 0 |
| Flt Permitted | 0.678 | | | | 0.935 | | 0.372 | | | 0.529 | | |
| Satd. Flow (perm) | 1164 | 1587 | 0 | 0 | 1526 | 1380 | 656 | 1579 | 0 | 900 | 1574 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 14 | | | | 101 | | 4 | | | 18 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 63 | 86 | 0 | 0 | 123 | 101 | 13 | 340 | 0 | 135 | 508 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

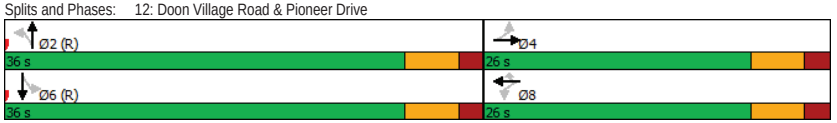




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.17 | 0.17 | | | 0.25 | 0.20 | 0.04 | 0.44 | | 0.31 | 0.66 | |
| Control Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.0 | 12.7 | | 12.2 | 16.8 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.0 | 12.7 | | 12.2 | 16.8 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.1 | | | 11.7 | | | 12.6 | | | 15.8 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.66 | | | |
| Intersection Signal Delay: 14.2 | | Intersection LOS: B | |
| Intersection Capacity Utilization 73.3% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2033 Background - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 63 | 86 | 123 | 101 | 13 | 340 | 135 | 508 |
| v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.04 | 0.44 | 0.31 | 0.66 |
| Control Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.0 | 12.7 | 12.2 | 16.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.0 | 12.7 | 12.2 | 16.8 |
| Queue Length 50th (m) | 5.3 | 6.1 | 10.7 | 0.0 | 0.8 | 24.7 | 9.2 | 41.6 |
| Queue Length 95th (m) | 13.4 | 15.0 | 22.3 | 8.9 | 3.3 | 43.8 | 20.4 | 72.9 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 375 | 521 | 492 | 513 | 317 | 766 | 435 | 770 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.04 | 0.44 | 0.31 | 0.66 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2033 Background - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1632 | 1587 | | | 1616 | 1380 | 1675 | 1579 | | 1616 | 1573 | |
| Flt Permitted | 0.68 | 1.00 | | | 0.93 | 1.00 | 0.37 | 1.00 | | 0.53 | 1.00 | |
| Satd. Flow (perm) | 1164 | 1587 | | | 1526 | 1380 | 656 | 1579 | | 901 | 1573 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 328 | 12 | 135 | 439 | 69 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 0 | 68 | 0 | 2 | 0 | 0 | 9 | 0 |
| Lane Group Flow (vph) | 63 | 77 | 0 | 0 | 123 | 33 | 13 | 338 | 0 | 135 | 499 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 375 | 511 | | | 492 | 445 | 317 | 764 | | 435 | 761 | |
| v/s Ratio Prot | | 0.05 | | | | | | 0.21 | | | c0.32 | |
| v/s Ratio Perm | 0.05 | | | | c0.08 | 0.02 | 0.02 | | | 0.15 | | |
| v/c Ratio | 0.17 | 0.15 | | | 0.25 | 0.07 | 0.04 | 0.44 | | 0.31 | 0.66 | |
| Uniform Delay, d1 | 15.0 | 14.9 | | | 15.5 | 14.6 | 8.4 | 10.5 | | 9.7 | 12.1 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.6 | | | 1.2 | 0.3 | 0.2 | 1.9 | | 1.9 | 4.4 | |
| Delay (s) | 16.0 | 15.6 | | | 16.7 | 14.9 | 8.7 | 12.4 | | 11.6 | 16.5 | |
| Level of Service | B | B | | | B | B | A | B | | B | B | |
| Approach Delay (s) | | 15.8 | | | 15.9 | | | 12.2 | | | 15.4 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 14.7 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.49 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 73.3% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:52:11 PM

## Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2033 | | | | | | |
| Leg North | 0.09 | ~1 | 2.48 | 0.07 | A | 2.80 | A |
| Leg West | 0.68 | 1.06 | 2.94 | 0.39 | A | | |
| Leg South | 0.17 | ~1 | 2.77 | 0.14 | A | | |
| Leg East | 0.25 | ~1 | 2.61 | 0.18 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM " model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:52:10 PM*

## File summary

| | |
|---|---|
| Title | (untitled) |
| Location | |
| Site Number | |
| Date | 2023-12-13 |
| Version | |
| Status | (new file) |
| Identifier | |
| Client | |
| Jobnumber | |
| Analyst | AdamMorrison |
| Description | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FB 2033, AM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2033, AM | FB 2033 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 2.80 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Strasburg Road | |
| West | West | Huron Road | |
| South | South | Strasburg Road | |
| East | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| South | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| South | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

#### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| **North** | Percentage | ROW Standard | | 90.00 |
| **West** | Percentage | ROW Standard | | 90.00 |
| **South** | Percentage | ROW Standard | | 90.00 |
| **East** | Percentage | ROW Standard | | 90.00 |

#### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| **North** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **West** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **South** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **East** | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| **North** | ONE HOUR | ✓ | 120.00 | 100.000 |
| **West** | ONE HOUR | ✓ | 763.00 | 100.000 |
| **South** | ONE HOUR | ✓ | 205.00 | 100.000 |
| **East** | ONE HOUR | ✓ | 319.00 | 100.000 |

# Turning Proportions

#### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.000 | 71.000 | 19.000 | 30.000 |
| | **West** | 210.000 | 0.000 | 31.000 | 522.000 |
| | **South** | 57.000 | 52.000 | 0.000 | 96.000 |
| | **East** | 70.000 | 224.000 | 25.000 | 0.000 |

#### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.00 | 0.59 | 0.16 | 0.25 |
| | **West** | 0.28 | 0.00 | 0.04 | 0.68 |
| | **South** | 0.28 | 0.25 | 0.00 | 0.47 |
| | **East** | 0.22 | 0.70 | 0.08 | 0.00 |





# Vehicle Mix

#### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 1.000 | 1.190 | 1.350 | 1.370 |
| | **West** | 1.050 | 1.000 | 1.210 | 1.050 |
| | **South** | 1.150 | 1.040 | 1.000 | 1.000 |
| | **East** | 1.250 | 1.130 | 1.090 | 1.000 |

#### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.0 | 19.0 | 35.0 | 37.0 |
| | **West** | 5.0 | 0.0 | 21.0 | 5.0 |
| | **South** | 15.0 | 4.0 | 0.0 | 0.0 |
| | **East** | 25.0 | 13.0 | 9.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.07 | 2.48 | 0.09 | −1 | A | 110.11 | 165.17 | 6.61 | 2.40 | 0.07 | 6.61 | 2.40 |
| **West** | 0.39 | 2.94 | 0.68 | 1.06 | A | 700.14 | 1050.21 | 46.72 | 2.67 | 0.52 | 46.72 | 2.67 |
| **South** | 0.14 | 2.77 | 0.17 | −1 | A | 188.11 | 282.17 | 11.99 | 2.55 | 0.13 | 11.99 | 2.55 |
| **East** | 0.18 | 2.61 | 0.25 | −1 | A | 292.72 | 439.08 | 18.06 | 2.47 | 0.20 | 18.06 | 2.47 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 90.34 | 22.59 | 90.11 | 253.04 | 226.02 | 0.00 | 2029.31 | 1178.16 | 0.045 | 0.00 | 0.06 | 2.329 | A |
| **West** | 574.43 | 143.61 | 572.89 | 260.57 | 55.57 | 0.00 | 2152.54 | 1757.06 | 0.267 | 0.00 | 0.38 | 2.404 | A |
| **South** | 154.33 | 38.58 | 153.94 | 56.32 | 572.15 | 0.00 | 1779.08 | 761.11 | 0.087 | 0.00 | 0.10 | 2.322 | A |
| **East** | 240.16 | 60.04 | 239.54 | 486.56 | 239.53 | 0.00 | 2019.54 | 1550.52 | 0.119 | 0.00 | 0.15 | 2.328 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 107.88 | 26.97 | 107.82 | 302.77 | 270.44 | 0.00 | 1997.19 | 1178.16 | 0.054 | 0.06 | 0.07 | 2.390 | A |
| **West** | 685.92 | 171.48 | 685.48 | 311.78 | 66.49 | 0.00 | 2144.64 | 1757.06 | 0.320 | 0.38 | 0.49 | 2.604 | A |
| **South** | 184.29 | 46.07 | 184.18 | 67.38 | 684.58 | 0.00 | 1697.79 | 761.11 | 0.109 | 0.10 | 0.13 | 2.492 | A |
| **East** | 286.77 | 71.69 | 286.62 | 582.17 | 286.59 | 0.00 | 1985.52 | 1550.52 | 0.144 | 0.15 | 0.19 | 2.438 | A |

#### Main results: (08:30-08:45)

| | Total | Intersection | Entry | Exit Flow | Circulating | Pedestrian | Capacity | Saturation | V/C | Start | End | Delay | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Leg | Demand (PCE/hr) | Arrivals (PCE) | Flow (PCE/hr) | (PCE/hr) | Flow (PCE/hr) | Demand (Ped/hr) | (PCE/hr) | Capacity (PCE/hr) | Ratio | Queue (PCE) | Queue (PCE) | (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 132.12 | 33.03 | 132.05 | 370.73 | 331.17 | 0.00 | 1953.29 | 1178.16 | 0.068 | 0.07 | 0.09 | 2.479 | A |
| West | 840.08 | 210.02 | 839.33 | 381.79 | 81.43 | 0.00 | 2133.84 | 1757.06 | 0.394 | 0.49 | 0.68 | 2.934 | A |
| South | 225.71 | 56.43 | 225.53 | 82.52 | 838.24 | 0.00 | 1586.71 | 761.11 | 0.142 | 0.13 | 0.17 | 2.772 | A |
| East | 351.23 | 87.81 | 350.99 | 712.84 | 350.92 | 0.00 | 1939.01 | 1550.52 | 0.181 | 0.19 | 0.25 | 2.609 | A |

### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 132.12 | 33.03 | 132.12 | 371.04 | 331.41 | 0.00 | 1953.12 | 1178.16 | 0.068 | 0.09 | 0.09 | 2.480 | A |
| West | 840.08 | 210.02 | 840.07 | 382.05 | 81.48 | 0.00 | 2133.81 | 1757.06 | 0.394 | 0.68 | 0.68 | 2.936 | A |
| South | 225.71 | 56.43 | 225.71 | 82.58 | 838.97 | 0.00 | 1586.18 | 761.11 | 0.142 | 0.17 | 0.17 | 2.773 | A |
| East | 351.23 | 87.81 | 351.22 | 713.46 | 351.22 | 0.00 | 1938.79 | 1550.52 | 0.181 | 0.25 | 0.25 | 2.609 | A |

### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 107.88 | 26.97 | 107.95 | 303.26 | 270.82 | 0.00 | 1996.92 | 1178.16 | 0.054 | 0.09 | 0.07 | 2.390 | A |
| West | 685.92 | 171.48 | 686.66 | 312.20 | 66.57 | 0.00 | 2144.58 | 1757.06 | 0.320 | 0.68 | 0.50 | 2.607 | A |
| South | 184.29 | 46.07 | 184.47 | 67.48 | 685.75 | 0.00 | 1696.95 | 761.11 | 0.109 | 0.17 | 0.13 | 2.494 | A |
| East | 286.77 | 71.69 | 287.01 | 583.15 | 287.08 | 0.00 | 1985.17 | 1550.52 | 0.144 | 0.25 | 0.19 | 2.441 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 90.34 | 22.59 | 90.40 | 253.90 | 226.76 | 0.00 | 2028.77 | 1178.16 | 0.045 | 0.07 | 0.06 | 2.330 | A |
| West | 574.43 | 143.61 | 574.88 | 261.41 | 55.74 | 0.00 | 2152.41 | 1757.06 | 0.267 | 0.50 | 0.39 | 2.411 | A |
| South | 154.33 | 38.58 | 154.45 | 56.50 | 574.12 | 0.00 | 1777.65 | 761.11 | 0.087 | 0.13 | 0.10 | 2.326 | A |
| East | 240.16 | 60.04 | 240.32 | 488.22 | 240.34 | 0.00 | 2018.95 | 1550.52 | 0.119 | 0.19 | 0.16 | 2.331 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.86 | 0.06 | 2.329 | A | A |
| West | 5.65 | 0.38 | 2.404 | A | A |
| South | 1.47 | 0.10 | 2.322 | A | A |
| East | 2.29 | 0.15 | 2.328 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.06 | 0.07 | 2.390 | A | A |
| West | 7.32 | 0.49 | 2.604 | A | A |
| South | 1.89 | 0.13 | 2.492 | A | A |
| East | 2.88 | 0.19 | 2.438 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.35 | 0.09 | 2.479 | A | A |
| West | 10.06 | 0.67 | 2.934 | A | A |
| South | 2.57 | 0.17 | 2.772 | A | A |
| East | 3.76 | 0.25 | 2.609 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|





| North | 1.36 | 0.09 | 2.480 | A | A |
|---|---|---|---|---|---|
| West | 10.24 | 0.68 | 2.936 | A | A |
| South | 2.60 | 0.17 | 2.773 | A | A |
| East | 3.81 | 0.25 | 2.609 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.09 | 0.07 | 2.390 | A | A |
| West | 7.59 | 0.51 | 2.607 | A | A |
| South | 1.94 | 0.13 | 2.494 | A | A |
| East | 2.96 | 0.20 | 2.441 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.89 | 0.06 | 2.330 | A | A |
| West | 5.86 | 0.39 | 2.411 | A | A |
| South | 1.51 | 0.10 | 2.326 | A | A |
| East | 2.36 | 0.16 | 2.331 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.38 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.15 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.49 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.19 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.68 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.68 | 0.00 | 0.00 | 0.00 | 1.06 | | | N/A | N/A |
| South | 0.17 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.50 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.13 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.19 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.16 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:48:20 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FB 2033 | | | | | | |
| Leg North | 0.33 | −1 | 3.21 | 0.24 | A | 3.01 | A |
| Leg West | 0.51 | 1.02 | 2.72 | 0.33 | A | | |
| Leg South | 0.14 | −1 | 2.40 | 0.12 | A | | |
| Leg East | 0.80 | 1.03 | 3.29 | 0.44 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM " model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:48:19 PM*

## File summary

| | |
|---|---|
| Title | (untitled) |
| Location | |
| Site Number | |
| Date | 2023-12-13 |
| Version | |
| Status | (new file) |
| Identifier | |
| Client | |
| Jobnumber | |
| Analyst | AdamMorrison |
| Description | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - FB 2033, PM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FB 2033, PM | FB 2033 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 3.01 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Strasburg Road | |
| **West** | West | Huron Road | |
| **South** | South | Strasburg Road | |
| **East** | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **South** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **South** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |





## Slope / Intercept / Capacity

### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| **North** | Percentage | ROW Standard | | 90.00 |
| **West** | Percentage | ROW Standard | | 90.00 |
| **South** | Percentage | ROW Standard | | 90.00 |
| **East** | Percentage | ROW Standard | | 90.00 |

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| **North** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **West** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **South** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **East** | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| **North** | ONE HOUR | ✓ | 341.00 | 100.000 |
| **West** | ONE HOUR | ✓ | 613.00 | 100.000 |
| **South** | ONE HOUR | ✓ | 194.00 | 100.000 |
| **East** | ONE HOUR | ✓ | 799.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.000 | 229.000 | 72.000 | 40.000 |
| | **West** | 125.000 | 0.000 | 57.000 | 431.000 |
| | **South** | 60.000 | 49.000 | 0.000 | 85.000 |
| | **East** | 28.000 | 673.000 | 98.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.00 | 0.67 | 0.21 | 0.12 |
| | **West** | 0.20 | 0.00 | 0.09 | 0.70 |
| | **South** | 0.31 | 0.25 | 0.00 | 0.44 |
| | **East** | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | East | 0.04 | 0.84 | 0.12 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.020 | 1.020 | 1.190 |
| | West | 1.040 | 1.000 | 1.000 | 1.020 |
| | South | 1.000 | 1.020 | 1.000 | 1.000 |
| | East | 1.520 | 1.020 | 1.000 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 2.0 | 2.0 | 19.0 |
| | West | 4.0 | 0.0 | 0.0 | 2.0 |
| | South | 0.0 | 2.0 | 0.0 | 0.0 |
| | East | 52.0 | 2.0 | 0.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.24 | 3.21 | 0.33 | −1 | A | 312.91 | 469.36 | 22.33 | 2.85 | 0.25 | 22.33 | 2.85 |
| West | 0.33 | 2.72 | 0.51 | 1.02 | A | 562.50 | 843.75 | 35.13 | 2.50 | 0.39 | 35.13 | 2.50 |
| South | 0.12 | 2.40 | 0.14 | −1 | A | 178.02 | 267.03 | 10.02 | 2.25 | 0.11 | 10.02 | 2.25 |
| East | 0.44 | 3.29 | 0.80 | 1.03 | A | 733.18 | 1099.76 | 53.21 | 2.90 | 0.59 | 53.21 | 2.90 |

### Main Results for each time segment

#### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 256.72 | 64.18 | 256.01 | 159.96 | 615.63 | 0.00 | 1747.64 | 943.26 | 0.147 | 0.00 | 0.18 | 2.502 | A |
| West | 461.50 | 115.37 | 460.34 | 713.98 | 157.66 | 0.00 | 2078.73 | 1831.09 | 0.222 | 0.00 | 0.29 | 2.273 | A |
| South | 146.05 | 36.51 | 145.71 | 170.43 | 447.56 | 0.00 | 1869.15 | 912.03 | 0.078 | 0.00 | 0.08 | 2.099 | A |
| East | 601.53 | 150.38 | 599.84 | 417.54 | 175.74 | 0.00 | 2065.66 | 1552.31 | 0.291 | 0.00 | 0.42 | 2.526 | A |

#### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 306.55 | 76.64 | 306.33 | 191.37 | 736.62 | 0.00 | 1660.17 | 943.26 | 0.185 | 0.18 | 0.23 | 2.758 | A |
| West | 551.07 | 137.77 | 550.75 | 854.30 | 188.65 | 0.00 | 2056.33 | 1831.09 | 0.268 | 0.29 | 0.37 | 2.444 | A |
| South | 174.40 | 43.60 | 174.31 | 203.92 | 535.47 | 0.00 | 1805.59 | 912.03 | 0.097 | 0.08 | 0.11 | 2.217 | A |
| East | 718.28 | 179.57 | 717.74 | 499.54 | 210.24 | 0.00 | 2040.71 | 1552.31 | 0.352 | 0.42 | 0.56 | 2.799 | A |

#### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 375.45 | 93.86 | 375.05 | 234.33 | 901.87 | 0.00 | 1540.71 | 943.26 | 0.244 | 0.23 | 0.33 | 3.204 | A |
| West | 674.93 | 168.73 | 674.38 | 1045.95 | 230.97 | 0.00 | 2025.73 | 1831.09 | 0.333 | 0.37 | 0.51 | 2.721 | A |
| South | 213.60 | 53.40 | 213.46 | 249.68 | 655.67 | 0.00 | 1718.69 | 912.03 | 0.124 | 0.11 | 0.14 | 2.403 | A |
| East | 879.72 | 219.93 | 878.75 | 611.68 | 257.45 | 0.00 | 2006.59 | 1552.31 | 0.438 | 0.56 | 0.80 | 3.282 | A |





#### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 375.45 | 93.86 | 375.44 | 234.52 | 902.83 | 0.00 | 1540.01 | 943.26 | 0.244 | 0.33 | 0.33 | 3.206 | A |
| West | 674.93 | 168.73 | 674.92 | 1047.06 | 231.21 | 0.00 | 2025.56 | 1831.09 | 0.333 | 0.51 | 0.51 | 2.723 | A |
| South | 213.60 | 53.40 | 213.60 | 249.93 | 656.20 | 0.00 | 1718.31 | 912.03 | 0.124 | 0.14 | 0.14 | 2.403 | A |
| East | 879.72 | 219.93 | 879.70 | 612.16 | 257.64 | 0.00 | 2006.45 | 1552.31 | 0.438 | 0.80 | 0.80 | 3.288 | A |

#### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 306.55 | 76.64 | 306.94 | 191.67 | 738.12 | 0.00 | 1659.09 | 943.26 | 0.185 | 0.33 | 0.24 | 2.762 | A |
| West | 551.07 | 137.77 | 551.61 | 856.03 | 189.03 | 0.00 | 2056.05 | 1831.09 | 0.268 | 0.51 | 0.38 | 2.448 | A |
| South | 174.40 | 43.60 | 174.54 | 204.32 | 536.32 | 0.00 | 1804.98 | 912.03 | 0.097 | 0.14 | 0.11 | 2.218 | A |
| East | 718.28 | 179.57 | 719.24 | 500.32 | 210.55 | 0.00 | 2040.49 | 1552.31 | 0.352 | 0.80 | 0.56 | 2.808 | A |

#### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 256.72 | 64.18 | 256.95 | 160.47 | 617.89 | 0.00 | 1746.01 | 943.26 | 0.147 | 0.24 | 0.18 | 2.507 | A |
| West | 461.50 | 115.37 | 461.83 | 716.60 | 158.24 | 0.00 | 2078.31 | 1831.09 | 0.222 | 0.38 | 0.29 | 2.276 | A |
| South | 146.05 | 36.51 | 146.14 | 171.04 | 449.03 | 0.00 | 1868.09 | 912.03 | 0.078 | 0.11 | 0.09 | 2.102 | A |
| East | 601.53 | 150.38 | 602.08 | 418.88 | 176.29 | 0.00 | 2065.26 | 1552.31 | 0.291 | 0.56 | 0.42 | 2.533 | A |

### Queueing Delay Results for each time segment

#### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.63 | 0.18 | 2.502 | A | A |
| West | 4.30 | 0.29 | 2.273 | A | A |
| South | 1.26 | 0.08 | 2.099 | A | A |
| East | 6.21 | 0.41 | 2.526 | A | A |

#### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.47 | 0.23 | 2.758 | A | A |
| West | 5.53 | 0.37 | 2.444 | A | A |
| South | 1.59 | 0.11 | 2.217 | A | A |
| East | 8.23 | 0.55 | 2.799 | A | A |

#### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.92 | 0.33 | 3.204 | A | A |
| West | 7.52 | 0.50 | 2.721 | A | A |
| South | 2.11 | 0.14 | 2.403 | A | A |
| East | 11.75 | 0.78 | 3.282 | A | A |

#### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| North | 5.00 | 0.33 | 3.206 | A | A |
| West | 7.64 | 0.51 | 2.723 | A | A |
| South | 2.14 | 0.14 | 2.403 | A | A |
| East | 12.00 | 0.80 | 3.288 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.59 | 0.24 | 2.762 | A | A |
| West | 5.71 | 0.38 | 2.448 | A | A |
| South | 1.63 | 0.11 | 2.218 | A | A |
| East | 8.57 | 0.57 | 2.808 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.72 | 0.18 | 2.507 | A | A |
| West | 4.44 | 0.30 | 2.276 | A | A |
| South | 1.29 | 0.09 | 2.102 | A | A |
| East | 6.46 | 0.43 | 2.533 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.29 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.42 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.23 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.37 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.56 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.33 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.51 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.80 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.33 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.51 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| South | 0.14 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.80 | 0.00 | 0.00 | 0.00 | 1.03 | | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.38 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.11 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.56 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.29 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.42 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

# Appendix F

## 2028 Total Traffic Operations Reports

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 365 | 15 | 299 | 156 | 146 |
| Future Volume (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 365 | 15 | 299 | 156 | 146 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.96 | 1.00 | | 0.98 | 0.99 | 1.00 | | 0.98 | | 0.98 |
| Frt | | | 0.850 | | | 0.850 | | 0.994 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1547 | 3374 | 1390 | 1561 | 3438 | 1390 | 1653 | 3254 | 0 | 2895 | 1759 | 1417 |
| Flt Permitted | 0.086 | | | 0.207 | | | 0.561 | | | 0.950 | | |
| Satd. Flow (perm) | 140 | 3374 | 1337 | 339 | 3438 | 1361 | 970 | 3254 | 0 | 2838 | 1759 | 1389 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 193 | | | 416 | | 2 | | | | 146 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Adj. Flow (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 365 | 15 | 299 | 156 | 146 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 380 | 0 | 299 | 156 | 146 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

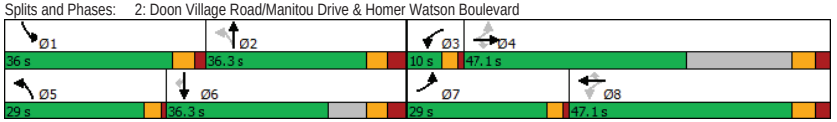




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 65.1 | 65.1 | 48.9 | 40.0 | 40.0 | 58.7 | 30.9 | | 21.6 | 30.0 | 30.0 |
| Actuated g/C Ratio | 0.51 | 0.46 | 0.46 | 0.34 | 0.28 | 0.28 | 0.41 | 0.22 | | 0.15 | 0.21 | 0.21 |
| v/c Ratio | 1.43 | 0.72 | 0.35 | 0.08 | 1.21 | 0.91 | 0.79 | 0.54 | | 0.68 | 0.42 | 0.36 |
| Control Delay | 242.7 | 35.4 | 8.6 | 21.1 | 146.2 | 34.9 | 43.6 | 52.8 | | 64.8 | 52.5 | 9.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 242.7 | 35.4 | 8.6 | 21.1 | 146.2 | 34.9 | 43.6 | 52.8 | | 64.8 | 52.5 | 9.3 |
| LOS | F | D | A | C | F | C | D | D | | E | D | A |
| Approach Delay | | 83.5 | | | 106.9 | | | 48.0 | | | 48.1 | |
| Approach LOS | | F | | | F | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 142 | | | |
| Natural Cycle: 145 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.43 | | | |
| Intersection Signal Delay: 82.1 | | Intersection LOS: F | |
| Intersection Capacity Utilization 126.5% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Total - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 380 | 299 | 156 | 146 |
| v/c Ratio | 1.43 | 0.72 | 0.35 | 0.08 | 1.21 | 0.91 | 0.79 | 0.54 | 0.68 | 0.42 | 0.36 |
| Control Delay | 242.7 | 35.4 | 8.6 | 21.1 | 146.2 | 34.9 | 43.6 | 52.8 | 64.8 | 52.5 | 9.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 242.7 | 35.4 | 8.6 | 21.1 | 146.2 | 34.9 | 43.6 | 52.8 | 64.8 | 52.5 | 9.3 |
| Queue Length 50th (m) | ~166.1 | 128.0 | 9.4 | 2.0 | ~219.2 | 69.7 | 89.3 | 52.5 | 43.4 | 40.5 | 0.0 |
| Queue Length 95th (m) | #245.7 | 185.2 | 33.5 | 6.3 | #275.2 | #158.2 | #131.2 | 73.4 | 59.0 | 63.2 | 18.8 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 318 | 1546 | 717 | 168 | 968 | 682 | 520 | 710 | 611 | 445 | 461 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.43 | 0.72 | 0.35 | 0.08 | 1.21 | 0.91 | 0.78 | 0.54 | 0.49 | 0.35 | 0.32 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 365 | 15 | 299 | 156 | 146 |
| Future Volume (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 365 | 15 | 299 | 156 | 146 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1547 | 3374 | 1338 | 1560 | 3438 | 1362 | 1648 | 3255 | | 2895 | 1759 | 1389 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.21 | 1.00 | 1.00 | 0.56 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 140 | 3374 | 1338 | 340 | 3438 | 1362 | 974 | 3255 | | 2895 | 1759 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 454 | 1107 | 254 | 14 | 1168 | 621 | 408 | 365 | 15 | 299 | 156 | 146 |
| RTOR Reduction (vph) | 0 | 0 | 106 | 0 | 0 | 294 | 0 | 2 | 0 | 0 | 0 | 116 |
| Lane Group Flow (vph) | 454 | 1107 | 148 | 14 | 1168 | 327 | 408 | 378 | 0 | 299 | 156 | 30 |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 55.6 | 31.0 | | 21.6 | 30.0 | 30.0 |
| Effective Green, g (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 55.6 | 31.0 | | 21.6 | 30.0 | 30.0 |
| Actuated g/C Ratio | 0.49 | 0.45 | 0.45 | 0.31 | 0.29 | 0.29 | 0.38 | 0.21 | | 0.15 | 0.21 | 0.21 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 312 | 1520 | 602 | 125 | 1011 | 400 | 489 | 698 | | 432 | 365 | 288 |
| v/s Ratio Prot | c0.25 | 0.33 | | 0.00 | 0.34 | | c0.14 | 0.12 | | 0.10 | 0.09 | |
| v/s Ratio Perm | c0.47 | | 0.11 | 0.03 | | 0.24 | c0.18 | | | | | 0.02 |
| v/c Ratio | 1.46 | 0.73 | 0.25 | 0.11 | 1.16 | 0.82 | 0.83 | 0.54 | | 0.69 | 0.43 | 0.11 |
| Uniform Delay, d1 | 47.1 | 32.5 | 24.5 | 34.9 | 51.0 | 47.4 | 37.3 | 50.4 | | 58.3 | 49.8 | 46.4 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 221.8 | 1.8 | 0.2 | 0.4 | 81.3 | 12.3 | 11.7 | 3.0 | | 6.0 | 3.6 | 0.7 |
| Delay (s) | 268.9 | 34.2 | 24.7 | 35.3 | 132.3 | 59.7 | 49.0 | 53.5 | | 64.3 | 53.4 | 47.1 |
| Level of Service | F | C | C | D | F | E | D | D | | E | D | D |
| Approach Delay (s) | | 91.6 | | | 106.5 | | | 51.1 | | | 57.3 | |
| Approach LOS | | F | | | F | | | D | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 86.5 | HCM 2000 Level of Service | F | |
| HCM 2000 Volume to Capacity ratio | 1.23 | | | |
| Actuated Cycle Length (s) | 144.5 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 126.5% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1712 | 2 | 0 | 1489 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1712 | 2 | 0 | 1489 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 1.00 | 0.99 | | 0.99 | | 1.00 | | | | 1.00 | |
| Frt | | | 0.850 | | 0.865 | | | | | | 0.992 | |
| Flt Protected | | 0.950 | | | | | 0.950 | | | | | |
| Satd. Flow (prot) | 0 | 1537 | 1444 | 0 | 1323 | 0 | 1637 | 3094 | 0 | 1775 | 3070 | 0 |
| Flt Permitted | | 0.757 | | | | | 0.950 | | | | | |
| Satd. Flow (perm) | 0 | 1223 | 1425 | 0 | 1323 | 0 | 1633 | 3094 | 0 | 1775 | 3070 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 213 | | 80 | | | | | | 5 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1712 | 2 | 0 | 1489 | 81 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 238 | 213 | 0 | 2 | 0 | 76 | 1714 | 0 | 0 | 1570 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

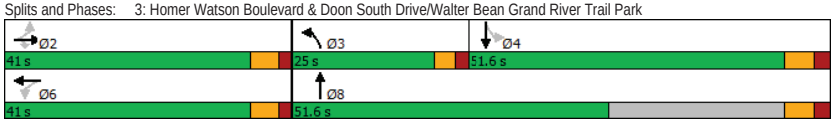




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 23.2 | 23.2 | | 23.2 | | 11.4 | 58.6 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.12 | 0.62 | | | 0.49 | |
| v/c Ratio | | 0.80 | 0.42 | | 0.01 | | 0.39 | 0.90 | | | 1.05 | |
| Control Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 24.6 | | | 64.7 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | | 0.0 | |
| Total Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 24.6 | | | 64.7 | |
| LOS | | D | A | | A | | D | C | | | E | |
| Approach Delay | | 31.5 | | | | | | 25.6 | | | 64.7 | |
| Approach LOS | | C | | | | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 94.8 | | | |
| Natural Cycle: 100 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.05 | | | |
| Intersection Signal Delay: 42.4 | | Intersection LOS: D | |
| Intersection Capacity Utilization 100.0% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2038 Total AM Peak Hour

| Lane Group | EBT | EBR | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 238 | 213 | 2 | 76 | 1714 | 1570 |
| v/c Ratio | 0.80 | 0.42 | 0.01 | 0.39 | 0.90 | 1.05 |
| Control Delay | 53.8 | 6.7 | 0.0 | 48.8 | 24.6 | 64.7 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.8 | 6.7 | 0.0 | 48.8 | 24.6 | 64.7 |
| Queue Length 50th (m) | 43.8 | 0.0 | 0.0 | 14.2 | 136.2 | ~184.2 |
| Queue Length 95th (m) | 75.9 | 17.2 | 0.0 | 31.4 | #253.1 | #287.9 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | |
| Base Capacity (vph) | 463 | 672 | 550 | 354 | 2343 | 1497 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.51 | 0.32 | 0.00 | 0.21 | 0.73 | 1.05 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2038 Total AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1712 | 2 | 0 | 1489 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1712 | 2 | 0 | 1489 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | | 0.99 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | | 1.00 | 0.85 | | 0.86 | | 1.00 | 1.00 | | | 0.99 | |
| Flt Protected | | 0.95 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | 1535 | 1425 | | 1323 | | 1637 | 3094 | | | 3072 | |
| Flt Permitted | | 0.76 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | 1222 | 1425 | | 1323 | | 1637 | 3094 | | | 3072 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1712 | 2 | 0 | 1489 | 81 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 0 | 238 | 52 | 0 | 0 | 0 | 76 | 1714 | 0 | 0 | 1567 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Effective Green, g (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.09 | 0.63 | | | 0.48 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | | 5.0 | |
| Lane Grp Cap (vph) | | 296 | 345 | | 320 | | 148 | 1936 | | | 1483 | |
| v/s Ratio Prot | | | | | 0.00 | | 0.05 | c0.55 | | | c0.51 | |
| v/s Ratio Perm | | c0.19 | 0.04 | | | | | | | | | |
| v/c Ratio | | 0.80 | 0.15 | | 0.00 | | 0.51 | 0.89 | | | 1.06 | |
| Uniform Delay, d1 | | 34.1 | 28.5 | | 27.5 | | 41.5 | 15.0 | | | 24.8 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 14.6 | 0.2 | | 0.0 | | 3.0 | 6.4 | | | 40.0 | |
| Delay (s) | | 48.7 | 28.7 | | 27.5 | | 44.5 | 21.4 | | | 64.8 | |
| Level of Service | | D | C | | C | | D | C | | | E | |
| Approach Delay (s) | | 39.2 | | | 27.5 | | | 22.4 | | | 64.8 | |
| Approach LOS | | D | | | C | | | C | | | E | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 41.8 | HCM 2000 Level of Service | D | | |
| HCM 2000 Volume to Capacity ratio | 0.99 | | | | |
| Actuated Cycle Length (s) | 95.7 | Sum of lost time (s) | 17.6 | | |
| Intersection Capacity Utilization | 100.0% | ICU Level of Service | F | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 132 | 28 | 116 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| Future Volume (vph) | 132 | 28 | 116 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.98 | | 0.99 | | 0.98 | | | 0.98 | 1.00 | | 0.99 |
| Frt | | 0.879 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1576 | 2168 | 0 | 1492 | 1743 | 1219 | 1429 | 4848 | 1417 | 2749 | 3312 | 1229 |
| Flt Permitted | 0.613 | | | 0.661 | | | 0.088 | | | 0.950 | | |
| Satd. Flow (perm) | 1010 | 2168 | 0 | 1031 | 1743 | 1196 | 132 | 4848 | 1393 | 2748 | 3312 | 1213 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 116 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Adj. Flow (vph) | 132 | 28 | 116 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 132 | 144 | 0 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

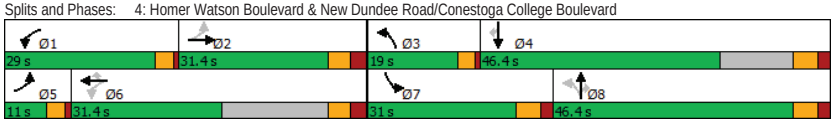




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 15.5 | 7.6 | | 15.5 | 8.0 | 8.0 | 60.9 | 46.8 | 46.8 | 10.1 | 40.2 | 40.2 |
| Actuated g/C Ratio | 0.17 | 0.09 | | 0.17 | 0.09 | 0.09 | 0.69 | 0.53 | 0.53 | 0.11 | 0.45 | 0.45 |
| v/c Ratio | 0.59 | 0.49 | | 0.38 | 0.15 | 0.34 | 0.65 | 0.62 | 0.24 | 0.26 | 1.07 | 0.04 |
| Control Delay | 41.9 | 18.1 | | 33.3 | 39.8 | 5.1 | 29.9 | 18.5 | 4.4 | 40.3 | 70.5 | 0.1 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 41.9 | 18.1 | | 33.3 | 39.8 | 5.1 | 29.9 | 18.5 | 4.4 | 40.3 | 70.5 | 0.1 |
| LOS | D | B | | C | D | A | C | B | A | D | E | A |
| Approach Delay | | 29.5 | | | 22.0 | | | 18.3 | | | 68.0 | |
| Approach LOS | | C | | | C | | | B | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 88.7 | | | |
| Natural Cycle: 150 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.07 | | | |
| Intersection Signal Delay: 39.7 | | Intersection LOS: D | |
| Intersection Capacity Utilization 90.1% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2038 Total - AM Peak Hour

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 132 | 144 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| v/c Ratio | 0.59 | 0.49 | 0.38 | 0.15 | 0.34 | 0.65 | 0.62 | 0.24 | 0.26 | 1.07 | 0.04 |
| Control Delay | 41.9 | 18.1 | 33.3 | 39.8 | 5.1 | 29.9 | 18.5 | 4.4 | 40.3 | 70.5 | 0.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 41.9 | 18.1 | 33.3 | 39.8 | 5.1 | 29.9 | 18.5 | 4.4 | 40.3 | 70.5 | 0.1 |
| Queue Length 50th (m) | 20.3 | 2.5 | 12.2 | 4.2 | 0.0 | 20.4 | 77.2 | 2.3 | 7.1 | ~172.7 | 0.0 |
| Queue Length 95th (m) | 36.6 | 12.1 | 24.6 | 11.7 | 2.6 | #56.0 | 108.8 | 15.4 | 15.1 | #240.9 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 222 | 697 | 426 | 849 | 653 | 310 | 2560 | 815 | 778 | 1952 | 764 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.59 | 0.21 | 0.19 | 0.03 | 0.12 | 0.65 | 0.62 | 0.24 | 0.11 | 0.82 | 0.03 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2038 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 132 | 28 | 116 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| Future Volume (vph) | 132 | 28 | 116 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.88 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1572 | 2174 | | 1487 | 1743 | 1199 | 1429 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Flt Permitted | 0.61 | 1.00 | | 0.66 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1015 | 2174 | | 1034 | 1743 | 1199 | 132 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 132 | 28 | 116 | 82 | 24 | 80 | 203 | 1582 | 194 | 82 | 1605 | 25 |
| RTOR Reduction (vph) | 0 | 106 | 0 | 0 | 0 | 74 | 0 | 0 | 82 | 0 | 0 | 14 |
| Lane Group Flow (vph) | 132 | 38 | 0 | 82 | 24 | 6 | 203 | 1582 | 112 | 82 | 1605 | 11 |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 15.3 | 8.1 | | 12.5 | 6.7 | 6.7 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Effective Green, g (s) | 15.3 | 8.1 | | 12.5 | 6.7 | 6.7 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Actuated g/C Ratio | 0.17 | 0.09 | | 0.14 | 0.07 | 0.07 | 0.66 | 0.51 | 0.51 | 0.09 | 0.45 | 0.45 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 214 | 192 | | 170 | 127 | 87 | 302 | 2485 | 715 | 234 | 1505 | 551 |
| v/s Ratio Prot | c0.05 | 0.02 | | 0.03 | 0.01 | | c0.11 | 0.33 | | 0.03 | c0.48 | |
| v/s Ratio Perm | c0.05 | | | 0.04 | | 0.00 | 0.33 | | 0.08 | | | 0.01 |
| v/c Ratio | 0.62 | 0.20 | | 0.48 | 0.19 | 0.07 | 0.67 | 0.64 | 0.16 | 0.35 | 1.07 | 0.02 |
| Uniform Delay, d1 | 34.5 | 38.6 | | 36.0 | 39.7 | 39.4 | 23.1 | 16.1 | 11.8 | 39.4 | 24.9 | 13.7 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 5.2 | 0.5 | | 0.8 | 0.7 | 0.3 | 5.8 | 1.3 | 0.5 | 0.9 | 43.2 | 0.1 |
| Delay (s) | 39.7 | 39.1 | | 36.8 | 40.5 | 39.7 | 28.9 | 17.4 | 12.3 | 40.3 | 68.1 | 13.8 |
| Level of Service | D | D | | D | D | D | C | B | B | D | E | B |
| Approach Delay (s) | | 39.4 | | | 38.5 | | | 18.0 | | | 66.0 | |
| Approach LOS | | D | | | D | | | B | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 40.1 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 0.93 | | | |
| Actuated Cycle Length (s) | 91.3 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 90.1% | ICU Level of Service | E | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 176 | 0 | 952 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 45 |
| Future Volume (vph) | 176 | 0 | 952 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 45 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1591 | 0 | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | 0 | 0 | 4803 | 1261 |
| Flt Permitted | 0.578 | | | 0.950 | | | 0.090 | | | | | |
| Satd. Flow (perm) | 968 | 0 | 1458 | 1441 | 1776 | 1365 | 148 | 3406 | 0 | 0 | 4803 | 1261 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 218 | | | 298 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Adj. Flow (vph) | 176 | 0 | 952 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 45 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 176 | 0 | 952 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 45 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

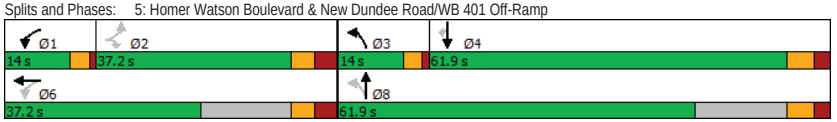




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.1 | | 30.1 | 47.3 | 44.1 | 121.8 | 66.5 | 63.6 | | | 49.5 | 49.5 |
| Actuated g/C Ratio | 0.25 | | 0.25 | 0.39 | 0.36 | 1.00 | 0.55 | 0.52 | | | 0.41 | 0.41 |
| v/c Ratio | 0.74 | | 1.82 | 0.43 | 0.47 | 0.66 | 0.72 | 0.50 | | | 0.73 | 0.08 |
| Control Delay | 63.3 | | 398.6 | 31.4 | 33.8 | 2.6 | 40.9 | 19.9 | | | 32.8 | 0.3 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 63.3 | | 398.6 | 31.4 | 33.8 | 2.6 | 40.9 | 19.9 | | | 32.8 | 0.3 |
| LOS | E | | F | C | C | A | D | B | | | C | A |
| Approach Delay | | 346.2 | | | 13.8 | | | 22.8 | | | 31.8 | |
| Approach LOS | | F | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 121.8 | | | |
| Natural Cycle: 150 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 1.82 | | | |
| Intersection Signal Delay: 94.7 | | Intersection LOS: F | |
| Intersection Capacity Utilization 120.7% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Total - AM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 176 | 952 | 239 | 299 | 907 | 142 | 897 | 1419 | 45 |
| v/c Ratio | 0.74 | 1.82 | 0.43 | 0.47 | 0.66 | 0.72 | 0.50 | 0.73 | 0.08 |
| Control Delay | 63.3 | 398.6 | 31.4 | 33.8 | 2.6 | 40.9 | 19.9 | 32.8 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 63.3 | 398.6 | 31.4 | 33.8 | 2.6 | 40.9 | 19.9 | 32.8 | 0.3 |
| Queue Length 50th (m) | 42.5 | ~330.6 | 45.6 | 59.8 | 0.0 | 17.1 | 74.2 | 108.3 | 0.0 |
| Queue Length 95th (m) | #81.4 | #420.5 | 72.2 | 90.0 | 0.0 | #47.5 | 91.6 | 126.0 | 0.0 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 238 | 524 | 559 | 643 | 1365 | 196 | 1934 | 2174 | 628 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.74 | 1.82 | 0.43 | 0.47 | 0.66 | 0.72 | 0.46 | 0.65 | 0.07 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Total - AM Peak Hour

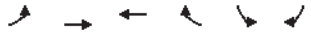
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 176 | 0 | 952 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 45 |
| Future Volume (vph) | 176 | 0 | 952 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 45 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1591 | | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | | | 4803 | 1261 |
| Flt Permitted | 0.58 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.09 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 967 | | 1458 | 1441 | 1776 | 1365 | 147 | 3406 | | | 4803 | 1261 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 176 | 0 | 952 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 45 |
| RTOR Reduction (vph) | 0 | 0 | 164 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| Lane Group Flow (vph) | 176 | 0 | 788 | 239 | 299 | 907 | 142 | 897 | 0 | 0 | 1419 | 18 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.1 | | 30.1 | 44.1 | 44.1 | 121.8 | 63.6 | 63.6 | | | 49.6 | 49.6 |
| Effective Green, g (s) | 30.1 | | 30.1 | 44.1 | 44.1 | 121.8 | 63.6 | 63.6 | | | 49.6 | 49.6 |
| Actuated g/C Ratio | 0.25 | | 0.25 | 0.36 | 0.36 | 1.00 | 0.52 | 0.52 | | | 0.41 | 0.41 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 238 | | 360 | 521 | 643 | 1365 | 192 | 1778 | | | 1955 | 513 |
| v/s Ratio Prot | | | | 0.04 | 0.17 | | 0.06 | 0.26 | | | 0.30 | |
| v/s Ratio Perm | 0.18 | | c0.54 | 0.13 | | c0.66 | c0.32 | | | | | 0.01 |
| v/c Ratio | 0.74 | | 2.19 | 0.46 | 0.47 | 0.66 | 0.74 | 0.50 | | | 0.73 | 0.04 |
| Uniform Delay, d1 | 42.2 | | 45.9 | 29.7 | 29.8 | 0.0 | 20.9 | 18.9 | | | 30.4 | 21.7 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 18.5 | | 543.9 | 1.3 | 2.4 | 2.6 | 16.6 | 0.5 | | | 1.7 | 0.1 |
| Delay (s) | 60.8 | | 589.7 | 31.1 | 32.2 | 2.6 | 37.5 | 19.4 | | | 32.1 | 21.8 |
| Level of Service | E | | F | C | C | A | D | B | | | C | C |
| Approach Delay (s) | | 507.2 | | | 13.4 | | | 21.8 | | | 31.7 | |
| Approach LOS | | F | | | B | | | C | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 130.2 | HCM 2000 Level of Service | F | | |
| HCM 2000 Volume to Capacity ratio | 1.23 | | | | |
| Actuated Cycle Length (s) | 121.8 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 120.7% | ICU Level of Service | H | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: New Dundee Road & Pinnacle Drive

2028 Total - AM Peak Hour



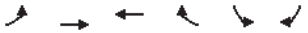
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 1177 | 400 | 19 | 64 | 8 |
| Future Volume (vph) | 4 | 1177 | 400 | 19 | 64 | 8 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.994 | | 0.985 | |
| Flt Protected | | | | | 0.957 | |
| Satd. Flow (prot) | 0 | 1616 | 1530 | 0 | 1664 | 0 |
| Flt Permitted | | | | | 0.957 | |
| Satd. Flow (perm) | 0 | 1616 | 1530 | 0 | 1664 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 25% | 2% | 7% | 11% | 0% | 0% |
| Adj. Flow (vph) | 4 | 1177 | 400 | 19 | 64 | 8 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 1181 | 419 | 0 | 72 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 86.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
6: New Dundee Road & Pinnacle Drive

2028 Total - AM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 1177 | 400 | 19 | 64 | 8 |
| Future Volume (Veh/h) | 4 | 1177 | 400 | 19 | 64 | 8 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 1177 | 400 | 19 | 64 | 8 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 419 | | | | 1594 | 410 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 419 | | | | 1594 | 410 |
| tC, single (s) | 4.3 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.4 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 46 | 99 |
| cM capacity (veh/h) | 1027 | | | | 118 | 646 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 1181 | 419 | 72 |
| Volume Left | 4 | 0 | 64 |
| Volume Right | 0 | 19 | 8 |
| cSH | 1027 | 1700 | 130 |
| Volume to Capacity | 0.00 | 0.25 | 0.55 |
| Queue Length 95th (m) | 0.1 | 0.0 | 21.6 |
| Control Delay (s) | 0.1 | 0.0 | 62.4 |
| Lane LOS | A | | F |
| Approach Delay (s) | 0.1 | 0.0 | 62.4 |
| Approach LOS | | | F |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 2.8 | | |
| Intersection Capacity Utilization | 86.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 65 | 907 | 353 | 100 | 345 | 132 |
| Future Volume (vph) | 65 | 907 | 353 | 100 | 345 | 132 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.963 | |
| Flt Protected | 0.950 | | | | 0.965 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1615 | 0 |
| Flt Permitted | 0.402 | | | | 0.965 | |
| Satd. Flow (perm) | 693 | 1845 | 1528 | 1311 | 1615 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 82 | 21 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Adj. Flow (vph) | 65 | 907 | 353 | 100 | 345 | 132 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 65 | 907 | 353 | 100 | 477 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |

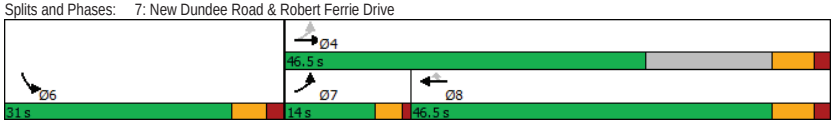




| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 41.0 | 38.5 | 29.7 | 29.7 | 25.1 | |
| Actuated g/C Ratio | 0.54 | 0.51 | 0.39 | 0.39 | 0.33 | |
| v/c Ratio | 0.14 | 0.97 | 0.59 | 0.18 | 0.87 | |
| Control Delay | 8.8 | 43.4 | 24.4 | 6.5 | 43.6 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 8.8 | 43.4 | 24.4 | 6.5 | 43.6 | |
| LOS | A | D | C | A | D | |
| Approach Delay | | 41.1 | 20.5 | | 43.6 | |
| Approach LOS | | D | C | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 91.5 | | | |
| Actuated Cycle Length: 76.2 | | | |
| Natural Cycle: 90 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 0.97 | | | |
| Intersection Signal Delay: 36.8 | | Intersection LOS: D | |
| Intersection Capacity Utilization 87.4% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
## 7: New Dundee Road & Robert Ferrie Drive

2028 Total - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 65 | 907 | 353 | 100 | 477 |
| v/c Ratio | 0.14 | 0.97 | 0.59 | 0.18 | 0.87 |
| Control Delay | 8.8 | 43.4 | 24.4 | 6.5 | 43.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 8.8 | 43.4 | 24.4 | 6.5 | 43.6 |
| Queue Length 50th (m) | 4.4 | 125.1 | 43.3 | 1.7 | 66.5 |
| Queue Length 95th (m) | 9.8 | #212.4 | 73.5 | 11.4 | #135.6 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 497 | 1314 | 806 | 730 | 546 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.13 | 0.69 | 0.44 | 0.14 | 0.87 |

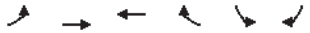
Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 7: New Dundee Road & Robert Ferrie Drive

2028 Total - AM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 65 | 907 | 353 | 100 | 345 | 132 |
| Future Volume (vph) | 65 | 907 | 353 | 100 | 345 | 132 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1615 | |
| Flt Permitted | 0.40 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 693 | 1845 | 1528 | 1311 | 1615 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 65 | 907 | 353 | 100 | 345 | 132 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 50 | 14 | 0 |
| Lane Group Flow (vph) | 65 | 907 | 353 | 50 | 463 | 0 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 39.4 | 39.4 | 29.7 | 29.7 | 25.1 | |
| Effective Green, g (s) | 39.4 | 39.4 | 29.7 | 29.7 | 25.1 | |
| Actuated g/C Ratio | 0.51 | 0.51 | 0.39 | 0.39 | 0.33 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 424 | 944 | 589 | 505 | 526 | |
| v/s Ratio Prot | 0.01 | c0.49 | 0.23 | | c0.29 | |
| v/s Ratio Perm | 0.07 | | | 0.04 | | |
| v/c Ratio | 0.15 | 0.96 | 0.60 | 0.10 | 0.88 | |
| Uniform Delay, d1 | 10.1 | 18.1 | 18.9 | 15.1 | 24.5 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.2 | 20.3 | 1.6 | 0.1 | 18.6 | |
| Delay (s) | 10.3 | 38.4 | 20.5 | 15.2 | 43.2 | |
| Level of Service | B | D | C | B | D | |
| Approach Delay (s) | | 36.5 | 19.4 | | 43.2 | |
| Approach LOS | | D | B | | D | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 34.1 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.99 | | |
| Actuated Cycle Length (s) | 77.0 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 87.4% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## Lanes, Volumes, Timings
## 8: New Dundee Road

2028 Total - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 508 | 82 | 13 | 325 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (vph) | 11 | 508 | 82 | 13 | 325 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.982 | | | 0.996 | | | 0.965 | | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.998 | | | 0.976 | | | 0.991 | |
| Satd. Flow (prot) | 0 | 1430 | 0 | 0 | 1431 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Flt Permitted | | 0.999 | | | 0.998 | | | 0.976 | | | 0.991 | |
| Satd. Flow (perm) | 0 | 1430 | 0 | 0 | 1431 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 18% | 6% | 7% | 23% | 7% | 10% | 0% | 4% | 33% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 508 | 82 | 13 | 325 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 601 | 0 | 0 | 348 | 0 | 0 | 92 | 0 | 0 | 65 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 63.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

2028 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 11 | 508 | 82 | 13 | 325 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (Veh/h) | 11 | 508 | 82 | 13 | 325 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 508 | 82 | 13 | 325 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 335 | | | 590 | | | 960 | 932 | 549 | 962 | 968 | 330 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 335 | | | 590 | | | 960 | 932 | 549 | 962 | 968 | 330 |
| tC, single (s) | 4.3 | | | 4.3 | | | 7.1 | 6.5 | 6.5 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.4 | | | 3.5 | 4.0 | 3.6 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 99 | | | 78 | 91 | 95 | 94 | 84 | 98 |
| cM capacity (veh/h) | 1140 | | | 890 | | | 201 | 258 | 480 | 206 | 250 | 716 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 601 | 348 | 92 | 65 |
| Volume Left | 11 | 13 | 45 | 12 |
| Volume Right | 82 | 10 | 24 | 12 |
| cSH | 1140 | 890 | 254 | 272 |
| Volume to Capacity | 0.01 | 0.01 | 0.36 | 0.24 |
| Queue Length 95th (m) | 0.2 | 0.4 | 12.7 | 7.3 |
| Control Delay (s) | 0.3 | 0.5 | 27.1 | 22.4 |
| Lane LOS | A | A | D | C |
| Approach Delay (s) | 0.3 | 0.5 | 27.1 | 22.4 |
| Approach LOS | | | D | C |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.9 | | |
| Intersection Capacity Utilization | 63.8% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

## Lanes, Volumes, Timings
## 10: Doon Mills Road & Apple Ridge Drive

2028 Total - AM Peak Hour

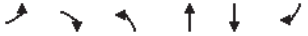
| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.973 | | | | 0.940 | |
| Flt Protected | 0.962 | | | 0.995 | | |
| Satd. Flow (prot) | 1613 | 0 | 0 | 1585 | 1465 | 0 |
| Flt Permitted | 0.962 | | | 0.995 | | |
| Satd. Flow (perm) | 1613 | 0 | 0 | 1585 | 1465 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 0% | 0% | 4% | 9% | 2% |
| Adj. Flow (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 277 | 0 | 0 | 407 | 330 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 73.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 10: Doon Mills Road & Apple Ridge Drive

2028 Total - AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 221 | 56 | 41 | 366 | 183 | 147 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 277 | 407 | 330 |
| Volume Left (vph) | 221 | 41 | 0 |
| Volume Right (vph) | 56 | 0 | 147 |
| Hadj (s) | 0.08 | 0.08 | -0.17 |
| Departure Headway (s) | 5.9 | 5.4 | 5.2 |
| Degree Utilization, x | 0.45 | 0.61 | 0.48 |
| Capacity (veh/h) | 569 | 645 | 657 |
| Control Delay (s) | 13.6 | 16.2 | 12.9 |
| Approach Delay (s) | 13.6 | 16.2 | 12.9 |
| Approach LOS | B | C | B |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Delay | 14.4 | | | |
| Level of Service | B | | | |
| Intersection Capacity Utilization | 73.1% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |

Lanes, Volumes, Timings
11: Biehn Drive & Carnydale Drive

2028 Total - AM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.867 | | 0.970 | | | |
| Flt Protected | 0.999 | | | | | 0.954 |
| Satd. Flow (prot) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Flt Permitted | 0.999 | | | | | 0.954 |
| Satd. Flow (perm) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 7% | 25% | 5% | 20% |
| Adj. Flow (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 309 | 0 | 18 | 0 | 0 | 169 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
11: Biehn Drive & Carnydale Drive

2028 Total - AM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (Veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 349 | 16 | | | 18 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 349 | 16 | | | 18 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 99 | 71 | | | 90 | |
| cM capacity (veh/h) | 584 | 1069 | | | 1579 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 309 | 18 | 169 |
| Volume Left | 4 | 0 | 164 |
| Volume Right | 305 | 4 | 0 |
| cSH | 1058 | 1700 | 1579 |
| Volume to Capacity | 0.29 | 0.01 | 0.10 |
| Queue Length 95th (m) | 9.8 | 0.0 | 2.8 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.6 | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 0.99 | |
| Frt | | 0.965 | | | | 0.850 | | 0.999 | | | 0.966 | |
| Flt Protected | 0.950 | | | | 0.994 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 1498 | 0 | 0 | 1500 | 1365 | 1519 | 1616 | 0 | 1519 | 1458 | 0 |
| Flt Permitted | 0.728 | | | | 0.974 | | 0.523 | | | 0.416 | | |
| Satd. Flow (perm) | 1224 | 1498 | 0 | 0 | 1467 | 1317 | 829 | 1616 | 0 | 664 | 1458 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 23 | | | | 74 | | 1 | | | 33 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 89 | 98 | 0 | 0 | 44 | 74 | 44 | 459 | 0 | 56 | 346 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

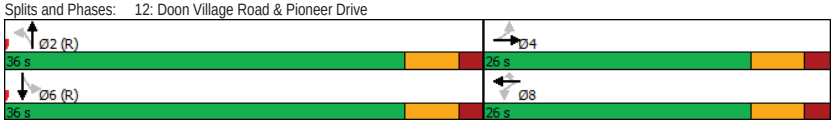




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.23 | 0.20 | | | 0.09 | 0.16 | 0.11 | 0.59 | | 0.17 | 0.48 | |
| Control Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.7 | 15.3 | | 10.8 | 12.4 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.7 | 15.3 | | 10.8 | 12.4 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.3 | | | 9.1 | | | 14.8 | | | 12.2 | |
| Approach LOS | | B | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.59 | | | |
| Intersection Signal Delay: 13.5 | | Intersection LOS: B | |
| Intersection Capacity Utilization 76.2% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2028 Total - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 89 | 98 | 44 | 74 | 44 | 459 | 56 | 346 |
| v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.11 | 0.59 | 0.17 | 0.48 |
| Control Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.7 | 15.3 | 10.8 | 12.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.7 | 15.3 | 10.8 | 12.4 |
| Queue Length 50th (m) | 7.7 | 6.3 | 3.6 | 0.0 | 2.7 | 37.0 | 3.5 | 23.2 |
| Queue Length 95th (m) | 17.5 | 16.1 | 9.9 | 7.7 | 7.6 | 63.6 | 9.8 | 43.2 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 394 | 498 | 473 | 474 | 401 | 782 | 321 | 722 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.11 | 0.59 | 0.17 | 0.48 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2028 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1598 | 1498 | | | 1498 | 1317 | 1505 | 1616 | | 1515 | 1459 | |
| Flt Permitted | 0.73 | 1.00 | | | 0.97 | 1.00 | 0.52 | 1.00 | | 0.42 | 1.00 | |
| Satd. Flow (perm) | 1225 | 1498 | | | 1466 | 1317 | 829 | 1616 | | 664 | 1459 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 50 | 0 | 1 | 0 | 0 | 17 | 0 |
| Lane Group Flow (vph) | 89 | 82 | 0 | 0 | 44 | 24 | 44 | 458 | 0 | 56 | 329 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 395 | 483 | | | 472 | 424 | 401 | 781 | | 321 | 705 | |
| v/s Ratio Prot | | 0.06 | | | | | | c0.28 | | | 0.23 | |
| v/s Ratio Perm | c0.07 | | | | 0.03 | 0.02 | 0.05 | | | 0.08 | | |
| v/c Ratio | 0.23 | 0.17 | | | 0.09 | 0.06 | 0.11 | 0.59 | | 0.17 | 0.47 | |
| Uniform Delay, d1 | 15.3 | 15.1 | | | 14.7 | 14.5 | 8.7 | 11.5 | | 9.0 | 10.7 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.8 | | | 0.4 | 0.3 | 0.6 | 3.2 | | 1.2 | 2.2 | |
| Delay (s) | 16.7 | 15.8 | | | 15.1 | 14.7 | 9.3 | 14.8 | | 10.2 | 12.9 | |
| Level of Service | B | B | | | B | B | A | B | | B | B | |
| Approach Delay (s) | | 16.2 | | | 14.9 | | | 14.3 | | | 12.5 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 14.0 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.44 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 76.2% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and New Dundee.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:44:08 PM

### Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2028 | | | | | | |
| **Leg North** | 0.55 | 1.02 | 3.75 | 0.35 | A | 4.01 | A |
| **Leg West** | 1.43 | 1.03 | 4.83 | 0.58 | A | | |
| **Leg East** | 0.35 | ~1 | 2.54 | 0.25 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM " model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:44:07 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FT 2028, AM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2028, AM | FT 2028 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 4.01 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Robert Ferrie Drive | |
| **West** | West | New Dundee Road | |
| **East** | East | New Dundee Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 477.00 | 100.000 |
| West | ONE HOUR | ✓ | 972.00 | 100.000 |
| East | ONE HOUR | ✓ | 453.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 132.000 | 345.000 |
| | West | 65.000 | 0.000 | 907.000 |
| | East | 100.000 | 353.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.28 | 0.72 |
| | West | 0.07 | 0.00 | 0.93 |
| | East | 0.22 | 0.78 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 1.000 | 1.030 | 1.010 |
| | West | 1.030 | 1.000 | 1.030 |
| | East | 1.070 | 1.080 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 3.0 | 1.0 |
| | West | 3.0 | 0.0 | 3.0 |
| | East | 7.0 | 8.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.35 | 3.75 | 0.55 | 1.02 | A | 437.70 | 656.56 | 36.98 | 3.38 | 0.41 | 36.98 | 3.38 |
| West | 0.58 | 4.83 | 1.43 | 1.03 | A | 891.92 | 1337.89 | 87.99 | 3.95 | 0.98 | 87.99 | 3.95 |
| East | 0.25 | 2.54 | 0.35 | −1 | A | 415.68 | 623.52 | 25.03 | 2.41 | 0.28 | 25.03 | 2.41 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 359.11 | 89.78 | 357.91 | 123.86 | 265.08 | 0.00 | 1568.05 | 856.58 | 0.229 | 0.00 | 0.30 | 3.018 | A |
| West | 731.77 | 182.94 | 729.23 | 364.13 | 258.87 | 0.00 | 1911.82 | 1690.18 | 0.383 | 0.00 | 0.64 | 3.129 | A |
| East | 341.04 | 85.26 | 340.18 | 939.33 | 48.77 | 0.00 | 2040.93 | 2001.44 | 0.167 | 0.00 | 0.22 | 2.280 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 428.81 | 107.20 | 428.45 | 148.22 | 317.17 | 0.00 | 1539.43 | 856.59 | 0.279 | 0.30 | 0.39 | 3.290 | A |
| West | 873.81 | 218.45 | 872.80 | 435.74 | 309.89 | 0.00 | 1880.46 | 1690.18 | 0.465 | 0.64 | 0.89 | 3.676 | A |
| East | 407.24 | 101.81 | 407.02 | 1124.32 | 58.37 | 0.00 | 2035.03 | 2001.44 | 0.200 | 0.22 | 0.27 | 2.383 | A |

#### Main results: (08:30-08:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 525.19 | 131.30 | 524.57 | 181.45 | 388.41 | 0.00 | 1500.28 | 856.59 | 0.350 | 0.39 | 0.54 | 3.745 | A |
| West | 1070.19 | 267.55 | 1068.07 | 533.57 | 379.41 | 0.00 | 1837.74 | 1690.18 | 0.582 | 0.89 | 1.42 | 4.804 | A |
| East | 498.76 | 124.69 | 498.44 | 1376.05 | 71.42 | 0.00 | 2027.00 | 2001.44 | 0.246 | 0.27 | 0.35 | 2.538 | A |

#### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 525.19 | 131.30 | 525.18 | 181.67 | 388.66 | 0.00 | 1500.14 | 856.59 | 0.350 | 0.54 | 0.55 | 3.748 | A |
| West | 1070.19 | 267.55 | 1070.16 | 533.99 | 379.85 | 0.00 | 1837.47 | 1690.18 | 0.582 | 1.42 | 1.43 | 4.832 | A |
| East | 498.76 | 124.69 | 498.76 | 1378.44 | 71.56 | 0.00 | 2026.92 | 2001.44 | 0.246 | 0.35 | 0.35 | 2.538 | A |

#### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 428.81 | 107.20 | 429.42 | 148.54 | 317.59 | 0.00 | 1539.20 | 856.59 | 0.279 | 0.55 | 0.39 | 3.295 | A |
| West | 873.81 | 218.45 | 875.91 | 436.42 | 310.59 | 0.00 | 1880.04 | 1690.18 | 0.465 | 1.43 | 0.90 | 3.702 | A |
| East | 407.24 | 101.81 | 407.56 | 1127.92 | 58.57 | 0.00 | 2034.90 | 2001.44 | 0.200 | 0.35 | 0.27 | 2.386 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 359.11 | 89.78 | 359.47 | 124.34 | 265.92 | 0.00 | 1567.59 | 856.58 | 0.229 | 0.39 | 0.30 | 3.026 | A |
| West | 731.77 | 182.94 | 732.81 | 365.40 | 260.00 | 0.00 | 1911.12 | 1690.18 | 0.383 | 0.90 | 0.64 | 3.151 | A |
| East | 341.04 | 85.26 | 341.26 | 943.80 | 49.00 | 0.00 | 2040.78 | 2001.44 | 0.167 | 0.27 | 0.22 | 2.282 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.42 | 0.29 | 3.018 | A | A |
| West | 9.31 | 0.62 | 3.129 | A | A |
| East | 3.19 | 0.21 | 2.280 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.77 | 0.38 | 3.290 | A | A |
| West | 13.04 | 0.87 | 3.676 | A | A |
| East | 3.99 | 0.27 | 2.383 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 8.00 | 0.53 | 3.745 | A | A |
| West | 20.60 | 1.37 | 4.804 | A | A |
| East | 5.19 | 0.35 | 2.538 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 8.17 | 0.54 | 3.748 | A | A |
| West | 21.36 | 1.42 | 4.832 | A | A |
| East | 5.26 | 0.35 | 2.538 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 6.01 | 0.40 | 3.295 | A | A |
| West | 13.86 | 0.92 | 3.702 | A | A |
| East | 4.11 | 0.27 | 2.386 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.61 | 0.31 | 3.026 | A | A |
| West | 9.82 | 0.65 | 3.151 | A | A |
| East | 3.29 | 0.22 | 2.282 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)





| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.30 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.64 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.89 | 0.00 | 0.00 | 1.03 | 1.03 | | | N/A | N/A |
| East | 0.27 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.54 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 1.42 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.55 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| West | 1.43 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.90 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.27 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.30 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.64 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and New Dundee.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:43:52 PM

### Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2028 | | | | | | |
| **Leg North** | 0.36 | ~1 | 4.46 | 0.26 | A | 5.24 | A |
| **Leg West** | 0.63 | 1.03 | 3.05 | 0.38 | A | | |
| **Leg East** | 2.57 | 4.07 | 6.52 | 0.72 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM " model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:43:51 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FT 2028, PM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2028, PM | FT 2028 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 5.24 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Robert Ferrie Drive | |
| **West** | West | New Dundee Road | |
| **East** | East | New Dundee Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 262.00 | 100.000 |
| West | ONE HOUR | ✓ | 678.00 | 100.000 |
| East | ONE HOUR | ✓ | 1305.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 93.000 | 169.000 |
| | West | 108.000 | 0.000 | 570.000 |
| | East | 309.000 | 996.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.35 | 0.65 |
| | West | 0.16 | 0.00 | 0.84 |
| | East | 0.24 | 0.76 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| | | | | |





| | | | | |
|---|---|---|---|---|
| | North | 1.000 | 1.020 | 1.020 |
| From | West | 1.010 | 1.000 | 1.030 |
| | East | 1.010 | 1.020 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 2.0 | 2.0 |
| | West | 1.0 | 0.0 | 3.0 |
| | East | 1.0 | 2.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.26 | 4.46 | 0.36 | −1 | A | 240.42 | 360.62 | 23.33 | 3.88 | 0.26 | 23.33 | 3.88 |
| West | 0.38 | 3.05 | 0.63 | 1.03 | A | 622.14 | 933.22 | 43.08 | 2.77 | 0.48 | 43.09 | 2.77 |
| East | 0.72 | 6.52 | 2.57 | 4.07 | A | 1197.49 | 1796.24 | 146.36 | 4.89 | 1.63 | 146.38 | 4.89 |

### Main Results for each time segment

#### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 197.25 | 49.31 | 196.52 | 312.81 | 746.92 | 0.00 | 1303.24 | 915.21 | 0.151 | 0.00 | 0.18 | 3.316 | A |
| West | 510.43 | 127.61 | 509.03 | 816.68 | 126.76 | 0.00 | 1993.00 | 1708.12 | 0.256 | 0.00 | 0.35 | 2.488 | A |
| East | 982.47 | 245.62 | 978.65 | 554.71 | 81.08 | 0.00 | 2021.07 | 1903.69 | 0.486 | 0.00 | 0.96 | 3.501 | A |

#### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 235.53 | 58.88 | 235.29 | 374.38 | 894.00 | 0.00 | 1222.41 | 915.22 | 0.193 | 0.18 | 0.24 | 3.719 | A |
| West | 609.51 | 152.38 | 609.09 | 977.52 | 151.77 | 0.00 | 1977.63 | 1708.12 | 0.308 | 0.35 | 0.46 | 2.701 | A |
| East | 1173.17 | 293.29 | 1171.36 | 663.84 | 97.02 | 0.00 | 2011.27 | 1903.69 | 0.583 | 0.96 | 1.41 | 4.351 | A |

#### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 288.47 | 72.12 | 288.02 | 457.94 | 1093.15 | 0.00 | 1112.95 | 915.22 | 0.259 | 0.24 | 0.35 | 4.449 | A |
| West | 746.49 | 186.62 | 745.79 | 1195.39 | 185.78 | 0.00 | 1956.73 | 1708.12 | 0.382 | 0.46 | 0.63 | 3.051 | A |
| East | 1436.83 | 359.21 | 1432.29 | 812.78 | 118.80 | 0.00 | 1997.89 | 1903.69 | 0.719 | 1.41 | 2.54 | 6.426 | A |

#### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 288.47 | 72.12 | 288.46 | 459.10 | 1096.52 | 0.00 | 1111.10 | 915.22 | 0.260 | 0.35 | 0.36 | 4.463 | A |
| West | 746.49 | 186.62 | 746.48 | 1198.91 | 186.07 | 0.00 | 1956.55 | 1708.12 | 0.382 | 0.63 | 0.63 | 3.053 | A |
| East | 1436.83 | 359.21 | 1436.71 | 813.64 | 118.91 | 0.00 | 1997.82 | 1903.69 | 0.719 | 2.54 | 2.57 | 6.524 | A |

#### Main results: (17:00-17:15)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | |

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 235.53 | 58.88 | 235.98 | 376.06 | 898.84 | 0.00 | 1219.75 | 915.22 | 0.193 | 0.36 | 0.25 | 3.733 | A |
| West | 609.51 | 152.38 | 610.20 | 982.60 | 152.21 | 0.00 | 1977.36 | 1708.12 | 0.308 | 0.63 | 0.46 | 2.706 | A |
| East | 1173.17 | 293.29 | 1177.70 | 665.21 | 97.20 | 0.00 | 2011.16 | 1903.69 | 0.583 | 2.57 | 1.44 | 4.418 | A |

### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 197.25 | 49.31 | 197.50 | 314.45 | 751.28 | 0.00 | 1300.85 | 915.21 | 0.152 | 0.25 | 0.18 | 3.330 | A |
| West | 510.43 | 127.61 | 510.85 | 821.38 | 127.39 | 0.00 | 1992.61 | 1708.12 | 0.256 | 0.46 | 0.35 | 2.496 | A |
| East | 982.47 | 245.62 | 984.36 | 556.87 | 81.37 | 0.00 | 2020.89 | 1903.69 | 0.486 | 1.44 | 0.97 | 3.542 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.67 | 0.18 | 3.316 | A | A |
| West | 5.19 | 0.35 | 2.488 | A | A |
| East | 13.93 | 0.93 | 3.501 | A | A |

### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.58 | 0.24 | 3.719 | A | A |
| West | 6.74 | 0.45 | 2.701 | A | A |
| East | 20.53 | 1.37 | 4.351 | A | A |

### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.21 | 0.35 | 4.449 | A | A |
| West | 9.29 | 0.62 | 3.051 | A | A |
| East | 36.20 | 2.41 | 6.426 | A | A |

### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.34 | 0.36 | 4.463 | A | A |
| West | 9.46 | 0.63 | 3.053 | A | A |
| East | 38.42 | 2.56 | 6.524 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.75 | 0.25 | 3.733 | A | A |
| West | 7.00 | 0.47 | 2.706 | A | A |
| East | 22.38 | 1.49 | 4.418 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.79 | 0.19 | 3.330 | A | A |
| West | 5.39 | 0.36 | 2.496 | A | A |
| East | 14.90 | 0.99 | 3.542 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)





| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.96 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.46 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 1.41 | 0.00 | 0.00 | 2.04 | 4.07 | | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.63 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 2.54 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.63 | 0.00 | 0.00 | 0.00 | 1.03 | | | N/A | N/A |
| East | 2.57 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.46 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 1.44 | 0.00 | 0.00 | 2.04 | 3.05 | | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.35 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.97 | 0.00 | 0.00 | 1.02 | 2.04 | | | N/A | N/A |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 331 | 22 | 728 | 438 | 444 |
| Future Volume (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 331 | 22 | 728 | 438 | 444 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.97 | 1.00 | | 0.98 | 0.99 | 1.00 | | 1.00 | | 0.97 |
| Frt | | | 0.850 | | | 0.850 | | 0.991 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1670 | 3471 | 1488 | 1686 | 3438 | 1417 | 1670 | 3308 | 0 | 3146 | 1863 | 1458 |
| Flt Permitted | 0.089 | | | 0.116 | | | 0.149 | | | 0.950 | | |
| Satd. Flow (perm) | 156 | 3471 | 1447 | 206 | 3438 | 1387 | 259 | 3308 | 0 | 3131 | 1863 | 1410 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 479 | | | 433 | | 4 | | | | 296 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Adj. Flow (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 331 | 22 | 728 | 438 | 444 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 353 | 0 | 728 | 438 | 444 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

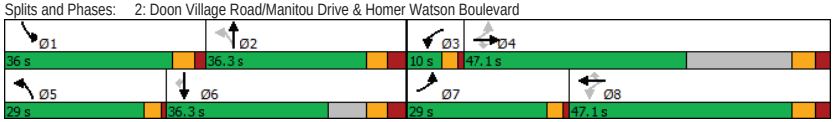




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 61.0 | 61.0 | 49.0 | 40.0 | 40.0 | 56.1 | 29.0 | | 30.0 | 37.2 | 37.2 |
| Actuated g/C Ratio | 0.49 | 0.41 | 0.41 | 0.33 | 0.27 | 0.27 | 0.38 | 0.20 | | 0.20 | 0.25 | 0.25 |
| v/c Ratio | 1.28 | 0.84 | 0.78 | 0.33 | 1.28 | 0.87 | 1.05 | 0.54 | | 1.15 | 0.94 | 0.77 |
| Control Delay | 183.1 | 46.6 | 18.2 | 29.6 | 179.3 | 28.3 | 106.0 | 56.7 | | 134.9 | 83.5 | 27.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 183.1 | 46.6 | 18.2 | 29.6 | 179.3 | 28.3 | 106.0 | 56.7 | | 134.9 | 83.5 | 27.0 |
| LOS | F | D | B | C | F | C | F | E | | F | F | C |
| Approach Delay | | 63.1 | | | 126.4 | | | 80.9 | | | 91.2 | |
| Approach LOS | | E | | | F | | | F | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 148.4 | | | |
| Natural Cycle: 145 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.28 | | | |
| Intersection Signal Delay: 90.0 | | Intersection LOS: F | |
| Intersection Capacity Utilization 124.7% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Total - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 353 | 728 | 438 | 444 |
| v/c Ratio | 1.28 | 0.84 | 0.78 | 0.33 | 1.28 | 0.87 | 1.05 | 0.54 | 1.15 | 0.94 | 0.77 |
| Control Delay | 183.1 | 46.6 | 18.2 | 29.6 | 179.3 | 28.3 | 106.0 | 56.7 | 134.9 | 83.5 | 27.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 183.1 | 46.6 | 18.2 | 29.6 | 179.3 | 28.3 | 106.0 | 56.7 | 134.9 | 83.5 | 27.0 |
| Queue Length 50th (m) | ~148.5 | 179.7 | 60.5 | 6.6 | ~245.2 | 57.0 | ~89.8 | 51.8 | ~135.6 | 135.4 | 45.4 |
| Queue Length 95th (m) | #218.2 | 212.2 | 123.2 | 13.8 | #289.7 | #135.4 | #157.7 | 69.3 | #176.7 | #206.1 | 93.9 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 330 | 1426 | 876 | 127 | 926 | 690 | 337 | 649 | 635 | 466 | 575 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.28 | 0.84 | 0.78 | 0.32 | 1.28 | 0.87 | 1.01 | 0.54 | 1.15 | 0.94 | 0.77 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2028 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 331 | 22 | 728 | 438 | 444 |
| Future Volume (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 331 | 22 | 728 | 438 | 444 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1670 | 3471 | 1447 | 1686 | 3438 | 1387 | 1668 | 3307 | | 3146 | 1863 | 1410 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.12 | 1.00 | 1.00 | 0.15 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 157 | 3471 | 1447 | 205 | 3438 | 1387 | 261 | 3307 | | 3146 | 1863 | 1410 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 421 | 1204 | 685 | 41 | 1189 | 600 | 341 | 331 | 22 | 728 | 438 | 444 |
| RTOR Reduction (vph) | 0 | 0 | 283 | 0 | 0 | 315 | 0 | 3 | 0 | 0 | 0 | 222 |
| Lane Group Flow (vph) | 421 | 1204 | 402 | 41 | 1189 | 285 | 341 | 350 | 0 | 728 | 438 | 222 |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 52.8 | 29.0 | | 30.0 | 37.2 | 37.2 |
| Effective Green, g (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 52.8 | 29.0 | | 30.0 | 37.2 | 37.2 |
| Actuated g/C Ratio | 0.47 | 0.41 | 0.41 | 0.31 | 0.27 | 0.27 | 0.35 | 0.19 | | 0.20 | 0.25 | 0.25 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 326 | 1419 | 591 | 110 | 940 | 379 | 316 | 642 | | 632 | 464 | 351 |
| v/s Ratio Prot | c0.22 | 0.35 | | 0.01 | 0.35 | | 0.17 | 0.11 | | c0.23 | 0.24 | |
| v/s Ratio Perm | c0.39 | | 0.28 | 0.10 | | 0.21 | c0.21 | | | | | 0.16 |
| v/c Ratio | 1.29 | 0.85 | 0.68 | 0.37 | 1.26 | 0.75 | 1.08 | 0.54 | | 1.15 | 0.94 | 0.63 |
| Uniform Delay, d1 | 48.5 | 39.9 | 36.1 | 38.4 | 54.2 | 49.6 | 44.6 | 54.2 | | 59.6 | 55.0 | 49.9 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 152.2 | 4.9 | 3.1 | 2.1 | 127.7 | 8.2 | 73.3 | 3.3 | | 85.6 | 29.9 | 8.4 |
| Delay (s) | 200.7 | 44.8 | 39.2 | 40.6 | 181.9 | 57.8 | 117.9 | 57.5 | | 145.2 | 84.9 | 58.3 |
| Level of Service | F | D | D | D | F | E | F | E | | F | F | E |
| Approach Delay (s) | | 71.6 | | | 138.1 | | | 87.2 | | | 104.8 | |
| Approach LOS | | E | | | F | | | F | | | F | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 100.4 | HCM 2000 Level of Service | F | |
| HCM 2000 Volume to Capacity ratio | 1.23 | | | |
| Actuated Cycle Length (s) | 149.2 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 124.7% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1889 | 6 | 2 | 1631 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1889 | 6 | 2 | 1631 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 0.99 | | | | | | | | | | |
| Frt | | | 0.850 | | | | | | | | 0.985 | |
| Flt Protected | | 0.953 | | | 0.979 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1493 | 1417 | 0 | 1517 | 0 | 1670 | 3182 | 0 | 1686 | 3173 | 0 |
| Flt Permitted | | 0.726 | | | 0.896 | | 0.950 | | | 0.088 | | |
| Satd. Flow (perm) | 0 | 1131 | 1417 | 0 | 1389 | 0 | 1670 | 3182 | 0 | 156 | 3173 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 125 | | | | | | | | 12 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1889 | 6 | 2 | 1631 | 187 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 144 | 125 | 0 | 7 | 0 | 127 | 1895 | 0 | 2 | 1818 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

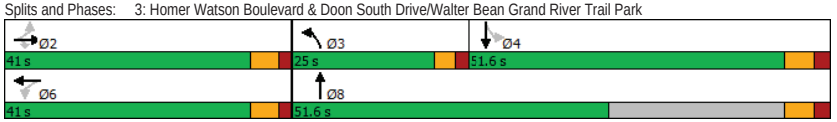




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.4 | 45.4 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| v/c Ratio | | 0.69 | 0.35 | | 0.03 | | 0.55 | 0.88 | | 0.03 | 1.17 | |
| Control Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 19.2 | | 18.0 | 110.0 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 19.2 | | 18.0 | 110.0 | |
| LOS | | D | A | | C | | D | B | | B | F | |
| Approach Delay | | 32.8 | | | 31.1 | | | 21.0 | | | 109.9 | |
| Approach LOS | | C | | | C | | | C | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 93.3 | | | |
| Natural Cycle: 110 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.17 | | | |
| Intersection Signal Delay: 61.1 | | Intersection LOS: E | |
| Intersection Capacity Utilization 104.6% | | ICU Level of Service G | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2038 Total PM Peak Hour

| Lane Group | EBT | EBR | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 144 | 125 | 7 | 127 | 1895 | 2 | 1818 |
| v/c Ratio | 0.69 | 0.35 | 0.03 | 0.55 | 0.88 | 0.03 | 1.17 |
| Control Delay | 53.5 | 8.9 | 31.1 | 48.1 | 19.2 | 18.0 | 110.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.5 | 8.9 | 31.1 | 48.1 | 19.2 | 18.0 | 110.0 |
| Queue Length 50th (m) | 25.3 | 0.0 | 1.1 | 22.5 | 129.1 | 0.2 | ~213.6 |
| Queue Length 95th (m) | 48.8 | 14.7 | 5.0 | 44.9 | #260.4 | 2.0 | #327.9 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | 35.0 | |
| Base Capacity (vph) | 428 | 614 | 525 | 361 | 2410 | 75 | 1550 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.20 | 0.01 | 0.35 | 0.79 | 0.03 | 1.17 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2038 Total PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1889 | 6 | 2 | 1631 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1889 | 6 | 2 | 1631 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | | 0.95 | 1.00 | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1487 | 1417 | | 1517 | | 1670 | 3181 | | 1686 | 3172 | |
| Flt Permitted | | 0.73 | 1.00 | | 0.90 | | 0.95 | 1.00 | | 0.09 | 1.00 | |
| Satd. Flow (perm) | | 1132 | 1417 | | 1389 | | 1670 | 3181 | | 156 | 3172 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1889 | 6 | 2 | 1631 | 187 |
| RTOR Reduction (vph) | 0 | 0 | 102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Lane Group Flow (vph) | 0 | 144 | 23 | 0 | 7 | 0 | 127 | 1895 | 0 | 2 | 1812 | 0 |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Effective Green, g (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Grp Cap (vph) | | 208 | 261 | | 256 | | 231 | 2163 | | 76 | 1548 | |
| v/s Ratio Prot | | | | | | | 0.08 | c0.60 | | | c0.57 | |
| v/s Ratio Perm | | c0.13 | 0.02 | | 0.01 | | | | | 0.01 | | |
| v/c Ratio | | 0.69 | 0.09 | | 0.03 | | 0.55 | 0.88 | | 0.03 | 1.17 | |
| Uniform Delay, d1 | | 35.5 | 31.5 | | 31.1 | | 37.4 | 11.8 | | 12.4 | 23.9 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 9.5 | 0.1 | | 0.0 | | 2.7 | 5.4 | | 0.6 | 84.0 | |
| Delay (s) | | 45.1 | 31.6 | | 31.2 | | 40.1 | 17.2 | | 13.0 | 107.8 | |
| Level of Service | | D | C | | C | | D | B | | B | F | |
| Approach Delay (s) | | 38.8 | | | 31.2 | | | 18.6 | | | 107.7 | |
| Approach LOS | | D | | | C | | | B | | | F | |

Intersection Summary

| | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 59.3 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 1.04 | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | 17.6 |
| Intersection Capacity Utilization | 104.6% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 228 | 29 | 175 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| Future Volume (vph) | 228 | 29 | 175 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.98 | | 0.99 | | 0.97 | | | 0.99 | 1.00 | | 0.98 |
| Frt | | 0.871 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 2500 | 0 | 1576 | 1827 | 1340 | 1547 | 4940 | 1377 | 2870 | 3471 | 1458 |
| Flt Permitted | 0.722 | | | 0.471 | | | 0.097 | | | 0.950 | | |
| Satd. Flow (perm) | 1217 | 2500 | 0 | 773 | 1827 | 1306 | 158 | 4940 | 1359 | 2869 | 3471 | 1425 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 175 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Adj. Flow (vph) | 228 | 29 | 175 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 228 | 204 | 0 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

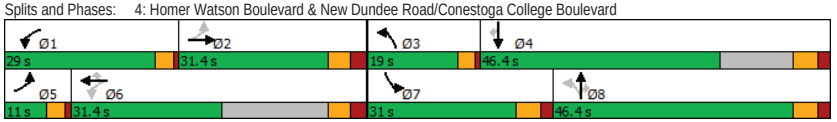




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 17.1 | 7.7 | | 21.5 | 10.2 | 10.2 | 56.5 | 41.4 | 41.4 | 10.3 | 40.9 | 40.9 |
| Actuated g/C Ratio | 0.19 | 0.08 | | 0.23 | 0.11 | 0.11 | 0.62 | 0.45 | 0.45 | 0.11 | 0.45 | 0.45 |
| v/c Ratio | 0.88 | 0.55 | | 0.54 | 0.26 | 0.42 | 0.65 | 0.76 | 0.13 | 0.32 | 1.04 | 0.08 |
| Control Delay | 67.6 | 15.9 | | 35.7 | 40.1 | 8.9 | 27.7 | 24.3 | 0.4 | 41.9 | 61.0 | 0.2 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 67.6 | 15.9 | | 35.7 | 40.1 | 8.9 | 27.7 | 24.3 | 0.4 | 41.9 | 61.0 | 0.2 |
| LOS | E | B | | D | D | A | C | C | A | D | E | A |
| Approach Delay | | 43.2 | | | 26.7 | | | 23.6 | | | 57.9 | |
| Approach LOS | | D | | | C | | | C | | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 91.7 | | | |
| Natural Cycle: 130 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.04 | | | |
| Intersection Signal Delay: 39.3 | | Intersection LOS: D | |
| Intersection Capacity Utilization 98.1% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2038 Total - PM Peak Hour

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 228 | 204 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| v/c Ratio | 0.88 | 0.55 | 0.54 | 0.26 | 0.42 | 0.65 | 0.76 | 0.13 | 0.32 | 1.04 | 0.08 |
| Control Delay | 67.6 | 15.9 | 35.7 | 40.1 | 8.9 | 27.7 | 24.3 | 0.4 | 41.9 | 61.0 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 67.6 | 15.9 | 35.7 | 40.1 | 8.9 | 27.7 | 24.3 | 0.4 | 41.9 | 61.0 | 0.2 |
| Queue Length 50th (m) | 36.6 | 2.6 | 21.7 | 9.2 | 0.0 | 16.4 | 89.7 | 0.0 | 8.9 | ~170.6 | 0.0 |
| Queue Length 95th (m) | #77.9 | 14.1 | 38.9 | 20.6 | 10.0 | 44.5 | 130.7 | 0.0 | 18.2 | #251.2 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 258 | 810 | 441 | 859 | 687 | 329 | 2227 | 705 | 784 | 1974 | 863 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.88 | 0.25 | 0.32 | 0.06 | 0.16 | 0.57 | 0.76 | 0.13 | 0.13 | 0.81 | 0.07 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2038 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 228 | 29 | 175 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| Future Volume (vph) | 228 | 29 | 175 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.87 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1612 | 2512 | | 1571 | 1827 | 1312 | 1547 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Flt Permitted | 0.72 | 1.00 | | 0.47 | 1.00 | 1.00 | 0.10 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1226 | 2512 | | 778 | 1827 | 1312 | 157 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 228 | 29 | 175 | 143 | 53 | 112 | 189 | 1688 | 89 | 101 | 1608 | 57 |
| RTOR Reduction (vph) | 0 | 160 | 0 | 0 | 0 | 100 | 0 | 0 | 49 | 0 | 0 | 32 |
| Lane Group Flow (vph) | 228 | 44 | 0 | 143 | 53 | 12 | 189 | 1688 | 40 | 101 | 1608 | 25 |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 14.7 | 7.7 | | 19.7 | 10.2 | 10.2 | 54.1 | 41.4 | 41.4 | 10.3 | 41.0 | 41.0 |
| Effective Green, g (s) | 14.7 | 7.7 | | 19.7 | 10.2 | 10.2 | 54.1 | 41.4 | 41.4 | 10.3 | 41.0 | 41.0 |
| Actuated g/C Ratio | 0.16 | 0.08 | | 0.21 | 0.11 | 0.11 | 0.59 | 0.45 | 0.45 | 0.11 | 0.45 | 0.45 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 226 | 210 | | 249 | 203 | 145 | 285 | 2230 | 613 | 322 | 1551 | 639 |
| v/s Ratio Prot | c0.08 | 0.02 | | c0.06 | 0.03 | | c0.09 | 0.34 | | 0.04 | c0.46 | |
| v/s Ratio Perm | c0.08 | | | 0.06 | | 0.01 | 0.30 | | 0.03 | | | 0.02 |
| v/c Ratio | 1.01 | 0.21 | | 0.57 | 0.26 | 0.09 | 0.66 | 0.76 | 0.07 | 0.31 | 1.04 | 0.04 |
| Uniform Delay, d1 | 38.0 | 39.2 | | 31.1 | 37.3 | 36.6 | 20.7 | 21.0 | 14.2 | 37.4 | 25.4 | 14.3 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 62.2 | 0.5 | | 2.0 | 0.7 | 0.3 | 5.7 | 2.5 | 0.2 | 0.6 | 33.0 | 0.1 |
| Delay (s) | 100.2 | 39.7 | | 33.1 | 38.0 | 36.8 | 26.4 | 23.4 | 14.4 | 38.0 | 58.3 | 14.4 |
| Level of Service | F | D | | C | D | D | C | C | B | D | E | B |
| Approach Delay (s) | | 71.6 | | | 35.3 | | | 23.3 | | | 55.7 | |
| Approach LOS | | E | | | D | | | C | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 41.6 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 0.96 | | | |
| Actuated Cycle Length (s) | 91.7 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 98.1% | ICU Level of Service | F | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 114 | 0 | 557 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 133 |
| Future Volume (vph) | 114 | 0 | 557 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 133 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1621 | 0 | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | 0 | 0 | 5036 | 1458 |
| Flt Permitted | 0.132 | | | 0.950 | | | 0.115 | | | | | |
| Satd. Flow (perm) | 225 | 0 | 1458 | 1637 | 1881 | 1390 | 198 | 3438 | 0 | 0 | 5036 | 1458 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 222 | | | 364 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Adj. Flow (vph) | 114 | 0 | 557 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 133 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 114 | 0 | 557 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 133 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

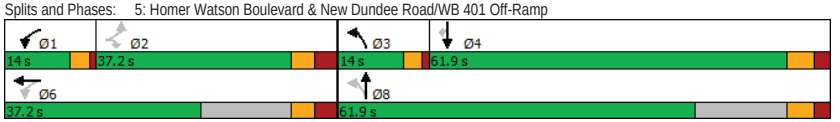




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.2 | | 30.2 | 47.4 | 44.2 | 116.0 | 60.5 | 57.6 | | | 43.5 | 43.5 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.41 | 0.38 | 1.00 | 0.52 | 0.50 | | | 0.38 | 0.38 |
| v/c Ratio | 1.97 | | 1.03 | 0.38 | 1.23 | 0.75 | 1.75 | 0.48 | | | 0.66 | 0.22 |
| Control Delay | 513.9 | | 72.1 | 27.6 | 148.7 | 3.7 | 379.5 | 20.0 | | | 31.6 | 7.5 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 513.9 | | 72.1 | 27.6 | 148.7 | 3.7 | 379.5 | 20.0 | | | 31.6 | 7.5 |
| LOS | F | | E | C | F | A | F | C | | | C | A |
| Approach Delay | | 147.1 | | | 65.4 | | | 138.3 | | | 29.3 | |
| Approach LOS | | F | | | E | | | F | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 116 | | | |
| Natural Cycle: 80 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 1.97 | | | |
| Intersection Signal Delay: 82.6 | | Intersection LOS: F | |
| Intersection Capacity Utilization 119.4% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Total - PM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 114 | 557 | 251 | 882 | 1036 | 400 | 816 | 1248 | 133 |
| v/c Ratio | 1.97 | 1.03 | 0.38 | 1.23 | 0.75 | 1.75 | 0.48 | 0.66 | 0.22 |
| Control Delay | 513.9 | 72.1 | 27.6 | 148.7 | 3.7 | 379.5 | 20.0 | 31.6 | 7.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 513.9 | 72.1 | 27.6 | 148.7 | 3.7 | 379.5 | 20.0 | 31.6 | 7.5 |
| Queue Length 50th (m) | ~42.3 | ~100.4 | 41.4 | ~262.0 | 0.0 | ~121.7 | 65.1 | 89.3 | 4.2 |
| Queue Length 95th (m) | #87.3 | #189.6 | 73.5 | #384.5 | 0.0 | #197.2 | 81.0 | 104.3 | 16.8 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 58 | 543 | 669 | 717 | 1390 | 228 | 2055 | 2400 | 749 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.97 | 1.03 | 0.38 | 1.23 | 0.75 | 1.75 | 0.40 | 0.52 | 0.18 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2028 Total - PM Peak Hour

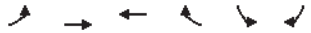
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 114 | 0 | 557 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 133 |
| Future Volume (vph) | 114 | 0 | 557 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 133 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1621 | | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | | | 5036 | 1458 |
| Flt Permitted | 0.13 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.12 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 226 | | 1458 | 1637 | 1881 | 1390 | 198 | 3438 | | | 5036 | 1458 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 114 | 0 | 557 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 133 |
| RTOR Reduction (vph) | 0 | 0 | 164 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 66 |
| Lane Group Flow (vph) | 114 | 0 | 393 | 251 | 882 | 1036 | 400 | 816 | 0 | 0 | 1248 | 67 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 115.9 | 57.6 | 57.6 | | | 43.6 | 43.6 |
| Effective Green, g (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 115.9 | 57.6 | 57.6 | | | 43.6 | 43.6 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.38 | 0.38 | 1.00 | 0.50 | 0.50 | | | 0.38 | 0.38 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 58 | | 379 | 624 | 717 | 1390 | 222 | 1708 | | | 1894 | 548 |
| v/s Ratio Prot | | | | 0.03 | c0.47 | | c0.16 | 0.24 | | | 0.25 | |
| v/s Ratio Perm | c0.50 | | 0.27 | 0.12 | | 0.75 | c0.74 | | | | | 0.05 |
| v/c Ratio | 1.97 | | 1.04 | 0.40 | 1.23 | 0.75 | 1.80 | 0.48 | | | 0.66 | 0.12 |
| Uniform Delay, d1 | 42.9 | | 42.9 | 26.2 | 35.9 | 0.0 | 25.0 | 19.2 | | | 30.0 | 23.6 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 490.5 | | 56.0 | 0.9 | 115.6 | 3.7 | 378.2 | 0.4 | | | 1.1 | 0.2 |
| Delay (s) | 533.3 | | 98.8 | 27.1 | 151.4 | 3.7 | 403.1 | 19.7 | | | 31.1 | 23.9 |
| Level of Service | F | | F | C | F | A | F | B | | | C | C |
| Approach Delay (s) | | 172.7 | | | 66.5 | | | 145.8 | | | 30.4 | |
| Approach LOS | | F | | | E | | | F | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 88.2 | HCM 2000 Level of Service | F | | |
| HCM 2000 Volume to Capacity ratio | 1.85 | | | | |
| Actuated Cycle Length (s) | 115.9 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 119.4% | ICU Level of Service | H | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: New Dundee Road & Pinnacle Drive

2028 Total - PM Peak Hour



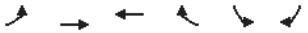
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 11 | 830 | 1388 | 97 | 52 | 12 |
| Future Volume (vph) | 11 | 830 | 1388 | 97 | 52 | 12 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.991 | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.961 | |
| Satd. Flow (prot) | 0 | 1601 | 1604 | 0 | 1654 | 0 |
| Flt Permitted | | 0.999 | | | 0.961 | |
| Satd. Flow (perm) | 0 | 1601 | 1604 | 0 | 1654 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 3% | 2% | 1% | 0% | 0% |
| Adj. Flow (vph) | 11 | 830 | 1388 | 97 | 52 | 12 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 841 | 1485 | 0 | 64 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 101.4% | | ICU Level of Service G | |
| Analysis Period (min) 15 | | | |



HCM Unsignalized Intersection Capacity Analysis
6: New Dundee Road & Pinnacle Drive

2028 Total - PM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 11 | 830 | 1388 | 97 | 52 | 12 |
| Future Volume (Veh/h) | 11 | 830 | 1388 | 97 | 52 | 12 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 830 | 1388 | 97 | 52 | 12 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1485 | | | | 2288 | 1436 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1485 | | | | 2288 | 1436 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 98 | | | | 0 | 93 |
| cM capacity (veh/h) | 459 | | | | 43 | 165 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 841 | 1485 | 64 |
| Volume Left | 11 | 0 | 52 |
| Volume Right | 0 | 97 | 12 |
| cSH | 459 | 1700 | 50 |
| Volume to Capacity | 0.02 | 0.87 | 1.29 |
| Queue Length 95th (m) | 0.6 | 0.0 | 47.0 |
| Control Delay (s) | 0.8 | 0.0 | 356.5 |
| Lane LOS | A | | F |
| Approach Delay (s) | 0.8 | 0.0 | 356.5 |
| Approach LOS | | | F |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 9.8 | | |
| Intersection Capacity Utilization | 101.4% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 108 | 570 | 996 | 309 | 169 | 93 |
| Future Volume (vph) | 108 | 570 | 996 | 309 | 169 | 93 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.952 | |
| Flt Protected | 0.950 | | | | 0.969 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1596 | 0 |
| Flt Permitted | 0.090 | | | | 0.969 | |
| Satd. Flow (perm) | 158 | 1845 | 1618 | 1389 | 1596 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 89 | 30 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Adj. Flow (vph) | 108 | 570 | 996 | 309 | 169 | 93 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 108 | 570 | 996 | 309 | 262 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |



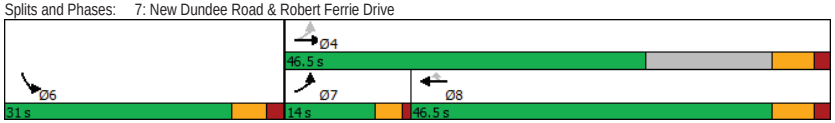


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 53.2 | 50.7 | 40.2 | 40.2 | 25.1 | |
| Actuated g/C Ratio | 0.60 | 0.57 | 0.45 | 0.45 | 0.28 | |
| v/c Ratio | 0.44 | 0.54 | 1.36 | 0.46 | 0.55 | |
| Control Delay | 15.0 | 13.7 | 193.5 | 14.8 | 29.8 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 15.0 | 13.7 | 193.5 | 14.8 | 29.8 | |
| LOS | B | B | F | B | C | |
| Approach Delay | | 13.9 | 151.2 | | 29.8 | |
| Approach LOS | | B | F | | C | |

**Intersection Summary**

Area Type: Other
Cycle Length: 91.5
Actuated Cycle Length: 88.4
Natural Cycle: 100
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.36
Intersection Signal Delay: 95.6 Intersection LOS: F
Intersection Capacity Utilization 96.7% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
## 7: New Dundee Road & Robert Ferrie Drive

2028 Total - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 108 | 570 | 996 | 309 | 262 |
| v/c Ratio | 0.44 | 0.54 | 1.36 | 0.46 | 0.55 |
| Control Delay | 15.0 | 13.7 | 193.5 | 14.8 | 29.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 15.0 | 13.7 | 193.5 | 14.8 | 29.8 |
| Queue Length 50th (m) | 7.5 | 57.8 | ~249.1 | 27.0 | 36.7 |
| Queue Length 95th (m) | 18.4 | 85.4 | #325.4 | 50.4 | 62.6 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 266 | 1132 | 735 | 679 | 474 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.41 | 0.50 | 1.36 | 0.46 | 0.55 |

Intersection Summary

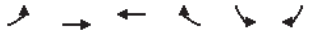
~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 7: New Dundee Road & Robert Ferrie Drive

2028 Total - PM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 108 | 570 | 996 | 309 | 169 | 93 |
| Future Volume (vph) | 108 | 570 | 996 | 309 | 169 | 93 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1596 | |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 159 | 1845 | 1618 | 1389 | 1596 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 108 | 570 | 996 | 309 | 169 | 93 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 49 | 22 | 0 |
| Lane Group Flow (vph) | 108 | 570 | 996 | 260 | 240 | 0 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 51.6 | 51.6 | 40.2 | 40.2 | 25.1 | |
| Effective Green, g (s) | 51.6 | 51.6 | 40.2 | 40.2 | 25.1 | |
| Actuated g/C Ratio | 0.58 | 0.58 | 0.45 | 0.45 | 0.28 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 217 | 1067 | 729 | 625 | 449 | |
| v/s Ratio Prot | 0.04 | c0.31 | c0.62 | | c0.15 | |
| v/s Ratio Perm | 0.25 | | | 0.19 | | |
| v/c Ratio | 0.50 | 0.53 | 1.37 | 0.42 | 0.54 | |
| Uniform Delay, d1 | 18.1 | 11.5 | 24.5 | 16.6 | 27.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.8 | 0.5 | 173.6 | 0.5 | 4.5 | |
| Delay (s) | 19.9 | 12.0 | 198.1 | 17.0 | 31.6 | |
| Level of Service | B | B | F | B | C | |
| Approach Delay (s) | | 13.2 | 155.2 | | 31.6 | |
| Approach LOS | | B | F | | C | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 97.9 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.01 | | |
| Actuated Cycle Length (s) | 89.2 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 96.7% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## Lanes, Volumes, Timings
## 8: New Dundee Road

2028 Total - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 593 | 89 | 20 | 629 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (vph) | 26 | 593 | 89 | 20 | 629 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.983 | | | 0.996 | | | 0.984 | | | 0.955 | |
| Flt Protected | | 0.998 | | | 0.999 | | | 0.979 | | | 0.997 | |
| Satd. Flow (prot) | 0 | 1504 | 0 | 0 | 1495 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Flt Permitted | | 0.998 | | | 0.999 | | | 0.979 | | | 0.997 | |
| Satd. Flow (perm) | 0 | 1504 | 0 | 0 | 1495 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 1% | 2% | 10% | 3% | 0% | 3% | 0% | 0% | 0% | 3% | 0% |
| Adj. Flow (vph) | 26 | 593 | 89 | 20 | 629 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 708 | 0 | 0 | 667 | 0 | 0 | 162 | 0 | 0 | 57 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 83.2% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

2028 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 26 | 593 | 89 | 20 | 629 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (Veh/h) | 26 | 593 | 89 | 20 | 629 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 26 | 593 | 89 | 20 | 629 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 647 | | | 682 | | | 1404 | 1376 | 638 | 1424 | 1412 | 638 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 647 | | | 682 | | | 1404 | 1376 | 638 | 1424 | 1412 | 638 |
| tC, single (s) | 4.1 | | | 4.2 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.3 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 97 | | | 98 | | | 21 | 46 | 96 | 93 | 74 | 96 |
| cM capacity (veh/h) | 948 | | | 874 | | | 86 | 139 | 481 | 61 | 131 | 480 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 708 | 667 | 162 | 57 |
| Volume Left | 26 | 20 | 68 | 4 |
| Volume Right | 89 | 18 | 19 | 19 |
| cSH | 948 | 874 | 118 | 156 |
| Volume to Capacity | 0.03 | 0.02 | 1.37 | 0.37 |
| Queue Length 95th (m) | 0.7 | 0.6 | 87.8 | 12.3 |
| Control Delay (s) | 0.7 | 0.6 | 277.9 | 40.8 |
| Lane LOS | A | A | F | E |
| Approach Delay (s) | 0.7 | 0.6 | 277.9 | 40.8 |
| Approach LOS | | | F | E |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | | 30.3 | | |
| Intersection Capacity Utilization | | 83.2% | ICU Level of Service | E |
| Analysis Period (min) | | 15 | | |

## Lanes, Volumes, Timings
## 10: Doon Mills Road & Apple Ridge Drive

2028 Total - PM Peak Hour

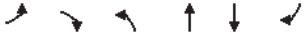
| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.983 | | | | 0.950 | |
| Flt Protected | 0.958 | | | 0.992 | | |
| Satd. Flow (prot) | 1662 | 0 | 0 | 1605 | 1542 | 0 |
| Flt Permitted | 0.958 | | | 0.992 | | |
| Satd. Flow (perm) | 1662 | 0 | 0 | 1605 | 1542 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | 2 | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 245 | 0 | 0 | 320 | 781 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 86.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 10: Doon Mills Road & Apple Ridge Drive

2028 Total - PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 215 | 30 | 50 | 270 | 490 | 291 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 245 | 320 | 781 |
| Volume Left (vph) | 215 | 50 | 0 |
| Volume Right (vph) | 30 | 0 | 291 |
| Hadj (s) | 0.10 | 0.07 | -0.20 |
| Departure Headway (s) | 6.5 | 5.8 | 5.1 |
| Degree Utilization, x | 0.44 | 0.51 | 1.11 |
| Capacity (veh/h) | 539 | 610 | 699 |
| Control Delay (s) | 14.6 | 14.7 | 87.4 |
| Approach Delay (s) | 14.6 | 14.7 | 87.4 |
| Approach LOS | B | B | F |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 56.9 | | |
| Level of Service | F | | |
| Intersection Capacity Utilization | 86.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.868 | | 0.983 | | | |
| Flt Protected | 0.999 | | | | | 0.955 |
| Satd. Flow (prot) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Flt Permitted | 0.999 | | | | | 0.955 |
| Satd. Flow (perm) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Confl. Peds. (#/hr) | 49 | | | 7 | 7 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 5% | 0% |
| Adj. Flow (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 276 | 0 | 16 | 0 | 0 | 221 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |





| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (Veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Pedestrians | 7 | | 49 | | | |
| Lane Width (m) | 3.6 | | 3.6 | | | |
| Walking Speed (m/s) | 1.2 | | 1.2 | | | |
| Percent Blockage | 1 | | 4 | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 500 | 22 | | | 23 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 500 | 22 | | | 23 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 98 | 74 | | | 87 | |
| cM capacity (veh/h) | 441 | 1055 | | | 1564 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 276 | 16 | 221 |
| Volume Left | 7 | 0 | 208 |
| Volume Right | 269 | 2 | 0 |
| cSH | 1019 | 1700 | 1564 |
| Volume to Capacity | 0.27 | 0.01 | 0.13 |
| Queue Length 95th (m) | 8.8 | 0.0 | 3.7 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | 8.4 | | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | | A |
| Analysis Period (min) | 15 | | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.976 | | | | 0.850 | | 0.995 | | | 0.985 | |
| Flt Protected | 0.950 | | | | 0.990 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1653 | 1587 | 0 | 0 | 1621 | 1430 | 1686 | 1579 | 0 | 1621 | 1585 | 0 |
| Flt Permitted | 0.678 | | | | 0.935 | | 0.220 | | | 0.487 | | |
| Satd. Flow (perm) | 1164 | 1587 | 0 | 0 | 1526 | 1380 | 388 | 1579 | 0 | 829 | 1585 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 14 | | | | 101 | | 4 | | | 13 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 63 | 86 | 0 | 0 | 123 | 101 | 13 | 384 | 0 | 135 | 686 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

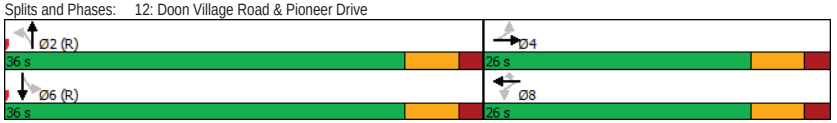




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.17 | 0.17 | | | 0.25 | 0.20 | 0.07 | 0.50 | | 0.34 | 0.89 | |
| Control Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.8 | 13.6 | | 12.9 | 31.0 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.8 | 13.6 | | 12.9 | 31.0 | |
| LOS | B | B | | | B | A | A | B | | B | C | |
| Approach Delay | | 15.1 | | | 11.7 | | | 13.5 | | | 28.0 | |
| Approach LOS | | B | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.89 | | | |
| Intersection Signal Delay: 20.9 | | Intersection LOS: C | |
| Intersection Capacity Utilization 78.2% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2028 Total - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 63 | 86 | 123 | 101 | 13 | 384 | 135 | 686 |
| v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.07 | 0.50 | 0.34 | 0.89 |
| Control Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.8 | 13.6 | 12.9 | 31.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.8 | 13.6 | 12.9 | 31.0 |
| Queue Length 50th (m) | 5.3 | 6.1 | 10.7 | 0.0 | 0.8 | 29.0 | 9.3 | 68.4 |
| Queue Length 95th (m) | 13.4 | 15.0 | 22.3 | 8.9 | 3.5 | 50.8 | 21.1 | #136.1 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 375 | 521 | 492 | 513 | 187 | 766 | 401 | 773 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.07 | 0.50 | 0.34 | 0.89 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2028 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1632 | 1587 | | | 1616 | 1380 | 1678 | 1580 | | 1617 | 1584 | |
| Flt Permitted | 0.68 | 1.00 | | | 0.93 | 1.00 | 0.22 | 1.00 | | 0.49 | 1.00 | |
| Satd. Flow (perm) | 1164 | 1587 | | | 1526 | 1380 | 388 | 1580 | | 828 | 1584 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 0 | 68 | 0 | 2 | 0 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 63 | 77 | 0 | 0 | 123 | 33 | 13 | 382 | 0 | 135 | 679 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 375 | 511 | | | 492 | 445 | 187 | 764 | | 400 | 766 | |
| v/s Ratio Prot | | 0.05 | | | | | | 0.24 | | | c0.43 | |
| v/s Ratio Perm | 0.05 | | | | c0.08 | 0.02 | 0.03 | | | 0.16 | | |
| v/c Ratio | 0.17 | 0.15 | | | 0.25 | 0.07 | 0.07 | 0.50 | | 0.34 | 0.89 | |
| Uniform Delay, d1 | 15.0 | 14.9 | | | 15.5 | 14.6 | 8.5 | 10.9 | | 9.9 | 14.5 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.6 | | | 1.2 | 0.3 | 0.7 | 2.3 | | 2.3 | 14.4 | |
| Delay (s) | 16.0 | 15.6 | | | 16.7 | 14.9 | 9.3 | 13.2 | | 12.1 | 28.8 | |
| Level of Service | B | B | | | B | B | A | B | | B | C | |
| Approach Delay (s) | | 15.8 | | | 15.9 | | | 13.1 | | | 26.1 | |
| Approach LOS | | B | | | B | | | B | | | C | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 20.4 | HCM 2000 Level of Service | C | |
| HCM 2000 Volume to Capacity ratio | 0.63 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 78.2% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:47:39 PM

## Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2028 | | | | | | |
| Leg North | 0.09 | ~1 | 2.60 | 0.07 | A | 3.37 | A |
| Leg West | 0.71 | 1.06 | 3.11 | 0.40 | A | | |
| Leg South | 0.85 | 1.02 | 4.16 | 0.46 | A | | |
| Leg East | 0.34 | ~1 | 2.76 | 0.23 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM " model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:47:38 PM*

## File summary

| | |
|---|---|
| Title | (untitled) |
| Location | |
| Site Number | |
| Date | 2023-12-13 |
| Version | |
| Status | (new file) |
| Identifier | |
| Client | |
| Jobnumber | |
| Analyst | AdamMorrison |
| Description | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FT 2028, AM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2028, AM | FT 2028 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 3.37 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Strasburg Road | |
| West | West | Huron Road | |
| South | South | Strasburg Road | |
| East | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| South | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| South | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

#### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| **North** | Percentage | ROW Standard | | 90.00 |
| **West** | Percentage | ROW Standard | | 90.00 |
| **South** | Percentage | ROW Standard | | 90.00 |
| **East** | Percentage | ROW Standard | | 90.00 |

#### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| **North** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **West** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **South** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **East** | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| **North** | ONE HOUR | ✓ | 113.00 | 100.000 |
| **West** | ONE HOUR | ✓ | 752.00 | 100.000 |
| **South** | ONE HOUR | ✓ | 668.00 | 100.000 |
| **East** | ONE HOUR | ✓ | 409.00 | 100.000 |

# Turning Proportions

#### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.000 | 67.000 | 18.000 | 28.000 |
| | **West** | 200.000 | 0.000 | 54.000 | 498.000 |
| | **South** | 55.000 | 74.000 | 0.000 | 539.000 |
| | **East** | 66.000 | 214.000 | 129.000 | 0.000 |

#### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.00 | 0.59 | 0.16 | 0.25 |
| | **West** | 0.27 | 0.00 | 0.07 | 0.66 |
| | **South** | 0.08 | 0.11 | 0.00 | 0.81 |
| | **East** | 0.16 | 0.52 | 0.32 | 0.00 |





# Vehicle Mix

#### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 1.000 | 1.190 | 1.350 | 1.370 |
| | **West** | 1.050 | 1.000 | 1.210 | 1.050 |
| | **South** | 1.150 | 1.040 | 1.000 | 1.000 |
| | **East** | 1.250 | 1.130 | 1.090 | 1.000 |

#### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.0 | 19.0 | 35.0 | 37.0 |
| | **West** | 5.0 | 0.0 | 21.0 | 5.0 |
| | **South** | 15.0 | 4.0 | 0.0 | 0.0 |
| | **East** | 25.0 | 13.0 | 9.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.07 | 2.60 | 0.09 | −1 | A | 103.69 | 155.54 | 6.48 | 2.50 | 0.07 | 6.48 | 2.50 |
| **West** | 0.40 | 3.11 | 0.71 | 1.06 | A | 690.05 | 1035.07 | 48.27 | 2.80 | 0.54 | 48.28 | 2.80 |
| **South** | 0.46 | 4.16 | 0.85 | 1.02 | A | 612.97 | 919.45 | 53.15 | 3.47 | 0.59 | 53.15 | 3.47 |
| **East** | 0.23 | 2.76 | 0.34 | −1 | A | 375.31 | 562.96 | 24.15 | 2.57 | 0.27 | 24.15 | 2.57 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 85.07 | 21.27 | 84.85 | 240.99 | 313.08 | 0.00 | 1966.37 | 1040.86 | 0.043 | 0.00 | 0.06 | 2.400 | A |
| **West** | 566.15 | 141.54 | 564.58 | 266.53 | 131.40 | 0.00 | 2097.72 | 1483.63 | 0.270 | 0.00 | 0.39 | 2.487 | A |
| **South** | 502.91 | 125.73 | 501.34 | 150.92 | 545.07 | 0.00 | 1798.66 | 1010.69 | 0.280 | 0.00 | 0.39 | 2.813 | A |
| **East** | 307.92 | 76.98 | 307.10 | 799.43 | 246.97 | 0.00 | 2014.16 | 1766.34 | 0.153 | 0.00 | 0.20 | 2.391 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 101.58 | 25.40 | 101.53 | 288.36 | 374.63 | 0.00 | 1921.87 | 1040.86 | 0.053 | 0.06 | 0.07 | 2.480 | A |
| **West** | 676.03 | 169.01 | 675.56 | 318.93 | 157.23 | 0.00 | 2079.04 | 1483.63 | 0.325 | 0.39 | 0.51 | 2.719 | A |
| **South** | 600.52 | 150.13 | 599.92 | 180.58 | 652.21 | 0.00 | 1721.20 | 1010.69 | 0.349 | 0.39 | 0.54 | 3.257 | A |
| **East** | 367.68 | 91.92 | 367.47 | 956.61 | 295.52 | 0.00 | 1979.06 | 1766.34 | 0.186 | 0.20 | 0.26 | 2.533 | A |

#### Main results: (08:30-08:45)

| | Total | Intersection | Entry | Exit Flow | Circulating | Pedestrian | Capacity | Saturation | V/C | Start | End | Delay | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Leg | Demand (PCE/hr) | Arrivals (PCE) | Flow (PCE/hr) | (PCE/hr) | Flow (PCE/hr) | Demand (Ped/hr) | (PCE/hr) | Capacity (PCE/hr) | Ratio | Queue (PCE) | Queue (PCE) | (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 124.42 | 31.10 | 124.34 | 353.06 | 458.71 | 0.00 | 1861.09 | 1040.86 | 0.067 | 0.07 | 0.09 | 2.600 | A |
| West | 827.97 | 206.99 | 827.15 | 390.50 | 192.54 | 0.00 | 2053.51 | 1483.63 | 0.403 | 0.51 | 0.71 | 3.110 | A |
| South | 735.48 | 183.87 | 734.28 | 221.13 | 798.57 | 0.00 | 1615.39 | 1010.69 | 0.455 | 0.54 | 0.84 | 4.141 | A |
| East | 450.32 | 112.58 | 449.97 | 1171.06 | 361.79 | 0.00 | 1931.16 | 1766.34 | 0.233 | 0.26 | 0.34 | 2.757 | A |

### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 124.42 | 31.10 | 124.41 | 353.42 | 459.12 | 0.00 | 1860.79 | 1040.86 | 0.067 | 0.09 | 0.09 | 2.600 | A |
| West | 827.97 | 206.99 | 827.96 | 390.86 | 192.68 | 0.00 | 2053.41 | 1483.63 | 0.403 | 0.71 | 0.71 | 3.113 | A |
| South | 735.48 | 183.87 | 735.47 | 221.30 | 799.33 | 0.00 | 1614.83 | 1010.69 | 0.455 | 0.84 | 0.85 | 4.155 | A |
| East | 450.32 | 112.58 | 450.31 | 1172.57 | 362.23 | 0.00 | 1930.84 | 1766.34 | 0.233 | 0.34 | 0.34 | 2.757 | A |

### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 101.58 | 25.40 | 101.66 | 288.94 | 375.29 | 0.00 | 1921.39 | 1040.86 | 0.053 | 0.09 | 0.07 | 2.481 | A |
| West | 676.03 | 169.01 | 676.84 | 319.49 | 157.46 | 0.00 | 2078.87 | 1483.63 | 0.325 | 0.71 | 0.51 | 2.725 | A |
| South | 600.52 | 150.13 | 601.71 | 180.87 | 653.42 | 0.00 | 1720.32 | 1010.69 | 0.349 | 0.85 | 0.55 | 3.272 | A |
| East | 367.68 | 91.92 | 368.02 | 958.93 | 296.21 | 0.00 | 1978.57 | 1766.34 | 0.186 | 0.34 | 0.26 | 2.535 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 85.07 | 21.27 | 85.13 | 241.88 | 314.19 | 0.00 | 1965.57 | 1040.86 | 0.043 | 0.07 | 0.06 | 2.403 | A |
| West | 566.15 | 141.54 | 566.62 | 267.48 | 131.84 | 0.00 | 2097.40 | 1483.63 | 0.270 | 0.51 | 0.39 | 2.495 | A |
| South | 502.91 | 125.73 | 503.51 | 151.43 | 547.03 | 0.00 | 1797.24 | 1010.69 | 0.280 | 0.55 | 0.40 | 2.827 | A |
| East | 307.92 | 76.98 | 308.13 | 802.61 | 247.93 | 0.00 | 2013.47 | 1766.34 | 0.153 | 0.26 | 0.21 | 2.396 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.84 | 0.06 | 2.400 | A | A |
| West | 5.76 | 0.38 | 2.487 | A | A |
| South | 5.77 | 0.38 | 2.813 | A | A |
| East | 3.02 | 0.20 | 2.391 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.04 | 0.07 | 2.480 | A | A |
| West | 7.53 | 0.50 | 2.719 | A | A |
| South | 7.98 | 0.53 | 3.257 | A | A |
| East | 3.83 | 0.26 | 2.533 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.33 | 0.09 | 2.600 | A | A |
| West | 10.50 | 0.70 | 3.110 | A | A |
| South | 12.32 | 0.82 | 4.141 | A | A |
| East | 5.09 | 0.34 | 2.757 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|





| North | 1.35 | 0.09 | 2.600 | A | A |
|---|---|---|---|---|---|
| West | 10.70 | 0.71 | 3.113 | A | A |
| South | 12.66 | 0.84 | 4.155 | A | A |
| East | 5.16 | 0.34 | 2.757 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.06 | 0.07 | 2.481 | A | A |
| West | 7.82 | 0.52 | 2.725 | A | A |
| South | 8.37 | 0.56 | 3.272 | A | A |
| East | 3.95 | 0.26 | 2.535 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.86 | 0.06 | 2.403 | A | A |
| West | 5.98 | 0.40 | 2.495 | A | A |
| South | 6.03 | 0.40 | 2.827 | A | A |
| East | 3.12 | 0.21 | 2.396 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.51 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.54 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.26 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.71 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.84 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.34 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.09 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.71 | 0.00 | 0.00 | 0.00 | 1.06 | | | N/A | N/A |
| South | 0.85 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| East | 0.34 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.51 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.55 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.26 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.40 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:47:08 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2028 | | | | | | |
| Leg North | 0.45 | −1 | 4.58 | 0.30 | A | 4.61 | A |
| Leg West | 0.75 | 1.02 | 3.80 | 0.42 | A | | |
| Leg South | 0.44 | −1 | 2.99 | 0.31 | A | | |
| Leg East | 2.09 | 3.05 | 5.70 | 0.67 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM " model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:47:07 PM*

## File summary

| | |
|---|---|
| Title | (untitled) |
| Location | |
| Site Number | |
| Date | 2023-12-13 |
| Version | |
| Status | (new file) |
| Identifier | |
| Client | |
| Jobnumber | |
| Analyst | AdamMorrison |
| Description | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - FT 2028, PM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2028, PM | FT 2028 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 4.61 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Strasburg Road | |
| West | West | Huron Road | |
| South | South | Strasburg Road | |
| East | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| South | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| South | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| East | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |





## Slope / Intercept / Capacity

### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | ROW Standard | | 90.00 |
| West | Percentage | ROW Standard | | 90.00 |
| South | Percentage | ROW Standard | | 90.00 |
| East | Percentage | ROW Standard | | 90.00 |

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.723 | 2192.710 |
| West | | (calculated) | (calculated) | 0.723 | 2192.710 |
| South | | (calculated) | (calculated) | 0.723 | 2192.710 |
| East | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 324.00 | 100.000 |
| West | ONE HOUR | ✓ | 648.00 | 100.000 |
| South | ONE HOUR | ✓ | 482.00 | 100.000 |
| East | ONE HOUR | ✓ | 1208.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.000 | 218.000 | 68.000 | 38.000 |
| | West | 119.000 | 0.000 | 116.000 | 413.000 |
| | South | 57.000 | 100.000 | 0.000 | 325.000 |
| | East | 26.000 | 643.000 | 539.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.00 | 0.67 | 0.21 | 0.12 |
| | West | 0.18 | 0.00 | 0.18 | 0.64 |
| | South | 0.12 | 0.21 | 0.00 | 0.67 |

| | | | | | |
|---|---|---|---|---|---|
| | East | 0.02 | 0.53 | 0.45 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.020 | 1.020 | 1.190 |
| | West | 1.040 | 1.000 | 1.000 | 1.020 |
| | South | 1.000 | 1.020 | 1.000 | 1.000 |
| | East | 1.520 | 1.020 | 1.000 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 2.0 | 2.0 | 19.0 |
| | West | 4.0 | 0.0 | 0.0 | 2.0 |
| | South | 0.0 | 2.0 | 0.0 | 0.0 |
| | East | 52.0 | 2.0 | 0.0 | 0.0 |

# Results

## Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.30 | 4.58 | 0.45 | −1 | A | 297.31 | 445.96 | 27.91 | 3.76 | 0.31 | 27.92 | 3.76 |
| West | 0.42 | 3.80 | 0.75 | 1.02 | A | 594.62 | 891.92 | 48.20 | 3.24 | 0.54 | 48.21 | 3.24 |
| South | 0.31 | 2.99 | 0.44 | −1 | A | 442.29 | 663.44 | 29.66 | 2.68 | 0.33 | 29.66 | 2.68 |
| East | 0.67 | 5.70 | 2.09 | 3.05 | A | 1108.48 | 1662.72 | 121.21 | 4.37 | 1.35 | 121.22 | 4.37 |

## Main Results for each time segment

### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 243.92 | 60.98 | 243.12 | 151.62 | 961.78 | 0.00 | 1497.39 | 799.14 | 0.163 | 0.00 | 0.20 | 2.976 | A |
| West | 487.85 | 121.96 | 486.39 | 721.02 | 483.88 | 0.00 | 1842.89 | 1454.52 | 0.265 | 0.00 | 0.37 | 2.704 | A |
| South | 362.87 | 90.72 | 361.92 | 542.43 | 427.83 | 0.00 | 1883.41 | 1261.65 | 0.193 | 0.00 | 0.24 | 2.374 | A |
| East | 909.45 | 227.36 | 906.20 | 582.54 | 207.21 | 0.00 | 2042.91 | 1702.51 | 0.445 | 0.00 | 0.81 | 3.215 | A |

### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 291.27 | 72.82 | 290.95 | 181.43 | 1150.99 | 0.00 | 1360.61 | 799.14 | 0.214 | 0.20 | 0.28 | 3.491 | A |
| West | 582.54 | 145.63 | 582.02 | 862.86 | 579.08 | 0.00 | 1774.07 | 1454.52 | 0.328 | 0.37 | 0.50 | 3.078 | A |
| South | 433.31 | 108.33 | 433.02 | 649.14 | 511.95 | 0.00 | 1822.59 | 1261.65 | 0.238 | 0.24 | 0.31 | 2.601 | A |
| East | 1085.97 | 271.49 | 1084.49 | 697.04 | 247.93 | 0.00 | 2013.47 | 1702.51 | 0.539 | 0.81 | 1.18 | 3.939 | A |

### Main results: (16:30-16:45)

| Leg | Total | Intersection | Entry | Exit Flow | Circulating | Pedestrian | Capacity | Saturation | V/C | Start | End | Delay | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|





| Leg | Demand (PCE/hr) | Arrivals (PCE) | Flow (PCE/hr) | (PCE/hr) | Flow (PCE/hr) | Demand (Ped/hr) | (PCE/hr) | Capacity (PCE/hr) | Ratio | Queue (PCE) | Queue (PCE) | (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 356.73 | 89.18 | 356.06 | 222.09 | 1407.94 | 0.00 | 1174.84 | 799.14 | 0.304 | 0.28 | 0.45 | 4.557 | A |
| West | 713.46 | 178.37 | 712.46 | 1055.64 | 708.36 | 0.00 | 1680.60 | 1454.52 | 0.425 | 0.50 | 0.75 | 3.789 | A |
| South | 530.69 | 132.67 | 530.19 | 794.14 | 626.68 | 0.00 | 1739.65 | 1261.65 | 0.305 | 0.31 | 0.44 | 2.986 | A |
| East | 1330.03 | 332.51 | 1326.49 | 853.33 | 303.53 | 0.00 | 1973.27 | 1702.51 | 0.674 | 1.18 | 2.07 | 5.635 | A |

### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 356.73 | 89.18 | 356.72 | 222.40 | 1411.43 | 0.00 | 1172.32 | 799.14 | 0.304 | 0.45 | 0.45 | 4.578 | A |
| West | 713.46 | 178.37 | 713.45 | 1058.03 | 710.12 | 0.00 | 1679.33 | 1454.52 | 0.425 | 0.75 | 0.75 | 3.800 | A |
| South | 530.69 | 132.67 | 530.69 | 796.00 | 627.57 | 0.00 | 1739.01 | 1261.65 | 0.305 | 0.44 | 0.44 | 2.990 | A |
| East | 1330.03 | 332.51 | 1329.95 | 854.38 | 303.88 | 0.00 | 1973.02 | 1702.51 | 0.674 | 2.07 | 2.09 | 5.697 | A |

### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 291.27 | 72.82 | 291.94 | 181.91 | 1156.05 | 0.00 | 1356.95 | 799.14 | 0.215 | 0.45 | 0.28 | 3.510 | A |
| West | 582.54 | 145.63 | 583.53 | 866.35 | 581.63 | 0.00 | 1772.22 | 1454.52 | 0.329 | 0.75 | 0.50 | 3.090 | A |
| South | 433.31 | 108.33 | 433.81 | 651.85 | 513.31 | 0.00 | 1821.61 | 1261.65 | 0.238 | 0.44 | 0.31 | 2.605 | A |
| East | 1085.97 | 271.49 | 1089.50 | 698.66 | 248.46 | 0.00 | 2013.08 | 1702.51 | 0.539 | 2.09 | 1.20 | 3.984 | A |

### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 243.92 | 60.98 | 244.25 | 152.24 | 966.71 | 0.00 | 1493.83 | 799.14 | 0.163 | 0.28 | 0.20 | 2.988 | A |
| West | 487.85 | 121.96 | 488.38 | 724.58 | 486.38 | 0.00 | 1841.08 | 1454.52 | 0.265 | 0.50 | 0.37 | 2.714 | A |
| South | 362.87 | 90.72 | 363.17 | 545.16 | 429.60 | 0.00 | 1882.13 | 1261.65 | 0.193 | 0.31 | 0.24 | 2.381 | A |
| East | 909.45 | 227.36 | 910.97 | 584.79 | 207.98 | 0.00 | 2042.35 | 1702.51 | 0.445 | 1.20 | 0.82 | 3.245 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.96 | 0.20 | 2.976 | A | A |
| West | 5.39 | 0.36 | 2.704 | A | A |
| South | 3.53 | 0.24 | 2.374 | A | A |
| East | 11.87 | 0.79 | 3.215 | A | A |

### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.15 | 0.28 | 3.491 | A | A |
| West | 7.33 | 0.49 | 3.078 | A | A |
| South | 4.62 | 0.31 | 2.601 | A | A |
| East | 17.28 | 1.15 | 3.939 | A | A |

### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 6.59 | 0.44 | 4.557 | A | A |
| West | 10.97 | 0.73 | 3.789 | A | A |
| South | 6.48 | 0.43 | 2.986 | A | A |
| East | 29.68 | 1.98 | 5.635 | A | A |

### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **North** | 6.76 | 0.45 | 4.578 | A | A |
| **West** | 11.24 | 0.75 | 3.800 | A | A |
| **South** | 6.59 | 0.44 | 2.990 | A | A |
| **East** | 31.17 | 2.08 | 5.697 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| **North** | 4.35 | 0.29 | 3.510 | A | A |
| **West** | 7.67 | 0.51 | 3.090 | A | A |
| **South** | 4.78 | 0.32 | 2.605 | A | A |
| **East** | 18.61 | 1.24 | 3.984 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| **North** | 3.09 | 0.21 | 2.988 | A | A |
| **West** | 5.62 | 0.37 | 2.714 | A | A |
| **South** | 3.65 | 0.24 | 2.381 | A | A |
| **East** | 12.60 | 0.84 | 3.245 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.37 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.81 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.50 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.31 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 1.18 | 0.00 | 0.00 | 2.04 | 3.05 | | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.45 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.75 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.44 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 2.07 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.45 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.75 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| **South** | 0.44 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 2.09 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.50 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.31 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 1.20 | 0.00 | 0.00 | 1.02 | 2.04 | | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.20 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.37 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.24 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.82 | 0.00 | 0.00 | 1.02 | 1.02 | | | N/A | N/A |

# Appendix G

## 2033 Total Traffic Operations Reports

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 365 | 15 | 314 | 156 | 152 |
| Future Volume (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 365 | 15 | 314 | 156 | 152 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.96 | 1.00 | | 0.98 | 0.99 | 1.00 | | 0.98 | | 0.98 |
| Frt | | | 0.850 | | | 0.850 | | 0.994 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1547 | 3374 | 1390 | 1561 | 3438 | 1390 | 1653 | 3254 | 0 | 2895 | 1759 | 1417 |
| Flt Permitted | 0.086 | | | 0.181 | | | 0.579 | | | 0.950 | | |
| Satd. Flow (perm) | 140 | 3374 | 1337 | 297 | 3438 | 1361 | 1001 | 3254 | 0 | 2838 | 1759 | 1389 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 193 | | | 416 | | 2 | | | | 152 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Adj. Flow (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 365 | 15 | 314 | 156 | 152 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 380 | 0 | 314 | 156 | 152 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

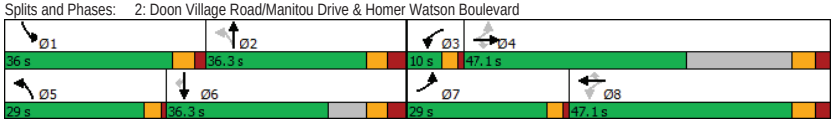




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 65.1 | 65.1 | 48.9 | 40.0 | 40.0 | 58.4 | 30.5 | | 22.4 | 30.4 | 30.4 |
| Actuated g/C Ratio | 0.51 | 0.46 | 0.46 | 0.34 | 0.28 | 0.28 | 0.41 | 0.21 | | 0.16 | 0.21 | 0.21 |
| v/c Ratio | 1.43 | 0.75 | 0.37 | 0.09 | 1.27 | 0.91 | 0.78 | 0.54 | | 0.69 | 0.42 | 0.37 |
| Control Delay | 243.9 | 36.9 | 9.5 | 21.6 | 169.4 | 35.0 | 43.2 | 53.5 | | 64.8 | 52.2 | 9.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 243.9 | 36.9 | 9.5 | 21.6 | 169.4 | 35.0 | 43.2 | 53.5 | | 64.8 | 52.2 | 9.1 |
| LOS | F | D | A | C | F | D | D | D | | E | D | A |
| Approach Delay | | 83.1 | | | 123.4 | | | 48.2 | | | 48.1 | |
| Approach LOS | | F | | | F | | | D | | | D | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 142.3 | | | |
| Natural Cycle: 145 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.43 | | | |
| Intersection Signal Delay: 88.0 | | Intersection LOS: F | |
| Intersection Capacity Utilization 127.7% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Total - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 380 | 314 | 156 | 152 |
| v/c Ratio | 1.43 | 0.75 | 0.37 | 0.09 | 1.27 | 0.91 | 0.78 | 0.54 | 0.69 | 0.42 | 0.37 |
| Control Delay | 243.9 | 36.9 | 9.5 | 21.6 | 169.4 | 35.0 | 43.2 | 53.5 | 64.8 | 52.2 | 9.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 243.9 | 36.9 | 9.5 | 21.6 | 169.4 | 35.0 | 43.2 | 53.5 | 64.8 | 52.2 | 9.1 |
| Queue Length 50th (m) | ~166.1 | 137.0 | 11.4 | 2.0 | ~236.5 | 69.7 | 89.3 | 52.8 | 45.6 | 40.5 | 0.0 |
| Queue Length 95th (m) | #248.2 | 200.1 | 37.7 | 6.3 | #296.3 | #159.0 | #129.7 | 74.1 | 61.8 | 63.2 | 18.8 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 318 | 1543 | 716 | 155 | 966 | 681 | 525 | 699 | 610 | 444 | 464 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.43 | 0.75 | 0.37 | 0.09 | 1.27 | 0.91 | 0.78 | 0.54 | 0.51 | 0.35 | 0.33 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 365 | 15 | 314 | 156 | 152 |
| Future Volume (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 365 | 15 | 314 | 156 | 152 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.96 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1547 | 3374 | 1338 | 1561 | 3438 | 1362 | 1648 | 3255 | | 2895 | 1759 | 1389 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.18 | 1.00 | 1.00 | 0.58 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 140 | 3374 | 1338 | 297 | 3438 | 1362 | 1005 | 3255 | | 2895 | 1759 | 1389 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 454 | 1158 | 266 | 14 | 1222 | 621 | 408 | 365 | 15 | 314 | 156 | 152 |
| RTOR Reduction (vph) | 0 | 0 | 106 | 0 | 0 | 294 | 0 | 2 | 0 | 0 | 0 | 120 |
| Lane Group Flow (vph) | 454 | 1158 | 160 | 14 | 1222 | 327 | 408 | 378 | 0 | 314 | 156 | 32 |
| Confl. Peds. (#/hr) | 8 | | 10 | 10 | | 8 | 5 | | 13 | 13 | | 5 |
| Heavy Vehicles (%) | 9% | 7% | 7% | 8% | 5% | 7% | 2% | 3% | 0% | 13% | 8% | 5% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 55.0 | 30.5 | | 22.4 | 30.4 | 30.4 |
| Effective Green, g (s) | 71.5 | 65.1 | 65.1 | 44.9 | 42.5 | 42.5 | 55.0 | 30.5 | | 22.4 | 30.4 | 30.4 |
| Actuated g/C Ratio | 0.49 | 0.45 | 0.45 | 0.31 | 0.29 | 0.29 | 0.38 | 0.21 | | 0.15 | 0.21 | 0.21 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 312 | 1516 | 601 | 113 | 1009 | 399 | 490 | 685 | | 447 | 369 | 291 |
| v/s Ratio Prot | c0.25 | 0.34 | | 0.00 | 0.36 | | c0.14 | 0.12 | | 0.11 | 0.09 | |
| v/s Ratio Perm | c0.47 | | 0.12 | 0.04 | | 0.24 | c0.18 | | | | | 0.02 |
| v/c Ratio | 1.46 | 0.76 | 0.27 | 0.12 | 1.21 | 0.82 | 0.83 | 0.55 | | 0.70 | 0.42 | 0.11 |
| Uniform Delay, d1 | 47.2 | 33.4 | 24.9 | 35.2 | 51.2 | 47.6 | 37.9 | 51.1 | | 58.0 | 49.6 | 46.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 221.8 | 2.3 | 0.2 | 0.5 | 104.3 | 12.4 | 11.5 | 3.2 | | 6.2 | 3.5 | 0.8 |
| Delay (s) | 269.1 | 35.8 | 25.1 | 35.7 | 155.5 | 60.0 | 49.4 | 54.2 | | 64.2 | 53.1 | 47.0 |
| Level of Service | F | D | C | D | F | E | D | D | | E | D | D |
| Approach Delay (s) | | 90.7 | | | 122.6 | | | 51.7 | | | 57.2 | |
| Approach LOS | | F | | | F | | | D | | | E | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 92.2 | HCM 2000 Level of Service | F | |
| HCM 2000 Volume to Capacity ratio | 1.23 | | | |
| Actuated Cycle Length (s) | 144.8 | Sum of lost time (s) | 24.4 | |
| Intersection Capacity Utilization | 127.7% | ICU Level of Service | H | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1792 | 2 | 0 | 1559 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1792 | 2 | 0 | 1559 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 1.00 | 0.99 | | 0.99 | | 1.00 | | | | 1.00 | |
| Frt | | | 0.850 | | 0.865 | | | | | | 0.993 | |
| Flt Protected | | 0.950 | | | | | 0.950 | | | | | |
| Satd. Flow (prot) | 0 | 1537 | 1444 | 0 | 1323 | 0 | 1637 | 3094 | 0 | 1775 | 3073 | 0 |
| Flt Permitted | | 0.757 | | | | | 0.950 | | | | | |
| Satd. Flow (perm) | 0 | 1223 | 1425 | 0 | 1323 | 0 | 1633 | 3094 | 0 | 1775 | 3073 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 213 | | 80 | | | | | | 5 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1792 | 2 | 0 | 1559 | 81 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 238 | 213 | 0 | 2 | 0 | 76 | 1794 | 0 | 0 | 1640 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

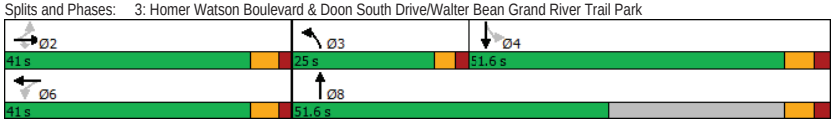




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 23.2 | 23.2 | | 23.2 | | 11.4 | 58.6 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.12 | 0.62 | | | 0.49 | |
| v/c Ratio | | 0.80 | 0.42 | | 0.01 | | 0.39 | 0.94 | | | 1.09 | |
| Control Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 28.9 | | | 80.6 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | | 0.0 | |
| Total Delay | | 53.8 | 6.7 | | 0.0 | | 48.8 | 28.9 | | | 80.6 | |
| LOS | | D | A | | A | | D | C | | | F | |
| Approach Delay | | 31.5 | | | | | | 29.7 | | | 80.6 | |
| Approach LOS | | C | | | | | | C | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 94.8 | | | |
| Natural Cycle: 100 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.09 | | | |
| Intersection Signal Delay: 51.0 | | Intersection LOS: D | |
| Intersection Capacity Utilization 100.0% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2032 Total AM Peak Hour

| Lane Group | EBT | EBR | WBT | NBL | NBT | SBT |
|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 238 | 213 | 2 | 76 | 1794 | 1640 |
| v/c Ratio | 0.80 | 0.42 | 0.01 | 0.39 | 0.94 | 1.09 |
| Control Delay | 53.8 | 6.7 | 0.0 | 48.8 | 28.9 | 80.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.8 | 6.7 | 0.0 | 48.8 | 28.9 | 80.6 |
| Queue Length 50th (m) | 43.8 | 0.0 | 0.0 | 14.2 | 151.3 | ~199.5 |
| Queue Length 95th (m) | 75.9 | 17.2 | 0.0 | 31.4 | #273.1 | #305.8 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | |
| Base Capacity (vph) | 463 | 672 | 550 | 354 | 2343 | 1499 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.51 | 0.32 | 0.00 | 0.21 | 0.77 | 1.09 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2032 Total AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1792 | 2 | 0 | 1559 | 81 |
| Future Volume (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1792 | 2 | 0 | 1559 | 81 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 0.99 | | 0.99 | | 1.00 | 1.00 | | | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Frt | | 1.00 | 0.85 | | 0.86 | | 1.00 | 1.00 | | | 0.99 | |
| Flt Protected | | 0.95 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (prot) | | 1535 | 1425 | | 1323 | | 1637 | 3094 | | | 3073 | |
| Flt Permitted | | 0.76 | 1.00 | | 1.00 | | 0.95 | 1.00 | | | 1.00 | |
| Satd. Flow (perm) | | 1222 | 1425 | | 1323 | | 1637 | 3094 | | | 3073 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 238 | 0 | 213 | 0 | 0 | 2 | 76 | 1792 | 2 | 0 | 1559 | 81 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 3 | 0 |
| Lane Group Flow (vph) | 0 | 238 | 52 | 0 | 0 | 0 | 76 | 1794 | 0 | 0 | 1637 | 0 |
| Confl. Peds. (#/hr) | 1 | | 1 | 1 | | 1 | 7 | | | | | 7 |
| Heavy Vehicles (%) | 2% | 0% | 3% | 0% | 0% | 0% | 3% | 9% | 0% | 0% | 9% | 4% |
| Turn Type | Perm | NA | Perm | | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Effective Green, g (s) | | 23.2 | 23.2 | | 23.2 | | 8.7 | 59.9 | | | 46.2 | |
| Actuated g/C Ratio | | 0.24 | 0.24 | | 0.24 | | 0.09 | 0.63 | | | 0.48 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | | 5.0 | |
| Lane Grp Cap (vph) | | 296 | 345 | | 320 | | 148 | 1936 | | | 1483 | |
| v/s Ratio Prot | | | | | 0.00 | | 0.05 | c0.58 | | | c0.53 | |
| v/s Ratio Perm | | c0.19 | 0.04 | | | | | | | | | |
| v/c Ratio | | 0.80 | 0.15 | | 0.00 | | 0.51 | 0.93 | | | 1.10 | |
| Uniform Delay, d1 | | 34.1 | 28.5 | | 27.5 | | 41.5 | 15.9 | | | 24.8 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | | 1.00 | |
| Incremental Delay, d2 | | 14.6 | 0.2 | | 0.0 | | 3.0 | 9.2 | | | 57.4 | |
| Delay (s) | | 48.7 | 28.7 | | 27.5 | | 44.5 | 25.1 | | | 82.1 | |
| Level of Service | | D | C | | C | | D | C | | | F | |
| Approach Delay (s) | | 39.2 | | | 27.5 | | | 25.9 | | | 82.1 | |
| Approach LOS | | D | | | C | | | C | | | F | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 50.7 | HCM 2000 Level of Service | | D | |
| HCM 2000 Volume to Capacity ratio | 1.02 | | | | |
| Actuated Cycle Length (s) | 95.7 | Sum of lost time (s) | | 17.6 | |
| Intersection Capacity Utilization | 100.0% | ICU Level of Service | | F | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 139 | 30 | 119 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| Future Volume (vph) | 139 | 30 | 119 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.98 | | 0.99 | | 0.98 | | | 0.98 | 1.00 | | 0.99 |
| Frt | | 0.880 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1576 | 2174 | 0 | 1492 | 1743 | 1219 | 1429 | 4848 | 1417 | 2749 | 3312 | 1229 |
| Flt Permitted | 0.624 | | | 0.658 | | | 0.088 | | | 0.950 | | |
| Satd. Flow (perm) | 1028 | 2174 | 0 | 1026 | 1743 | 1196 | 132 | 4848 | 1393 | 2748 | 3312 | 1213 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 119 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Adj. Flow (vph) | 139 | 30 | 119 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 139 | 149 | 0 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

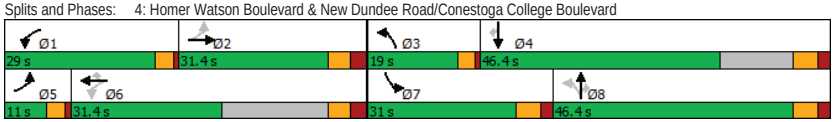




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 15.5 | 7.6 | | 15.8 | 8.1 | 8.1 | 60.9 | 46.8 | 46.8 | 10.2 | 40.2 | 40.2 |
| Actuated g/C Ratio | 0.17 | 0.09 | | 0.18 | 0.09 | 0.09 | 0.69 | 0.53 | 0.53 | 0.11 | 0.45 | 0.45 |
| v/c Ratio | 0.62 | 0.51 | | 0.39 | 0.16 | 0.36 | 0.69 | 0.65 | 0.25 | 0.27 | 1.12 | 0.04 |
| Control Delay | 43.5 | 18.5 | | 33.5 | 39.8 | 5.8 | 32.4 | 19.2 | 4.8 | 40.5 | 90.3 | 0.1 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 43.5 | 18.5 | | 33.5 | 39.8 | 5.8 | 32.4 | 19.2 | 4.8 | 40.5 | 90.3 | 0.1 |
| LOS | D | B | | C | D | A | C | B | A | D | F | A |
| Approach Delay | | 30.5 | | | 22.4 | | | 19.2 | | | 86.6 | |
| Approach LOS | | C | | | C | | | B | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 88.9 | | | |
| Natural Cycle: 150 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.12 | | | |
| Intersection Signal Delay: 47.9 | | Intersection LOS: D | |
| Intersection Capacity Utilization 93.2% | | ICU Level of Service F | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2033 Total - AM Peak Hour

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 139 | 149 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| v/c Ratio | 0.62 | 0.51 | 0.39 | 0.16 | 0.36 | 0.69 | 0.65 | 0.25 | 0.27 | 1.12 | 0.04 |
| Control Delay | 43.5 | 18.5 | 33.5 | 39.8 | 5.8 | 32.4 | 19.2 | 4.8 | 40.5 | 90.3 | 0.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 43.5 | 18.5 | 33.5 | 39.8 | 5.8 | 32.4 | 19.2 | 4.8 | 40.5 | 90.3 | 0.1 |
| Queue Length 50th (m) | 21.5 | 2.7 | 12.9 | 4.3 | 0.0 | 22.5 | 82.9 | 3.2 | 7.4 | ~188.3 | 0.0 |
| Queue Length 95th (m) | 38.2 | 12.5 | 25.4 | 12.1 | 3.5 | #62.2 | 117.7 | 17.2 | 15.6 | #259.2 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 223 | 700 | 426 | 848 | 652 | 310 | 2554 | 814 | 777 | 1948 | 763 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.62 | 0.21 | 0.20 | 0.03 | 0.13 | 0.69 | 0.65 | 0.25 | 0.11 | 0.86 | 0.04 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2033 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 139 | 30 | 119 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| Future Volume (vph) | 139 | 30 | 119 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.99 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 |
| Flpb, ped/bikes | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.88 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1572 | 2180 | | 1487 | 1743 | 1199 | 1429 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Flt Permitted | 0.62 | 1.00 | | 0.66 | 1.00 | 1.00 | 0.09 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1031 | 2180 | | 1029 | 1743 | 1199 | 132 | 4848 | 1395 | 2749 | 3312 | 1213 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 139 | 30 | 119 | 86 | 25 | 84 | 213 | 1655 | 204 | 86 | 1681 | 27 |
| RTOR Reduction (vph) | 0 | 108 | 0 | 0 | 0 | 78 | 0 | 0 | 83 | 0 | 0 | 15 |
| Lane Group Flow (vph) | 139 | 41 | 0 | 86 | 25 | 6 | 213 | 1655 | 121 | 86 | 1681 | 12 |
| Confl. Peds. (#/hr) | 6 | | 8 | 8 | | 6 | 1 | | 3 | 3 | | 1 |
| Heavy Vehicles (%) | 7% | 11% | 40% | 13% | 9% | 22% | 18% | 7% | 5% | 19% | 9% | 21% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 15.4 | 8.2 | | 12.8 | 6.9 | 6.9 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Effective Green, g (s) | 15.4 | 8.2 | | 12.8 | 6.9 | 6.9 | 60.6 | 46.8 | 46.8 | 7.8 | 41.5 | 41.5 |
| Actuated g/C Ratio | 0.17 | 0.09 | | 0.14 | 0.08 | 0.08 | 0.66 | 0.51 | 0.51 | 0.09 | 0.45 | 0.45 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 216 | 195 | | 173 | 131 | 90 | 301 | 2479 | 713 | 234 | 1502 | 550 |
| v/s Ratio Prot | c0.05 | 0.02 | | 0.03 | 0.01 | | c0.12 | 0.34 | | 0.03 | c0.51 | |
| v/s Ratio Perm | c0.06 | | | 0.04 | | 0.01 | 0.35 | | 0.09 | | | 0.01 |
| v/c Ratio | 0.64 | 0.21 | | 0.50 | 0.19 | 0.07 | 0.71 | 0.67 | 0.17 | 0.37 | 1.12 | 0.02 |
| Uniform Delay, d1 | 34.8 | 38.6 | | 35.9 | 39.7 | 39.3 | 24.0 | 16.6 | 12.0 | 39.5 | 25.0 | 13.8 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 6.4 | 0.5 | | 0.8 | 0.7 | 0.3 | 7.4 | 1.4 | 0.5 | 1.0 | 63.2 | 0.1 |
| Delay (s) | 41.2 | 39.2 | | 36.7 | 40.4 | 39.7 | 31.4 | 18.0 | 12.5 | 40.5 | 88.2 | 13.9 |
| Level of Service | D | D | | D | D | D | C | B | B | D | F | B |
| Approach Delay (s) | | 40.1 | | | 38.5 | | | 18.8 | | | 84.8 | |
| Approach LOS | | D | | | D | | | B | | | F | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 48.3 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 0.98 | | | |
| Actuated Cycle Length (s) | 91.5 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 93.2% | ICU Level of Service | F | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 179 | 0 | 981 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 47 |
| Future Volume (vph) | 179 | 0 | 981 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 47 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1591 | 0 | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | 0 | 0 | 4803 | 1261 |
| Flt Permitted | 0.572 | | | 0.950 | | | 0.080 | | | | | |
| Satd. Flow (perm) | 958 | 0 | 1458 | 1441 | 1776 | 1365 | 131 | 3406 | 0 | 0 | 4803 | 1261 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 213 | | | 288 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Adj. Flow (vph) | 179 | 0 | 981 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 47 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 179 | 0 | 981 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 47 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

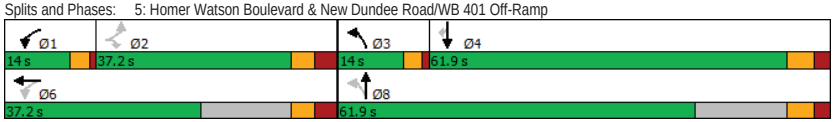




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.1 | | 30.1 | 47.3 | 44.1 | 123.4 | 68.1 | 65.2 | | | 51.2 | 51.2 |
| Actuated g/C Ratio | 0.24 | | 0.24 | 0.38 | 0.36 | 1.00 | 0.55 | 0.53 | | | 0.41 | 0.41 |
| v/c Ratio | 0.77 | | 1.90 | 0.45 | 0.49 | 0.70 | 0.78 | 0.52 | | | 0.75 | 0.08 |
| Control Delay | 66.9 | | 435.9 | 32.6 | 34.9 | 3.0 | 50.1 | 20.1 | | | 33.2 | 0.3 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 66.9 | | 435.9 | 32.6 | 34.9 | 3.0 | 50.1 | 20.1 | | | 33.2 | 0.3 |
| LOS | E | | F | C | C | A | D | C | | | C | A |
| Approach Delay | | 379.0 | | | 14.4 | | | 24.1 | | | 32.2 | |
| Approach LOS | | F | | | B | | | C | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 123.4 | | | |
| Natural Cycle: 150 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 1.90 | | | |
| Intersection Signal Delay: 101.4 | | Intersection LOS: F | |
| Intersection Capacity Utilization 124.6% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Total - AM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 179 | 981 | 251 | 310 | 952 | 146 | 942 | 1486 | 47 |
| v/c Ratio | 0.77 | 1.90 | 0.45 | 0.49 | 0.70 | 0.78 | 0.52 | 0.75 | 0.08 |
| Control Delay | 66.9 | 435.9 | 32.6 | 34.9 | 3.0 | 50.1 | 20.1 | 33.2 | 0.3 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 66.9 | 435.9 | 32.6 | 34.9 | 3.0 | 50.1 | 20.1 | 33.2 | 0.3 |
| Queue Length 50th (m) | 44.6 | ~356.4 | 50.0 | 64.4 | 0.0 | 19.9 | 79.3 | 115.8 | 0.0 |
| Queue Length 95th (m) | #83.7 | #439.3 | 76.3 | 93.7 | 0.0 | #55.5 | 97.7 | 134.1 | 0.0 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 233 | 516 | 552 | 634 | 1365 | 188 | 1908 | 2145 | 621 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.77 | 1.90 | 0.45 | 0.49 | 0.70 | 0.78 | 0.49 | 0.69 | 0.08 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Total - AM Peak Hour

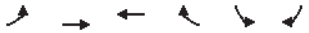
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 179 | 0 | 981 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 47 |
| Future Volume (vph) | 179 | 0 | 981 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 47 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1591 | | 1458 | 1441 | 1776 | 1365 | 1561 | 3406 | | | 4803 | 1261 |
| Flt Permitted | 0.57 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.08 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 957 | | 1458 | 1441 | 1776 | 1365 | 131 | 3406 | | | 4803 | 1261 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 179 | 0 | 981 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 47 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 27 |
| Lane Group Flow (vph) | 179 | 0 | 820 | 251 | 310 | 952 | 146 | 942 | 0 | 0 | 1486 | 20 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 6% | 0% | 2% | 17% | 7% | 9% | 8% | 6% | 0% | 0% | 8% | 18% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.1 | | 30.1 | 44.1 | 44.1 | 123.4 | 65.2 | 65.2 | | | 51.2 | 51.2 |
| Effective Green, g (s) | 30.1 | | 30.1 | 44.1 | 44.1 | 123.4 | 65.2 | 65.2 | | | 51.2 | 51.2 |
| Actuated g/C Ratio | 0.24 | | 0.24 | 0.36 | 0.36 | 1.00 | 0.53 | 0.53 | | | 0.41 | 0.41 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 233 | | 355 | 514 | 634 | 1365 | 185 | 1799 | | | 1992 | 523 |
| v/s Ratio Prot | | | | 0.04 | 0.17 | | 0.06 | 0.28 | | | 0.31 | |
| v/s Ratio Perm | 0.19 | | c0.56 | 0.13 | | c0.70 | c0.35 | | | | | 0.02 |
| v/c Ratio | 0.77 | | 2.31 | 0.49 | 0.49 | 0.70 | 0.79 | 0.52 | | | 0.75 | 0.04 |
| Uniform Delay, d1 | 43.4 | | 46.6 | 30.9 | 30.9 | 0.0 | 25.0 | 19.0 | | | 30.6 | 21.5 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 21.3 | | 598.2 | 1.5 | 2.7 | 3.0 | 22.4 | 0.5 | | | 1.9 | 0.1 |
| Delay (s) | 64.7 | | 644.8 | 32.4 | 33.6 | 3.0 | 47.4 | 19.5 | | | 32.5 | 21.5 |
| Level of Service | E | | F | C | C | A | D | B | | | C | C |
| Approach Delay (s) | | 555.3 | | | 14.1 | | | 23.2 | | | 32.1 | |
| Approach LOS | | F | | | B | | | C | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 139.8 | HCM 2000 Level of Service | F | | |
| HCM 2000 Volume to Capacity ratio | 1.30 | | | | |
| Actuated Cycle Length (s) | 123.4 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 124.6% | ICU Level of Service | H | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: New Dundee Road & Pinnacle Drive

2033 Total - AM Peak Hour



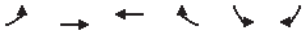
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 1209 | 412 | 19 | 64 | 8 |
| Future Volume (vph) | 4 | 1209 | 412 | 19 | 64 | 8 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.994 | | 0.985 | |
| Flt Protected | | | | | 0.957 | |
| Satd. Flow (prot) | 0 | 1616 | 1530 | 0 | 1664 | 0 |
| Flt Permitted | | | | | 0.957 | |
| Satd. Flow (perm) | 0 | 1616 | 1530 | 0 | 1664 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 25% | 2% | 7% | 11% | 0% | 0% |
| Adj. Flow (vph) | 4 | 1209 | 412 | 19 | 64 | 8 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 1213 | 431 | 0 | 72 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 87.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
6: New Dundee Road & Pinnacle Drive

2033 Total - AM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 1209 | 412 | 19 | 64 | 8 |
| Future Volume (Veh/h) | 4 | 1209 | 412 | 19 | 64 | 8 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 1209 | 412 | 19 | 64 | 8 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 431 | | | | 1638 | 422 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 431 | | | | 1638 | 422 |
| tC, single (s) | 4.3 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.4 | | | | 3.5 | 3.3 |
| p0 queue free % | 100 | | | | 42 | 99 |
| cM capacity (veh/h) | 1016 | | | | 111 | 636 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 1213 | 431 | 72 |
| Volume Left | 4 | 0 | 64 |
| Volume Right | 0 | 19 | 8 |
| cSH | 1016 | 1700 | 123 |
| Volume to Capacity | 0.00 | 0.25 | 0.59 |
| Queue Length 95th (m) | 0.1 | 0.0 | 23.4 |
| Control Delay (s) | 0.1 | 0.0 | 69.6 |
| Lane LOS | A | | F |
| Approach Delay (s) | 0.1 | 0.0 | 69.6 |
| Approach LOS | | | F |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 3.0 | | |
| Intersection Capacity Utilization | 87.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 65 | 925 | 363 | 100 | 345 | 132 |
| Future Volume (vph) | 65 | 925 | 363 | 100 | 345 | 132 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.963 | |
| Flt Protected | 0.950 | | | | 0.965 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1615 | 0 |
| Flt Permitted | 0.395 | | | | 0.965 | |
| Satd. Flow (perm) | 681 | 1845 | 1528 | 1311 | 1615 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 79 | 21 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Adj. Flow (vph) | 65 | 925 | 363 | 100 | 345 | 132 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 65 | 925 | 363 | 100 | 477 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |



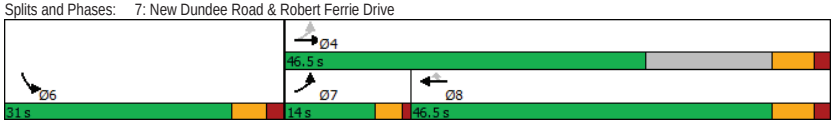


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 41.9 | 39.4 | 30.5 | 30.5 | 25.1 | |
| Actuated g/C Ratio | 0.54 | 0.51 | 0.40 | 0.40 | 0.33 | |
| v/c Ratio | 0.14 | 0.98 | 0.60 | 0.18 | 0.88 | |
| Control Delay | 8.8 | 45.0 | 24.5 | 6.8 | 45.1 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 8.8 | 45.0 | 24.5 | 6.8 | 45.1 | |
| LOS | A | D | C | A | D | |
| Approach Delay | | 42.7 | 20.6 | | 45.1 | |
| Approach LOS | | D | C | | D | |

**Intersection Summary**

Area Type: Other
Cycle Length: 91.5
Actuated Cycle Length: 77
Natural Cycle: 90
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 0.98
Intersection Signal Delay: 38.0 Intersection LOS: D
Intersection Capacity Utilization 88.4% ICU Level of Service E
Analysis Period (min) 15

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
## 7: New Dundee Road & Robert Ferrie Drive

2033 Total - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 65 | 925 | 363 | 100 | 477 |
| v/c Ratio | 0.14 | 0.98 | 0.60 | 0.18 | 0.88 |
| Control Delay | 8.8 | 45.0 | 24.5 | 6.8 | 45.1 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 8.8 | 45.0 | 24.5 | 6.8 | 45.1 |
| Queue Length 50th (m) | 4.4 | 130.0 | 44.9 | 2.0 | 66.5 |
| Queue Length 95th (m) | 9.6 | #219.3 | 76.2 | 11.7 | #138.0 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 494 | 1298 | 796 | 721 | 540 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.13 | 0.71 | 0.46 | 0.14 | 0.88 |

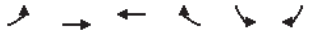
Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 7: New Dundee Road & Robert Ferrie Drive

2033 Total - AM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 65 | 925 | 363 | 100 | 345 | 132 |
| Future Volume (vph) | 65 | 925 | 363 | 100 | 345 | 132 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.96 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1637 | 1845 | 1528 | 1311 | 1615 | |
| Flt Permitted | 0.40 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 681 | 1845 | 1528 | 1311 | 1615 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 65 | 925 | 363 | 100 | 345 | 132 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 48 | 14 | 0 |
| Lane Group Flow (vph) | 65 | 925 | 363 | 52 | 463 | 0 |
| Heavy Vehicles (%) | 3% | 3% | 8% | 7% | 1% | 3% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 40.3 | 40.3 | 30.5 | 30.5 | 25.1 | |
| Effective Green, g (s) | 40.3 | 40.3 | 30.5 | 30.5 | 25.1 | |
| Actuated g/C Ratio | 0.52 | 0.52 | 0.39 | 0.39 | 0.32 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 423 | 954 | 598 | 513 | 520 | |
| v/s Ratio Prot | 0.01 | c0.50 | 0.24 | | c0.29 | |
| v/s Ratio Perm | 0.07 | | | 0.04 | | |
| v/c Ratio | 0.15 | 0.97 | 0.61 | 0.10 | 0.89 | |
| Uniform Delay, d1 | 10.1 | 18.2 | 18.9 | 15.0 | 25.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 0.2 | 21.7 | 1.7 | 0.1 | 20.0 | |
| Delay (s) | 10.2 | 40.0 | 20.7 | 15.1 | 45.0 | |
| Level of Service | B | D | C | B | D | |
| Approach Delay (s) | | 38.0 | 19.5 | | 45.0 | |
| Approach LOS | | D | B | | D | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 35.3 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 1.00 | | | |
| Actuated Cycle Length (s) | 77.9 | Sum of lost time (s) | 16.5 | |
| Intersection Capacity Utilization | 88.4% | ICU Level of Service | E | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

## Lanes, Volumes, Timings
## 8: New Dundee Road

2033 Total - AM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 11 | 524 | 82 | 13 | 336 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (vph) | 11 | 524 | 82 | 13 | 336 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.982 | | | 0.996 | | | 0.965 | | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.998 | | | 0.976 | | | 0.991 | |
| Satd. Flow (prot) | 0 | 1430 | 0 | 0 | 1431 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Flt Permitted | | 0.999 | | | 0.998 | | | 0.976 | | | 0.991 | |
| Satd. Flow (perm) | 0 | 1430 | 0 | 0 | 1431 | 0 | 0 | 1332 | 0 | 0 | 1498 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 18% | 6% | 7% | 23% | 7% | 10% | 0% | 4% | 33% | 0% | 0% | 0% |
| Adj. Flow (vph) | 11 | 524 | 82 | 13 | 336 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 617 | 0 | 0 | 359 | 0 | 0 | 92 | 0 | 0 | 65 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 64.9% | | ICU Level of Service C | |
| Analysis Period (min) 15 | | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

2033 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 11 | 524 | 82 | 13 | 336 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Future Volume (Veh/h) | 11 | 524 | 82 | 13 | 336 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 524 | 82 | 13 | 336 | 10 | 45 | 23 | 24 | 12 | 41 | 12 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 346 | | | 606 | | | 986 | 959 | 565 | 990 | 995 | 341 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 346 | | | 606 | | | 986 | 959 | 565 | 990 | 995 | 341 |
| tC, single (s) | 4.3 | | | 4.3 | | | 7.1 | 6.5 | 6.5 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.4 | | | 2.4 | | | 3.5 | 4.0 | 3.6 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 99 | | | 99 | | | 77 | 91 | 95 | 94 | 83 | 98 |
| cM capacity (veh/h) | 1129 | | | 878 | | | 192 | 249 | 470 | 197 | 241 | 706 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 617 | 359 | 92 | 65 |
| Volume Left | 11 | 13 | 45 | 12 |
| Volume Right | 82 | 10 | 24 | 12 |
| cSH | 1129 | 878 | 243 | 262 |
| Volume to Capacity | 0.01 | 0.01 | 0.38 | 0.25 |
| Queue Length 95th (m) | 0.2 | 0.4 | 13.4 | 7.6 |
| Control Delay (s) | 0.3 | 0.5 | 28.5 | 23.2 |
| Lane LOS | A | A | D | C |
| Approach Delay (s) | 0.3 | 0.5 | 28.5 | 23.2 |
| Approach LOS | | | D | C |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| Average Delay | | 4.0 | | | |
| Intersection Capacity Utilization | | 64.9% | ICU Level of Service | | C |
| Analysis Period (min) | | 15 | | | |

## Lanes, Volumes, Timings
## 10: Doon Mills Road & Apple Ridge Drive

2033 Total - AM Peak Hour

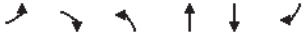
| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.973 | | | | 0.940 | |
| Flt Protected | 0.962 | | | 0.995 | | |
| Satd. Flow (prot) | 1613 | 0 | 0 | 1585 | 1465 | 0 |
| Flt Permitted | 0.962 | | | 0.995 | | |
| Satd. Flow (perm) | 1613 | 0 | 0 | 1585 | 1465 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | | 1 | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 3% | 0% | 0% | 4% | 9% | 2% |
| Adj. Flow (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 277 | 0 | 0 | 407 | 330 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 73.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 10: Doon Mills Road & Apple Ridge Drive

2033 Total - AM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Future Volume (vph) | 221 | 56 | 41 | 366 | 183 | 147 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 221 | 56 | 41 | 366 | 183 | 147 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 277 | 407 | 330 |
| Volume Left (vph) | 221 | 41 | 0 |
| Volume Right (vph) | 56 | 0 | 147 |
| Hadj (s) | 0.08 | 0.08 | -0.17 |
| Departure Headway (s) | 5.9 | 5.4 | 5.2 |
| Degree Utilization, x | 0.45 | 0.61 | 0.48 |
| Capacity (veh/h) | 569 | 645 | 657 |
| Control Delay (s) | 13.6 | 16.2 | 12.9 |
| Approach Delay (s) | 13.6 | 16.2 | 12.9 |
| Approach LOS | B | C | B |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 14.4 | | |
| Level of Service | B | | |
| Intersection Capacity Utilization | 73.1% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

Lanes, Volumes, Timings
11: Biehn Drive & Carnydale Drive

2033 Total - AM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 0.867 | | 0.970 | | | |
| Flt Protected | 0.999 | | | | | 0.954 |
| Satd. Flow (prot) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Flt Permitted | 0.999 | | | | | 0.954 |
| Satd. Flow (perm) | 1529 | 0 | 1442 | 0 | 0 | 1493 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 7% | 25% | 5% | 20% |
| Adj. Flow (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 309 | 0 | 18 | 0 | 0 | 169 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



HCM Unsignalized Intersection Capacity Analysis
11: Biehn Drive & Carnydale Drive

2033 Total - AM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Future Volume (Veh/h) | 4 | 305 | 14 | 4 | 164 | 5 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 4 | 305 | 14 | 4 | 164 | 5 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 349 | 16 | | | 18 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 349 | 16 | | | 18 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 99 | 71 | | | 90 | |
| cM capacity (veh/h) | 584 | 1069 | | | 1579 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 309 | 18 | 169 |
| Volume Left | 4 | 0 | 164 |
| Volume Right | 305 | 4 | 0 |
| cSH | 1058 | 1700 | 1579 |
| Volume to Capacity | 0.29 | 0.01 | 0.10 |
| Queue Length 95th (m) | 9.8 | 0.0 | 2.8 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.6 | | |
| Intersection Capacity Utilization | 44.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 0.99 | |
| Frt | | 0.965 | | | | 0.850 | | 0.999 | | | 0.966 | |
| Flt Protected | 0.950 | | | | 0.994 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 1498 | 0 | 0 | 1500 | 1365 | 1519 | 1616 | 0 | 1519 | 1458 | 0 |
| Flt Permitted | 0.728 | | | | 0.974 | | 0.523 | | | 0.416 | | |
| Satd. Flow (perm) | 1224 | 1498 | 0 | 0 | 1467 | 1317 | 829 | 1616 | 0 | 664 | 1458 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 23 | | | | 74 | | 1 | | | 33 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 89 | 98 | 0 | 0 | 44 | 74 | 44 | 459 | 0 | 56 | 346 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

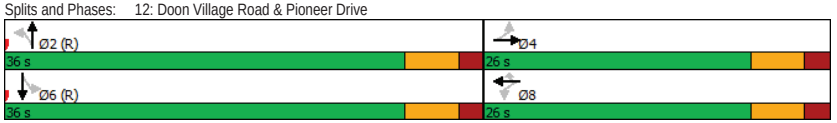




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.23 | 0.20 | | | 0.09 | 0.16 | 0.11 | 0.59 | | 0.17 | 0.48 | |
| Control Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.7 | 15.3 | | 10.8 | 12.4 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 17.3 | 13.5 | | | 15.4 | 5.4 | 9.7 | 15.3 | | 10.8 | 12.4 | |
| LOS | B | B | | | B | A | A | B | | B | B | |
| Approach Delay | | 15.3 | | | 9.1 | | | 14.8 | | | 12.2 | |
| Approach LOS | | B | | | A | | | B | | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.59 | | | |
| Intersection Signal Delay: 13.5 | | Intersection LOS: B | |
| Intersection Capacity Utilization 76.2% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2033 Total - AM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 89 | 98 | 44 | 74 | 44 | 459 | 56 | 346 |
| v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.11 | 0.59 | 0.17 | 0.48 |
| Control Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.7 | 15.3 | 10.8 | 12.4 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 17.3 | 13.5 | 15.4 | 5.4 | 9.7 | 15.3 | 10.8 | 12.4 |
| Queue Length 50th (m) | 7.7 | 6.3 | 3.6 | 0.0 | 2.7 | 37.0 | 3.5 | 23.2 |
| Queue Length 95th (m) | 17.5 | 16.1 | 9.9 | 7.7 | 7.6 | 63.6 | 9.8 | 43.2 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 394 | 498 | 473 | 474 | 401 | 782 | 321 | 722 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.23 | 0.20 | 0.09 | 0.16 | 0.11 | 0.59 | 0.17 | 0.48 |

Intersection Summary



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2033 Total - AM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Future Volume (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.96 | | | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.97 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1598 | 1498 | | | 1498 | 1317 | 1505 | 1616 | | 1515 | 1459 | |
| Flt Permitted | 0.73 | 1.00 | | | 0.97 | 1.00 | 0.52 | 1.00 | | 0.42 | 1.00 | |
| Satd. Flow (perm) | 1225 | 1498 | | | 1466 | 1317 | 829 | 1616 | | 664 | 1459 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 89 | 75 | 23 | 5 | 39 | 74 | 44 | 456 | 3 | 56 | 268 | 78 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 50 | 0 | 1 | 0 | 0 | 17 | 0 |
| Lane Group Flow (vph) | 89 | 82 | 0 | 0 | 44 | 24 | 44 | 458 | 0 | 56 | 329 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 4% | 3% | 13% | 20% | 8% | 9% | 11% | 2% | 0% | 11% | 10% | 3% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 395 | 483 | | | 472 | 424 | 401 | 781 | | 321 | 705 | |
| v/s Ratio Prot | | 0.06 | | | | | | c0.28 | | | 0.23 | |
| v/s Ratio Perm | c0.07 | | | | 0.03 | 0.02 | 0.05 | | | 0.08 | | |
| v/c Ratio | 0.23 | 0.17 | | | 0.09 | 0.06 | 0.11 | 0.59 | | 0.17 | 0.47 | |
| Uniform Delay, d1 | 15.3 | 15.1 | | | 14.7 | 14.5 | 8.7 | 11.5 | | 9.0 | 10.7 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.3 | 0.8 | | | 0.4 | 0.3 | 0.6 | 3.2 | | 1.2 | 2.2 | |
| Delay (s) | 16.7 | 15.8 | | | 15.1 | 14.7 | 9.3 | 14.8 | | 10.2 | 12.9 | |
| Level of Service | B | B | | | B | B | A | B | | B | B | |
| Approach Delay (s) | | 16.2 | | | 14.9 | | | 14.3 | | | 12.5 | |
| Approach LOS | | B | | | B | | | B | | | B | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 14.0 | HCM 2000 Level of Service | B | |
| HCM 2000 Volume to Capacity ratio | 0.44 | | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 | |
| Intersection Capacity Utilization | 76.2% | ICU Level of Service | D | |
| Analysis Period (min) | 15 | | | |
| c Critical Lane Group | | | | |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:42:34 PM

### Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2033 | | | | | | |
| **Leg North** | 0.55 | 1.02 | 3.77 | 0.35 | A | 4.09 | A |
| **Leg West** | 1.49 | 1.03 | 4.96 | 0.59 | A | | |
| **Leg East** | 0.36 | ~1 | 2.56 | 0.25 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM " model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:42:34 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FT 2033, AM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2033, AM | FT 2033 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 4.09 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Robert Ferrie Drive | |
| **West** | West | New Dundee Road | |
| **East** | East | New Dundee Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 477.00 | 100.000 |
| West | ONE HOUR | ✓ | 990.00 | 100.000 |
| East | ONE HOUR | ✓ | 463.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 132.000 | 345.000 |
| | West | 65.000 | 0.000 | 925.000 |
| | East | 100.000 | 363.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.28 | 0.72 |
| | West | 0.07 | 0.00 | 0.93 |
| | East | 0.22 | 0.78 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 1.000 | 1.030 | 1.010 |
| | West | 1.030 | 1.000 | 1.030 |
| | East | 1.070 | 1.080 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 3.0 | 1.0 |
| | West | 3.0 | 0.0 | 3.0 |
| | East | 7.0 | 8.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.35 | 3.77 | 0.55 | 1.02 | A | 437.70 | 656.56 | 37.16 | 3.40 | 0.41 | 37.16 | 3.40 |
| West | 0.59 | 4.96 | 1.49 | 1.03 | A | 908.44 | 1362.66 | 91.37 | 4.02 | 1.02 | 91.38 | 4.02 |
| East | 0.25 | 2.56 | 0.36 | −1 | A | 424.86 | 637.29 | 25.73 | 2.42 | 0.29 | 25.73 | 2.42 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 359.11 | 89.78 | 357.91 | 123.86 | 272.59 | 0.00 | 1563.93 | 850.84 | 0.230 | 0.00 | 0.30 | 3.028 | A |
| West | 745.32 | 186.33 | 742.71 | 371.63 | 258.86 | 0.00 | 1911.82 | 1692.73 | 0.390 | 0.00 | 0.65 | 3.165 | A |
| East | 348.57 | 87.14 | 347.69 | 952.81 | 48.76 | 0.00 | 2040.93 | 2002.60 | 0.171 | 0.00 | 0.22 | 2.290 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 428.81 | 107.20 | 428.45 | 148.21 | 326.16 | 0.00 | 1534.49 | 850.84 | 0.279 | 0.30 | 0.39 | 3.305 | A |
| West | 889.99 | 222.50 | 888.93 | 444.72 | 309.89 | 0.00 | 1880.47 | 1692.73 | 0.473 | 0.65 | 0.92 | 3.736 | A |
| East | 416.23 | 104.06 | 416.01 | 1140.46 | 58.36 | 0.00 | 2035.03 | 2002.60 | 0.205 | 0.22 | 0.28 | 2.396 | A |

#### Main results: (08:30-08:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 525.19 | 131.30 | 524.57 | 181.45 | 399.41 | 0.00 | 1494.23 | 850.84 | 0.351 | 0.39 | 0.55 | 3.768 | A |
| West | 1090.01 | 272.50 | 1087.76 | 544.57 | 379.40 | 0.00 | 1837.75 | 1692.73 | 0.593 | 0.92 | 1.48 | 4.929 | A |
| East | 509.77 | 127.44 | 509.43 | 1395.74 | 71.42 | 0.00 | 2027.01 | 2002.60 | 0.251 | 0.28 | 0.36 | 2.556 | A |

#### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 525.19 | 131.30 | 525.18 | 181.67 | 399.67 | 0.00 | 1494.09 | 850.84 | 0.352 | 0.55 | 0.55 | 3.772 | A |
| West | 1090.01 | 272.50 | 1089.97 | 545.00 | 379.85 | 0.00 | 1837.47 | 1692.73 | 0.593 | 1.48 | 1.49 | 4.960 | A |
| East | 509.77 | 127.44 | 509.77 | 1398.25 | 71.56 | 0.00 | 2026.92 | 2002.60 | 0.252 | 0.36 | 0.36 | 2.557 | A |

#### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 428.81 | 107.20 | 429.42 | 148.55 | 326.59 | 0.00 | 1534.25 | 850.84 | 0.279 | 0.55 | 0.40 | 3.312 | A |
| West | 889.99 | 222.50 | 892.22 | 445.43 | 310.59 | 0.00 | 1880.03 | 1692.73 | 0.473 | 1.49 | 0.93 | 3.764 | A |
| East | 416.23 | 104.06 | 416.56 | 1144.23 | 58.58 | 0.00 | 2034.90 | 2002.60 | 0.205 | 0.36 | 0.28 | 2.397 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 359.11 | 89.78 | 359.48 | 124.34 | 273.46 | 0.00 | 1563.45 | 850.84 | 0.230 | 0.40 | 0.30 | 3.038 | A |
| West | 745.32 | 186.33 | 746.41 | 372.94 | 260.00 | 0.00 | 1911.12 | 1692.73 | 0.390 | 0.93 | 0.66 | 3.185 | A |
| East | 348.57 | 87.14 | 348.79 | 957.40 | 49.01 | 0.00 | 2040.78 | 2002.60 | 0.171 | 0.28 | 0.22 | 2.294 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.43 | 0.30 | 3.028 | A | A |
| West | 9.59 | 0.64 | 3.165 | A | A |
| East | 3.27 | 0.22 | 2.290 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.79 | 0.39 | 3.305 | A | A |
| West | 13.49 | 0.90 | 3.736 | A | A |
| East | 4.10 | 0.27 | 2.396 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 8.05 | 0.54 | 3.768 | A | A |
| West | 21.50 | 1.43 | 4.929 | A | A |
| East | 5.35 | 0.36 | 2.556 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 8.22 | 0.55 | 3.772 | A | A |
| West | 22.32 | 1.49 | 4.960 | A | A |
| East | 5.42 | 0.36 | 2.557 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 6.04 | 0.40 | 3.312 | A | A |
| West | 14.36 | 0.96 | 3.764 | A | A |
| East | 4.22 | 0.28 | 2.397 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.63 | 0.31 | 3.038 | A | A |
| West | 10.12 | 0.67 | 3.185 | A | A |
| East | 3.38 | 0.23 | 2.294 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)





| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.30 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.65 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.92 | 0.00 | 0.00 | 1.03 | 1.03 | | | N/A | N/A |
| East | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.55 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 1.48 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.55 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| West | 1.49 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.40 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.93 | 0.00 | 0.00 | 0.00 | 1.03 | | | N/A | N/A |
| East | 0.28 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.30 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.66 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Robert Ferrie and New Dundee.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:41:54 PM

### Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2033 | | | | | | |
| **Leg North** | 0.36 | ~1 | 4.54 | 0.26 | A | 5.45 | A |
| **Leg West** | 0.65 | 1.03 | 3.08 | 0.39 | A | | |
| **Leg East** | 2.75 | 4.07 | 6.85 | 0.73 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2033, PM " model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:41:53 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FT 2033, PM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2033, PM | FT 2033 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,East | | | | 5.45 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Robert Ferrie Drive | |
| **West** | West | New Dundee Road | |
| **East** | East | New Dundee Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 3.50 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.647 | 2016.168 |
| West | | (calculated) | (calculated) | 0.723 | 2436.345 |
| East | | (calculated) | (calculated) | 0.723 | 2436.345 |

*The slope and intercept shown above include any corrections and adjustments.*

### Leg Capacity Adjustments

| Leg | Type | Reason | Direct Capacity Adjustment (PCE/hr) | Percentage Capacity Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | | | 85.00 |
| West | Percentage | | | 85.00 |
| East | Percentage | | | 85.00 |

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 262.00 | 100.000 |
| West | ONE HOUR | ✓ | 689.00 | 100.000 |
| East | ONE HOUR | ✓ | 1329.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.000 | 93.000 | 169.000 |
| | West | 108.000 | 0.000 | 581.000 |
| | East | 309.000 | 1020.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.00 | 0.35 | 0.65 |
| | West | 0.16 | 0.00 | 0.84 |
| | East | 0.23 | 0.77 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| | North | 1.000 | 1.020 | 1.020 |
| From | West | 1.010 | 1.000 | 1.030 |
| | East | 1.010 | 1.020 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | |
|---|---|---|---|---|
| | | North | West | East |
| From | North | 0.0 | 2.0 | 2.0 |
| | West | 1.0 | 0.0 | 3.0 |
| | East | 1.0 | 2.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.26 | 4.54 | 0.36 | −1 | A | 240.42 | 360.62 | 23.65 | 3.93 | 0.26 | 23.65 | 3.93 |
| West | 0.39 | 3.08 | 0.65 | 1.03 | A | 632.24 | 948.36 | 44.14 | 2.79 | 0.49 | 44.14 | 2.79 |
| East | 0.73 | 6.85 | 2.75 | 4.07 | A | 1219.51 | 1829.27 | 154.21 | 5.06 | 1.71 | 154.22 | 5.06 |

### Main Results for each time segment

#### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 197.25 | 49.31 | 196.52 | 312.79 | 764.87 | 0.00 | 1293.38 | 909.70 | 0.153 | 0.00 | 0.18 | 3.346 | A |
| West | 518.72 | 129.68 | 517.28 | 834.63 | 126.76 | 0.00 | 1993.00 | 1710.30 | 0.260 | 0.00 | 0.36 | 2.502 | A |
| East | 1000.54 | 250.14 | 996.58 | 562.95 | 81.08 | 0.00 | 2021.07 | 1906.15 | 0.495 | 0.00 | 0.99 | 3.563 | A |

#### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 235.53 | 58.88 | 235.28 | 374.36 | 915.48 | 0.00 | 1210.60 | 909.71 | 0.195 | 0.18 | 0.25 | 3.764 | A |
| West | 619.40 | 154.85 | 618.97 | 999.00 | 151.77 | 0.00 | 1977.63 | 1710.30 | 0.313 | 0.36 | 0.47 | 2.721 | A |
| East | 1194.74 | 298.69 | 1192.82 | 673.72 | 97.02 | 0.00 | 2011.27 | 1906.15 | 0.594 | 0.99 | 1.47 | 4.465 | A |

#### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 288.47 | 72.12 | 288.00 | 457.86 | 1119.24 | 0.00 | 1098.62 | 909.70 | 0.263 | 0.25 | 0.36 | 4.528 | A |
| West | 758.60 | 189.65 | 757.88 | 1221.47 | 185.77 | 0.00 | 1956.73 | 1710.30 | 0.388 | 0.47 | 0.65 | 3.082 | A |
| East | 1463.26 | 365.81 | 1458.30 | 824.86 | 118.80 | 0.00 | 1997.89 | 1906.15 | 0.732 | 1.47 | 2.71 | 6.728 | A |

#### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 288.47 | 72.12 | 288.46 | 459.09 | 1122.93 | 0.00 | 1096.59 | 909.70 | 0.263 | 0.36 | 0.36 | 4.543 | A |
| West | 758.60 | 189.65 | 758.60 | 1225.32 | 186.07 | 0.00 | 1956.55 | 1710.30 | 0.388 | 0.65 | 0.65 | 3.085 | A |
| East | 1463.26 | 365.81 | 1463.11 | 825.75 | 118.91 | 0.00 | 1997.82 | 1906.15 | 0.732 | 2.71 | 2.75 | 6.847 | A |

#### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 235.53 | 58.88 | 235.99 | 376.14 | 920.77 | 0.00 | 1207.70 | 909.71 | 0.195 | 0.36 | 0.25 | 3.782 | A |
| West | 619.40 | 154.85 | 620.11 | 1004.53 | 152.22 | 0.00 | 1977.35 | 1710.30 | 0.313 | 0.65 | 0.47 | 2.724 | A |
| East | 1194.74 | 298.69 | 1199.70 | 675.13 | 97.20 | 0.00 | 2011.16 | 1906.15 | 0.594 | 2.75 | 1.51 | 4.541 | A |

### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 197.25 | 49.31 | 197.50 | 314.47 | 769.45 | 0.00 | 1290.86 | 909.70 | 0.153 | 0.25 | 0.18 | 3.361 | A |
| West | 518.72 | 129.68 | 519.15 | 839.55 | 127.40 | 0.00 | 1992.61 | 1710.30 | 0.260 | 0.47 | 0.36 | 2.510 | A |
| East | 1000.54 | 250.14 | 1002.55 | 565.17 | 81.38 | 0.00 | 2020.89 | 1906.15 | 0.495 | 1.51 | 1.01 | 3.603 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.69 | 0.18 | 3.346 | A | A |
| West | 5.31 | 0.35 | 2.502 | A | A |
| East | 14.42 | 0.96 | 3.563 | A | A |

### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.62 | 0.24 | 3.764 | A | A |
| West | 6.90 | 0.46 | 2.721 | A | A |
| East | 21.43 | 1.43 | 4.465 | A | A |

### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.30 | 0.35 | 4.528 | A | A |
| West | 9.54 | 0.64 | 3.082 | A | A |
| East | 38.46 | 2.56 | 6.728 | A | A |

### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 5.43 | 0.36 | 4.543 | A | A |
| West | 9.72 | 0.65 | 3.085 | A | A |
| East | 41.00 | 2.73 | 6.847 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.79 | 0.25 | 3.782 | A | A |
| West | 7.16 | 0.48 | 2.724 | A | A |
| East | 23.45 | 1.56 | 4.541 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 2.81 | 0.19 | 3.361 | A | A |
| West | 5.51 | 0.37 | 2.510 | A | A |
| East | 15.46 | 1.03 | 3.603 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)





| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.99 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.47 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 1.47 | 0.00 | 0.00 | 3.05 | 4.07 | | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.65 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 2.71 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.65 | 0.00 | 0.00 | 0.00 | 1.03 | | | N/A | N/A |
| East | 2.75 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.47 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 1.51 | 0.00 | 0.00 | 2.04 | 3.05 | | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.18 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 1.01 | 0.00 | 0.00 | 1.02 | 2.04 | | | N/A | N/A |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 331 | 22 | 764 | 438 | 458 |
| Future Volume (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 331 | 22 | 764 | 438 | 458 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Storage Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 0.0 | 105.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 2 | | 1 |
| Taper Length (m) | 80.0 | | | 90.0 | | | 20.0 | | | 100.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 0.95 | 0.97 | 1.00 | 1.00 |
| Ped Bike Factor | | | 0.97 | 1.00 | | 0.98 | 0.99 | 1.00 | | 1.00 | | 0.97 |
| Frt | | | 0.850 | | | 0.850 | | 0.991 | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1670 | 3471 | 1488 | 1686 | 3438 | 1417 | 1670 | 3308 | 0 | 3146 | 1863 | 1458 |
| Flt Permitted | 0.089 | | | 0.098 | | | 0.138 | | | 0.950 | | |
| Satd. Flow (perm) | 156 | 3471 | 1447 | 174 | 3438 | 1387 | 241 | 3308 | 0 | 3131 | 1863 | 1410 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 477 | | | 433 | | 4 | | | | 300 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 449.7 | | | 2462.2 | | | 122.0 | | | 383.8 | |
| Travel Time (s) | | 32.4 | | | 177.3 | | | 8.8 | | | 27.6 | |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Adj. Flow (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 331 | 22 | 764 | 438 | 458 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 353 | 0 | 764 | 438 | 458 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | 1 |
| Detector Template | Left | Thru | Right | Left | Thru | Right | Left | Thru | | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

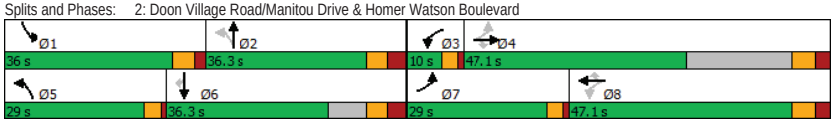




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Detector Phase | 7 | 4 | 4 | 3 | 8 | 8 | 5 | 2 | | 1 | 6 | 6 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 15.0 | | 5.0 | 15.0 | 15.0 |
| Minimum Split (s) | 9.0 | 47.1 | 47.1 | 9.0 | 47.1 | 47.1 | 9.0 | 36.3 | | 11.0 | 36.3 | 36.3 |
| Total Split (s) | 29.0 | 47.1 | 47.1 | 10.0 | 47.1 | 47.1 | 29.0 | 36.3 | | 36.0 | 36.3 | 36.3 |
| Total Split (%) | 19.5% | 31.7% | 31.7% | 6.7% | 31.7% | 31.7% | 19.5% | 24.5% | | 24.3% | 24.5% | 24.5% |
| Maximum Green (s) | 25.0 | 40.0 | 40.0 | 6.0 | 40.0 | 40.0 | 25.0 | 29.0 | | 30.0 | 29.0 | 29.0 |
| Yellow Time (s) | 3.0 | 4.2 | 4.2 | 3.0 | 4.2 | 4.2 | 3.0 | 3.7 | | 4.0 | 3.7 | 3.7 |
| All-Red Time (s) | 1.0 | 2.9 | 2.9 | 1.0 | 2.9 | 2.9 | 1.0 | 3.6 | | 2.0 | 3.6 | 3.6 |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lead/Lag | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Recall Mode | None | None | None | None | None | None | None | Max | | None | Max | Max |
| Walk Time (s) | | 22.0 | 22.0 | | 22.0 | 22.0 | | 10.0 | | | 10.0 | 10.0 |
| Flash Dont Walk (s) | | 18.0 | 18.0 | | 18.0 | 18.0 | | 19.0 | | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | 0 | | 0 | 0 | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 72.1 | 61.0 | 61.0 | 49.0 | 40.0 | 40.0 | 57.3 | 29.0 | | 30.0 | 36.0 | 36.0 |
| Actuated g/C Ratio | 0.49 | 0.41 | 0.41 | 0.33 | 0.27 | 0.27 | 0.39 | 0.20 | | 0.20 | 0.24 | 0.24 |
| v/c Ratio | 1.28 | 0.88 | 0.82 | 0.37 | 1.34 | 0.87 | 1.02 | 0.54 | | 1.20 | 0.97 | 0.80 |
| Control Delay | 183.1 | 49.5 | 21.2 | 31.9 | 202.8 | 28.3 | 98.6 | 56.7 | | 155.1 | 90.9 | 29.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 |
| Total Delay | 183.1 | 49.5 | 21.2 | 31.9 | 202.8 | 28.3 | 98.6 | 56.7 | | 155.1 | 90.9 | 29.6 |
| LOS | F | D | C | C | F | C | F | E | | F | F | C |
| Approach Delay | | 64.6 | | | 143.4 | | | 77.3 | | | 103.5 | |
| Approach LOS | | E | | | F | | | E | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 148.4 | | | |
| Actuated Cycle Length: 148.4 | | | |
| Natural Cycle: 145 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.34 | | | |
| Intersection Signal Delay: 98.0 | | Intersection LOS: F | |
| Intersection Capacity Utilization 127.2% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard



## Queues
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Total - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 353 | 764 | 438 | 458 |
| v/c Ratio | 1.28 | 0.88 | 0.82 | 0.37 | 1.34 | 0.87 | 1.02 | 0.54 | 1.20 | 0.97 | 0.80 |
| Control Delay | 183.1 | 49.5 | 21.2 | 31.9 | 202.8 | 28.3 | 98.6 | 56.7 | 155.1 | 90.9 | 29.6 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 183.1 | 49.5 | 21.2 | 31.9 | 202.8 | 28.3 | 98.6 | 56.7 | 155.1 | 90.9 | 29.6 |
| Queue Length 50th (m) | ~148.5 | 193.2 | 74.7 | 6.9 | ~263.4 | 57.0 | ~94.6 | 51.8 | ~147.5 | 135.4 | 49.4 |
| Queue Length 95th (m) | #218.2 | #231.3 | 144.7 | 14.2 | #308.3 | #135.4 | #160.3 | 69.3 | #188.9 | #206.1 | 99.4 |
| Internal Link Dist (m) | | 425.7 | | | 2438.2 | | | 98.0 | | 359.8 | |
| Turn Bay Length (m) | 275.0 | | 80.0 | 120.0 | | 200.0 | 25.0 | | 105.0 | | 65.0 |
| Base Capacity (vph) | 330 | 1426 | 875 | 118 | 926 | 690 | 333 | 649 | 635 | 451 | 569 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 1.28 | 0.88 | 0.82 | 0.36 | 1.34 | 0.87 | 1.02 | 0.54 | 1.20 | 0.97 | 0.80 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 2: Doon Village Road/Manitou Drive & Homer Watson Boulevard

2033 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 331 | 22 | 764 | 438 | 458 |
| Future Volume (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 331 | 22 | 764 | 438 | 458 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Lane Util. Factor | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | | 0.97 | 1.00 | 1.00 |
| Frpb, ped/bikes | 1.00 | 1.00 | 0.97 | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | | 1.00 | 1.00 | 0.97 |
| Flpb, ped/bikes | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 0.99 | | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1670 | 3471 | 1447 | 1686 | 3438 | 1387 | 1668 | 3307 | | 3146 | 1863 | 1410 |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 0.10 | 1.00 | 1.00 | 0.14 | 1.00 | | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 157 | 3471 | 1447 | 174 | 3438 | 1387 | 242 | 3307 | | 3146 | 1863 | 1410 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 421 | 1261 | 715 | 43 | 1243 | 600 | 341 | 331 | 22 | 764 | 438 | 458 |
| RTOR Reduction (vph) | 0 | 0 | 282 | 0 | 0 | 315 | 0 | 3 | 0 | 0 | 0 | 228 |
| Lane Group Flow (vph) | 421 | 1261 | 433 | 43 | 1243 | 285 | 341 | 350 | 0 | 764 | 438 | 230 |
| Confl. Peds. (#/hr) | 8 | | 4 | 4 | | 8 | 14 | | 3 | 3 | | 14 |
| Heavy Vehicles (%) | 1% | 4% | 0% | 0% | 5% | 5% | 1% | 1% | 0% | 4% | 2% | 2% |
| Turn Type | pm+pt | NA | Perm | pm+pt | NA | Perm | pm+pt | NA | | Prot | NA | Perm |
| Protected Phases | 7 | 4 | | 3 | 8 | | 5 | 2 | | 1 | 6 | |
| Permitted Phases | 4 | | 4 | 8 | | 8 | 2 | | | | | 6 |
| Actuated Green, G (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 54.0 | 29.0 | | 30.0 | 36.0 | 36.0 |
| Effective Green, g (s) | 69.8 | 61.0 | 61.0 | 45.6 | 40.8 | 40.8 | 54.0 | 29.0 | | 30.0 | 36.0 | 36.0 |
| Actuated g/C Ratio | 0.47 | 0.41 | 0.41 | 0.31 | 0.27 | 0.27 | 0.36 | 0.19 | | 0.20 | 0.24 | 0.24 |
| Clearance Time (s) | 4.0 | 7.1 | 7.1 | 4.0 | 7.1 | 7.1 | 4.0 | 7.3 | | 6.0 | 7.3 | 7.3 |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 5.0 | 3.0 | 3.0 |
| Lane Grp Cap (vph) | 326 | 1419 | 591 | 101 | 940 | 379 | 326 | 642 | | 632 | 449 | 340 |
| v/s Ratio Prot | c0.22 | 0.36 | | 0.01 | 0.36 | | 0.17 | 0.11 | | c0.24 | c0.24 | |
| v/s Ratio Perm | c0.39 | | 0.30 | 0.12 | | 0.21 | 0.20 | | | | | 0.16 |
| v/c Ratio | 1.29 | 0.89 | 0.73 | 0.43 | 1.32 | 0.75 | 1.05 | 0.54 | | 1.21 | 0.98 | 0.68 |
| Uniform Delay, d1 | 48.5 | 40.9 | 37.2 | 39.1 | 54.2 | 49.6 | 46.0 | 54.2 | | 59.6 | 56.2 | 51.3 |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 152.2 | 7.2 | 4.7 | 2.9 | 152.5 | 8.2 | 62.4 | 3.3 | | 108.3 | 36.8 | 10.4 |
| Delay (s) | 200.7 | 48.1 | 41.9 | 42.0 | 206.7 | 57.8 | 108.4 | 57.5 | | 167.9 | 93.0 | 61.7 |
| Level of Service | F | D | D | D | F | E | F | E | | F | F | E |
| Approach Delay (s) | | 73.1 | | | 155.6 | | | 82.5 | | | 118.8 | |
| Approach LOS | | E | | | F | | | F | | | F | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 108.9 | HCM 2000 Level of Service | F | | |
| HCM 2000 Volume to Capacity ratio | 1.24 | | | | |
| Actuated Cycle Length (s) | 149.2 | Sum of lost time (s) | 24.4 | | |
| Intersection Capacity Utilization | 127.2% | ICU Level of Service | H | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1975 | 6 | 2 | 1707 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1975 | 6 | 2 | 1707 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Storage Length (m) | 0.0 | | 0.0 | 0.0 | | 0.0 | 110.0 | | 0.0 | 35.0 | | 0.0 |
| Storage Lanes | 0 | | 1 | 0 | | 0 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 7.5 | | | 7.5 | | | 70.0 | | | 55.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 0.95 | 1.00 | 0.95 | 0.95 |
| Ped Bike Factor | | 0.99 | | | | | | | | | | |
| Frt | | | 0.850 | | | | | | | | 0.985 | |
| Flt Protected | | 0.953 | | | 0.979 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 0 | 1493 | 1417 | 0 | 1517 | 0 | 1670 | 3182 | 0 | 1686 | 3173 | 0 |
| Flt Permitted | | 0.726 | | | 0.896 | | 0.950 | | | 0.088 | | |
| Satd. Flow (perm) | 0 | 1131 | 1417 | 0 | 1389 | 0 | 1670 | 3182 | 0 | 156 | 3173 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 125 | | | | | | | | 11 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 319.9 | | | 88.4 | | | 562.4 | | | 2462.2 | |
| Travel Time (s) | | 23.0 | | | 6.4 | | | 40.5 | | | 177.3 | |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1975 | 6 | 2 | 1707 | 187 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 144 | 125 | 0 | 7 | 0 | 127 | 1981 | 0 | 2 | 1894 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 0.0 | | | 0.0 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.11 | 1.29 | 1.29 | 1.29 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 | 1.09 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | 1 | 1 | 2 | | 1 | 2 | | 1 | 2 | |
| Detector Template | Left | Thru | Right | Left | Thru | | Left | Thru | | Left | Thru | |
| Leading Detector (m) | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | 2.0 | 10.0 | | 2.0 | 10.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | 2.0 | 0.6 | | 2.0 | 0.6 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

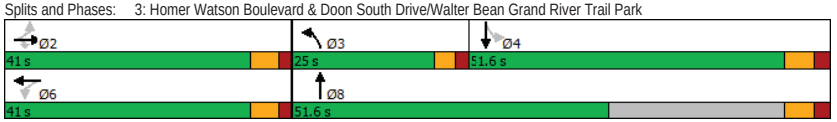




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Detector Phase | 2 | 2 | 2 | 6 | 6 | | 3 | 8 | | 4 | 4 | |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | 10.0 | 20.0 | | 20.0 | 20.0 | |
| Minimum Split (s) | 29.0 | 29.0 | 29.0 | 29.0 | 29.0 | | 15.0 | 26.6 | | 26.6 | 26.6 | |
| Total Split (s) | 41.0 | 41.0 | 41.0 | 41.0 | 41.0 | | 25.0 | 51.6 | | 51.6 | 51.6 | |
| Total Split (%) | 34.9% | 34.9% | 34.9% | 34.9% | 34.9% | | 21.3% | 43.9% | | 43.9% | 43.9% | |
| Maximum Green (s) | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | | 20.0 | 45.0 | | 45.0 | 45.0 | |
| Yellow Time (s) | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 3.0 | 4.2 | | 4.2 | 4.2 | |
| All-Red Time (s) | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.4 | | 2.4 | 2.4 | |
| Lost Time Adjust (s) | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lead/Lag | | | | | | | Lead | | | Lag | Lag | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Recall Mode | None | None | None | None | None | | None | Max | | Max | Max | |
| Walk Time (s) | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | | | 7.0 | | 7.0 | 7.0 | |
| Flash Dont Walk (s) | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 | | | 13.0 | | 13.0 | 13.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | 0 | 0 | 0 | | | 0 | | 0 | 0 | |
| Act Effct Green (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.4 | 45.4 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| v/c Ratio | | 0.69 | 0.35 | | 0.03 | | 0.55 | 0.92 | | 0.03 | 1.22 | |
| Control Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 22.3 | | 18.0 | 130.8 | |
| Queue Delay | | 0.0 | 0.0 | | 0.0 | | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | | 53.5 | 8.9 | | 31.1 | | 48.1 | 22.3 | | 18.0 | 130.8 | |
| LOS | | D | A | | C | | D | C | | B | F | |
| Approach Delay | | 32.8 | | | 31.1 | | | 23.9 | | | 130.7 | |
| Approach LOS | | C | | | C | | | C | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 117.6 | | | |
| Actuated Cycle Length: 93.3 | | | |
| Natural Cycle: 120 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.22 | | | |
| Intersection Signal Delay: 71.8 | | Intersection LOS: E | |
| Intersection Capacity Utilization 107.2% | | ICU Level of Service G | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park



## Queues
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2032 Total PM Peak Hour

| Lane Group | EBT | EBR | WBT | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 144 | 125 | 7 | 127 | 1981 | 2 | 1894 |
| v/c Ratio | 0.69 | 0.35 | 0.03 | 0.55 | 0.92 | 0.03 | 1.22 |
| Control Delay | 53.5 | 8.9 | 31.1 | 48.1 | 22.3 | 18.0 | 130.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 53.5 | 8.9 | 31.1 | 48.1 | 22.3 | 18.0 | 130.8 |
| Queue Length 50th (m) | 25.3 | 0.0 | 1.1 | 22.5 | 144.4 | 0.2 | ~229.7 |
| Queue Length 95th (m) | 48.8 | 14.7 | 5.0 | 44.9 | #281.5 | 2.0 | #346.7 |
| Internal Link Dist (m) | 295.9 | | 64.4 | | 538.4 | | 2438.2 |
| Turn Bay Length (m) | | | | 110.0 | | 35.0 | |
| Base Capacity (vph) | 428 | 614 | 525 | 361 | 2410 | 75 | 1550 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.34 | 0.20 | 0.01 | 0.35 | 0.82 | 0.03 | 1.22 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
### 3: Homer Watson Boulevard & Doon South Drive/Walter Bean Grand River Trail Park

2032 Total PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1975 | 6 | 2 | 1707 | 187 |
| Future Volume (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1975 | 6 | 2 | 1707 | 187 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1750 | 1550 | 1550 | 1550 | 1775 | 1775 | 1775 | 1775 | 1775 | 1775 |
| Total Lost time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Lane Util. Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 0.95 | | 1.00 | 0.95 | |
| Frpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 1.00 | 0.85 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 0.99 | |
| Flt Protected | | 0.95 | 1.00 | | 0.98 | | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | | 1487 | 1417 | | 1517 | | 1670 | 3181 | | 1686 | 3173 | |
| Flt Permitted | | 0.73 | 1.00 | | 0.90 | | 0.95 | 1.00 | | 0.09 | 1.00 | |
| Satd. Flow (perm) | | 1132 | 1417 | | 1389 | | 1670 | 3181 | | 156 | 3173 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 141 | 3 | 125 | 3 | 4 | 0 | 127 | 1975 | 6 | 2 | 1707 | 187 |
| RTOR Reduction (vph) | 0 | 0 | 102 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| Lane Group Flow (vph) | 0 | 144 | 23 | 0 | 7 | 0 | 127 | 1981 | 0 | 2 | 1888 | 0 |
| Confl. Peds. (#/hr) | 4 | | | | | 4 | | | | | | |
| Heavy Vehicles (%) | 4% | 67% | 5% | 0% | 0% | 0% | 1% | 6% | 0% | 0% | 5% | 2% |
| Turn Type | Perm | NA | Perm | Perm | NA | | Prot | NA | | Perm | NA | |
| Protected Phases | | 2 | | | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | | | | | 4 | | |
| Actuated Green, G (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Effective Green, g (s) | | 17.2 | 17.2 | | 17.2 | | 12.9 | 63.4 | | 45.5 | 45.5 | |
| Actuated g/C Ratio | | 0.18 | 0.18 | | 0.18 | | 0.14 | 0.68 | | 0.49 | 0.49 | |
| Clearance Time (s) | | 6.0 | 6.0 | | 6.0 | | 5.0 | 6.6 | | 6.6 | 6.6 | |
| Vehicle Extension (s) | | 3.0 | 3.0 | | 3.0 | | 3.0 | 5.0 | | 5.0 | 5.0 | |
| Lane Grp Cap (vph) | | 208 | 261 | | 256 | | 231 | 2163 | | 76 | 1549 | |
| v/s Ratio Prot | | | | | | | 0.08 | c0.62 | | | c0.60 | |
| v/s Ratio Perm | | c0.13 | 0.02 | | 0.01 | | | | | 0.01 | | |
| v/c Ratio | | 0.69 | 0.09 | | 0.03 | | 0.55 | 0.92 | | 0.03 | 1.22 | |
| Uniform Delay, d1 | | 35.5 | 31.5 | | 31.1 | | 37.4 | 12.6 | | 12.4 | 23.9 | |
| Progression Factor | | 1.00 | 1.00 | | 1.00 | | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | | 9.5 | 0.1 | | 0.0 | | 2.7 | 7.6 | | 0.6 | 104.7 | |
| Delay (s) | | 45.1 | 31.6 | | 31.2 | | 40.1 | 20.2 | | 13.0 | 128.5 | |
| Level of Service | | D | C | | C | | D | C | | B | F | |
| Approach Delay (s) | | 38.8 | | | 31.2 | | | 21.4 | | | 128.4 | |
| Approach LOS | | D | | | C | | | C | | | F | |

Intersection Summary

| | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 69.9 | HCM 2000 Level of Service | | E | |
| HCM 2000 Volume to Capacity ratio | 1.08 | | | | |
| Actuated Cycle Length (s) | 93.2 | Sum of lost time (s) | | 17.6 | |
| Intersection Capacity Utilization | 107.2% | ICU Level of Service | | G | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 240 | 31 | 180 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| Future Volume (vph) | 240 | 31 | 180 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Storage Length (m) | 50.0 | | 0.0 | 50.0 | | 0.0 | 205.0 | | 0.0 | 175.0 | | 190.0 |
| Storage Lanes | 1 | | 0 | 1 | | 1 | 1 | | 1 | 2 | | 1 |
| Taper Length (m) | 75.0 | | | 50.0 | | | 100.0 | | | 75.0 | | |
| Lane Util. Factor | 1.00 | 0.95 | 0.95 | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Ped Bike Factor | 0.99 | 0.98 | | 0.99 | | 0.97 | | | 0.99 | 1.00 | | 0.98 |
| Frt | | 0.872 | | | | 0.850 | | | 0.850 | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1621 | 2504 | 0 | 1576 | 1827 | 1340 | 1547 | 4940 | 1377 | 2870 | 3471 | 1458 |
| Flt Permitted | 0.721 | | | 0.450 | | | 0.096 | | | 0.950 | | |
| Satd. Flow (perm) | 1215 | 2504 | 0 | 738 | 1827 | 1306 | 156 | 4940 | 1359 | 2869 | 3471 | 1425 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 180 | | | | 138 | | | 169 | | | 122 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 181.6 | | | 324.8 | | | 266.0 | | | 278.1 | |
| Travel Time (s) | | 13.1 | | | 23.4 | | | 19.2 | | | 20.0 | |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Adj. Flow (vph) | 240 | 31 | 180 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 240 | 211 | 0 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 7.2 | | | 7.2 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.09 | 1.09 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | 2 | | 1 | 2 | 1 | 1 | 2 | 1 | 1 | 2 | 1 |
| Detector Template | Left | Thru | | Left | Thru | Right | Left | Thru | Right | Left | Thru | Right |
| Leading Detector (m) | 2.0 | 10.0 | | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | 0.6 | | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Detector 2 Position(m) | | 9.4 | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | 0.6 | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |

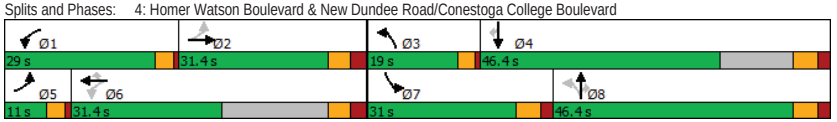




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Detector Phase | 5 | 2 | | 1 | 6 | 6 | 3 | 8 | 8 | 7 | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 10.0 | 5.0 | 5.0 |
| Minimum Split (s) | 9.0 | 40.4 | | 9.0 | 40.4 | 40.4 | 9.0 | 32.6 | 32.6 | 16.0 | 32.6 | 32.6 |
| Total Split (s) | 11.0 | 31.4 | | 29.0 | 31.4 | 31.4 | 19.0 | 46.4 | 46.4 | 31.0 | 46.4 | 46.4 |
| Total Split (%) | 8.0% | 22.8% | | 21.0% | 22.8% | 22.8% | 13.8% | 33.7% | 33.7% | 22.5% | 33.7% | 33.7% |
| Maximum Green (s) | 7.0 | 25.0 | | 25.0 | 25.0 | 25.0 | 15.0 | 40.0 | 40.0 | 25.0 | 40.0 | 40.0 |
| Yellow Time (s) | 3.0 | 3.7 | | 3.0 | 3.7 | 3.7 | 3.0 | 4.2 | 4.2 | 4.0 | 4.2 | 4.2 |
| All-Red Time (s) | 1.0 | 2.7 | | 1.0 | 2.7 | 2.7 | 1.0 | 2.2 | 2.2 | 2.0 | 2.2 | 2.2 |
| Lost Time Adjust (s) | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Lost Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lead/Lag | Lead | Lag | | Lead | Lag | Lag | Lead | Lag | Lag | Lead | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Recall Mode | None | None | | None | None | None | None | Max | Max | None | Max | Max |
| Walk Time (s) | | 10.0 | | | 10.0 | 10.0 | | 7.0 | 7.0 | | 7.0 | 7.0 |
| Flash Dont Walk (s) | | 24.0 | | | 24.0 | 24.0 | | 19.0 | 19.0 | | 19.0 | 19.0 |
| Pedestrian Calls (#/hr) | | 0 | | | 0 | 0 | | 0 | 0 | | 0 | 0 |
| Act Effct Green (s) | 17.1 | 7.7 | | 22.1 | 10.6 | 10.6 | 57.9 | 41.8 | 41.8 | 10.3 | 40.4 | 40.4 |
| Actuated g/C Ratio | 0.18 | 0.08 | | 0.24 | 0.11 | 0.11 | 0.63 | 0.45 | 0.45 | 0.11 | 0.44 | 0.44 |
| v/c Ratio | 0.94 | 0.57 | | 0.57 | 0.26 | 0.44 | 0.66 | 0.79 | 0.13 | 0.33 | 1.11 | 0.09 |
| Control Delay | 79.0 | 16.3 | | 36.7 | 40.1 | 9.8 | 28.5 | 25.7 | 0.4 | 42.5 | 87.6 | 0.2 |
| Queue Delay | 0.0 | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 79.0 | 16.3 | | 36.7 | 40.1 | 9.8 | 28.5 | 25.7 | 0.4 | 42.5 | 87.6 | 0.2 |
| LOS | E | B | | D | D | A | C | C | A | D | F | A |
| Approach Delay | | 49.7 | | | 27.5 | | | 24.8 | | | 82.2 | |
| Approach LOS | | D | | | C | | | C | | | F | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 137.8 | | | |
| Actuated Cycle Length: 92.6 | | | |
| Natural Cycle: 140 | | | |
| Control Type: Semi Act-Uncoord | | | |
| Maximum v/c Ratio: 1.11 | | | |
| Intersection Signal Delay: 50.1 | | Intersection LOS: D | |
| Intersection Capacity Utilization 101.5% | | ICU Level of Service G | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard



## Queues
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2033 Total - PM Peak Hour

| Lane Group | EBL | EBT | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 240 | 211 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| v/c Ratio | 0.94 | 0.57 | 0.57 | 0.26 | 0.44 | 0.66 | 0.79 | 0.13 | 0.33 | 1.11 | 0.09 |
| Control Delay | 79.0 | 16.3 | 36.7 | 40.1 | 9.8 | 28.5 | 25.7 | 0.4 | 42.5 | 87.6 | 0.2 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 79.0 | 16.3 | 36.7 | 40.1 | 9.8 | 28.5 | 25.7 | 0.4 | 42.5 | 87.6 | 0.2 |
| Queue Length 50th (m) | 39.7 | 2.9 | 23.4 | 9.7 | 0.0 | 18.2 | 97.1 | 0.0 | 9.6 | ~193.1 | 0.0 |
| Queue Length 95th (m) | #85.0 | 14.5 | 40.5 | 20.9 | 11.7 | #51.6 | 141.7 | 0.1 | 19.0 | #270.9 | 0.0 |
| Internal Link Dist (m) | | 157.6 | | 300.8 | | | 242.0 | | | 254.1 | |
| Turn Bay Length (m) | 50.0 | | 50.0 | | | 205.0 | | | 175.0 | | 190.0 |
| Base Capacity (vph) | 255 | 810 | 439 | 851 | 682 | 325 | 2229 | 705 | 778 | 1957 | 856 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.94 | 0.26 | 0.34 | 0.06 | 0.17 | 0.61 | 0.79 | 0.13 | 0.14 | 0.86 | 0.07 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 4: Homer Watson Boulevard & New Dundee Road/Conestoga College Boulevard

2033 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 240 | 31 | 180 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| Future Volume (vph) | 240 | 31 | 180 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| Ideal Flow (vphpl) | 1775 | 1775 | 1775 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 |
| Total Lost time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Lane Util. Factor | 1.00 | 0.95 | | 1.00 | 1.00 | 1.00 | 1.00 | 0.91 | 1.00 | 0.97 | 0.95 | 1.00 |
| Frpb, ped/bikes | 1.00 | 0.98 | | 1.00 | 1.00 | 0.98 | 1.00 | 1.00 | 0.99 | 1.00 | 1.00 | 0.98 |
| Flpb, ped/bikes | 0.99 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | 1.00 | 0.87 | | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | 0.85 |
| Flt Protected | 0.95 | 1.00 | | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (prot) | 1612 | 2516 | | 1571 | 1827 | 1312 | 1547 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Flt Permitted | 0.72 | 1.00 | | 0.45 | 1.00 | 1.00 | 0.10 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 |
| Satd. Flow (perm) | 1224 | 2516 | | 744 | 1827 | 1312 | 156 | 4940 | 1359 | 2870 | 3471 | 1430 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 240 | 31 | 180 | 150 | 55 | 118 | 199 | 1764 | 94 | 106 | 1683 | 60 |
| RTOR Reduction (vph) | 0 | 165 | 0 | 0 | 0 | 104 | 0 | 0 | 52 | 0 | 0 | 34 |
| Lane Group Flow (vph) | 240 | 46 | 0 | 150 | 55 | 14 | 199 | 1764 | 42 | 106 | 1683 | 26 |
| Confl. Peds. (#/hr) | 11 | | 13 | 13 | | 11 | 7 | | 1 | 1 | | 7 |
| Heavy Vehicles (%) | 4% | 7% | 16% | 7% | 4% | 11% | 9% | 5% | 8% | 14% | 4% | 2% |
| Turn Type | pm+pt | NA | | pm+pt | NA | Perm | pm+pt | NA | Perm | Prot | NA | Perm |
| Protected Phases | 5 | 2 | | 1 | 6 | | 3 | 8 | | 7 | 4 | |
| Permitted Phases | 2 | | | 6 | | 6 | 8 | | 8 | | | 4 |
| Actuated Green, G (s) | 14.7 | 7.7 | | 20.5 | 10.6 | 10.6 | 55.5 | 41.8 | 41.8 | 10.3 | 40.4 | 40.4 |
| Effective Green, g (s) | 14.7 | 7.7 | | 20.5 | 10.6 | 10.6 | 55.5 | 41.8 | 41.8 | 10.3 | 40.4 | 40.4 |
| Actuated g/C Ratio | 0.16 | 0.08 | | 0.22 | 0.11 | 0.11 | 0.60 | 0.45 | 0.45 | 0.11 | 0.44 | 0.44 |
| Clearance Time (s) | 4.0 | 6.4 | | 4.0 | 6.4 | 6.4 | 4.0 | 6.4 | 6.4 | 6.0 | 6.4 | 6.4 |
| Vehicle Extension (s) | 3.0 | 3.0 | | 0.2 | 3.0 | 3.0 | 3.0 | 4.0 | 4.0 | 3.0 | 4.0 | 4.0 |
| Lane Grp Cap (vph) | 223 | 209 | | 253 | 209 | 150 | 299 | 2232 | 614 | 319 | 1515 | 624 |
| v/s Ratio Prot | c0.08 | 0.02 | | c0.06 | 0.03 | | c0.10 | 0.36 | | 0.04 | c0.48 | |
| v/s Ratio Perm | c0.09 | | | 0.07 | | 0.01 | 0.30 | | 0.03 | | | 0.02 |
| v/c Ratio | 1.08 | 0.22 | | 0.59 | 0.26 | 0.09 | 0.67 | 0.79 | 0.07 | 0.33 | 1.11 | 0.04 |
| Uniform Delay, d1 | 38.4 | 39.6 | | 31.0 | 37.4 | 36.6 | 21.5 | 21.6 | 14.3 | 37.9 | 26.1 | 14.9 |
| Progression Factor | 1.00 | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Incremental Delay, d2 | 82.0 | 0.5 | | 2.5 | 0.7 | 0.3 | 5.5 | 2.9 | 0.2 | 0.6 | 59.8 | 0.1 |
| Delay (s) | 120.4 | 40.1 | | 33.5 | 38.1 | 36.9 | 27.0 | 24.6 | 14.6 | 38.5 | 85.9 | 15.1 |
| Level of Service | F | D | | C | D | D | C | C | B | D | F | B |
| Approach Delay (s) | | 82.8 | | | 35.5 | | | 24.3 | | | 80.9 | |
| Approach LOS | | F | | | D | | | C | | | F | |

| Intersection Summary | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 53.1 | HCM 2000 Level of Service | D | |
| HCM 2000 Volume to Capacity ratio | 1.01 | | | |
| Actuated Cycle Length (s) | 92.5 | Sum of lost time (s) | 22.8 | |
| Intersection Capacity Utilization | 101.5% | ICU Level of Service | G | |
| Analysis Period (min) | 15 | | | |

c Critical Lane Group

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 117 | 0 | 575 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 135 |
| Future Volume (vph) | 117 | 0 | 575 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 135 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Storage Length (m) | 75.0 | | 0.0 | 0.0 | | 0.0 | 180.0 | | 0.0 | 0.0 | | 65.0 |
| Storage Lanes | 1 | | 1 | 1 | | 1 | 1 | | 0 | 0 | | 1 |
| Taper Length (m) | 25.0 | | | 7.5 | | | 100.0 | | | 7.5 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | 1.00 | 1.00 | 0.91 | 1.00 |
| Ped Bike Factor | | | | | | | | | | | | |
| Frt | | | 0.850 | | | 0.850 | | | | | | 0.850 |
| Flt Protected | 0.950 | | | 0.950 | | | 0.950 | | | | | |
| Satd. Flow (prot) | 1621 | 0 | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | 0 | 0 | 5036 | 1458 |
| Flt Permitted | 0.132 | | | 0.950 | | | 0.106 | | | | | |
| Satd. Flow (perm) | 225 | 0 | 1458 | 1637 | 1881 | 1390 | 183 | 3438 | 0 | 0 | 5036 | 1458 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | | 216 | | | 352 | | | | | | 105 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 1202.5 | | | 483.0 | | | 320.0 | | | 175.5 | |
| Travel Time (s) | | 86.6 | | | 34.8 | | | 23.0 | | | 12.6 | |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Adj. Flow (vph) | 117 | 0 | 575 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 135 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 117 | 0 | 575 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 135 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.11 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 | 1.11 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Number of Detectors | 1 | | 1 | 1 | 2 | 1 | 1 | 2 | | | 2 | 1 |
| Detector Template | Left | | Right | Left | Thru | Right | Left | Thru | | | Thru | Right |
| Leading Detector (m) | 2.0 | | 2.0 | 2.0 | 10.0 | 2.0 | 2.0 | 10.0 | | | 10.0 | 2.0 |
| Trailing Detector (m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Position(m) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Size(m) | 2.0 | | 2.0 | 2.0 | 0.6 | 2.0 | 2.0 | 0.6 | | | 0.6 | 2.0 |
| Detector 1 Type | Cl+Ex | | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | | | Cl+Ex | Cl+Ex |
| Detector 1 Channel | | | | | | | | | | | | |
| Detector 1 Extend (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Queue (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 1 Delay (s) | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Detector 2 Position(m) | | | | | 9.4 | | | 9.4 | | | 9.4 | |
| Detector 2 Size(m) | | | | | 0.6 | | | 0.6 | | | 0.6 | |
| Detector 2 Type | | | | | Cl+Ex | | | Cl+Ex | | | Cl+Ex | |
| Detector 2 Channel | | | | | | | | | | | | |
| Detector 2 Extend (s) | | | | | 0.0 | | | 0.0 | | | 0.0 | |

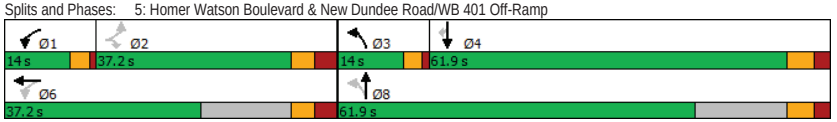




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Detector Phase | 2 | | 2 | 1 | 6 | | 3 | 8 | | | 4 | 4 |
| Switch Phase | | | | | | | | | | | | |
| Minimum Initial (s) | 10.0 | | 10.0 | 5.0 | 10.0 | | 5.0 | 20.0 | | | 20.0 | 20.0 |
| Minimum Split (s) | 33.2 | | 33.2 | 9.0 | 33.2 | | 9.0 | 26.9 | | | 26.9 | 26.9 |
| Total Split (s) | 37.2 | | 37.2 | 14.0 | 37.2 | | 14.0 | 61.9 | | | 61.9 | 61.9 |
| Total Split (%) | 29.3% | | 29.3% | 11.0% | 29.3% | | 11.0% | 48.7% | | | 48.7% | 48.7% |
| Maximum Green (s) | 30.0 | | 30.0 | 10.0 | 30.0 | | 10.0 | 55.0 | | | 55.0 | 55.0 |
| Yellow Time (s) | 3.7 | | 3.7 | 3.0 | 3.7 | | 3.0 | 4.2 | | | 4.2 | 4.2 |
| All-Red Time (s) | 3.5 | | 3.5 | 1.0 | 3.5 | | 1.0 | 2.7 | | | 2.7 | 2.7 |
| Lost Time Adjust (s) | 0.0 | | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Lost Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lead/Lag | Lag | | Lag | Lead | | | Lead | | | | Lag | Lag |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Recall Mode | Max | | Max | None | Max | | None | None | | | None | None |
| Walk Time (s) | 7.0 | | 7.0 | | 7.0 | | | 15.0 | | | 15.0 | 15.0 |
| Flash Dont Walk (s) | 19.0 | | 19.0 | | 19.0 | | | 5.0 | | | 5.0 | 5.0 |
| Pedestrian Calls (#/hr) | 0 | | 0 | | 0 | | | 0 | | | 0 | 0 |
| Act Effct Green (s) | 30.1 | | 30.1 | 47.4 | 44.2 | 118.2 | 62.8 | 59.9 | | | 45.8 | 45.8 |
| Actuated g/C Ratio | 0.25 | | 0.25 | 0.40 | 0.37 | 1.00 | 0.53 | 0.51 | | | 0.39 | 0.39 |
| v/c Ratio | 2.05 | | 1.08 | 0.40 | 1.30 | 0.78 | 1.87 | 0.49 | | | 0.67 | 0.21 |
| Control Delay | 557.7 | | 89.8 | 29.1 | 177.0 | 4.4 | 429.9 | 20.0 | | | 31.5 | 7.5 |
| Queue Delay | 0.0 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | 0.0 | 0.0 |
| Total Delay | 557.7 | | 89.8 | 29.1 | 177.0 | 4.4 | 429.9 | 20.0 | | | 31.5 | 7.5 |
| LOS | F | | F | C | F | A | F | C | | | C | A |
| Approach Delay | | 168.9 | | | 76.9 | | | 153.2 | | | 29.3 | |
| Approach LOS | | F | | | E | | | F | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 127.1 | | | |
| Actuated Cycle Length: 118.2 | | | |
| Natural Cycle: 80 | | | |
| Control Type: Actuated-Uncoordinated | | | |
| Maximum v/c Ratio: 2.05 | | | |
| Intersection Signal Delay: 93.1 | | Intersection LOS: F | |
| Intersection Capacity Utilization 123.1% | | ICU Level of Service H | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp



## Queues
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Total - PM Peak Hour

| Lane Group | EBL | EBR | WBL | WBT | WBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 117 | 575 | 264 | 912 | 1085 | 412 | 856 | 1309 | 135 |
| v/c Ratio | 2.05 | 1.08 | 0.40 | 1.30 | 0.78 | 1.87 | 0.49 | 0.67 | 0.21 |
| Control Delay | 557.7 | 89.8 | 29.1 | 177.0 | 4.4 | 429.9 | 20.0 | 31.5 | 7.5 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 557.7 | 89.8 | 29.1 | 177.0 | 4.4 | 429.9 | 20.0 | 31.5 | 7.5 |
| Queue Length 50th (m) | ~45.2 | ~116.1 | 45.9 | ~287.7 | 0.0 | ~134.0 | 69.4 | 95.2 | 4.5 |
| Queue Length 95th (m) | #90.0 | #202.8 | 77.2 | #400.9 | 0.0 | #208.6 | 86.1 | 111.0 | 17.1 |
| Internal Link Dist (m) | | | | 459.0 | | | 296.0 | 151.5 | |
| Turn Bay Length (m) | 75.0 | | | | | 180.0 | | | 65.0 |
| Base Capacity (vph) | 57 | 532 | 656 | 703 | 1390 | 220 | 2015 | 2353 | 737 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 2.05 | 1.08 | 0.40 | 1.30 | 0.78 | 1.87 | 0.42 | 0.56 | 0.18 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 5: Homer Watson Boulevard & New Dundee Road/WB 401 Off-Ramp

2033 Total - PM Peak Hour

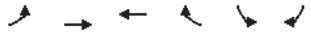
| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 117 | 0 | 575 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 135 |
| Future Volume (vph) | 117 | 0 | 575 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 135 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1750 | 1775 | 1900 | 1750 | 1775 | 1900 | 1900 | 1900 | 1900 | 1750 |
| Total Lost time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | 4.0 | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Lane Util. Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 0.95 | | | 0.91 | 1.00 |
| Frpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Flpb, ped/bikes | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | 1.00 | | 0.85 | 1.00 | 1.00 | 0.85 | 1.00 | 1.00 | | | 1.00 | 0.85 |
| Flt Protected | 0.95 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.95 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (prot) | 1621 | | 1458 | 1637 | 1881 | 1390 | 1637 | 3438 | | | 5036 | 1458 |
| Flt Permitted | 0.13 | | 1.00 | 0.95 | 1.00 | 1.00 | 0.11 | 1.00 | | | 1.00 | 1.00 |
| Satd. Flow (perm) | 226 | | 1458 | 1637 | 1881 | 1390 | 182 | 3438 | | | 5036 | 1458 |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 117 | 0 | 575 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 135 |
| RTOR Reduction (vph) | 0 | 0 | 161 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 64 |
| Lane Group Flow (vph) | 117 | 0 | 414 | 264 | 912 | 1085 | 412 | 856 | 0 | 0 | 1309 | 71 |
| Confl. Peds. (#/hr) | | | | | | | | | 2 | 2 | | |
| Heavy Vehicles (%) | 4% | 0% | 2% | 3% | 1% | 7% | 3% | 5% | 0% | 0% | 3% | 2% |
| Turn Type | Perm | | Perm | pm+pt | NA | Free | pm+pt | NA | | | NA | Perm |
| Protected Phases | | | | 1 | 6 | | 3 | 8 | | | 4 | |
| Permitted Phases | 2 | | 2 | 6 | | Free | 8 | | | | | 4 |
| Actuated Green, G (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 118.2 | 59.9 | 59.9 | | | 45.9 | 45.9 |
| Effective Green, g (s) | 30.2 | | 30.2 | 44.2 | 44.2 | 118.2 | 59.9 | 59.9 | | | 45.9 | 45.9 |
| Actuated g/C Ratio | 0.26 | | 0.26 | 0.37 | 0.37 | 1.00 | 0.51 | 0.51 | | | 0.39 | 0.39 |
| Clearance Time (s) | 7.2 | | 7.2 | 4.0 | 7.2 | | 4.0 | 6.9 | | | 6.9 | 6.9 |
| Vehicle Extension (s) | 5.0 | | 5.0 | 5.0 | 5.0 | | 5.0 | 5.0 | | | 5.0 | 5.0 |
| Lane Grp Cap (vph) | 57 | | 372 | 612 | 703 | 1390 | 215 | 1742 | | | 1955 | 566 |
| v/s Ratio Prot | | | | 0.04 | c0.48 | | c0.16 | 0.25 | | | 0.26 | |
| v/s Ratio Perm | c0.52 | | 0.28 | 0.12 | | 0.78 | c0.81 | | | | | 0.05 |
| v/c Ratio | 2.05 | | 1.11 | 0.43 | 1.30 | 0.78 | 1.92 | 0.49 | | | 0.67 | 0.13 |
| Uniform Delay, d1 | 44.0 | | 44.0 | 27.6 | 37.0 | 0.0 | 26.7 | 19.1 | | | 29.9 | 23.2 |
| Progression Factor | 1.00 | | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | 528.8 | | 81.0 | 1.0 | 144.2 | 4.4 | 429.1 | 0.5 | | | 1.2 | 0.2 |
| Delay (s) | 572.8 | | 125.0 | 28.6 | 181.2 | 4.4 | 455.9 | 19.6 | | | 31.1 | 23.4 |
| Level of Service | F | | F | C | F | A | F | B | | | C | C |
| Approach Delay (s) | | 200.7 | | | 78.5 | | | 161.4 | | | 30.3 | |
| Approach LOS | | F | | | E | | | F | | | C | |

| Intersection Summary | | | | | |
|---|---|---|---|---|---|
| HCM 2000 Control Delay | 99.7 | HCM 2000 Level of Service | F | | |
| HCM 2000 Volume to Capacity ratio | 1.96 | | | | |
| Actuated Cycle Length (s) | 118.2 | Sum of lost time (s) | 22.1 | | |
| Intersection Capacity Utilization | 123.1% | ICU Level of Service | H | | |
| Analysis Period (min) | 15 | | | | |

c Critical Lane Group

Lanes, Volumes, Timings
6: New Dundee Road & Pinnacle Drive

2033 Total - PM Peak Hour



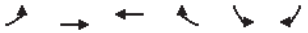
| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 11 | 855 | 1432 | 97 | 52 | 12 |
| Future Volume (vph) | 11 | 855 | 1432 | 97 | 52 | 12 |
| Ideal Flow (vphpl) | 1650 | 1650 | 1650 | 1650 | 1765 | 1765 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | 0.991 | | 0.975 | |
| Flt Protected | | 0.999 | | | 0.961 | |
| Satd. Flow (prot) | 0 | 1601 | 1604 | 0 | 1654 | 0 |
| Flt Permitted | | 0.999 | | | 0.961 | |
| Satd. Flow (perm) | 0 | 1601 | 1604 | 0 | 1654 | 0 |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 800.9 | 1202.5 | | 173.1 | |
| Travel Time (s) | | 57.7 | 86.6 | | 12.5 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 3% | 2% | 1% | 0% | 0% |
| Adj. Flow (vph) | 11 | 855 | 1432 | 97 | 52 | 12 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 0 | 866 | 1529 | 0 | 64 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.20 | 1.20 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Sign Control | | Free | Free | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 104.1% | | ICU Level of Service G | |
| Analysis Period (min) 15 | | | |



HCM Unsignalized Intersection Capacity Analysis
6: New Dundee Road & Pinnacle Drive

2033 Total - PM Peak Hour



| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 11 | 855 | 1432 | 97 | 52 | 12 |
| Future Volume (Veh/h) | 11 | 855 | 1432 | 97 | 52 | 12 |
| Sign Control | | Free | Free | | Stop | |
| Grade | | 0% | 0% | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 11 | 855 | 1432 | 97 | 52 | 12 |
| Pedestrians | | | | | | |
| Lane Width (m) | | | | | | |
| Walking Speed (m/s) | | | | | | |
| Percent Blockage | | | | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | None | None | | | |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 1529 | | | | 2358 | 1480 |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 1529 | | | | 2358 | 1480 |
| tC, single (s) | 4.1 | | | | 6.4 | 6.2 |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 2.2 | | | | 3.5 | 3.3 |
| p0 queue free % | 98 | | | | 0 | 92 |
| cM capacity (veh/h) | 441 | | | | 39 | 156 |

| Direction, Lane # | EB 1 | WB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 866 | 1529 | 64 |
| Volume Left | 11 | 0 | 52 |
| Volume Right | 0 | 97 | 12 |
| cSH | 441 | 1700 | 45 |
| Volume to Capacity | 0.02 | 0.90 | 1.42 |
| Queue Length 95th (m) | 0.6 | 0.0 | 49.8 |
| Control Delay (s) | 0.8 | 0.0 | 424.8 |
| Lane LOS | A | | F |
| Approach Delay (s) | 0.8 | 0.0 | 424.8 |
| Approach LOS | | | F |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 11.4 | | |
| Intersection Capacity Utilization | 104.1% | ICU Level of Service | G |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 108 | 581 | 1020 | 309 | 169 | 93 |
| Future Volume (vph) | 108 | 581 | 1020 | 309 | 169 | 93 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Storage Length (m) | 30.0 | | | 25.0 | 0.0 | 0.0 |
| Storage Lanes | 1 | | | 1 | 1 | 0 |
| Taper Length (m) | 60.0 | | | | 7.5 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | | | 0.850 | 0.952 | |
| Flt Protected | 0.950 | | | | 0.969 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1596 | 0 |
| Flt Permitted | 0.090 | | | | 0.969 | |
| Satd. Flow (perm) | 158 | 1845 | 1618 | 1389 | 1596 | 0 |
| Right Turn on Red | | | | Yes | | Yes |
| Satd. Flow (RTOR) | | | | 87 | 30 | |
| Link Speed (k/h) | | 50 | 50 | | 50 | |
| Link Distance (m) | | 2839.6 | 800.9 | | 225.4 | |
| Travel Time (s) | | 204.5 | 57.7 | | 16.2 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Adj. Flow (vph) | 108 | 581 | 1020 | 309 | 169 | 93 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 108 | 581 | 1020 | 309 | 262 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Left | Right | Left | Right |
| Median Width(m) | | 3.6 | 3.6 | | 3.6 | |
| Link Offset(m) | | 0.0 | 0.0 | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | 4.8 | | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.09 | 1.00 | 1.20 | 1.20 | 1.10 | 1.10 |
| Turning Speed (k/h) | 25 | | | 15 | 25 | 15 |
| Number of Detectors | 1 | 2 | 2 | 1 | 1 | |
| Detector Template | Left | Thru | Thru | Right | Left | |
| Leading Detector (m) | 2.0 | 10.0 | 10.0 | 2.0 | 2.0 | |
| Trailing Detector (m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Position(m) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Size(m) | 2.0 | 0.6 | 0.6 | 2.0 | 2.0 | |
| Detector 1 Type | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | Cl+Ex | |
| Detector 1 Channel | | | | | | |
| Detector 1 Extend (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Queue (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 1 Delay (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Detector 2 Position(m) | | 9.4 | 9.4 | | | |
| Detector 2 Size(m) | | 0.6 | 0.6 | | | |
| Detector 2 Type | | Cl+Ex | Cl+Ex | | | |
| Detector 2 Channel | | | | | | |
| Detector 2 Extend (s) | | 0.0 | 0.0 | | | |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |



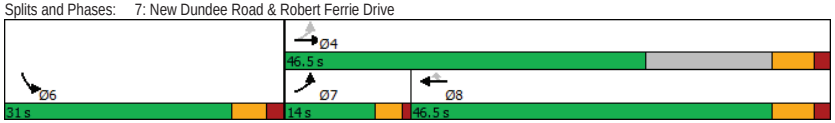


| Lane Group | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Permitted Phases | 4 | | | 8 | | |
| Detector Phase | 7 | 4 | 8 | 8 | 6 | |
| Switch Phase | | | | | | |
| Minimum Initial (s) | 5.0 | 5.0 | 5.0 | 5.0 | 8.0 | |
| Minimum Split (s) | 9.0 | 46.5 | 46.5 | 46.5 | 20.0 | |
| Total Split (s) | 14.0 | 46.5 | 46.5 | 46.5 | 31.0 | |
| Total Split (%) | 15.3% | 50.8% | 50.8% | 50.8% | 33.9% | |
| Maximum Green (s) | 10.0 | 40.0 | 40.0 | 40.0 | 25.0 | |
| Yellow Time (s) | 3.0 | 4.6 | 4.6 | 4.6 | 4.0 | |
| All-Red Time (s) | 1.0 | 1.9 | 1.9 | 1.9 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Lost Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lead/Lag | Lead | | Lag | Lag | | |
| Lead-Lag Optimize? | | | | | | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Recall Mode | None | None | None | None | Max | |
| Walk Time (s) | | 31.0 | 31.0 | 31.0 | 7.0 | |
| Flash Dont Walk (s) | | 9.0 | 9.0 | 9.0 | 7.0 | |
| Pedestrian Calls (#/hr) | | 0 | 0 | 0 | 0 | |
| Act Effct Green (s) | 53.2 | 50.7 | 40.2 | 40.2 | 25.1 | |
| Actuated g/C Ratio | 0.60 | 0.57 | 0.45 | 0.45 | 0.28 | |
| v/c Ratio | 0.44 | 0.55 | 1.39 | 0.46 | 0.55 | |
| Control Delay | 15.0 | 13.9 | 207.5 | 15.0 | 29.8 | |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | |
| Total Delay | 15.0 | 13.9 | 207.5 | 15.0 | 29.8 | |
| LOS | B | B | F | B | C | |
| Approach Delay | | 14.1 | 162.7 | | 29.8 | |
| Approach LOS | | B | F | | C | |

**Intersection Summary**

Area Type: Other
Cycle Length: 91.5
Actuated Cycle Length: 88.4
Natural Cycle: 100
Control Type: Actuated-Uncoordinated
Maximum v/c Ratio: 1.39
Intersection Signal Delay: 102.5 Intersection LOS: F
Intersection Capacity Utilization 98.2% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 7: New Dundee Road & Robert Ferrie Drive



## Queues
## 7: New Dundee Road & Robert Ferrie Drive

2033 Total - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | SBL |
|---|---|---|---|---|---|
| Lane Group Flow (vph) | 108 | 581 | 1020 | 309 | 262 |
| v/c Ratio | 0.44 | 0.55 | 1.39 | 0.46 | 0.55 |
| Control Delay | 15.0 | 13.9 | 207.5 | 15.0 | 29.8 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 15.0 | 13.9 | 207.5 | 15.0 | 29.8 |
| Queue Length 50th (m) | 7.5 | 59.5 | ~258.4 | 27.3 | 36.7 |
| Queue Length 95th (m) | 18.4 | 88.1 | #335.2 | 50.8 | 62.6 |
| Internal Link Dist (m) | | 2815.6 | 776.9 | | 201.4 |
| Turn Bay Length (m) | 30.0 | | | 25.0 | |
| Base Capacity (vph) | 266 | 1132 | 735 | 679 | 474 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.41 | 0.51 | 1.39 | 0.46 | 0.55 |

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 7: New Dundee Road & Robert Ferrie Drive

2033 Total - PM Peak Hour

| Movement | EBL | EBT | WBT | WBR | SBL | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 108 | 581 | 1020 | 309 | 169 | 93 |
| Future Volume (vph) | 108 | 581 | 1020 | 309 | 169 | 93 |
| Ideal Flow (vphpl) | 1775 | 1900 | 1650 | 1650 | 1765 | 1765 |
| Total Lost time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Frt | 1.00 | 1.00 | 1.00 | 0.85 | 0.95 | |
| Flt Protected | 0.95 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (prot) | 1670 | 1845 | 1618 | 1389 | 1596 | |
| Flt Permitted | 0.09 | 1.00 | 1.00 | 1.00 | 0.97 | |
| Satd. Flow (perm) | 159 | 1845 | 1618 | 1389 | 1596 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 108 | 581 | 1020 | 309 | 169 | 93 |
| RTOR Reduction (vph) | 0 | 0 | 0 | 48 | 22 | 0 |
| Lane Group Flow (vph) | 108 | 581 | 1020 | 261 | 240 | 0 |
| Heavy Vehicles (%) | 1% | 3% | 2% | 1% | 2% | 2% |
| Turn Type | pm+pt | NA | NA | Perm | Prot | |
| Protected Phases | 7 | 4 | 8 | | 6 | |
| Permitted Phases | 4 | | | 8 | | |
| Actuated Green, G (s) | 51.6 | 51.6 | 40.2 | 40.2 | 25.1 | |
| Effective Green, g (s) | 51.6 | 51.6 | 40.2 | 40.2 | 25.1 | |
| Actuated g/C Ratio | 0.58 | 0.58 | 0.45 | 0.45 | 0.28 | |
| Clearance Time (s) | 4.0 | 6.5 | 6.5 | 6.5 | 6.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | |
| Lane Grp Cap (vph) | 217 | 1067 | 729 | 625 | 449 | |
| v/s Ratio Prot | 0.04 | c0.31 | c0.63 | | c0.15 | |
| v/s Ratio Perm | 0.25 | | | 0.19 | | |
| v/c Ratio | 0.50 | 0.54 | 1.40 | 0.42 | 0.54 | |
| Uniform Delay, d1 | 18.1 | 11.6 | 24.5 | 16.6 | 27.1 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.8 | 0.6 | 187.9 | 0.5 | 4.5 | |
| Delay (s) | 19.9 | 12.1 | 212.4 | 17.0 | 31.6 | |
| Level of Service | B | B | F | B | C | |
| Approach Delay (s) | | 13.4 | 167.0 | | 31.6 | |
| Approach LOS | | B | F | | C | |

Intersection Summary

| | | | | |
|---|---|---|---|---|
| HCM 2000 Control Delay | 105.0 | HCM 2000 Level of Service | F |
| HCM 2000 Volume to Capacity ratio | 1.02 | | |
| Actuated Cycle Length (s) | 89.2 | Sum of lost time (s) | 16.5 |
| Intersection Capacity Utilization | 98.2% | ICU Level of Service | F |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

## Lanes, Volumes, Timings
## 8: New Dundee Road

2033 Total - PM Peak Hour

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 26 | 611 | 89 | 20 | 649 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (vph) | 26 | 611 | 89 | 20 | 649 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Ideal Flow (vphpl) | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 | 1550 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Frt | | 0.983 | | | 0.996 | | | 0.984 | | | 0.955 | |
| Flt Protected | | 0.998 | | | 0.999 | | | 0.979 | | | 0.997 | |
| Satd. Flow (prot) | 0 | 1504 | 0 | 0 | 1496 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Flt Permitted | | 0.998 | | | 0.999 | | | 0.979 | | | 0.997 | |
| Satd. Flow (perm) | 0 | 1504 | 0 | 0 | 1496 | 0 | 0 | 1475 | 0 | 0 | 1450 | 0 |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 734.0 | | | 2839.6 | | | 383.9 | | | 563.5 | |
| Travel Time (s) | | 52.8 | | | 204.5 | | | 27.6 | | | 40.6 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 1% | 2% | 10% | 3% | 0% | 3% | 0% | 0% | 0% | 3% | 0% |
| Adj. Flow (vph) | 26 | 611 | 89 | 20 | 649 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 0 | 726 | 0 | 0 | 687 | 0 | 0 | 162 | 0 | 0 | 57 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 0.0 | | | 0.0 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 | 1.29 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization 84.5% | | ICU Level of Service E | |
| Analysis Period (min) 15 | | | |



## HCM Unsignalized Intersection Capacity Analysis
## 8: New Dundee Road

2033 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (veh/h) | 26 | 611 | 89 | 20 | 649 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Future Volume (Veh/h) | 26 | 611 | 89 | 20 | 649 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Sign Control | | Free | | | Free | | | Stop | | | Stop | |
| Grade | | 0% | | | 0% | | | 0% | | | 0% | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 26 | 611 | 89 | 20 | 649 | 18 | 68 | 75 | 19 | 4 | 34 | 19 |
| Pedestrians | | | | | | | | | | | | |
| Lane Width (m) | | | | | | | | | | | | |
| Walking Speed (m/s) | | | | | | | | | | | | |
| Percent Blockage | | | | | | | | | | | | |
| Right turn flare (veh) | | | | | | | | | | | | |
| Median type | | None | | | None | | | | | | | |
| Median storage veh) | | | | | | | | | | | | |
| Upstream signal (m) | | | | | | | | | | | | |
| pX, platoon unblocked | | | | | | | | | | | | |
| vC, conflicting volume | 667 | | | 700 | | | 1442 | 1414 | 656 | 1462 | 1450 | 658 |
| vC1, stage 1 conf vol | | | | | | | | | | | | |
| vC2, stage 2 conf vol | | | | | | | | | | | | |
| vCu, unblocked vol | 667 | | | 700 | | | 1442 | 1414 | 656 | 1462 | 1450 | 658 |
| tC, single (s) | 4.1 | | | 4.2 | | | 7.1 | 6.5 | 6.2 | 7.1 | 6.5 | 6.2 |
| tC, 2 stage (s) | | | | | | | | | | | | |
| tF (s) | 2.2 | | | 2.3 | | | 3.5 | 4.0 | 3.3 | 3.5 | 4.0 | 3.3 |
| p0 queue free % | 97 | | | 98 | | | 15 | 43 | 96 | 93 | 73 | 96 |
| cM capacity (veh/h) | 932 | | | 861 | | | 80 | 132 | 469 | 55 | 124 | 468 |

| Direction, Lane # | EB 1 | WB 1 | NB 1 | SB 1 |
|---|---|---|---|---|
| Volume Total | 726 | 687 | 162 | 57 |
| Volume Left | 26 | 20 | 68 | 4 |
| Volume Right | 89 | 18 | 19 | 19 |
| cSH | 932 | 861 | 111 | 147 |
| Volume to Capacity | 0.03 | 0.02 | 1.46 | 0.39 |
| Queue Length 95th (m) | 0.7 | 0.6 | 93.0 | 13.3 |
| Control Delay (s) | 0.7 | 0.6 | 320.4 | 44.3 |
| Lane LOS | A | A | F | E |
| Approach Delay (s) | 0.7 | 0.6 | 320.4 | 44.3 |
| Approach LOS | | | F | E |

| Intersection Summary | | | | |
|---|---|---|---|---|
| Average Delay | | 33.9 | | |
| Intersection Capacity Utilization | | 84.5% | ICU Level of Service | E |
| Analysis Period (min) | | 15 | | |

## Lanes, Volumes, Timings
## 10: Doon Mills Road & Apple Ridge Drive

2033 Total - PM Peak Hour

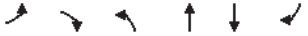
| Lane Group | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.983 | | | | 0.950 | |
| Flt Protected | 0.958 | | | 0.992 | | |
| Satd. Flow (prot) | 1662 | 0 | 0 | 1605 | 1542 | 0 |
| Flt Permitted | 0.958 | | | 0.992 | | |
| Satd. Flow (perm) | 1662 | 0 | 0 | 1605 | 1542 | 0 |
| Link Speed (k/h) | 50 | | | 50 | 50 | |
| Link Distance (m) | 204.8 | | | 367.3 | 715.4 | |
| Travel Time (s) | 14.7 | | | 26.4 | 51.5 | |
| Confl. Peds. (#/hr) | 2 | | | | | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 2% | 2% | 2% | 1% |
| Adj. Flow (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 245 | 0 | 0 | 320 | 781 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Left | Left | Right |
| Median Width(m) | 3.6 | | | 0.0 | 0.0 | |
| Link Offset(m) | 0.0 | | | 0.0 | 0.0 | |
| Crosswalk Width(m) | 4.8 | | | 4.8 | 4.8 | |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | 25 | | | 15 |
| Sign Control | Stop | | | Stop | Stop | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 86.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 10: Doon Mills Road & Apple Ridge Drive

2033 Total - PM Peak Hour



| Movement | EBL | EBR | NBL | NBT | SBT | SBR |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Sign Control | Stop | | | Stop | Stop | |
| Traffic Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Future Volume (vph) | 215 | 30 | 50 | 270 | 490 | 291 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 215 | 30 | 50 | 270 | 490 | 291 |

| Direction, Lane # | EB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total (vph) | 245 | 320 | 781 |
| Volume Left (vph) | 215 | 50 | 0 |
| Volume Right (vph) | 30 | 0 | 291 |
| Hadj (s) | 0.10 | 0.07 | -0.20 |
| Departure Headway (s) | 6.5 | 5.8 | 5.1 |
| Degree Utilization, x | 0.44 | 0.51 | 1.11 |
| Capacity (veh/h) | 539 | 610 | 699 |
| Control Delay (s) | 14.6 | 14.7 | 87.4 |
| Approach Delay (s) | 14.6 | 14.7 | 87.4 |
| Approach LOS | B | B | F |

| Intersection Summary | | | |
|---|---|---|---|
| Delay | 56.9 | | |
| Level of Service | F | | |
| Intersection Capacity Utilization | 86.9% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

## Lanes, Volumes, Timings
## 11: Biehn Drive & Carnydale Drive

2033 Total - PM Peak Hour

| Lane Group | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Ideal Flow (vphpl) | 1765 | 1765 | 1650 | 1650 | 1650 | 1650 |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | | | | | | |
| Frt | 0.868 | | 0.983 | | | |
| Flt Protected | 0.999 | | | | | 0.955 |
| Satd. Flow (prot) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Flt Permitted | 0.999 | | | | | 0.955 |
| Satd. Flow (perm) | 1530 | 0 | 1622 | 0 | 0 | 1505 |
| Link Speed (k/h) | 50 | | 50 | | | 50 |
| Link Distance (m) | 263.9 | | 234.9 | | | 249.5 |
| Travel Time (s) | 19.0 | | 16.9 | | | 18.0 |
| Confl. Peds. (#/hr) | 49 | | | 7 | 7 | |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 0% | 0% | 0% | 0% | 5% | 0% |
| Adj. Flow (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Shared Lane Traffic (%) | | | | | | |
| Lane Group Flow (vph) | 276 | 0 | 16 | 0 | 0 | 221 |
| Enter Blocked Intersection | No | No | No | No | No | No |
| Lane Alignment | Left | Right | Left | Right | Left | Left |
| Median Width(m) | 3.6 | | 0.0 | | | 0.0 |
| Link Offset(m) | 0.0 | | 0.0 | | | 0.0 |
| Crosswalk Width(m) | 4.8 | | 4.8 | | | 4.8 |
| Two way Left Turn Lane | | | | | | |
| Headway Factor | 1.10 | 1.10 | 1.20 | 1.20 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | 15 | | 15 | 25 | |
| Sign Control | Stop | | Free | | | Free |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Control Type: Unsignalized | | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |



## HCM Unsignalized Intersection Capacity Analysis
## 11: Biehn Drive & Carnydale Drive

2033 Total - PM Peak Hour

| Movement | WBL | WBR | NBT | NBR | SBL | SBT |
|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | |
| Traffic Volume (veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Future Volume (Veh/h) | 7 | 269 | 14 | 2 | 208 | 13 |
| Sign Control | Stop | | Free | | | Free |
| Grade | 0% | | 0% | | | 0% |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Hourly flow rate (vph) | 7 | 269 | 14 | 2 | 208 | 13 |
| Pedestrians | 7 | | 49 | | | |
| Lane Width (m) | 3.6 | | 3.6 | | | |
| Walking Speed (m/s) | 1.2 | | 1.2 | | | |
| Percent Blockage | 1 | | 4 | | | |
| Right turn flare (veh) | | | | | | |
| Median type | | | None | | | None |
| Median storage veh) | | | | | | |
| Upstream signal (m) | | | | | | |
| pX, platoon unblocked | | | | | | |
| vC, conflicting volume | 500 | 22 | | | 23 | |
| vC1, stage 1 conf vol | | | | | | |
| vC2, stage 2 conf vol | | | | | | |
| vCu, unblocked vol | 500 | 22 | | | 23 | |
| tC, single (s) | 6.4 | 6.2 | | | 4.1 | |
| tC, 2 stage (s) | | | | | | |
| tF (s) | 3.5 | 3.3 | | | 2.2 | |
| p0 queue free % | 98 | 74 | | | 87 | |
| cM capacity (veh/h) | 441 | 1055 | | | 1564 | |

| Direction, Lane # | WB 1 | NB 1 | SB 1 |
|---|---|---|---|
| Volume Total | 276 | 16 | 221 |
| Volume Left | 7 | 0 | 208 |
| Volume Right | 269 | 2 | 0 |
| cSH | 1019 | 1700 | 1564 |
| Volume to Capacity | 0.27 | 0.01 | 0.13 |
| Queue Length 95th (m) | 8.8 | 0.0 | 3.7 |
| Control Delay (s) | 9.8 | 0.0 | 7.3 |
| Lane LOS | A | | A |
| Approach Delay (s) | 9.8 | 0.0 | 7.3 |
| Approach LOS | A | | |

| Intersection Summary | | | |
|---|---|---|---|
| Average Delay | 8.4 | | |
| Intersection Capacity Utilization | 45.7% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Storage Length (m) | 20.0 | | 0.0 | 0.0 | | 30.0 | 20.0 | | 0.0 | 30.0 | | 0.0 |
| Storage Lanes | 1 | | 0 | 0 | | 1 | 1 | | 0 | 1 | | 0 |
| Taper Length (m) | 15.0 | | | 7.5 | | | 10.0 | | | 10.0 | | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Ped Bike Factor | 0.99 | 0.99 | | | 1.00 | 0.96 | 0.99 | 1.00 | | 1.00 | 1.00 | |
| Frt | | 0.976 | | | | 0.850 | | 0.995 | | | 0.985 | |
| Flt Protected | 0.950 | | | | 0.990 | | 0.950 | | | 0.950 | | |
| Satd. Flow (prot) | 1653 | 1587 | 0 | 0 | 1621 | 1430 | 1686 | 1579 | 0 | 1621 | 1585 | 0 |
| Flt Permitted | 0.678 | | | | 0.935 | | 0.220 | | | 0.487 | | |
| Satd. Flow (perm) | 1164 | 1587 | 0 | 0 | 1526 | 1380 | 388 | 1579 | 0 | 829 | 1585 | 0 |
| Right Turn on Red | | | Yes | | | Yes | | | Yes | | | Yes |
| Satd. Flow (RTOR) | | 14 | | | | 101 | | 4 | | | 13 | |
| Link Speed (k/h) | | 50 | | | 50 | | | 50 | | | 50 | |
| Link Distance (m) | | 184.2 | | | 333.0 | | | 586.7 | | | 311.9 | |
| Travel Time (s) | | 13.3 | | | 24.0 | | | 42.2 | | | 22.5 | |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Peak Hour Factor | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Shared Lane Traffic (%) | | | | | | | | | | | | |
| Lane Group Flow (vph) | 63 | 86 | 0 | 0 | 123 | 101 | 13 | 384 | 0 | 135 | 686 | 0 |
| Enter Blocked Intersection | No | No | No | No | No | No | No | No | No | No | No | No |
| Lane Alignment | Left | Left | Right | Left | Left | Right | Left | Left | Right | Left | Left | Right |
| Median Width(m) | | 3.6 | | | 3.6 | | | 3.6 | | | 3.6 | |
| Link Offset(m) | | 0.0 | | | 0.0 | | | 0.0 | | | 0.0 | |
| Crosswalk Width(m) | | 4.8 | | | 4.8 | | | 4.8 | | | 4.8 | |
| Two way Left Turn Lane | | | | | | | | | | | | |
| Headway Factor | 1.09 | 1.20 | 1.20 | 1.20 | 1.20 | 1.11 | 1.09 | 1.20 | 1.20 | 1.09 | 1.20 | 1.20 |
| Turning Speed (k/h) | 25 | | 15 | 25 | | 15 | 25 | | 15 | 25 | | 15 |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Minimum Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (s) | 26.0 | 26.0 | | 26.0 | 26.0 | 26.0 | 36.0 | 36.0 | | 36.0 | 36.0 | |
| Total Split (%) | 41.9% | 41.9% | | 41.9% | 41.9% | 41.9% | 58.1% | 58.1% | | 58.1% | 58.1% | |
| Maximum Green (s) | 20.0 | 20.0 | | 20.0 | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Yellow Time (s) | 4.0 | 4.0 | | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | | 4.0 | 4.0 | |
| All-Red Time (s) | 2.0 | 2.0 | | 2.0 | 2.0 | 2.0 | 2.0 | 2.0 | | 2.0 | 2.0 | |
| Lost Time Adjust (s) | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Lost Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lead/Lag | | | | | | | | | | | | |
| Lead-Lag Optimize? | | | | | | | | | | | | |
| Walk Time (s) | 9.0 | 9.0 | | 9.0 | 9.0 | 9.0 | 16.0 | 16.0 | | 16.0 | 16.0 | |
| Flash Dont Walk (s) | 11.0 | 11.0 | | 11.0 | 11.0 | 11.0 | 14.0 | 14.0 | | 14.0 | 14.0 | |
| Pedestrian Calls (#/hr) | 0 | 0 | | 0 | 0 | 0 | 0 | 0 | | 0 | 0 | |

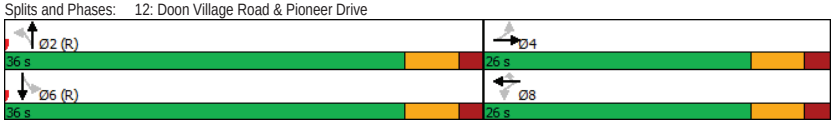




| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Act Effct Green (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| v/c Ratio | 0.17 | 0.17 | | | 0.25 | 0.20 | 0.07 | 0.50 | | 0.34 | 0.89 | |
| Control Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.8 | 13.6 | | 12.9 | 31.0 | |
| Queue Delay | 0.0 | 0.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | | 0.0 | 0.0 | |
| Total Delay | 16.6 | 14.1 | | | 17.2 | 5.0 | 9.8 | 13.6 | | 12.9 | 31.0 | |
| LOS | B | B | | | B | A | A | B | | B | C | |
| Approach Delay | | 15.1 | | | 11.7 | | | 13.5 | | | 28.0 | |
| Approach LOS | | B | | | B | | | B | | | C | |

| Intersection Summary | | | |
|---|---|---|---|
| Area Type: | Other | | |
| Cycle Length: 62 | | | |
| Actuated Cycle Length: 62 | | | |
| Offset: 0 (0%), Referenced to phase 2:NBTL and 6:SBTL, Start of Green | | | |
| Natural Cycle: 65 | | | |
| Control Type: Pretimed | | | |
| Maximum v/c Ratio: 0.89 | | | |
| Intersection Signal Delay: 20.9 | | Intersection LOS: C | |
| Intersection Capacity Utilization 78.2% | | ICU Level of Service D | |
| Analysis Period (min) 15 | | | |

Splits and Phases: 12: Doon Village Road & Pioneer Drive



## Queues
## 12: Doon Village Road & Pioneer Drive

2033 Total - PM Peak Hour

| Lane Group | EBL | EBT | WBT | WBR | NBL | NBT | SBL | SBT |
|---|---|---|---|---|---|---|---|---|
| Lane Group Flow (vph) | 63 | 86 | 123 | 101 | 13 | 384 | 135 | 686 |
| v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.07 | 0.50 | 0.34 | 0.89 |
| Control Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.8 | 13.6 | 12.9 | 31.0 |
| Queue Delay | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total Delay | 16.6 | 14.1 | 17.2 | 5.0 | 9.8 | 13.6 | 12.9 | 31.0 |
| Queue Length 50th (m) | 5.3 | 6.1 | 10.7 | 0.0 | 0.8 | 29.0 | 9.3 | 68.4 |
| Queue Length 95th (m) | 13.4 | 15.0 | 22.3 | 8.9 | 3.5 | 50.8 | 21.1 | #136.1 |
| Internal Link Dist (m) | | 160.2 | 309.0 | | | 562.7 | | 287.9 |
| Turn Bay Length (m) | 20.0 | | | 30.0 | 20.0 | | 30.0 | |
| Base Capacity (vph) | 375 | 521 | 492 | 513 | 187 | 766 | 401 | 773 |
| Starvation Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Spillback Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Storage Cap Reductn | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reduced v/c Ratio | 0.17 | 0.17 | 0.25 | 0.20 | 0.07 | 0.50 | 0.34 | 0.89 |

Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



## HCM Signalized Intersection Capacity Analysis
## 12: Doon Village Road & Pioneer Drive

2033 Total - PM Peak Hour

| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Future Volume (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| Ideal Flow (vphpl) | 1775 | 1650 | 1650 | 1650 | 1650 | 1750 | 1775 | 1650 | 1650 | 1775 | 1650 | 1650 |
| Total Lost time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Util. Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frpb, ped/bikes | 1.00 | 0.99 | | | 1.00 | 0.96 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Flpb, ped/bikes | 0.99 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Frt | 1.00 | 0.98 | | | 1.00 | 0.85 | 1.00 | 1.00 | | 1.00 | 0.98 | |
| Flt Protected | 0.95 | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | 0.95 | 1.00 | |
| Satd. Flow (prot) | 1632 | 1587 | | | 1616 | 1380 | 1678 | 1580 | | 1617 | 1584 | |
| Flt Permitted | 0.68 | 1.00 | | | 0.93 | 1.00 | 0.22 | 1.00 | | 0.49 | 1.00 | |
| Satd. Flow (perm) | 1164 | 1587 | | | 1526 | 1380 | 388 | 1580 | | 828 | 1584 | |
| Peak-hour factor, PHF | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Adj. Flow (vph) | 63 | 72 | 14 | 25 | 98 | 101 | 13 | 372 | 12 | 135 | 617 | 69 |
| RTOR Reduction (vph) | 0 | 9 | 0 | 0 | 0 | 68 | 0 | 2 | 0 | 0 | 7 | 0 |
| Lane Group Flow (vph) | 63 | 77 | 0 | 0 | 123 | 33 | 13 | 382 | 0 | 135 | 679 | 0 |
| Confl. Peds. (#/hr) | 10 | | 11 | 11 | | 10 | 15 | | 5 | 5 | | 15 |
| Heavy Vehicles (%) | 2% | 1% | 0% | 0% | 1% | 4% | 0% | 4% | 0% | 4% | 2% | 4% |
| Turn Type | Perm | NA | | Perm | NA | Perm | Perm | NA | | Perm | NA | |
| Protected Phases | | 4 | | | 8 | | | 2 | | | 6 | |
| Permitted Phases | 4 | | | 8 | | 8 | 2 | | | 6 | | |
| Actuated Green, G (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Effective Green, g (s) | 20.0 | 20.0 | | | 20.0 | 20.0 | 30.0 | 30.0 | | 30.0 | 30.0 | |
| Actuated g/C Ratio | 0.32 | 0.32 | | | 0.32 | 0.32 | 0.48 | 0.48 | | 0.48 | 0.48 | |
| Clearance Time (s) | 6.0 | 6.0 | | | 6.0 | 6.0 | 6.0 | 6.0 | | 6.0 | 6.0 | |
| Lane Grp Cap (vph) | 375 | 511 | | | 492 | 445 | 187 | 764 | | 400 | 766 | |
| v/s Ratio Prot | | 0.05 | | | | | | 0.24 | | | c0.43 | |
| v/s Ratio Perm | 0.05 | | | | c0.08 | 0.02 | 0.03 | | | 0.16 | | |
| v/c Ratio | 0.17 | 0.15 | | | 0.25 | 0.07 | 0.07 | 0.50 | | 0.34 | 0.89 | |
| Uniform Delay, d1 | 15.0 | 14.9 | | | 15.5 | 14.6 | 8.5 | 10.9 | | 9.9 | 14.5 | |
| Progression Factor | 1.00 | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | 1.00 | |
| Incremental Delay, d2 | 1.0 | 0.6 | | | 1.2 | 0.3 | 0.7 | 2.3 | | 2.3 | 14.4 | |
| Delay (s) | 16.0 | 15.6 | | | 16.7 | 14.9 | 9.3 | 13.2 | | 12.1 | 28.8 | |
| Level of Service | B | B | | | B | B | A | B | | B | C | |
| Approach Delay (s) | | 15.8 | | | 15.9 | | | 13.1 | | | 26.1 | |
| Approach LOS | | B | | | B | | | B | | | C | |

Intersection Summary

| | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 20.4 | HCM 2000 Level of Service | C |
| HCM 2000 Volume to Capacity ratio | 0.63 | | |
| Actuated Cycle Length (s) | 62.0 | Sum of lost time (s) | 12.0 |
| Intersection Capacity Utilization | 78.2% | ICU Level of Service | D |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**The users of this computer program for the solution of an engineering problem are in no way relieved of their responsibility for the correctness of the solution**

**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:38:04 PM

### Summary of intersection performance

| | AM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2033 | | | | | | |
| **Leg North** | 0.10 | ~1 | 2.63 | 0.07 | A | 3.49 | A |
| **Leg West** | 0.78 | 1.06 | 3.23 | 0.42 | A | | |
| **Leg South** | 0.90 | 1.02 | 4.36 | 0.47 | A | | |
| **Leg East** | 0.37 | ~1 | 2.82 | 0.24 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM " model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM" model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:38:03 PM*

### File summary

| | |
|---|---|
| **Title** | (untitled) |
| **Location** | |
| **Site Number** | |
| **Date** | 2023-12-13 |
| **Version** | |
| **Status** | (new file) |
| **Identifier** | |
| **Client** | |
| **Jobnumber** | |
| **Analyst** | AdamMorrison |
| **Description** | |

### Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

### Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |





# (Default Analysis Set) - FT 2033, AM

### Data Errors and Warnings

*No errors or warnings*

### Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

### Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2033, AM | FT 2033 | AM | | ONE HOUR | 08:00 | 09:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

### Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 3.49 | A |

### Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

### Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| **North** | North | Strasburg Road | |
| **West** | West | Huron Road | |
| **South** | South | Strasburg Road | |
| **East** | East | Huron Road | |

### Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| **North** | 0.00 | 99999.00 | | 0.00 |
| **West** | 0.00 | 99999.00 | | 0.00 |
| **South** | 0.00 | 99999.00 | | 0.00 |
| **East** | 0.00 | 99999.00 | | 0.00 |

### Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | I' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| **North** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **West** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| **South** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **East** | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |

### Slope / Intercept / Capacity

#### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| **North** | Percentage | ROW Standard | | 90.00 |
| **West** | Percentage | ROW Standard | | 90.00 |
| **South** | Percentage | ROW Standard | | 90.00 |
| **East** | Percentage | ROW Standard | | 90.00 |

#### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| **North** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **West** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **South** | | (calculated) | (calculated) | 0.723 | 2192.710 |
| **East** | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

### Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

### General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| **North** | ONE HOUR | ✓ | 120.00 | 100.000 |
| **West** | ONE HOUR | ✓ | 789.00 | 100.000 |
| **South** | ONE HOUR | ✓ | 678.00 | 100.000 |
| **East** | ONE HOUR | ✓ | 425.00 | 100.000 |

# Turning Proportions

#### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.000 | 71.000 | 19.000 | 30.000 |
| | **West** | 210.000 | 0.000 | 56.000 | 523.000 |
| | **South** | 57.000 | 77.000 | 0.000 | 544.000 |
| | **East** | 70.000 | 225.000 | 130.000 | 0.000 |

#### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.00 | 0.59 | 0.16 | 0.25 |
| | **West** | 0.27 | 0.00 | 0.07 | 0.66 |
| | **South** | 0.08 | 0.11 | 0.00 | 0.80 |
| | **East** | 0.16 | 0.53 | 0.31 | 0.00 |





# Vehicle Mix

#### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 1.000 | 1.190 | 1.350 | 1.370 |
| | **West** | 1.050 | 1.000 | 1.210 | 1.050 |
| | **South** | 1.150 | 1.040 | 1.000 | 1.000 |
| | **East** | 1.250 | 1.130 | 1.090 | 1.000 |

#### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | **North** | **West** | **South** | **East** |
| **From** | **North** | 0.0 | 19.0 | 35.0 | 37.0 |
| | **West** | 5.0 | 0.0 | 21.0 | 5.0 |
| | **South** | 15.0 | 4.0 | 0.0 | 0.0 |
| | **East** | 25.0 | 13.0 | 9.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.07 | 2.63 | 0.10 | −1 | A | 110.11 | 165.17 | 6.94 | 2.52 | 0.08 | 6.94 | 2.52 |
| **West** | 0.42 | 3.23 | 0.78 | 1.06 | A | 724.00 | 1086.00 | 52.12 | 2.88 | 0.58 | 52.12 | 2.88 |
| **South** | 0.47 | 4.36 | 0.90 | 1.02 | A | 622.14 | 933.22 | 55.92 | 3.60 | 0.62 | 55.92 | 3.60 |
| **East** | 0.24 | 2.82 | 0.37 | −1 | A | 389.99 | 584.98 | 25.53 | 2.62 | 0.28 | 25.53 | 2.62 |

### Main Results for each time segment

#### Main results: (08:00-08:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 90.34 | 22.59 | 90.10 | 252.99 | 324.33 | 0.00 | 1958.24 | 1046.38 | 0.046 | 0.00 | 0.06 | 2.417 | A |
| **West** | 594.00 | 148.50 | 592.33 | 280.03 | 134.40 | 0.00 | 2095.55 | 1494.10 | 0.283 | 0.00 | 0.42 | 2.536 | A |
| **South** | 510.43 | 127.61 | 508.81 | 153.92 | 572.81 | 0.00 | 1778.59 | 1000.09 | 0.287 | 0.00 | 0.41 | 2.875 | A |
| **East** | 319.96 | 79.99 | 319.10 | 823.41 | 258.21 | 0.00 | 2006.03 | 1762.32 | 0.160 | 0.00 | 0.21 | 2.421 | A |

#### Main results: (08:15-08:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **North** | 107.88 | 26.97 | 107.82 | 302.73 | 388.09 | 0.00 | 1912.14 | 1046.38 | 0.056 | 0.06 | 0.07 | 2.503 | A |
| **West** | 709.29 | 177.32 | 708.78 | 335.09 | 160.82 | 0.00 | 2076.44 | 1494.10 | 0.342 | 0.42 | 0.55 | 2.790 | A |
| **South** | 609.51 | 152.38 | 608.87 | 184.17 | 685.43 | 0.00 | 1697.18 | 1000.09 | 0.359 | 0.41 | 0.57 | 3.357 | A |
| **East** | 382.07 | 95.52 | 381.84 | 985.31 | 308.99 | 0.00 | 1969.33 | 1762.32 | 0.194 | 0.21 | 0.27 | 2.574 | A |

#### Main results: (08:30-08:45)

| | Total | Intersection | Entry | Exit Flow | Circulating | Pedestrian | Capacity | Saturation | V/C | Start | End | Delay | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|

| Leg | Demand (PCE/hr) | Arrivals (PCE) | Flow (PCE/hr) | (PCE/hr) | Flow (PCE/hr) | Demand (Ped/hr) | (PCE/hr) | Capacity (PCE/hr) | Ratio | Queue (PCE) | Queue (PCE) | (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 132.12 | 33.03 | 132.04 | 370.63 | 475.18 | 0.00 | 1849.18 | 1046.38 | 0.071 | 0.07 | 0.10 | 2.630 | A |
| West | 868.71 | 217.18 | 867.80 | 410.29 | 196.93 | 0.00 | 2050.34 | 1494.10 | 0.424 | 0.55 | 0.77 | 3.225 | A |
| South | 746.49 | 186.62 | 745.18 | 225.52 | 839.21 | 0.00 | 1586.00 | 1000.10 | 0.471 | 0.57 | 0.90 | 4.341 | A |
| East | 467.93 | 116.98 | 467.56 | 1206.14 | 378.25 | 0.00 | 1919.26 | 1762.32 | 0.244 | 0.27 | 0.36 | 2.815 | A |

### Main results: (08:45-09:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 132.12 | 33.03 | 132.12 | 371.04 | 475.64 | 0.00 | 1848.85 | 1046.38 | 0.071 | 0.10 | 0.10 | 2.630 | A |
| West | 868.71 | 217.18 | 868.70 | 410.68 | 197.08 | 0.00 | 2050.23 | 1494.10 | 0.424 | 0.77 | 0.78 | 3.228 | A |
| South | 746.49 | 186.62 | 746.47 | 225.71 | 840.07 | 0.00 | 1585.38 | 1000.10 | 0.471 | 0.90 | 0.90 | 4.357 | A |
| East | 467.93 | 116.98 | 467.93 | 1207.80 | 378.74 | 0.00 | 1918.90 | 1762.32 | 0.244 | 0.36 | 0.37 | 2.815 | A |

### Main results: (09:00-09:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 107.88 | 26.97 | 107.96 | 303.36 | 388.81 | 0.00 | 1911.62 | 1046.38 | 0.056 | 0.10 | 0.08 | 2.506 | A |
| West | 709.29 | 177.32 | 710.19 | 335.71 | 161.06 | 0.00 | 2076.27 | 1494.10 | 0.342 | 0.78 | 0.55 | 2.794 | A |
| South | 609.51 | 152.38 | 610.81 | 184.48 | 686.78 | 0.00 | 1696.21 | 1000.09 | 0.359 | 0.90 | 0.57 | 3.371 | A |
| East | 382.07 | 95.52 | 382.43 | 987.84 | 309.75 | 0.00 | 1968.78 | 1762.32 | 0.194 | 0.37 | 0.27 | 2.576 | A |

### Main results: (09:15-09:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 90.34 | 22.59 | 90.40 | 253.94 | 325.50 | 0.00 | 1957.39 | 1046.38 | 0.046 | 0.08 | 0.06 | 2.419 | A |
| West | 594.00 | 148.50 | 594.53 | 281.04 | 134.86 | 0.00 | 2095.22 | 1494.10 | 0.284 | 0.55 | 0.42 | 2.543 | A |
| South | 510.43 | 127.61 | 511.08 | 154.45 | 574.93 | 0.00 | 1777.07 | 1000.09 | 0.287 | 0.57 | 0.41 | 2.891 | A |
| East | 319.96 | 79.99 | 320.19 | 826.76 | 259.25 | 0.00 | 2005.29 | 1762.32 | 0.160 | 0.27 | 0.22 | 2.427 | A |

## Queueing Delay Results for each time segment

### Queueing Delay results: (08:00-08:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.90 | 0.06 | 2.417 | A | A |
| West | 6.16 | 0.41 | 2.536 | A | A |
| South | 5.99 | 0.40 | 2.875 | A | A |
| East | 3.17 | 0.21 | 2.421 | A | A |

### Queueing Delay results: (08:15-08:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.11 | 0.07 | 2.503 | A | A |
| West | 8.10 | 0.54 | 2.790 | A | A |
| South | 8.34 | 0.56 | 3.357 | A | A |
| East | 4.04 | 0.27 | 2.574 | A | A |

### Queueing Delay results: (08:30-08:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.43 | 0.10 | 2.630 | A | A |
| West | 11.41 | 0.76 | 3.225 | A | A |
| South | 13.09 | 0.87 | 4.341 | A | A |
| East | 5.40 | 0.36 | 2.815 | A | A |

### Queueing Delay results: (08:45-09:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|





| North | 1.45 | 0.10 | 2.630 | A | A |
|---|---|---|---|---|---|
| West | 11.64 | 0.78 | 3.228 | A | A |
| South | 13.47 | 0.90 | 4.357 | A | A |
| East | 5.48 | 0.37 | 2.815 | A | A |

### Queueing Delay results: (09:00-09:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 1.14 | 0.08 | 2.506 | A | A |
| West | 8.42 | 0.56 | 2.794 | A | A |
| South | 8.77 | 0.58 | 3.371 | A | A |
| East | 4.17 | 0.28 | 2.576 | A | A |

### Queueing Delay results: (09:15-09:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 0.92 | 0.06 | 2.419 | A | A |
| West | 6.40 | 0.43 | 2.543 | A | A |
| South | 6.26 | 0.42 | 2.891 | A | A |
| East | 3.28 | 0.22 | 2.427 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (08:00-08:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.42 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.41 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.21 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:15-08:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.07 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.55 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.57 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.27 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:30-08:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.77 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.90 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.36 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (08:45-09:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.10 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.78 | 0.00 | 0.00 | 0.00 | 1.06 | | | N/A | N/A |
| South | 0.90 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| East | 0.37 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:00-09:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.08 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.55 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.57 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.27 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (09:15-09:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| North | 0.06 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| West | 0.42 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| South | 0.41 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| East | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





# Junctions 8

## ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]
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**Filename:** Strasburg and Huron.arc8
**Path:** C:\Users\AdamMorrison\OneDrive - Paradigm\Desktop\Projects\230376 - Arcady
**Report generation date:** 2023-12-13 2:37:29 PM

## Summary of intersection performance

| | PM | | | | | | |
|---|---|---|---|---|---|---|---|
| | Queue (PCE) | 95% Queue (PCE) | Delay (s) | V/C Ratio | LOS | Intersection Delay (s) | Intersection LOS |
| | A1 - FT 2033 | | | | | | |
| Leg North | 0.51 | 1.04 | 4.88 | 0.33 | A | 4.93 | A |
| Leg West | 0.82 | 1.02 | 3.96 | 0.45 | A | | |
| Leg South | 0.46 | 1.00 | 3.08 | 0.32 | A | | |
| Leg East | 2.34 | 3.06 | 6.21 | 0.70 | A | | |

*Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.*

*"D1 - Existing, AM" model duration: 8:00 AM - 9:30 AM*
*"D2 - Existing, PM" model duration: 4:00 PM - 5:30 PM*
*"D3 - FB 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D4 - FB 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D5 - FB 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D6 - FB 2033, PM" model duration: 4:00 PM - 5:30 PM*
*"D7 - FT 2028, AM" model duration: 8:00 AM - 9:30 AM*
*"D8 - FT 2028, PM" model duration: 4:00 PM - 5:30 PM*
*"D9 - FT 2033, AM" model duration: 8:00 AM - 9:30 AM*
*"D10 - FT 2033, PM " model duration: 4:00 PM - 5:30 PM*

*Run using Junctions 8.0.6.541 at 2023-12-13 2:37:28 PM*

## File summary

| | |
|---|---|
| Title | (untitled) |
| Location | |
| Site Number | |
| Date | 2023-12-13 |
| Version | |
| Status | (new file) |
| Identifier | |
| Client | |
| Jobnumber | |
| Analyst | AdamMorrison |
| Description | |

## Analysis Options

| Vehicle Length (m) | Do Queue Variations | Calculate Residual Capacity | Residual Capacity Criteria Type | V/C Ratio Threshold | Average Delay Threshold (s) | Queue Threshold (PCE) |
|---|---|---|---|---|---|---|
| 5.75 | ✓ | | N/A | 0.85 | 36.00 | 20.00 |

## Units

| Distance Units | Speed Units | Traffic Units Input | Traffic Units Results | Flow Units | Average Delay Units | Total Delay Units | Rate Of Delay Units |
|---|---|---|---|---|---|---|---|
| m | kph | PCE | PCE | perHour | s | -Min | perMin |

# (Default Analysis Set) - FT 2033, PM

## Data Errors and Warnings

*No errors or warnings*

## Analysis Set Details

| Name | Roundabout Capacity Model | Description | Include In Report | Use Specific Demand Set(s) | Specific Demand Set (s) | Locked | Network Flow Scaling Factor (%) | Network Capacity Scaling Factor (%) | Reason For Scaling Factors |
|---|---|---|---|---|---|---|---|---|---|
| (Default Analysis Set) | ARCADY | | ✓ | | | | 100.000 | 100.000 | |

## Demand Set Details

| Name | Scenario Name | Time Period Name | Description | Traffic Profile Type | Model Start Time (HH:mm) | Model Finish Time (HH:mm) | Model Time Period Length (min) | Time Segment Length (min) | Results For Central Hour Only | Single Time Segment Only | Locked | Run Automatically | Use Relationship | Relationship |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FT 2033, PM | FT 2033 | PM | | ONE HOUR | 16:00 | 17:30 | 90 | 15 | | | | ✓ | | |

# Intersection Network

## Intersections

| Intersection | Name | Intersection Type | Leg Order | Grade Separated | Large Roundabout | Do Geometric Delay | Intersection Delay (s) | Intersection LOS |
|---|---|---|---|---|---|---|---|---|
| 1 | (untitled) | Roundabout | North,West,South,East | | | | 4.93 | A |

## Intersection Network Options

| Driving Side | Lighting |
|---|---|
| Right | Normal/unknown |

# Legs

## Legs

| Leg | Leg | Name | Description |
|---|---|---|---|
| North | North | Strasburg Road | |
| West | West | Huron Road | |
| South | South | Strasburg Road | |
| East | East | Huron Road | |

## Capacity Options

| Leg | Minimum Capacity (PCE/hr) | Maximum Capacity (PCE/hr) | Assume Flat Start Profile | Initial Queue (PCE) |
|---|---|---|---|---|
| North | 0.00 | 99999.00 | | 0.00 |
| West | 0.00 | 99999.00 | | 0.00 |
| South | 0.00 | 99999.00 | | 0.00 |
| East | 0.00 | 99999.00 | | 0.00 |

## Roundabout Geometry

| Leg | V - Approach road half-width (m) | E - Entry width (m) | l' - Effective flare length (m) | R - Entry radius (m) | D - Inscribed circle diameter (m) | PHI - Conflict (entry) angle (deg) | Exit Only |
|---|---|---|---|---|---|---|---|
| North | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| West | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| South | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |
| East | 7.00 | 8.00 | 30.00 | 20.00 | 55.00 | 25.00 | |





## Slope / Intercept / Capacity

### Leg Intercept Adjustments

| Leg | Type | Reason | Direct Intercept Adjustment (PCE/hr) | Percentage Intercept Adjustment (%) |
|---|---|---|---|---|
| North | Percentage | ROW Standard | | 90.00 |
| West | Percentage | ROW Standard | | 90.00 |
| South | Percentage | ROW Standard | | 90.00 |
| East | Percentage | ROW Standard | | 90.00 |

### Roundabout Slope and Intercept used in model

| Leg | Enter slope and intercept directly | Entered slope | Entered intercept (PCE/hr) | Final Slope | Final Intercept (PCE/hr) |
|---|---|---|---|---|---|
| North | | (calculated) | (calculated) | 0.723 | 2192.710 |
| West | | (calculated) | (calculated) | 0.723 | 2192.710 |
| South | | (calculated) | (calculated) | 0.723 | 2192.710 |
| East | | (calculated) | (calculated) | 0.723 | 2192.710 |

*The slope and intercept shown above include any corrections and adjustments.*

# Traffic Flows

## Demand Set Data Options

| Default Vehicle Mix | Vehicle Mix Varies Over Time | Vehicle Mix Varies Over Turn | Vehicle Mix Varies Over Entry | Vehicle Mix Source | PCE Factor for a Truck (PCE) | Default Turning Proportions | Estimate from entry/exit counts | Turning Proportions Vary Over Time | Turning Proportions Vary Over Turn | Turning Proportions Vary Over Entry |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ✓ | ✓ | Truck Percentages | 2.00 | | | | ✓ | ✓ |

# Entry Flows

## General Flows Data

| Leg | Profile Type | Use Turning Counts | Average Demand Flow (PCE/hr) | Flow Scaling Factor (%) |
|---|---|---|---|---|
| North | ONE HOUR | ✓ | 341.00 | 100.000 |
| West | ONE HOUR | ✓ | 677.00 | 100.000 |
| South | ONE HOUR | ✓ | 492.00 | 100.000 |
| East | ONE HOUR | ✓ | 1247.00 | 100.000 |

# Turning Proportions

### Turning Counts / Proportions (PCE/hr) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.000 | 229.000 | 72.000 | 40.000 |
| | West | 125.000 | 0.000 | 118.000 | 434.000 |
| | South | 60.000 | 103.000 | 0.000 | 329.000 |
| | East | 28.000 | 676.000 | 543.000 | 0.000 |

### Turning Proportions (PCE) - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.00 | 0.67 | 0.21 | 0.12 |
| | West | 0.18 | 0.00 | 0.17 | 0.64 |
| | South | 0.12 | 0.21 | 0.00 | 0.67 |

| | | | | | |
|---|---|---|---|---|---|
| | East | 0.02 | 0.54 | 0.44 | 0.00 |

# Vehicle Mix

### Average PCE Per Vehicle - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 1.000 | 1.020 | 1.020 | 1.190 |
| | West | 1.040 | 1.000 | 1.000 | 1.020 |
| | South | 1.000 | 1.020 | 1.000 | 1.000 |
| | East | 1.520 | 1.020 | 1.000 | 1.000 |

### Truck Percentages - Intersection 1 (for whole period)

| | | To | | | |
|---|---|---|---|---|---|
| | | North | West | South | East |
| From | North | 0.0 | 2.0 | 2.0 | 19.0 |
| | West | 4.0 | 0.0 | 0.0 | 2.0 |
| | South | 0.0 | 2.0 | 0.0 | 0.0 |
| | East | 52.0 | 2.0 | 0.0 | 0.0 |

# Results

### Results Summary for whole modelled period

| Leg | Max V/C Ratio | Max Delay (s) | Max Queue (PCE) | Max 95th percentile Queue (PCE) | Max LOS | Average Demand (PCE/hr) | Total Intersection Arrivals (PCE) | Total Queueing Delay (PCE-min) | Average Queueing Delay (s) | Rate Of Queueing Delay (PCE-min/min) | Inclusive Total Queueing Delay (PCE-min) | Inclusive Average Queueing Delay (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.33 | 4.88 | 0.51 | 1.04 | A | 312.91 | 469.36 | 30.82 | 3.94 | 0.34 | 30.82 | 3.94 |
| West | 0.45 | 3.96 | 0.82 | 1.02 | A | 621.23 | 931.84 | 52.01 | 3.35 | 0.58 | 52.02 | 3.35 |
| South | 0.32 | 3.08 | 0.46 | 1.00 | A | 451.47 | 677.20 | 30.97 | 2.74 | 0.34 | 30.97 | 2.74 |
| East | 0.70 | 6.21 | 2.34 | 3.06 | A | 1144.27 | 1716.40 | 133.04 | 4.65 | 1.48 | 133.05 | 4.65 |

### Main Results for each time segment

#### Main results: (16:00-16:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 256.72 | 64.18 | 255.85 | 159.87 | 991.68 | 0.00 | 1475.78 | 803.89 | 0.174 | 0.00 | 0.22 | 3.060 | A |
| West | 509.68 | 127.42 | 508.12 | 756.21 | 491.33 | 0.00 | 1837.51 | 1467.36 | 0.277 | 0.00 | 0.39 | 2.760 | A |
| South | 370.40 | 92.60 | 369.41 | 549.88 | 449.57 | 0.00 | 1867.69 | 1248.61 | 0.198 | 0.00 | 0.25 | 2.411 | A |
| East | 938.81 | 234.70 | 935.35 | 602.78 | 216.21 | 0.00 | 2036.40 | 1697.78 | 0.461 | 0.00 | 0.87 | 3.321 | A |

#### Main results: (16:15-16:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 306.55 | 76.64 | 306.19 | 191.30 | 1186.77 | 0.00 | 1334.73 | 803.89 | 0.230 | 0.22 | 0.31 | 3.631 | A |
| West | 608.61 | 152.15 | 608.04 | 904.97 | 587.99 | 0.00 | 1767.62 | 1467.36 | 0.344 | 0.39 | 0.53 | 3.165 | A |
| South | 442.30 | 110.57 | 441.99 | 658.06 | 537.97 | 0.00 | 1803.78 | 1248.61 | 0.245 | 0.25 | 0.32 | 2.654 | A |
| East | 1121.03 | 280.26 | 1119.38 | 721.26 | 258.70 | 0.00 | 2005.68 | 1697.78 | 0.559 | 0.87 | 1.28 | 4.130 | A |

#### Main results: (16:30-16:45)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 375.45 | 93.86 | 374.67 | 234.15 | 1451.38 | 0.00 | 1143.44 | 803.89 | 0.328 | 0.31 | 0.50 | 4.852 | A |
| West | 745.39 | 186.35 | 744.27 | 1106.94 | 719.10 | 0.00 | 1672.83 | 1467.37 | 0.446 | 0.53 | 0.81 | 3.949 | A |
| South | 541.70 | 135.43 | 541.16 | 804.88 | 658.49 | 0.00 | 1716.65 | 1248.61 | 0.316 | 0.32 | 0.46 | 3.073 | A |
| East | 1372.97 | 343.24 | 1368.82 | 882.95 | 316.71 | 0.00 | 1963.75 | 1697.78 | 0.699 | 1.28 | 2.32 | 6.121 | A |





#### Main results: (16:45-17:00)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 375.45 | 93.86 | 375.43 | 234.51 | 1455.45 | 0.00 | 1140.49 | 803.89 | 0.329 | 0.50 | 0.51 | 4.881 | A |
| West | 745.39 | 186.35 | 745.37 | 1109.76 | 721.12 | 0.00 | 1671.38 | 1467.37 | 0.446 | 0.81 | 0.82 | 3.965 | A |
| South | 541.70 | 135.43 | 541.70 | 807.00 | 659.50 | 0.00 | 1715.93 | 1248.61 | 0.316 | 0.46 | 0.46 | 3.077 | A |
| East | 1372.97 | 343.24 | 1372.87 | 884.10 | 317.09 | 0.00 | 1963.47 | 1697.78 | 0.699 | 2.32 | 2.34 | 6.207 | A |

#### Main results: (17:00-17:15)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 306.55 | 76.64 | 307.33 | 191.85 | 1192.62 | 0.00 | 1330.51 | 803.89 | 0.230 | 0.51 | 0.31 | 3.651 | A |
| West | 608.61 | 152.15 | 609.72 | 909.05 | 590.89 | 0.00 | 1765.52 | 1467.36 | 0.345 | 0.82 | 0.54 | 3.179 | A |
| South | 442.30 | 110.57 | 442.84 | 661.12 | 539.50 | 0.00 | 1802.68 | 1248.61 | 0.245 | 0.46 | 0.33 | 2.658 | A |
| East | 1121.03 | 280.26 | 1125.18 | 723.04 | 259.29 | 0.00 | 2005.26 | 1697.78 | 0.559 | 2.34 | 1.30 | 4.187 | A |

#### Main results: (17:15-17:30)

| Leg | Total Demand (PCE/hr) | Intersection Arrivals (PCE) | Entry Flow (PCE/hr) | Exit Flow (PCE/hr) | Circulating Flow (PCE/hr) | Pedestrian Demand (Ped/hr) | Capacity (PCE/hr) | Saturation Capacity (PCE/hr) | V/C Ratio | Start Queue (PCE) | End Queue (PCE) | Delay (s) | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 256.72 | 64.18 | 257.09 | 160.54 | 997.01 | 0.00 | 1471.92 | 803.89 | 0.174 | 0.31 | 0.22 | 3.076 | A |
| West | 509.68 | 127.42 | 510.26 | 760.11 | 493.98 | 0.00 | 1835.59 | 1467.36 | 0.278 | 0.54 | 0.39 | 2.771 | A |
| South | 370.40 | 92.60 | 370.72 | 552.76 | 451.48 | 0.00 | 1866.31 | 1248.61 | 0.198 | 0.33 | 0.25 | 2.417 | A |
| East | 938.81 | 234.70 | 940.52 | 605.17 | 217.03 | 0.00 | 2035.81 | 1697.78 | 0.461 | 1.30 | 0.88 | 3.355 | A |

### Queueing Delay Results for each time segment

#### Queueing Delay results: (16:00-16:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 3.20 | 0.21 | 3.060 | A | A |
| West | 5.74 | 0.38 | 2.760 | A | A |
| South | 3.66 | 0.24 | 2.411 | A | A |
| East | 12.64 | 0.84 | 3.321 | A | A |

#### Queueing Delay results: (16:15-16:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 4.54 | 0.30 | 3.631 | A | A |
| West | 7.87 | 0.52 | 3.165 | A | A |
| South | 4.81 | 0.32 | 2.654 | A | A |
| East | 18.66 | 1.24 | 4.130 | A | A |

#### Queueing Delay results: (16:30-16:45)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| North | 7.37 | 0.49 | 4.852 | A | A |
| West | 11.93 | 0.80 | 3.949 | A | A |
| South | 6.80 | 0.45 | 3.073 | A | A |
| East | 33.08 | 2.21 | 6.121 | A | A |

#### Queueing Delay results: (16:45-17:00)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **North** | 7.58 | 0.51 | 4.881 | A | A |
| **West** | 12.24 | 0.82 | 3.965 | A | A |
| **South** | 6.92 | 0.46 | 3.077 | A | A |
| **East** | 34.98 | 2.33 | 6.207 | A | A |

### Queueing Delay results: (17:00-17:15)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| **North** | 4.78 | 0.32 | 3.651 | A | A |
| **West** | 8.25 | 0.55 | 3.179 | A | A |
| **South** | 4.99 | 0.33 | 2.658 | A | A |
| **East** | 20.22 | 1.35 | 4.187 | A | A |

### Queueing Delay results: (17:15-17:30)

| Leg | Queueing Total Delay (PCE-min) | Queueing Rate Of Delay (PCE-min/min) | Average Delay Per Arriving Vehicle (s) | Unsignalised Level Of Service | Signalised Level Of Service |
|---|---|---|---|---|---|
| **North** | 3.35 | 0.22 | 3.076 | A | A |
| **West** | 5.99 | 0.40 | 2.771 | A | A |
| **South** | 3.79 | 0.25 | 2.417 | A | A |
| **East** | 13.46 | 0.90 | 3.355 | A | A |

## Queue Variation Results for each time segment

### Queue Variation results: (16:00-16:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.87 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (16:15-16:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.31 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.53 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.32 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 1.28 | 0.00 | 0.00 | 2.04 | 3.06 | | | N/A | N/A |

### Queue Variation results: (16:30-16:45)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.50 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.81 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.46 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 2.32 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |





### Queue Variation results: (16:45-17:00)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.51 | 0.00 | 0.00 | 0.00 | 1.04 | | | N/A | N/A |
| **West** | 0.82 | 0.00 | 0.00 | 0.00 | 1.02 | | | N/A | N/A |
| **South** | 0.46 | 0.00 | 0.00 | 0.00 | 1.00 | | | N/A | N/A |
| **East** | 2.34 | ? | ? | ? | ? | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |

### Queue Variation results: (17:00-17:15)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.31 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.54 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.33 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 1.30 | 0.00 | 0.00 | 2.04 | 2.04 | | | N/A | N/A |

### Queue Variation results: (17:15-17:30)

| Leg | Mean (PCE) | Q05 (PCE) | Q50 (PCE) | Q90 (PCE) | Q95 (PCE) | Percentile Message | Marker Message | Probability Of Reaching Or Exceeding Marker | Probability Of Exactly Reaching Marker |
|---|---|---|---|---|---|---|---|---|---|
| **North** | 0.22 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **West** | 0.39 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **South** | 0.25 | −1 | −1 | −1 | −1 | Percentiles could not be calculated. This may be because the mean queue is very small or very big. | | N/A | N/A |
| **East** | 0.88 | 0.00 | 0.00 | 1.02 | 2.04 | | | N/A | N/A |

# Appendix H

## OTM Traffic Control Signal Warrants

# Signal Justification Calculation for Forecast Volumes
## (OTM Book 12 - Justification 7)

Horizon Year: 2033 Total
Region/City/Township: Kitchener

Major Street: New Dundee Road
Minor Street: Pinnacle Road
North/South?: N

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Free

PM Forecast Only? N

| Warrant Results | | |
|---|---|---|
| 150% Satisfied | No | Justification for new intersections with forecast traffic |
| 120% Satisfied | No | Justification for existing intersections with forecast traffic |

| | Major Street | | | | | | Minor Street | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | New Dundee Road | | | | | | Pinnacle Road | | | | | | |
| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | | Peds |
| Time Period | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right | Crossing |
| AM Peak Hour | 4 | 1209 | 0 | 0 | 412 | 19 | 0 | 0 | 0 | 64 | 0 | 8 | |
| PM Peak Hour | 11 | 855 | 0 | 0 | 1432 | 97 | 0 | 0 | 0 | 52 | 0 | 12 | |
| verage Hourly Volun | 4 | 516 | 0 | 0 | 461 | 29 | 0 | 0 | 0 | 29 | 0 | 5 | 0 |

| Warrant | AHV |
|---|---|
| 1A - All | 1044 |
| 1B - Minor | 34 |
| 2A - Major | 1010 |
| 2B - Cross | 29 |

### Warrant 1 - Minimum Vehicular Volume

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 1A | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | All Approaches | 480 | 720 | 600 | 900 | 1044 |
| | | | | | % Fulfilled | 217.4% |

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 1B | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | Minor Street Approaches | 180 | 255 | 180 | 255 | 34 |
| | | | | | % Fulfilled | 18.9% |

### Warrant 2 - Delay To Cross Traffic

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 2A | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | Major Street Approaches | 480 | 720 | 600 | 900 | 1010 |
| | | | | | % Fulfilled | 210.4% |

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 2B | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | Traffic Crossing Major Street | 50 | 75 | 50 | 75 | 29 |
| | | | | | % Fulfilled | 58.0% |

# Signal Justification Calculation for Forecast Volumes
## (OTM Book 12 - Justification 7)

Horizon Year: 2033 Total
Region/City/Township: Kitchener

Major Street: New Dundee Road
Minor Street: Reidel Road
North/South?: N

Number of Approach Lanes: 1
Tee Intersection? N
Flow Conditions: Free

PM Forecast Only? N

| Warrant Results | | |
|---|---|---|
| 150% Satisfied | No | Justification for new intersections with forecast traffic |
| 120% Satisfied | No | Justification for existing intersections with forecast traffic |

| | Major Street | | | | | | Minor Street | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | New Dundee Road | | | | | | Reidel Road | | | | | | |
| | Eastbound | | | Westbound | | | Northbound | | | Southbound | | | Peds |
| Time Period | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right | Crossing |
| AM Peak Hour | 11 | 524 | 82 | 13 | 336 | 10 | 45 | 23 | 24 | 12 | 41 | 12 | |
| PM Peak Hour | 26 | 611 | 89 | 20 | 649 | 18 | 68 | 75 | 19 | 4 | 34 | 19 | |
| verage Hourly Volun | 9 | 284 | 43 | 8 | 246 | 7 | 28 | 25 | 11 | 4 | 19 | 8 | 0 |

| Warrant | AHV |
|---|---|
| 1A - All | 691 |
| 1B - Minor | 94 |
| 2A - Major | 597 |
| 2B - Cross | 57 |

### Warrant 1 - Minimum Vehicular Volume

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 1A | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | All Approaches | 480 | 720 | 600 | 900 | 691 |
| | | | | | % Fulfilled | 144.0% |

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 1B | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | Minor Street Approaches | 120 | 170 | 120 | 170 | 94 |
| | | | | | % Fulfilled | 78.3% |

### Warrant 2 - Delay To Cross Traffic

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 2A | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | Major Street Approaches | 480 | 720 | 600 | 900 | 597 |
| | | | | | % Fulfilled | 124.4% |

| | Approach Lanes | 1 | | 2 or more | | Average |
|---|---|---|---|---|---|---|
| 2B | Flow Conditions | Free | Restricted | Free | Restricted | Hourly Volume |
| | | X | | | | |
| | Traffic Crossing Major Street | 50 | 75 | 50 | 75 | 57 |
| | | | | | % Fulfilled | 113.5% |

# Signal Justification Calculation for Forecast Volumes
## (OTM Book 12 - Justification 7)

Horizon Year: 2033 Total
Region/City/Township: Kitchener

Major Street: Doon Mills Road
Minor Street: Apple Ridge Drive
North/South?: Y

Number of Approach Lanes: 1
Tee Intersection? Y
Flow Conditions: Restricted

PM Forecast Only? N

| Warrant Results | | |
|---|---|---|
| 150% Satisfied | No | Justification for new intersections with forecast traffic |
| 120% Satisfied | No | Justification for existing intersections with forecast traffic |

| | Major Street | | | | | | Minor Street | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Doon Mills Road | | | | | | Apple Ridge Drive | | | | | | |
| | Northbound | | | Southbound | | | Eastbound | | | Westbound | | | Peds |
| Time Period | Left | Through | Right | Left | Through | Right | Left | Through | Right | Left | Through | Right | Crossing |
| AM Peak Hour | 41 | 366 | 0 | 0 | 183 | 147 | 221 | 0 | 56 | 0 | 0 | 0 | |
| PM Peak Hour | 50 | 270 | 0 | 0 | 490 | 291 | 215 | 0 | 30 | 0 | 0 | 0 | |
| verage Hourly Volun | 23 | 159 | 0 | 0 | 168 | 110 | 109 | 0 | 22 | 0 | 0 | 0 | 0 |

| Warrant | AHV |
|---|---|
| 1A - All | 590 |
| 1B - Minor | 131 |
| 2A - Major | 460 |
| 2B - Cross | 109 |

## Warrant 1 - Minimum Vehicular Volume

| | Approach Lanes | 1 | | 2 or more | | Average Hourly Volume |
|---|---|---|---|---|---|---|
| 1A | Flow Conditions | Free | Restricted | Free | Restricted | |
| | | | X | | | |
| | All Approaches | 480 | 720 | 600 | 900 | 590 |
| | | | | | % Fulfilled | 81.9% |

| | Approach Lanes | 1 | | 2 or more | | Average Hourly Volume |
|---|---|---|---|---|---|---|
| 1B | Flow Conditions | Free | Restricted | Free | Restricted | |
| | | | X | | | |
| | Minor Street Approaches | 180 | 255 | 180 | 255 | 131 |
| | | | | | % Fulfilled | 51.2% |

## Warrant 2 - Delay To Cross Traffic

| | Approach Lanes | 1 | | 2 or more | | Average Hourly Volume |
|---|---|---|---|---|---|---|
| 2A | Flow Conditions | Free | Restricted | Free | Restricted | |
| | | | X | | | |
| | Major Street Approaches | 480 | 720 | 600 | 900 | 460 |
| | | | | | % Fulfilled | 63.8% |

| | Approach Lanes | 1 | | 2 or more | | Average Hourly Volume |
|---|---|---|---|---|---|---|
| 2B | Flow Conditions | Free | Restricted | Free | Restricted | |
| | | | X | | | |
| | Traffic Crossing Major Street | 50 | 75 | 50 | 75 | 109 |
| | | | | | % Fulfilled | 145.3% |

# Final Environmental Study Report (ESR)
# Volume 4 - Technical Appendices

City of Kitchener
Biehn Drive Municipal Class Environmental Assessment

November 2024

**Submitted by:**
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5

# Appendix J

Dewatering Assessment

BT ENGINEERING

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# Dewatering Assessment, Biehn Drive Extension, City of Kitchener, Ontario

March 14, 2024

Prepared for:
BT Engineering

Cambium Reference: 1969-002

CAMBIUM INC.

866.217.7900

cambium-inc.com

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# 1.0 Introduction

Cambium Inc. (Cambium) is pleased to provide BT Engineering (the client) with dewatering assessment to present the background review, groundwater levels, and dewatering estimates in support of the proposed roadway extension of Biehn Drive. The extension is from Biehn Drive's current terminus, approximately 60 m west of Spencer Court, south to the future Robert Ferrie Drive Extension located in the City of Kitchener Ontario (referred to herein as the Site).

It is understood that the works will also include a trunk sanitary sewer, storm sewers and a watermain, in addition to the roadway extension. Groundwater levels and a dewatering assessment is required for the construction and placement of linear infrastructure such as storm and sanitary sewer along the roadway at the proposed Biehn Drive Extension. Due to the presence of the Strasburg Creek Wetland Complex across the linear infrastructure alignment, some of the installation will be completed using trenchless horizontal directional drilling (HDD). A site location plan is included in Figure 1 and the construction alignment and profile is included in Appendix A.

The purpose of the dewatering investigation was to obtain information about the subsurface conditions by means of a number of boreholes and based on the findings provide recommendations pertaining to the geotechnical design of the new features.

## 1.1 Scope of Work

The scope of work for the dewatering assessment included the following tasks:

- **Well Installation and Water Level Measurement:** Seven boreholes which were advanced at the Site as part of the geotechnical investigation and four of the boreholes were completed as monitoring wells to allow for measurement of stabilized groundwater levels and to facilitate hydrogeological testing.
- **Single Well Hydraulic Tests (SWHT) and Analysis:** SWHTs were completed at each monitoring wells to provide estimates of hydraulic conductivity of the native soils for dewatering calculations.

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- **Estimation of Dewatering Requirements:** The volume of water required for dewatering at the Site was estimated using borehole information, results obtained from SWHT analysis, and watermain excavation design parameters.
- **Assessment of Water Taking Registration Requirements:** An assessment of Permit to Take Water (PTTW) and/or Environmental Activity Sector Registry (EASR) registration requirements was completed based on the dewatering volume estimated for the Site.
- **Groundwater Sampling and Analysis for Discharge Characterization:** One groundwater quality sample was collected and submitted for laboratory analysis and compared against Provincial Water Quality Objective (PWQO) Standards for overland discharge flow.
- **Report preparation:** A dewatering assessment report was prepared presenting the results, findings, and recommendations of this investigation.

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# 2.0 Well Installation and Testing

## 2.1 Past Investigation

### 2.1.1 Peto MacCallum Geotechnical Investigations

Previous geotechnical investigations were completed by Peto MacCallum Ltd. during December 1986 and November 2020. One shallow monitoring well was installed to a depth of 4.6 m below ground surface (mbgs) during December 1986. The soils encountered were mainly topsoil consisting of silt and trace gravel up to a maximum depth of 1.6 mbgs, followed by sand and gravel to installed depth. Depth to water level ranged between 2.40 mbgs and 2.90 mbgs.

Two monitoring wells MW108-20 and MW109-20 were installed closer to the Biehn Drive Extension during the November 2020 geotechnical investigation; however, a detailed geotechnical report or monitoring well logs were not available at the time of this report's preparation. Available borehole logs and a borehole location plan are provided in Appendix B.

It should be noted that Peto MacCallum completed the investigation for the entire proposed development at the Site. The focus of the current dewatering assessment is confined to the Biehn Drive Extension roadway only.

### 2.1.2 MTE Consultants Geotechnical Investigation

MTE Consultants completed a geotechnical investigation during December 2019 and January 2020 for the entire development at the Site. During the investigation, a total of eleven monitoring wells were installed on the entire development area. Monitoring wells MW104-20, MW105-20, MW108-20, and MW109-20 were installed closer to and along the alignment of Biehn Drive Extension. Detailed geotechnical report was not made available at the time of this report's preparation. Only borehole logs and a site location plan were provided by the client.

Based on the sub-surface soils encountered at the Site, silty sand to sand was the predominant soil type across the Site. All the borehole logs and the site location plan are included in Appendix C.

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A long-term, 12-months monitoring was completed at the Site and based on the water level data provided by MTE (Appendix C), depth to water levels ranged between 4.64 mbgs and 6.72 mbgs at all the monitoring wells, except monitoring well MW105-20. As this monitoring well was situated within a wetland area, the water levels ranged from 0.61 mbgs to 0.95 mbgs.

### 2.1.3 Previous Cambium Geotechnical Investigation

Cambium completed a geotechnical investigation on this property in 2022 to determine the subsurface and groundwater conditions. This previous investigation consisted of 6 boreholes at the Site to a maximum depth of 8.2 m below ground surface (mbgs), cumulating in our report entitled "*Geotechnical Investigation Report – Biehn Drive Extension, Kitchener, ON*" dated April 14, 2022. Three of these boreholes were outfitted with monitoring wells (BH101-22, BH104-22, and BH106-22) and were monitored as part of this hydrogeological investigation. The previous borehole locations and the previous borehole logs are included in Appendix D.

Based on the results of this borehole investigation, subsurface conditions at the Site generally consist of a layer topsoil, overlying a native deposit consisting of silty sand to sand. Groundwater measurements were taken from the monitoring wells two weeks after completion of drilling on February 4, 2022, and groundwater levels ranged from 0.41 mbgs to 4.10 mbgs, and BH106-22 was dry during the monitoring event.

## 2.2 Results of Current Subsurface Investigations

Cambium completed a supplemental borehole investigation at the Site on September 28, 29, 30 and August 1, 2023, in order to understand the groundwater and hydrogeologic conditions across the wetland feature. A total of six boreholes, designated as BH201-23 through BH206-23, were advanced into the subsurface at predetermined locations. These boreholes were terminated at depths of 6.7 to 9.8 m below ground surface. Three of these boreholes were outfitted with monitoring wells (BH202-23, BH203-23, and BH205-23) and were monitored as part of this hydrogeological investigation. The borehole locations are shown on Figure 2 of this report and the borehole logs are included in Appendix D.

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The locations and elevations of the boreholes were obtained using a Realtime Kinematic Unit (RTK) using a site benchmark (BM). The BM is recognized as the top of the southeast corner concrete pad for a generator found just south of the hydrant at the south end at Cobbledick Road, which has elevation of 85.44 m based on the existing topographic survey provided by the client.

In summary, the subsurface conditions consist of a peat or pavement buildup underlain predominantly by a sand to silty sand deposits.

## 2.3 Groundwater Levels

Cambium completed on-site water level monitoring for the well that they installed on three occasions: February 4, 2022, October 10, 2023, and March 11, 2024. Well construction details and water levels are summarized in Table 1.

**Table 1 Well Details and Water Levels**

| Well | | BH101-22 | BH104-22 | BH106-22 | BH202-23 | BH203-23 | BH206-23 |
|---|---|---|---|---|---|---|---|
| Top of Pipe Elevation (masl) | | 314.51 | 322.18 | 325.83 | 312.43 | 314.19 | 313.70 |
| Ground Surface Elevation (masl) | | 313.42 | 320.99 | 324.77 | 312.58 | 312.95 | 312.57 |
| Stick-up (m) | | 1.09[1] | 1.19 | 1.06 | -0.15 | 0.91 | 1.02 |
| February 4, 2022 | Water Level (mbgs) | 0.41 | 4.10 | Dry | - | - | - |
| | Groundwater Elev.(masl) | 313.01 | 316.89 | - | - | - | - |
| October 10, 2023 | Water Level (mbgs) | 0.60 | In-accessible | In-accessible | 0.95 | 0.26 | 0.19 |
| | Groundwater Elev.(masl) | 312.82 | - | - | 311.63 | 312.69 | 312.38 |
| March 11, 2024 | Water Level (mbgs) | 0.38 | 4.04 | 5.66 | 0.67 | 0.15 | -0.14 |
| | Groundwater Elev.(masl) | 313.04 | 316.95 | 319.11 | 311.91 | 312.80 | 312.71 |

1. *Stick-up value was measured at 1.04 m on October 13, 2023, due to minor subsidence of the monitoring well.*

Groundwater levels ranged between -0.14 mbgs to 5.66 mbgs, with equivalent elevations of 311.63 masl and 319.11 masl. It is noted that the deeper water levels measured at BH104-22

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and BH106-22 are interpreted to be due to elevational difference between the boreholes and is situated farther away from the low-lying Strasburg Creek Wetland Complex. The other four wells monitor water levels within the wetland complex or immediately adjacent to and reported water levels are much closer to the ground surface; the water level reported from BH206-23 (within the wetland complex) was reported at 0.14 metres above ground surface, indicating that the shallow water table has risen up to the surface water levels within the wetland complex during the spring months.

Water levels are expected to fluctuate with seasonal variation. As discussed above, MTE consultants conducted a long-term water level monitoring program for the entire development (not just the extension area); the water levels from their two closest monitoring wells to the extension area (MW104-20 and MW109-20) reported peak water levels in late April/early May and that the seasonal fluctuation from spring high to summer/fall low was approximately 1 m to 1.5 m (Appendix C).

The water elevations measured on October 10, 2023 and March 11, 2024, from the monitoring wells installed within the wetland (BH101-22, BH203-23, and BH206-23) reported similar elevations that are higher than the elevation at the adjacent monitoring well, BH202-23. This indicates that the groundwater within the shallow unconfined aquifer in the wetland complex has slight upward gradients as indicated by the high water levels.

## 2.4 Single Well Hydraulic Tests

The hydraulic conductivity (k-value) of the soils were estimated based on the results obtained from the single well response tests (slug tests). Aquifer response test (slug tests/single well response tests) was conducted on February 4, 2022, for the old Cambium well and on October 11, 2023, for the newly installed Cambium wells. Either falling head test or rising head tests were performed in the monitoring wells BH101-22, BH104-22, BH202-23, BH203-23, and BH206-23. Results of hydraulic conductivity tests are presented below in Table 2 and analytical data is included in Appendix E.

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**Table 2 Results of Estimated Hydraulic Conductivity as per Slug Test**

| Monitoring well | Estimated Hydraulic Conductivity (m/sec) | Tested Soil Type |
|---|---|---|
| BH101-22 | $3.59 \times 10^{-6}$ | Sand, Silty Sand and trace Clay |
| BH104-22 | $3.08 \times 10^{-6}$ | Sand, trace Silt and Clay |
| BH202-23 | $1.10 \times 10^{-5}$ | Sand, trace to some Silt, trace Clay |
| BH203-23 | $8.65 \times 10^{-6}$ | Silty Sand |
| BH206-23 | $1.55 \times 10^{-6}$ | Sand, some Clay |

The hydraulic conductivity was estimated utilizing Aquifer Test Pro slug test software using the Hvorslev method. The estimated hydraulic conductivities ranged between $1.15 \times 10^{-6}$ m/sec and $1.10 \times 10^{-5}$ m/sec and the geometric mean of hydraulic conductivity was calculated at $4.39 \times 10^{-6}$ m/sec.

## 2.5 Open Cut and Trenchless Construction Methods

A hydrogeologic cross section (Figure 3) was prepared depicting the existing ground surface profile, lithology, water levels, and the alignment of the proposed new 525 mm trunk sewer across the wetland complex.

The alignment on either side of the wetland complex will use traditional open cut excavation and the sewer alignment across the creek would entirely be a trenchless construction method using either by a microtunnelling or horizontal directional drilling (HDD) method of installation (see Section 3.5 for more details).

Microtunnelling is a pit launched technique with extreme accuracy and low risk, but however, has a high upfront costs. On the other hand, the HDD is surface launched making it a cost effective technique.

Based on Figure 3, the proposed trunk sewer alignment will intercept soils that range from silt to silty sand, with trace to some clay. The ground surface elevation varies somewhat across the alignment, but the average ground surface elevation within the wetland area is approximately 313.25 masl.

The dewatering estimates for both open-cut and trenchless construction and an evaluation of excavation methods are described below in Section 3.0.

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# 3.0 Dewatering Assessment – Open Cut Excavation

Construction dewatering is intended to lower the groundwater levels in the excavation area in order to ensure a dry working condition for the placement of linear infrastructure such as storm and sanitary sewers and watermains.

The requirements for construction dewatering generally depend on the Site's soil and groundwater conditions including soil type, soil permeability or hydraulic conductivity, local groundwater levels, and the design of the proposed works, such as the foundation and/or excavation elevation, as well as the size of proposed structure / excavation.

## 3.1 Excavation Design Parameters

The proposed development works include the installation of linear infrastructure along the proposed road extension. The proposed alignment and profile of linear excavation was included in Appendix A.

### 3.1.1 Trench Segments

Traditional open cut trench excavation methods will be used for the installation of linear infrastructure from 10+000 to 10+320. For this dewatering calculation, it is assumed that all trench excavations will be 2 m wide, and that the linear infrastructure installation will be conducted in 50 m segments. Based off the alignment drawings provided, the bottom of the linear infrastructure elevation at 10+000 is approximately 312.00 masl, and it dips down to approximately 310.50 masl by 10+320.

As determined through the water levels recorded by Cambium on February 4, 2022, October 10, 2023, and March 11, 2024, the water levels within the area of the wetland complex are very shallow; however, the water levels dropped to 316.95 masl at BH104-22 on March 11, 2024, which is located about 100 m south of the wetland complex. This water elevation is representative of spring water elevations and was used for this dewatering assessment. This water elevation is also similar to the elevations recorded at MW109-20 within MTE Consultants long-term water level monitoring program. The water elevation of 316.95 masl be used for the dewatering assessment for the open cut excavation from 10+000 to 10+320.

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To facilitate safe working conditions, water levels will be lowered to 1 m below the invert of proposed sewer line at each excavation. To be conservative, it is assumed that water levels will be lowered to 309.50 masl for each trench segment; therefore, a drawdown of 7.45 m was used for this dewatering assessment.

The thickness of the aquifer within this area is unknown. For the purposes of this dewatering assessment, it was assumed that the aquifer extends several metres below the base of the construction excavation, and an aquifer thickness of 12 m was used.

### 3.1.2 Pilot Holes or Entry & Exit Shafts

Due to the presence of the wetland, it is proposed that microtunnelling methods will be used from approximately 10+320 to 10+500. However, to initiate the microtunnelling, two receiving pits (one on each side of the wetland) will need to be excavated. It is assumed that each receiving pit will have a radius of 6 m or have a length and width of 6 m and will extend to 6 mbgs. Therefore, to ensure safe working conditions, groundwater levels will be lowered to 7 mbgs (1 m below the base of the excavation).

The shallowest water level measured at the Site were on March 11, 2024, at -0.14 mbgs. Therefore, it is known that the spring groundwater levels are above, at, or just below the ground surface and therefore, groundwater level is considered at ground surface and was used for this dewatering assessment. A total of 7 m of drawdown is anticipated at the Site.

The thickness of the aquifer within the wetland complex area is considered as the same aquifer thickness of 12 m that was used for this dewatering assessment.

## 3.2 Estimated Construction Dewatering Rates (50 m Trench Segment)

A modified Dupuit-Forchheimer equation was used to estimate the dewatering rate required for the proposed linear trench excavation (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln(R_0/r_s)} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right]$$

$Where$:

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$Q = dewatering\ rate\ (m^3/s)$

$K = hydraulic\ conductivity\ (m/s)$

$H = initial\ hydraulic\ head\ in\ aquifer\ (m)$

$h = target\ hydraulic\ head\ (initial\ hydraulic\ head - target\ drawdown)\ (m)$

$R_0 = zone\ of\ influence\ (from\ excavation\ center) = 3000(H-h)\sqrt{K}\ (m)$

$r_s = equivalent\ single\ well\ radius = width\ of\ trench/2\ (m)$

$x = unit\ length\ of\ trench\ (m)$

$L = distance\ to\ line\ source\ = R_0/2(m)$

The radius of influence for each excavation was estimated from soil hydraulic conductivity using the method of Sichardt (1930). In conditions of low hydraulic conductivity, where $R_0$ is calculated to be less than $r_s$ , the denominator of the first right hand term of the above equation is amended to be $\ln((R_0 + r_s)/r_s)$.

A summary of calculated dewatering rates, given a target depth to water of 309.50 masl and a unit trench length of 50 m, is provided in Table 3. Detailed calculations are provided in Appendix F.

**Table 3 Calculated Construction Dewatering Rates – 50 m Trench Segment**

| | Hydraulic Conductivity (K) | Zone of Influence ($R_0$) | Dewatering Rate (Q) | |
|---|---|---|---|---|
| | (m/s) | (m) | L/day | L/s |
| Minimum | 1.15 x10$^{-6}$ | 24 | 32,400 | 0.37 |
| Maximum | 1.10 x10$^{-5}$ | 74 | 124,700 | 1.44 |
| Geom. Mean | 4.39 x10$^{-6}$ | 47 | 70,700 | 0.82 |

Given a maximum estimated hydraulic conductivity of 1.10 x10$^{-5}$ m/s, the estimated $R_0$ for dewatering is 75 m and the estimated construction dewatering rate is 124,700 L/day or 1.44 L/s.

It is noted that the above equation is designed to represent steady state pumping conditions. In general, at the beginning of the pumping, the pumping rate required to lower Site water levels to acceptable levels may be greater than the rate estimated for steady state conditions as incoming water replaces the volume of excavated soils. Additionally, the above equation does

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not account for any precipitation that may occur during the construction process. To account for these factors and the uncertainty of the aquifer thickness, a safety factor of 2 was applied and the estimated dewatering rate per unit trench length is estimated at 249,300 L/day or 2.89 L/sec.

## 3.3 Estimated Construction Dewatering Rates (Receiving Pit)

A modified Dupuit-Forchheimer equation was used to estimate the dewatering rate required for the proposed square excavation (Powers, 2007):

$$Q = \frac{\pi K(H^2 - h^2)}{\ln(R_0/r_s)}$$

$Where$:

$Q = dewatering\ rate\ (m^3/s)$

$K = hydraulic\ conductivity\ (m/s)$

$H = initial\ hydraulic\ head\ in\ aquifer\ (m)$

$h = target\ hydraulic\ head\ (initial\ hydraulic\ head - target\ drawdown)\ (m)$

$R_0 = zone\ of\ influence\ (from\ excavation\ center) = 3000(H - h)\sqrt{K}\ (m)$

$r_s = equivalent\ single\ well\ radius$

For square excavations, the equivalent radius ($r_s$)can be determined as the radius of a circle with the same area as the excavation, or with the same perimeter as the excavation.

Here, the equivalent area method was used such that

$$r_s = \sqrt{\frac{ab}{\pi}}$$

A summary of calculated dewatering rates, given a target depth to water of 7.0 mbgs, and a length and width of 6.0 m, is provided in Table 4. Detailed calculations are provided in Appendix F.

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**Table 4 Calculated Construction Dewatering Rates – Per Receiving Pit**

| | Hydraulic Conductivity (K) | Zone of Influence ($R_0$) | Dewatering Rate (Q) | |
|---|---|---|---|---|
| | (m/s) | (m) | L/day | L/s |
| Minimum | $1.15 \times 10^{-6}$ | 23 | 19,600 | 0.23 |
| Maximum | $1.10 \times 10^{-5}$ | 70 | 117,500 | 1.36 |
| Geom. Mean | $4.39 \times 10^{-6}$ | 44 | 55,300 | 0.64 |

Given a maximum estimated hydraulic conductivity of $1.10 \times 10^{-5}$ m/s, the estimated $R_0$ for dewatering is 70 m and the estimated construction dewatering rate is 117,500 L/day or 1.36 L/s.

It is noted that the above equation is designed to represent steady state pumping conditions. In general, at the beginning of the pumping, the pumping rate required to lower Site water levels to acceptable levels may be greater than the rate estimated for steady state conditions as incoming water replaces the volume of excavated soils. Additionally, the above equation does not account for any precipitation that may occur during the construction process. To account for these factors and the uncertainty of the aquifer thickness, a safety factor of 2 was applied and the estimated dewatering rate per each receiving pit is estimated at 235,000 L/day or 2.72 L/sec.

## 3.4 Assessment of Required Regulatory Permits or Registration

Any construction dewatering or other water taking in Ontario is governed by the Ontario Water Resources Act (OWRA) (Ontario Regulation 387/04 and/or Ontario Regulation 63/16) and/or the Environmental Protection Act (Registrations under Part II.2).

Where construction dewatering is required in amounts in excess of 400,000 L/day, a Permit To Take Water (PTTW) must be obtained. For temporary construction dewatering (six months or less) greater than 50,000 L/day but less than 400,000 L/day, registration through Environmental Activity and Sector Registry (EASR) is required.

Based on the estimated dewatering rate for each 50 m trench segment of 249,300 L/day (including a safety factor) and the estimated dewatering rate for each receiving pit of 235,000 L/day (including a safety factor), an EASR registration will be required as dewatering rates

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exceed 50,000 L/day. Additionally, if multiple excavations are dewatering simultaneously, dewatering rates could exceed 400,000 L/day and a PTTW may be required.

It is imperative that daily dewatering rates be monitored (or the dewatering of stagnant water in the construction excavation estimated) to ensure that the short-term dewatering rates are less than 400,000 L/day. If the rates are greater than 400,000 L/day, operations would be required to cease until a Permit to Take Water (PTTW) was acquired.

### 3.1.4 Zone of Influence

The dewatering calculations include estimates of the horizontal distance away from the walls of each excavation where the influence of water withdrawal will be negligible (i.e., the length to zero drawdown).

The length to zero drawdown from the construction excavation to accommodate each 50 m linear infrastructure was calculated at about 74 m from the walls of the construction excavations and at about 70 m from the walls of the construction excavation for each receiving pit (Appendix F). The area included within the length to zero drawdown from the excavation is the zone of influence (ZOI).

The ZOI predominantly encompasses open land with no known structure or infrastructure; however, there are existing houses within the calculated ZOI within the northern end of the road extension. During construction dewatering activities, the areas adjacent to the construction excavations should be monitored regularly for land settlement and stability.

## 3.5 Trenchless Horizontal Directional Drilling (HDD)

Trenchless construction consists of installing pipes such as sewer lines and watermains via tunneling under a highway, a waterbody, a wetland etc. Trenchless construction should be considered in areas where conventional open-trench construction methods are undesirable. Trenchless construction usually includes tunneling using a jacked, non man-entry microtunnel boring machine (MTBM), (usually referred to as “microtunnelling), and horizontal directional drilling (HDD) also known as directional boring. Open trenching, as in this case, will be done all the way up to the point where horizontal drilling started. The crossing of the wetland complex

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using HDD primarily consists of drilling a small diameter pilot hole (~ 6 inch to 8 inch) along the drilling path and then enlarging / reaming the pilot hole up to a diameter which can facilitate the pipe string pull-back (generally 1.5 times pipe diameter). Microtunnelling boring machine can usually create tunnels from 0.5 m to 4 m in diameter and includes a vacuum extraction system which promotes a cleaner environment and little to no dewatering along the path.

Microtunnelling will be launched from receiving pits on either side of the wetland complex (dewatering for each receiving pit calculated in Section 3.3).

Directional drilling is best suited for clays. Soft to hard clays are the preferred soils for HDD applications, although its use in cohesionless fine sands and silts is also acceptable (Gokhale & Iseley, 1997). Soils containing more than 50% gravel or loose soils are generally unsuitable (Hair, 1994). Directional boring should not be conducted in soils that contain material with particle diameters greater than 3”, since these particles are too large to be suspended in the drilling fluid (Gelinas, et al., 2010). HDD can be used successfully underwater, in saturated soils, under permafrost, and in a soil that is likely to erode (Hashash, 2011).

The following hydrogeologic information is required for the selection of the trenchless method:

- The presence and depth of gravels, cobbles, boulders, loose sand, soft clay etc.,
- Soil and rock stratigraphy and depth to bedrock,
- Groundwater levels and elevations, groundwater conditions such as unconfined or confined, and
- The presence of expansive or collapsible materials.

Accordingly, a cross section was prepared (Figure 3) to depict the existing geologic and hydrogeologic conditions across the proposed trenchless alignment. The length of trenchless excavation extends approximately 120 m (from 10+340 to 10+460) between the boreholes BH201-23, BH203-23 through BH206-23, and BH101-22 and the lithology along the alignment predominantly consists of silt to silty sand with trace clay throughout.

A length of about 120 m of the sewer and waterman installation will be below the water table. Groundwater is being discharged to the wetland complex at an approximate elevation of 312.6

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to 313.0 masl. The deepest point of alignment will be at an elevation of approximately 309.62 masl under the Creek, and therefore, the maximum height of water column above the deepest part of sewer line will be about 3.38 m.

It should be noted that trenchless construction would normally require less or no dewatering than traditional open cut installations. Drilling fluid is used to suspend and remove the soil cuttings and also to stabilize the hole, reduce friction and control soil pressure below the surface.

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## 4.0 Water Quality Assessment

Groundwater samples were collected from the monitoring well BH101-22 on February 4, 2022, and were submitted for chemical analysis in order to identify compliance issues (if any) when compared to Provincial Water Quality Objective (PWQO) parameters. Groundwater sample was collected in unfiltered form and submitted to SGS Laboratories for chemical analysis. SGS has been accredited by Canadian Association for Laboratory Accreditation (CALA). The laboratory analytical results are presented in Appendix G.

The chemical results were tabulated in Table 5 indicating parameter exceedances in comparison to the guideline values.

**Table 5 Guideline Violation of Groundwater Samples Compared to PWQO (µg/L)**

| Sample ID | Filtration | Parameter | Measured Concentration | Guideline Value |
|---|---|---|---|---|
| BH101-22 | Unfiltered | Zinc | **856** | 30 |
| BH101-22 | Unfiltered | Thallium | **0.80** | 0.3 |
| BH101-22 | Unfiltered | Lead | **153** | 5 |
| BH101-22 | Unfiltered | Nickel | **127** | 25 |
| BH101-22 | Unfiltered | Iron | **130000** | 300 |
| BH101-22 | Unfiltered | Cadmium | **1.64** | 0.2 |
| BH101-22 | Unfiltered | Arsenic | **26.6** | 5 |
| BH101-22 | Unfiltered | Silver | **0.4** | 0.1 |

*Note: Bolded values exceeding the applicable standard.*

Based on the results of the chemical analysis, the following comments on the groundwater quality are provided.

- The concentrations of most metals, including zinc, thallium, lead, nickel, iron, cadmium, arsenic, and silver in the unfiltered groundwater sample, exceeded the PWQO guideline values.
- The groundwater dewatering contractor should verify the quality of the filtered sample before being discharged as over land flow to the nearby wetland.

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- If discharged as overland flow, the concentration of total suspended solids (TSS) should not exceed 25 mg/L concentrations. Standard discharge mitigation BMP for TSS (discharge running through fine mesh filter bags) must be utilized during construction as TSS is expected to be very high due to the type of construction activities at the site.

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## 5.0 Recommendations

Cambium recommends the following as part of this assessment.

- As EASR registration will be required prior to the initiation of any dewatering activities. A dewatering and discharge plan should be prepared to support the EASR registration.
- If simultaneous excavations are planned (multiple trench segments and/or receiving pits), a PTTW registration will be required.
- Regardless, is imperative that daily dewatering rates be monitored (or the dewatering of stagnant water in the construction excavation estimated) to ensure that the short-term dewatering rates are less than 400,000 L/day. If the rates are greater than 400,000 L/day, operations would be required to cease until a Permit to Take Water (PTTW) was acquired.
- If possible, during the period of active dewatering, water levels should be monitored within the excavation footprints and in the existing monitoring wells to confirm the estimated zone of influence.
- All daily water takings and discharge rates shall be recorded both manually once a day and using continuous data logging devices (continuously recording flow meters with totalizing function) and maintained for the purpose of the mandatory water taking reporting.
- If dewatered groundwater is to be discharged as overland flow, the concentration of total suspended solids (TSS) should not exceed 25 mg/L concentrations. Standard discharge mitigation plan for TSS (discharge running through fine mesh filter bags) must be utilized during construction as TSS is expected to be very high due to the type of construction activities at the site.
- During construction dewatering activities, the areas adjacent to the construction excavations should be monitored regularly for land settlement and stability issues.
- The proposed trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland Complex, based on hydrogeologic conditions assessed across the area.

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## 6.0 Closing

We trust that the information in this submission meets your current requirements. If you have any questions regarding the contents of this report, please contact the undersigned.

All information received from the Client in the preparation of the report has been assumed correct and Cambium assumes no responsibility for the accuracy, completeness, or workmanship of any such information.

Respectfully submitted,

**Cambium Inc.**

DocuSigned by:
6AAA0661AAA8459...

Nicole Latimer, M.Sc., GIT
Project Coordinator

DocuSigned by:
Sudhakar Kurli
3611EDDBEA134BF...

Sudhakar Kurli, M.Sc., P.Geo.
Project Manager/Hydrogeologist

*\\cambiumincstorage.file.core.windows.net\projects\11900 to 11999\11969-002 BT Eng (London) - Geo & HydroG - Kitchener\Deliverables\REPORT - HydroG\Final\2024-03-14 Dewatering Assessment, Biehn Drive Extension, Kitchener.docx*

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# 7.0 References

Gelinas, M., Mathy, D., Rotter, J., Creviston, S., Hooshialsadat, P., Soldati, M., & Winzler, J. J. (2010). One Project, Four Trenchless Methods. *Pipeline Division Specialty Conference*.

Gokhale, S., & Iseley, T. (1997). Trenchless Installation of Conduits Beneath Roadways. In *Synthesis of Highway Practices 242.* Washington, DC: Transporation Research Board of the National Academies.

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Hashash, Y. (2011). *Evaluation of Horizontonal Directional Drilling (HDD).* Illinois Center for Transportation, Department of Civil and Environmental Engineering.

Kyrieleis, W. a. (1930). *Grundwasserabsenkung bei Fundierungsarbeiten.* Berlin: Springer.

Powers, J. P. (2007). *Construction dewatering and groundwater control.*

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# 8.0 Standard Limitations

Limited Warranty

In performing work on behalf of a client, Cambium relies on its client to provide instructions on the scope of its retainer and, on that basis, Cambium determines the precise nature of the work to be performed. Cambium undertakes all work in accordance with applicable accepted industry practices and standards. Unless required under local laws, other than as expressly stated herein, no other warranties or conditions, either expressed or implied, are made regarding the services, work or reports provided.

Reliance on Materials and Information

The findings and results presented in reports prepared by Cambium are based on the materials and information provided by the client to Cambium and on the facts, conditions and circumstances encountered by Cambium during the performance of the work requested by the client. In formulating its findings and results into a report, Cambium assumes that the information and materials provided by the client or obtained by Cambium from the client or otherwise are factual, accurate and represent a true depiction of the circumstances that exist. Cambium relies on its client to inform Cambium if there are changes to any such information and materials. Cambium does not review, analyze, or attempt to verify the accuracy or completeness of the information or materials provided, or circumstances encountered, other than in accordance with applicable accepted industry practice. Cambium will not be responsible for matters arising from incomplete, incorrect, or misleading information or from facts or circumstances that are not fully disclosed to or that are concealed from Cambium during the provision of services, work, or reports.

Facts, conditions, information, and circumstances may vary with time and locations and Cambium's work is based on a review of such matters as they existed at the particular time and location indicated in its reports. No assurance is made by Cambium that the facts, conditions, information, circumstances, or any underlying assumptions made by Cambium in connection with the work performed will not change after the work is completed and a report is submitted. If any such changes occur or additional information is obtained, Cambium should be advised and requested to consider if the changes or additional information affect its findings or results.

When preparing reports, Cambium considers applicable legislation, regulations, governmental guidelines, and policies to the extent they are within its knowledge, but Cambium is not qualified to advise with respect to legal matters. The presentation of information regarding applicable legislation, regulations, governmental guidelines, and policies is for information only and is not intended to and should not be interpreted as constituting a legal opinion concerning the work completed or conditions outlined in a report. All legal matters should be reviewed and considered by an appropriately qualified legal practitioner.

Site Assessments

A site assessment is created using data and information collected during the investigation of a site and based on conditions encountered at the time and particular locations at which fieldwork is conducted. The information, sample results and data collected represent the conditions only at the specific times at which and at those specific locations from which the information, samples and data were obtained and the information, sample results and data may vary at other locations and times. To the extent that Cambium's work or report considers any locations or times other than those from which information, sample results and data was specifically received, the work or report is based on a reasonable extrapolation from such information, sample results and data but the actual conditions encountered may vary from those extrapolations.

Only conditions at the site and locations chosen for study by the client are evaluated; no adjacent or other properties are evaluated unless specifically requested by the client. Any physical or other aspects of the site chosen for study by the client, or any other matter not specifically addressed in a report prepared by Cambium, are beyond the scope of the work performed by Cambium and such matters have not been investigated or addressed.

Reliance

Cambium's services, work and reports may be relied on by the client and its corporate directors and officers, employees, and professional advisors. Cambium is not responsible for the use of its work or reports by any other party, or for the reliance on, or for any decision which is made by any party using the services or work performed by or a report prepared by Cambium without Cambium's express written consent. Any party that relies on services or work performed by Cambium or a report prepared by Cambium without Cambium's express written consent, does so at its own risk. No report of Cambium may be disclosed or referred to in any public document without Cambium's express prior written consent. Cambium specifically disclaims any liability or responsibility to any such party for any loss, damage, expense, fine, penalty or other such thing which may arise or result from the use of any information, recommendation or other matter arising from the services, work or reports provided by Cambium.

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Personal Liability

The client expressly agrees that Cambium employees shall have no personal liability to the client with respect to a claim, whether in contract, tort and/or other cause of action in law. Furthermore, the client agrees that it will bring no proceedings nor take any action in any court of law against Cambium employees in their personal capacity.

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# Appended Figures

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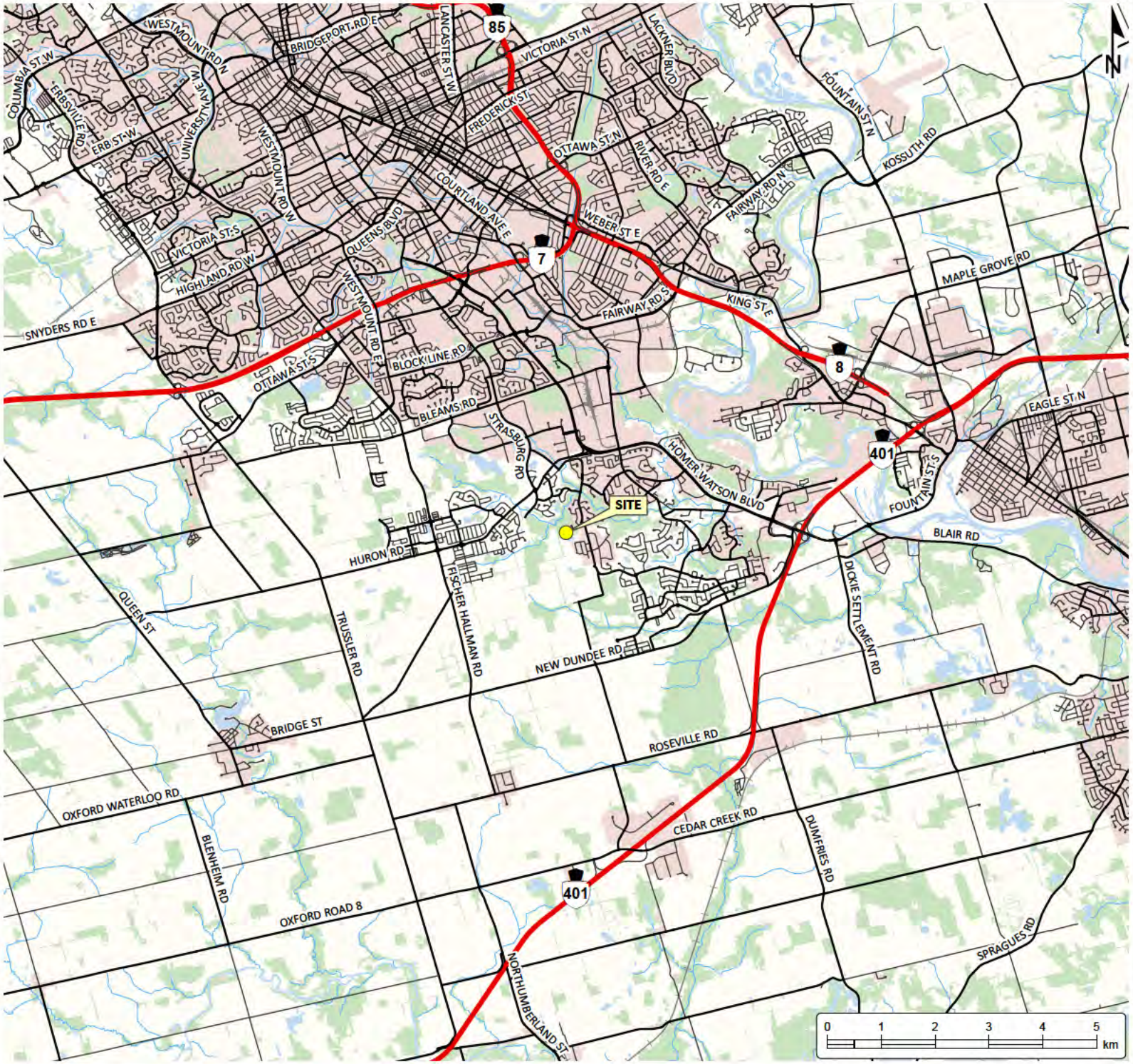


# DEWATERING ASSESSMENT

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

**LEGEND**

- Highway
- Major Road
- Minor Road
- Railway
- Watercourse
- First Nations Reserve
- Provincial Park
- Water Area
- Wooded Area
- Built Up Area

**Notes:**
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- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
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CAMBIUM
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www.cambium-inc.com

## SITE LOCATION PLAN

| | | | |
|---|---|---|---|
| Project No.: 11969-002 | | Date: December 2023 | Rev.: |
| Scale: 1:100,000 | | Projection: NAD 1983 UTM Zone 17N | |
| Created by: MAT | Checked by: SK | Figure: 1 | |

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# DEWATERING ASSESSMENT

BT ENGINEERING
Biehn Drive
Kitchener, Ontario

## LEGEND

- Benchmark
- Borehole
- Monitoring Well
- Contours (5m Interval)
- Provincially Significant Wetlands
- Section Profile

**Notes:**
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Peterborough, Ontario, K9H 1E5
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## BOREHOLE LOCATION PLAN

| | | | |
|---|---|---|---|
| Project No.: 11969-002 | | Date: December 2023 | |
| | | Rev.: | |
| Scale: 1:1,500 | | Projection: NAD 1983 UTM Zone 17N | |
| Created by: MAT | Checked by: SK | Figure: 2 | |

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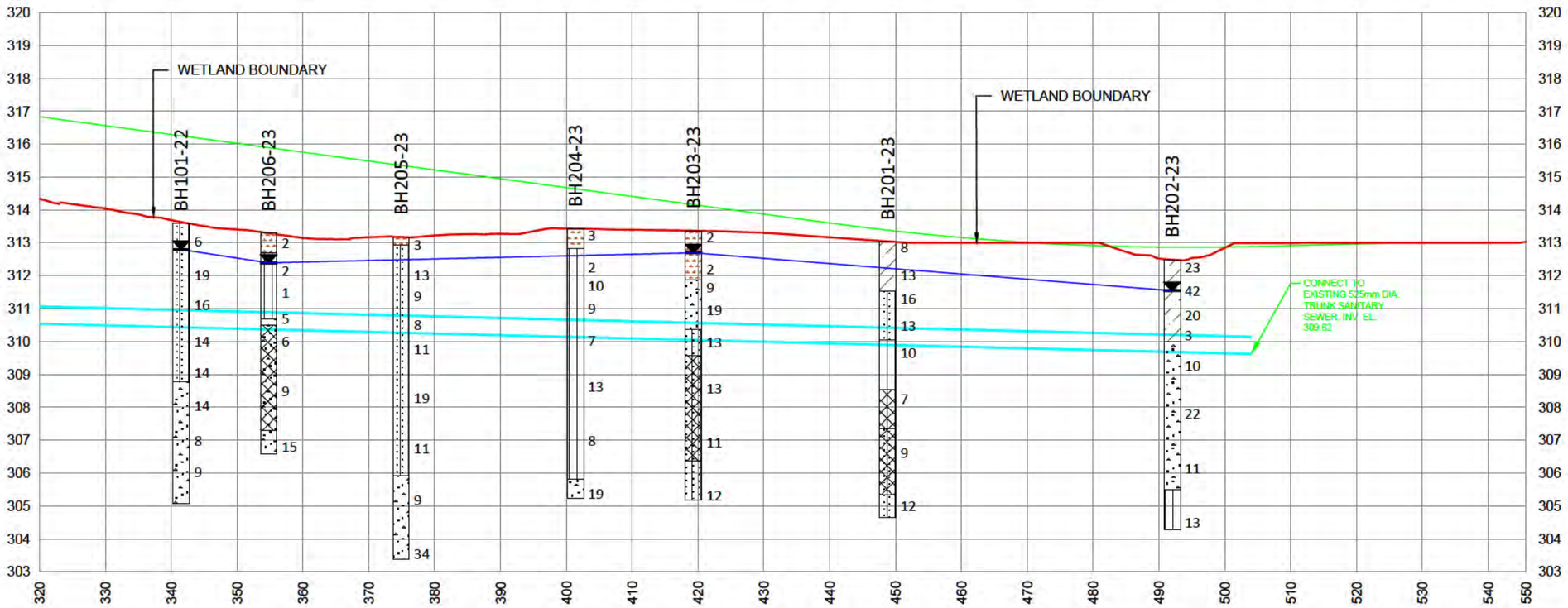
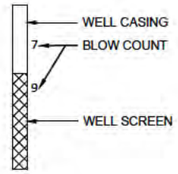



# DEWATERING ASSESSMENT

BT ENGINEERING
Biehn Drive Kitchener, Ontario

LEGEND

- WATER LEVEL INDICATOR
- FILL
- PEAT
- SILT
- SILTY SAND
- SAND
- WATER LEVEL
- GROUND SURFACE
- PROPOSED SURFACE GRADING
- PROPOSED SEWER




Notes:
1. Survey completed by Cambium Inc. December 6, 2023
2. Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.

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## PROFILE CROSS SECTION

| Project No.: | Date: December 2023 |
|---|---|
| 11969-002 | Rev.: |
| Horizontal Scale: N/A | Vertical Scale: N/A |
| Drawn By: MAT | Checked By: SK |
| Figure: 3 | |

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# Appendix A

# Linear Alignment and Profile

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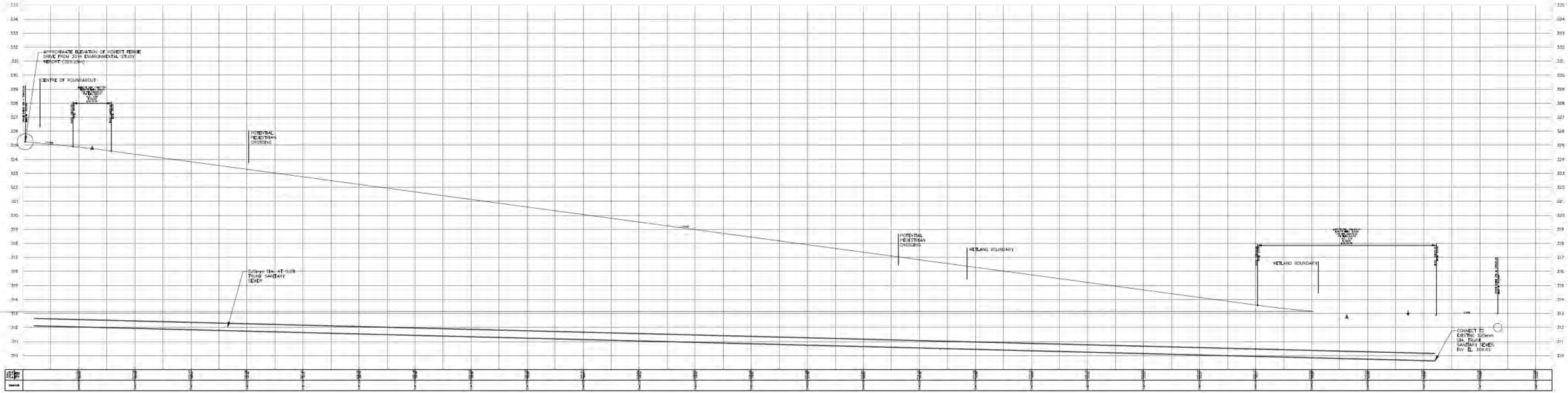

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# Appendix B

# Borehole Logs (Peto MacCallum)

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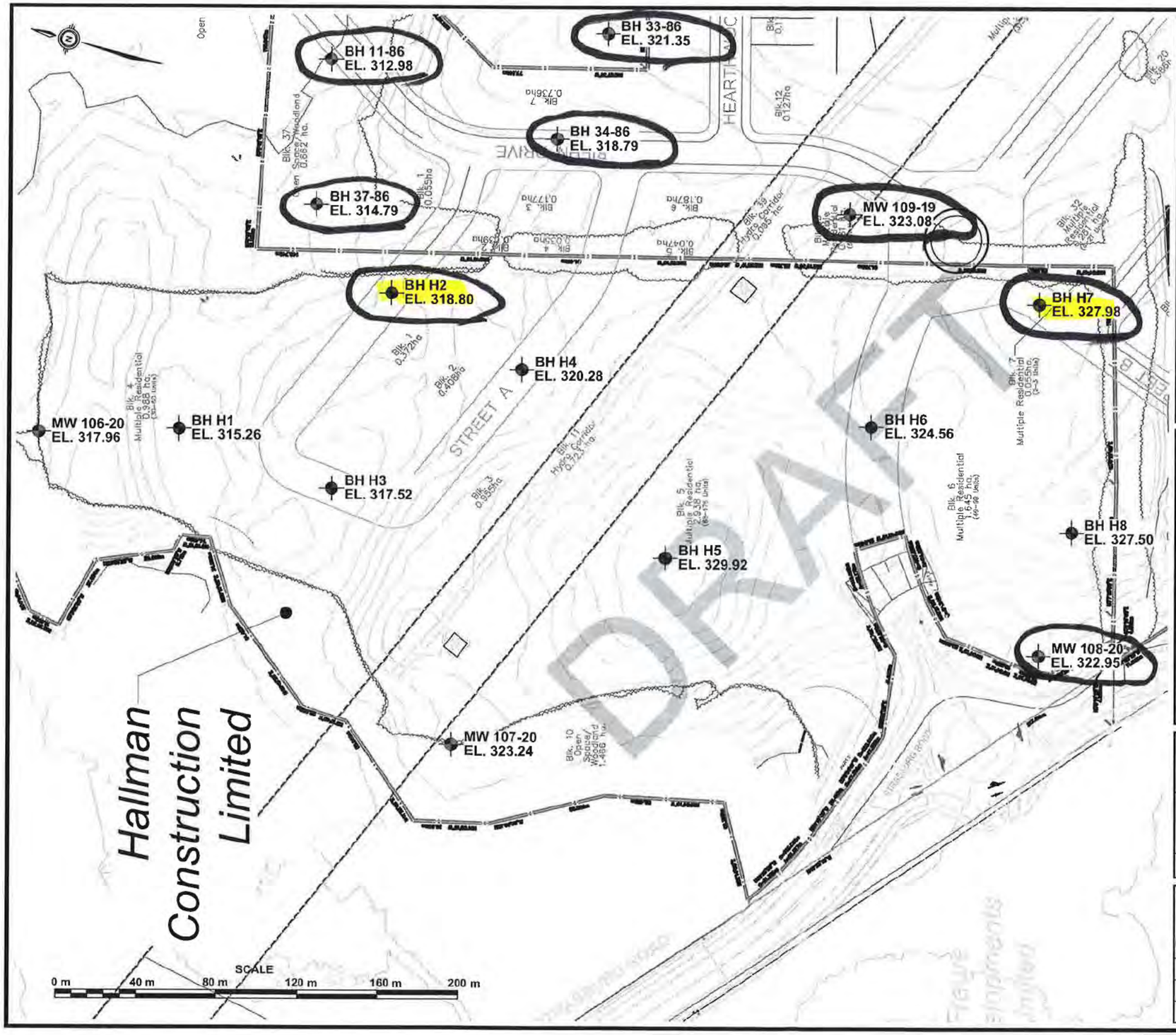


KEY PLAN

**LEGEND:**

- BOREHOLE LOCATION
- PREVIOUS INVESTIGATION BOREHOLE / MONITORING WELL
  PML REF: 86F423

**REFERENCE:**

BOREHOLE LOCATION PLAN REPRODUCED FROM DRAWING SUPPLIED BY CLIENT.

**NOTES:**

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE BOREHOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE BOREHOLES MAY VARY.

THE BOREHOLE LOCATIONS AND GEODETIC ELEVATIONS WERE SURVEYED WITH A SOKKIA GCX3 REAL TIME KINEMATIC RECEIVER CONNECTED TO THE GLOBAL NAVIGATION SATELLITE SYSTEM.

**HALLMAN CONSTRUCTION LIMITED**

**BRIGADOON SOUTH SUBDIVISION**

**HALLMAN LANDS**

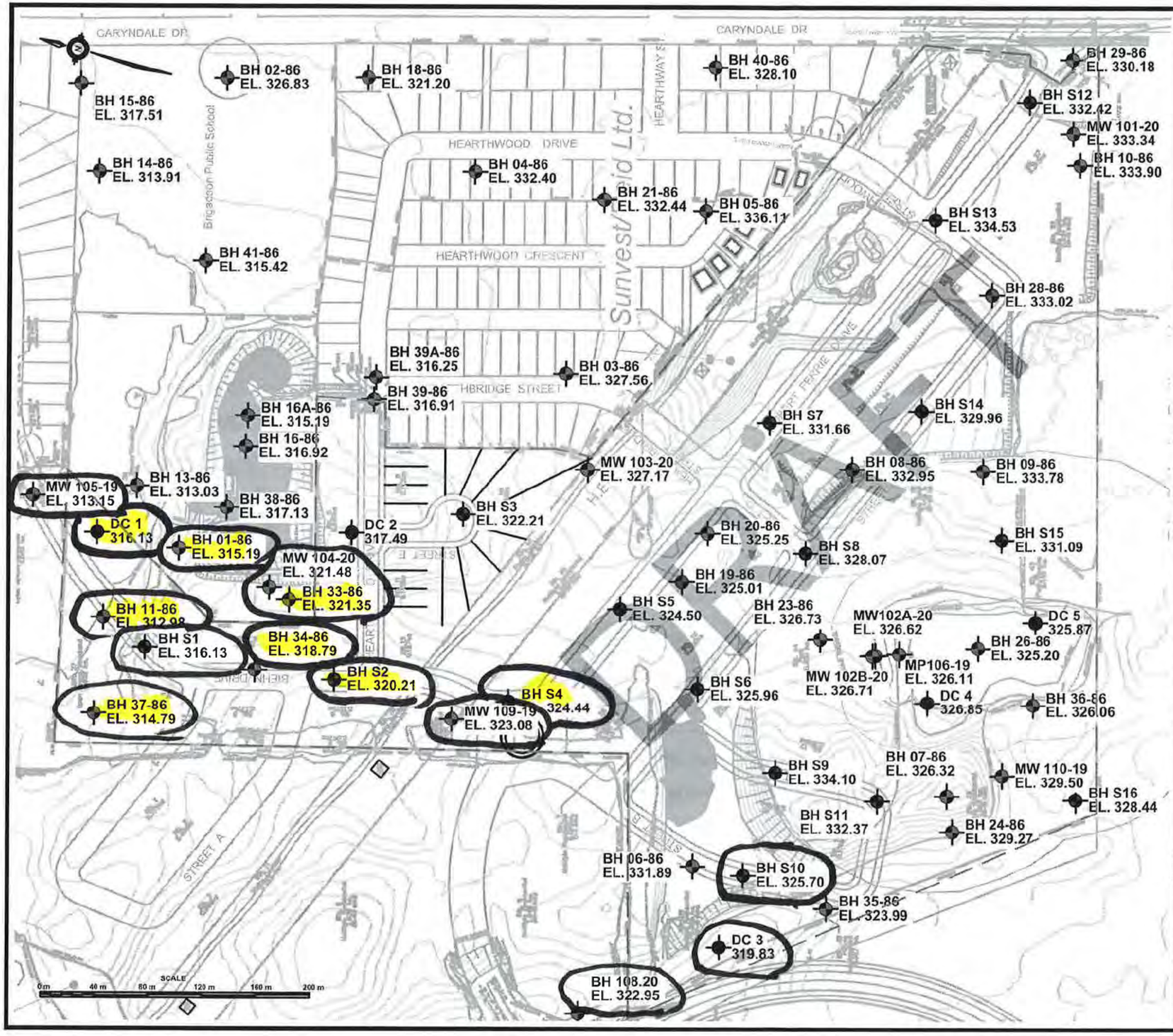
**KITCHENER, ONTARIO**

**BOREHOLE LOCATION PLAN**

PML Peto MacCallum Ltd.
CONSULTING ENGINEERS

| | | | | | |
|---|---|---|---|---|---|
| DRAWN | D. BRICE | DATE | SCALE | PML REF. | DWG. NO. |
| CHECKED | W. LOGHRIN | FEBRUARY 2021 | AS SHOWN | 20KF063A | 1 |
| APPROVED | G. MITCHELL | | | | |

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A



KEY PLAN

**LEGEND:**

- BOREHOLE LOCATION
- DYNAMIC CONE PENETRATION TEST
- PREVIOUS INVESTIGATION BOREHOLES / MONITORING WELLS
  PML REF: 86F423

**REFERENCE:**

TEST HOLE LOCATION PLAN REPRODUCED FROM DRAWING SUPPLIED BY CLIENT.

**NOTES:**

THE INFERRED STRATIGRAPHY REFERRED TO IN THE REPORT IS BASED ON THE DATA FROM THESE TEST HOLES SUPPLEMENTED BY GEOLOGICAL EVIDENCE. THE ACTUAL STRATIGRAPHY BETWEEN THE TEST HOLES MAY VARY.

THE TEST HOLE LOCATIONS AND GEODETIC ELEVATIONS WERE SURVEYED WITH A SOKKIA GCX3 REAL TIME KINEMATIC RECEIVER CONNECTED TO THE GLOBAL NAVIGATION SATELLITE SYSTEM.

## SUNVEST CONSTRUCTION LIMITED

BRIGADOON SOUTH SUBDIVISION
SUNVEST LANDS
KITCHENER, ONTARIO

TEST HOLE LOCATION PLAN

Peto MacCallum Ltd.
CONSULTING ENGINEERS

| | | | | | |
|---|---|---|---|---|---|
| DRAWN | D. BRICE | DATE | SCALE | PML REF. | DWG. NO. |
| CHECKED | W. LOGHRIN | APRIL 2021 | AS SHOWN | 20KF063B | 1 |
| APPROVED | W. LOGHRIN | | | | |

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Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE NO. DC-1

**PROJECT** Brigadoon South Subdivision - Sunvest Reid Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD**
**BORING DATE**
**PML REF.** 20KF063B
**ENGINEER** W. Loghrin
**TECHNICIAN**

| SOIL PROFILE | | | SAMPLES | | | ELEVATION SCALE | SHEAR STRENGTH (kPa) | NATURAL MOISTURE CONTENT | UNIT WEIGHT | GROUND WATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|---|
| DEPTH / ELEV (metres) | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES | | +FIELD VANE △TORVANE ○ Qu ▲POCKET PENETROMETER ○ Q; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● | PLASTIC LIMIT $w_P$ — $w$ — LIQUID LIMIT $w_L$; WATER CONTENT (%) | kN/m³ | GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL |
| | SURFACE ELEVATION | | | | | | 50 100 150 200; 20 40 60 80 | 10 20 30 40 | | |
| 0.0 | | | | | | | | | | |
| 1.0 | | | | | | | | | | |
| 2.0 | | | | | | | | | | |
| 3.0 | | | | | | | | | | |
| 4.0 | | | | | | | | | | |
| 5.0 | | | | | | | | | | |
| 6.0 | | | | | | | | | | |
| 7.0 | | | | | | | | | | |
| 8.0 | | | | | | | | | | |
| 9.0 | | | | | | | | | | |
| 10.0 | | | | | | | | | | |
| 11.0 | | | | | | | | | | |
| 12.0 | | | | | | | | | | |
| 13.0 | | | | | | | | | | |
| 14.0 | | | | | | | | | | |
| 15.0 | | | | | | | | | | |

DRAFT

**NOTES**

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Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE NO. DC-3



**PROJECT** Brigadoon South Subdivision - Sunvest Reid Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD** Dynamic Cone Penetration Test
**BORING DATE**
**PML REF.** 20KF063B
**ENGINEER** W. Loghrin
**TECHNICIAN** R. Bhavsar

| DEPTH ELEV (metres) | DESCRIPTION | STRAT PLOT | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: "N" VALUES | ELEVATION SCALE |
|---|---|---|---|---|---|---|
| 0.0 | SURFACE ELEVATION 319.83<br>See BH 35-86 for soil stratigraphy | | | | | 319 |
| 1.0 | | | | | | 318 |
| 2.0 | | | | | | 317 |
| 3.0 | | | | | | 316 |
| 4.0 | | | | | | 315 |
| 5.0 | | | | | | 314 |
| 6.0 | | | | | | 313 |
| 7.0 | | | | | | 312 |
| 8.0 | | | | | | 311 |
| 9.0 | | | | | | 310 |
| 10.0 | | | | | | 309 |
| 11.0 | | | | | | 308 |
| 12.0 | | | | | | 307 |
| 13.0 | | | | | | 306 |
| 14.0 | | | | | | 305 |
| 15.0 | CONTINUED | | | | | |

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○Qu
▲POCKET PENETROMETER ○Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $w_P$ | NATURAL MOISTURE CONTENT $w$ | LIQUID LIMIT $w_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

DRAFT

**NOTES**

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Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE NO. DC-3



**PROJECT** Brigadoon South Subdivision - Sunvest Reid Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD** Dynamic Cone Penetration Test
**BORING DATE**
**PML REF.** 20KF063B
**ENGINEER** W. Loghrin
**TECHNICIAN** R. Bhavsar

| DEPTH ELEV (metres) | DESCRIPTION | STRAT PLOT | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: "N" VALUES | ELEVATION SCALE | SHEAR STRENGTH (kPa): +FIELD VANE △TORVANE ○Qu ▲POCKET PENETROMETER ○Q; DYNAMIC CONE PENETRATION × STANDARD PENETRATION TEST ● | PLASTIC LIMIT $w_P$ / NATURAL MOISTURE CONTENT $w$ / LIQUID LIMIT $w_L$; WATER CONTENT (%) | UNIT WEIGHT kN/m³ | GROUND WATER OBSERVATIONS AND REMARKS; GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL |
|---|---|---|---|---|---|---|---|---|---|---|
| 15.0 | CONTINUED FROM PREVIOUS PAGE | | | | | | 50 100 150 200; 20 40 60 80 | 10 20 30 40 | | |
| 16.1 | DYNAMIC CONE TERMINATED AT 16.1 m | | | | | 304 | | | | |

DRAFT

**NOTES**

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Peto MacCallum Ltd.
CONSULTING ENGINEERS

# LOG OF BOREHOLE NO. S-2

**PROJECT** Brigadoon South Subdivision - Sunvest Reid Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** 11/24/20
**PML REF.** 20KF063B
**ENGINEER** W. Loghrin
**TECHNICIAN** R. Bhavsar

SURFACE ELEVATION 320.21

| DEPTH (metres) | ELEV | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES |
|---|---|---|---|---|---|---|
| 0.0 | | | | | | |
| | 0.51 | TOPSOIL: Dark brown silt, some sand, trace clay, rootlets, moist | | 1 | SS | 3 |
| | 319.70 | SILTY SAND: Loose brown silty sand, trace gravel, trace clay, moist | | 2 | SS | 6 |
| 1.0 | | | | | | |
| | | | | 3 | SS | 5 |
| 2.0 | 2.2 | | | | | |
| | 318.0 | becoming compact | | 4 | SS | 29 |
| 3.0 | 3.0 | | | | | |
| | 317.2 | becoming wet | | 5 | SS | 30 |
| 4.0 | 4.1 | | | | | |
| | 316.1 | SAND: Compact to dense brown sand, some silt, trace to some gravel, wet | | 6 | SS | 30 |
| 5.0 | | | | | | |
| 6.0 | | | | 7 | SS | 35 |
| 7.0 | | | | | | |
| | | | | 8 | SS | 17 |
| 8.0 | 8.7 | | | | | |
| | 311.5 | becoming very dense, occasional wet silt layers | | 9 | SS | 56 |
| 9.0 | | | | | | |
| 10.0 | 10.2 | | | | | |
| | 310.0 | becoming loose | | 10 | SS | 5 |
| 11.0 | 11.3 | | | | | |
| | 308.9 | BOREHOLE TERMINATED at 11.3 m | | | | |
| 12.0 | | | | | | |
| 13.0 | | | | | | |
| 14.0 | | | | | | |
| 15.0 | | | | | | |

ELEVATION SCALE: 320, 319, 318, 317, 316, 315, 314, 313, 312, 311, 310, 309

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Sampler wet from 4.6 m to completion.

Upon Completion of augering, Cave @ 4.9 m, Free water @ 3.1 m.

DRAFT

**NOTES**

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# LOG OF BOREHOLE NO. S-4

**PROJECT** Brigadoon South Subdivision - Sunvest Reid Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** 11/24/20
**PML REF.** 20KF063B
**ENGINEER** W. Loghrin
**TECHNICIAN** R. Bhavsar

| DEPTH (metres) | ELEV | DESCRIPTION | NUMBER | TYPE | "N" VALUES |
|---|---|---|---|---|---|
| | | SURFACE ELEVATION 324.44 | | | |
| 0.0 | 324.44 | TOPSOIL: Dark brown silt, some sand, trace gravel, rootlets, moist | 1A, 1B | SS | 4 |
| 0.31 | 324.13 | SANDY SILT: Loose brown sandy silt, trace gravel, moist | | | |
| 1.00 | 323.44 | SAND: Compact brown sand, trace to some gravel, trace silt, moist | 2 | SS | 6 |
| | | | 3 | SS | 15 |
| 2.2 | 322.2 | becoming dense | 4 | SS | 34 |
| | | | 5 | SS | 48 |
| | | | 6 | SS | 34 |
| | | | 7 | SS | 38 |
| | | | 8 | SS | 33 |
| 8.7 | 315.7 | GRAVELLY SAND: Dense to very dense brown gravelly sand, trace silt, wet | 9 | SS | 38 |
| | | | 10 | SS | 72/280mm |
| 11.3 | 313.1 | BOREHOLE TERMINATED at 11.3 m | | | |

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ● Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $W_P$ | NATURAL MOISTURE CONTENT $W$ | LIQUID LIMIT $W_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Sampler wet from 9.1 m to completion.

Upon Completion of augering,
Cave @ 7.9 m,
Free water @ 7.7 m.

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**NOTES**

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# LOG OF BOREHOLE NO. S-10

**PROJECT** Brigadoon South Subdivision - Sunvest Reid Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** 11/27/20
**PML REF.** 20KF063B
**ENGINEER** W. Loghrin
**TECHNICIAN** R. Bhavsar

| DEPTH (metres) | ELEV | DESCRIPTION | STRAT PLOT | NUMBER | TYPE | "N" VALUES |
|---|---|---|---|---|---|---|
| | | SURFACE ELEVATION 325.70 | | | | |
| 0.15 | 325.55 | TOPSOIL: Dark brown silt, trace sand, trace clay, rootlets, moist | | 1 | SS | 6 |
| 0.97 | | CLAYEY SILT: Stiff brown clayey silt, trace gravel, trace sand, DTPL | | 2 | SS | 12 |
| 2.2 | 324.73 | SILT: Compact brown silt, some sand, trace gravel, trace clay, moist | | 3 | SS | 13 |
| 4.1 | 323.5 | CLAYEY SILT: Stiff to very stiff brown clayey silt, trace gravel, trace sand, DTPL to APL | | 4 | SS | 13 |
| | 321.6 | becoming grey, very stiff to hard | | 5 | SS | 20 |
| | | | | 6 | SS | 22 |
| | | | | 7 | SS | 35 |
| 7.8 | | | | | | |
| 8.2 | 317.9 | SILTY SAND: Dense brown silty sand, trace gravel, trace clay, wet | | 8 | SS | 34 |
| | 317.5 | BOREHOLE TERMINATED at 8.2 m | | | | |

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

ELEVATION SCALE: 325, 324, 323, 322, 321, 320, 319, 318

PLASTIC LIMIT $W_P$ | NATURAL MOISTURE CONTENT $W$ | LIQUID LIMIT $W_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Upon Completion of augering,
No cave,
No free water.

DRAFT

**NOTES**

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# LOG OF BOREHOLE NO. H-7

**PROJECT** Brigadoon South Subdivision - Hallman Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** 11/26/20
**PML REF.** 20KF063A
**ENGINEER** W. Loghrin
**TECHNICIAN** R. Bhavsar

| DEPTH ELEV (metres) | DESCRIPTION | NUMBER | TYPE | "N" VALUES |
|---|---|---|---|---|
| | SURFACE ELEVATION 327.98 | | | |
| 0.20 / 327.78 | TOPSOIL: Dark brown clayey silt, trace sand, rootlets, moist | 1 | SS | 2 |
| 0.69 / 327.29 | CLAYEY SILT: Soft brown clayey silt, trace sand, APL | | | |
| | SILTY SAND: Loose brown silty sand, trace gravel, trace clay, moist | 2 | SS | 7 |
| 1.5 / 326.5 | becoming compact | 3 | SS | 20 |
| | | 4 | SS | 20 |
| 3.0 / 325.0 | becoming dense | 5 | SS | 40 |
| 4.1 / 323.9 | becoming very dense | 6 | SS | 56 |
| | | 7 | SS | 39 |
| | | 8 | SS | 50 |
| 8.2 / 319.8 | BOREHOLE TERMINATED at 8.2 m | | | |

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○ Qu
▲POCKET PENETROMETER ○ Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

ELEVATION SCALE: 327, 326, 325, 324, 323, 322, 321, 320

PLASTIC LIMIT $w_P$ — NATURAL MOISTURE CONTENT $w$ — LIQUID LIMIT $w_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%)
GR SA SI&CL

Upon Completion of augering,
No cave,
No free water.

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**NOTES**

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# LOG OF BOREHOLE NO. H-2

**PROJECT** Brigadoon South Subdivision - Hallman Lands
**LOCATION** Kitchener, Ontario
**BORING METHOD** Continuous Flight Solid Stem Augers
**BORING DATE** 11/25/20
**PML REF.** 20KF063A
**ENGINEER** W. Loghrin
**TECHNICIAN** R. Bhavsar

| DEPTH (metres) | ELEV | DESCRIPTION | NUMBER | TYPE | "N" VALUES |
|---|---|---|---|---|---|
| | | SURFACE ELEVATION 318.80 | | | |
| 0.20 | 318.60 | TOPSOIL: Brown silt, some sand, trace clay, rootlets, moist | 1A / 1B | SS | 1 |
| 0.69 | 318.11 | SILT: Very loose brown silt, trace sand, trace clay, moist to wet | | | |
| 1.5 | 317.3 | CLAYEY SILT: Very stiff brown clayey silt, trace sand, trace gravel, DTPL to APL | 2 | SS | 28 |
| | | becoming soft to stiff, some sand, APL | 3 | SS | 8 |
| | | | 4 | SS | 2 |
| 3.6 | 315.2 | | 5 | SS | 10 |
| 4.1 | | SAND: Brown sand, some silt, trace clay, trace gravel, wet | | | |
| | 314.7 | CLAYEY SILT: Stiff grey clayey silt, some sand, trace gravel, APL to WTPL | 6 | SS | 11 |
| | | | 7 | SS | 11 |
| 8.2 | 310.6 | BOREHOLE TERMINATED at 8.2 m | 8 | SS | 8 |

SHEAR STRENGTH (kPa)
+FIELD VANE △TORVANE ○Qu
▲POCKET PENETROMETER ○Q
50 100 150 200
DYNAMIC CONE PENETRATION ×
STANDARD PENETRATION TEST ●
20 40 60 80

PLASTIC LIMIT $W_P$ — NATURAL MOISTURE CONTENT $W$ — LIQUID LIMIT $W_L$
WATER CONTENT (%)
10 20 30 40

UNIT WEIGHT kN/m³

GROUND WATER OBSERVATIONS AND REMARKS
GRAIN SIZE DISTRIBUTION (%) GR SA SI&CL

Sampler wet from 3.1 m to completion

Upon Completion of augering, Cave @ 6.1 m, Free water @ 4.7 m

***NOTES***

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# LOG OF BOREHOLE No. 1 & 2

JOB NAME: PROPOSED RESIDENTIAL SUBDIVISION — JOB No.: 86 F 423
LOCATION: Biehn Drive, Kitchener, Ontario — BORING DATE: 1986 12 11 & 12 — ENGINEER: G. Mitchell
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: D. Kelly

| DEPTH in METRES | DESCRIPTION | ELEVATION | NUMBER | TYPE | BLOWS/0.3m N-VALUES |
|---|---|---|---|---|---|
| | **BOREHOLE 1** GROUND ELEVATION: 315.19 | | | | |
| 0.45 | TOPSOIL: Dark brown silt, organics, very moist | 315 | 1 | SS | 6 |
| 1.20 | SAND AND GRAVEL: Compact brown fine to medium sand and gravel, little silt, moist | 314 | 2 | SS | 11 |
| 1.5 | SAND: Compact to dense brown fine sand, numerous sandy silt seams, wet to saturated | 313 | 3 | SS | 21 |
| | | | 4 | SS | 44 |
| 3.0 | | 312 | 5 | SS | 38 |
| | | 311 | | | |
| 4.5 4.55 | | | 6 | SS | 25 |
| | BOREHOLE TERMINATED AT 4.55 m | | | | |
| | **BOREHOLE 2** GROUND ELEVATION: 326.83 | | | | |
| 0.3 | TOPSOIL: Dark brown silt, organics, moist | | | | |
| 0.60 | SILT: Very loose brown silt, trace sand, wet | 326 | 1 | SS | 2 |
| 1.5 1.52 | SAND: Loose to compact brown silty fine sand, moist | 325 | 2 | SS | 6 |
| 2.75 | Occasional gravel seams | 324 | 3 | SS | 21 |
| 3.0 | | | 4 | SS | 26 |
| | | 323 | | | |
| 4.5 4.55 | Becoming dense to very dense | 322 | 5 | SS | 53* |
| | | 321 | | | |
| 6.0 6.10 | Occasional silt seams | | 6 | SS | 54 |
| | | 320 | | | |
| 7.5 | | 319 | 7 | SS | 42 |
| | | 318 | | | |
| 9.0 9.15 | | | 8 | SS | 35 |
| | BOREHOLE TERMINATED AT 9.15 m | | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ▲
STANDARD PENETRATION TEST •
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT $W$
$W_P$ — $W$ — $W_L$
WATER CONTENT %: 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling, borehole caved to 0.75 m with no free water

Following Sample 6, sampler wet

Upon completion of drilling, borehole open with no free water

DRAFT

NOTES:
* Sampler overfilled.
Borehole 2: Bulk sample taken from 1.65 to 3.00 m

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# LOG OF BOREHOLE No. 6

JOB NAME PROPOSED RESIDENTIAL SUBDIVISION — JOB No. 86 F 423
LOCATION Biehn Drive, Kitchener, Ontario — BORING DATE 1986 12 15 — ENGINEER G. Mitchell
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN D. Kelly

| DEPTH in METRES | DESCRIPTION | LEGEND | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/0.3m N VALUES |
|---|---|---|---|---|---|---|
| | BOREHOLE 6 | | | | | |
| | GROUND ELEVATION: 331.89 | | | | | |
| 0.10 | TOPSOIL: Dark brown sandy silt, organics, moist | | | 1 | SS | 2 |
| | SAND: Loose to compact brown fine to medium sand, little silt, moist | | 331 | 2 | SS | 7 |
| | | | 330 | 3 | SS | 12 |
| | | | 329 | 4 | SS | 18 |
| | | | | 5 | SS | 16 |
| | | | 328 | | | |
| | | | 327 | 6 | SS | 15 |
| 6.10 | | | 326 | | | |
| | Occasional sandy silt seams and coarse sand seams | | | 7 | SS | 24 |
| | | | 325 | | | |
| | | | 324 | 8 | SS | 23 |
| 9.15 | | | 323 | 9 | SS | 15 |
| | BOREHOLE TERMINATED AT 9.15 m | | | | | |

SHEAR STRENGTH $C_u$ •
DYNAMIC CONE PENETRATION STANDARD PENETRATION TEST ○
BLOWS/0.3m 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT $W$
$W_P$ W $W_L$
WATER CONTENT % 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling, borehole open with no free water

DRAFT

NOTES: Bulk sample taken from 1.50 to 4.50 m

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# LOG OF BOREHOLE No. 11 & 12

JOB NAME: PROPOSED RESIDENTIAL SUBDIVISION — JOB No.: 86 F 423
LOCATION: Biehn Drive, Kitchener, Ontario — BORING DATE: 1986 12 12 — ENGINEER: G. Mitchell
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: D. Kelly

## BOREHOLE 11

GROUND ELEVATION: 312.98

| DEPTH in METRES | DESCRIPTION | ELEVATION | NUMBER | TYPE | BLOWS/0.3m N VALUES | GROUNDWATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|
| 0.55 | TOPSOIL: Black silt, organics, very moist | | 1 | SS | 2 | 43% |
| | SAND: Loose to compact brown fine sand, little silt, occasional silt seams, saturated | 312 | 2 | SS | 18 | Water level at surface |
| | | 311 | 3 | SS | 20 | |
| | | 310 | 4 | SS | 12 | |
| | | 309 | 5 | SS | 19 | |
| 4.55 | | | 6 | SS | 9 | |
| | BOREHOLE TERMINATED AT 4.55 m | | | | | Upon completion of drilling, borehole caved to 0.55 m with water level at surface |

## BOREHOLE 12

GROUND ELEVATION: 313.18

| DEPTH in METRES | DESCRIPTION | ELEVATION | NUMBER | TYPE | BLOWS/0.3m N VALUES | GROUNDWATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|
| | PEAT: Black fibrous peat, saturated | 313 | 1 | SS | 1 | 385% |
| 1.10 | MARL: Grey marl, saturated | 312 | 2 | SS | 2 | 172% |
| 1.60 | SAND: Loose to compact brown fine to medium sand, little silt, saturated | | 3 | SS | 18 | 56% |
| | | 311 | 4 | SS | 13 | Water level at surface |
| | | 310 | 5 | SS | 26 | |
| | | 309 | 6 | SS | 9 | |
| 4.55 | BOREHOLE TERMINATED AT 4.55 m | | | | | Upon completion of drilling, borehole caved to 0.30 m with water level at surface |

SHEAR STRENGTH $C_u$ ●
DYNAMIC CONE PENETRATION ○
STANDARD PENETRATION TEST ●
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT $W_L$
PLASTIC LIMIT $W_P$
WATER CONTENT $W$
$W_P$ W $W_L$
WATER CONTENT %: 10 20 30

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NOTES:
Water samples taken in Borehole 11.

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# LOG OF BOREHOLE No. 33 & 34

JOB NAME PROPOSED RESIDENTIAL SUBDIVISION — JOB No. 86 F 423
LOCATION Biehn Drive, Kitchener, Ontario — BORING DATE 1986 12 14 — ENGINEER G. Mitchell
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN D. Kelly

## BOREHOLE 33

GROUND ELEVATION 321.35

| DEPTH in METRES | DESCRIPTION | ELEVATION | NUMBER | TYPE | BLOWS/0.3m N VALUES |
|---|---|---|---|---|---|
| 0.45 | TOPSOIL: Dark brown sandy silt, organics, moist | 321 | 1 | SS | 7 |
| | SAND: Compact to dense brown fine sand, little silt, very moist to moist | 320 | 2 | SS | 12 |
| | | | 3 | SS | 28 |
| 2.75 | | 319 | 4 | SS | 43 |
| | Becoming very dense fine to medium sand, damp | 318 | 5 | SS | 67* |
| 4.00 | | | | | |
| 4.55 | SILT TILL: Very hard brown clayey silt, little sand and gravel, D.T.P.L. | 317 | 6 | SS | 65* |
| | BOREHOLE TERMINATED AT 4.55 m | | | | |

## BOREHOLE 34

GROUND ELEVATION: 318.79

| DEPTH in METRES | DESCRIPTION | ELEVATION | NUMBER | TYPE | BLOWS/0.3m N VALUES |
|---|---|---|---|---|---|
| 0.60 | TOPSOIL: Dark brown silt, organics, very moist | 318 | 1 | SS | 3 |
| 1.20 | SILT: Loose brown silt, little clay, trace sand, wet | | 2 | SS | 8 |
| | SAND AND GRAVEL: Compact to dense brown fine to coarse sand and gravel, moist to wet | 317 | 3 | SS | 44 |
| 2.70 | | 316 | 4 | SS | 42 |
| 3.25 | Becoming saturated | | 5 | SS | 27 |
| | SAND: Compact to dense grey medium to coarse sand, saturated | 315 | | | |
| 4.55 | | | 6 | SS | 41 |
| | BOREHOLE TERMINATED AT 4.55 m | 314 | | | |

SHEAR STRENGTH $C_u$ ▲
DYNAMIC CONE PENETRATION ○
STANDARD PENETRATION TEST ●
BLOWS/0.3m: 20 40 60 80

LIQUID LIMIT $w_L$
PLASTIC LIMIT $w_P$
WATER CONTENT $w$
$w_P$ ⟡ $w_L$
WATER CONTENT %: 10 20 30

GROUNDWATER OBSERVATIONS AND REMARKS

Upon completion of drilling, borehole open with no free water

Bentonite Seal
Native Backfill
12 mm PVC Pipe
Piezometer Tip

Upon completion of drilling, borehole caved to 2.55 m with no free water

PIEZOMETER READINGS:

1987 01 11: 2.40 m
1987 02 19: 2.90 m

NOTES: * Sampler overfilled.

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# LOG OF BOREHOLE No. 35 & 36

JOB NAME PROPOSED RESIDENTIAL SUBDIVISON — JOB No. 86 F 423
LOCATION Biehn Drive, Kitchener, Ontario — BORING DATE 1986 12 15 — ENGINEER G. Mitchell
BORING METHOD Continuous Flight Solid Stem Augers — TECHNICIAN D. Kelly

| DEPTH in METRES | DESCRIPTION | ELEVATION | SAMPLES NUMBER | SAMPLES TYPE | BLOWS/0.3m N VALUES | SHEAR STRENGTH $C_u$ / DYNAMIC CONE PENETRATION / STANDARD PENETRATION TEST (BLOWS/0.3m: 20, 40, 60, 80) | LIQUID LIMIT $W_L$, PLASTIC LIMIT $W_P$, WATER CONTENT $W$ ($W_P$ — $W$ — $W_L$; WATER CONTENT %: 10, 20, 30) | GROUNDWATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|---|---|
| | BOREHOLE 35<br>GROUND ELEVATION: 323.99 | | | | | | | |
| 0.45 | TOPSOIL: Dark brown sandy silt, organics, moist | | 1 | SS | 5 | | | |
| | SAND: Loose to compact brown fine to medium sand, little gravel, moist to damp | 323 | 2 | SS | 5 | | | |
| 1.5 | | 322 | 3 | SS | 11 | | | |
| 3.0 | | 321 | 4 | SS | 9 | | | |
| | | | 5 | SS | 27 | | | |
| 4.00 | | 320 | | | | | | |
| 4.55 | Becoming very dense | | 6 | SS | 65 | | | |
| | BOREHOLE TERMINATED AT 4.55 m | | | | | | | Upon completion of drilling, borehole caved to 4.00 m with no free water |
| | BOREHOLE 36<br>GROUND ELEVATION: 326.06 | | | | | | | |
| 0.42 | TOPSOIL: Black sandy silt, organics, very moist | | 1 | SS | 7 | | | |
| | SAND: Very loose to compact brown fine sand, little silt, saturated | 325 | 2 | SS | 2 | | | |
| 1.5 | | | | | | | | |
| 2.10 | | 324 | 3 | SS | 8 | | | |
| | Becoming grey with occasional cobbles | | 4 | SS | 54* | | | |
| 3.35 | | 323 | 5 | SS | 24 | | | |
| | SILT: Very stiff grey clayey silt, trace sand, D.T.P.L. | 322 | | | | | | |
| 4.55 | | | 6 | SS | 20 | | | |
| | BOREHOLE TERMINATED AT 4.55 m | | | | | | | Upon completion of drilling, borehole caved to 1.15 m and wet |

NOTES: * Driving on cobble.

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## LOG OF BOREHOLE No. 37 & 38

JOB NAME: PROPOSED RESIDENTIAL SUBDIVISION — JOB No.: 86 F 423
LOCATION: Biehn Drive, Kitchener, Ontario — BORING DATE: 1986 12 12 — ENGINEER: G. Mitchell
BORING METHOD: Continuous Flight Solid Stem Augers — TECHNICIAN: D. Kelly

| DEPTH in METRES | DESCRIPTION | GRAPHIC | ELEVATION | SAMPLES: NUMBER | SAMPLES: TYPE | SAMPLES: BLOWS/0.3m N VALUES | SHEAR STRENGTH $C_u$ ▲ / DYNAMIC CONE PENETRATION + / STANDARD PENETRATION TEST + (BLOWS/0.3m: 20, 40, 60, 80) | LIQUID LIMIT $W_L$ / PLASTIC LIMIT $W_P$ / WATER CONTENT W (WATER CONTENT %: 10, 20, 30) | GROUNDWATER OBSERVATIONS AND REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| | **BOREHOLE 37**<br>GROUND ELEVATION: 314.79 | | | | | | | | |
| 0.45 | TOPSOIL: Dark brown silt, organics, very moist | | | 1 | SS | 2 | | | Water level at surface |
| | SILT: Compact brown sandy silt, saturated | | 314 | 2 | SS | 12 | | | |
| 1.5 1.50 | SAND: Compact to dense brown fine sand, occasional coarse sand seams, saturated | | 313 | 3 | SS | 26 | | | |
| 3.0 | | | 312 | 4 | SS | 33 | | | |
| | | | | 5 | SS | 28 | | | |
| 3.65 | Becoming grey fine to coarse sand | | 311 | | | | | | |
| 4.5 4.55 | | | | 6 | SS | 27 | | | |
| | BOREHOLE TERMINATED AT 4.55 m | | 310 | | | | | | Upon completion of drilling, borehole caved to 1.35 m with no free water |
| 6.0 | | | | | | | | | |
| | **BOREHOLE 38**<br>GROUND ELEVATION: 317.13 | | | | | | | | |
| 0.0 | | | | | | | | | |
| 0.60 | TOPSOIL: Dark brown to black silt, organics, very moist | | | 1 | SS | 4 | | | |
| | SILT: Loose to compact brown sandy silt, trace clay, very moist to saturated | | 316 | 2 | SS | 12 | | | |
| 1.5 | | | | 3 | SS | 8 | | | |
| | | | 315 | | | | | | |
| 3.0 3.00 | | | | 4 | SS | 3 | | | |
| | SAND: Loose brown fine sand, little silt, saturated | | 314 | 5 | SS | 2 | | | |
| | | | 313 | | | | | | |
| 4.5 4.55 | | | | 6 | SS | 10 | | | |
| | BOREHOLE TERMINATED AT 4.55 m | | | | | | | | Upon completion of drilling, borehole caved to 3.00 m with no free water<br>Wet at 3.00 m |
| 6.0 | | | | | | | | | |

DRAFT

NOTES

CHECKED BY: gh



MEMBER OF THE ASSOCIATION OF CONSULTING ENGINEERS OF CANADA

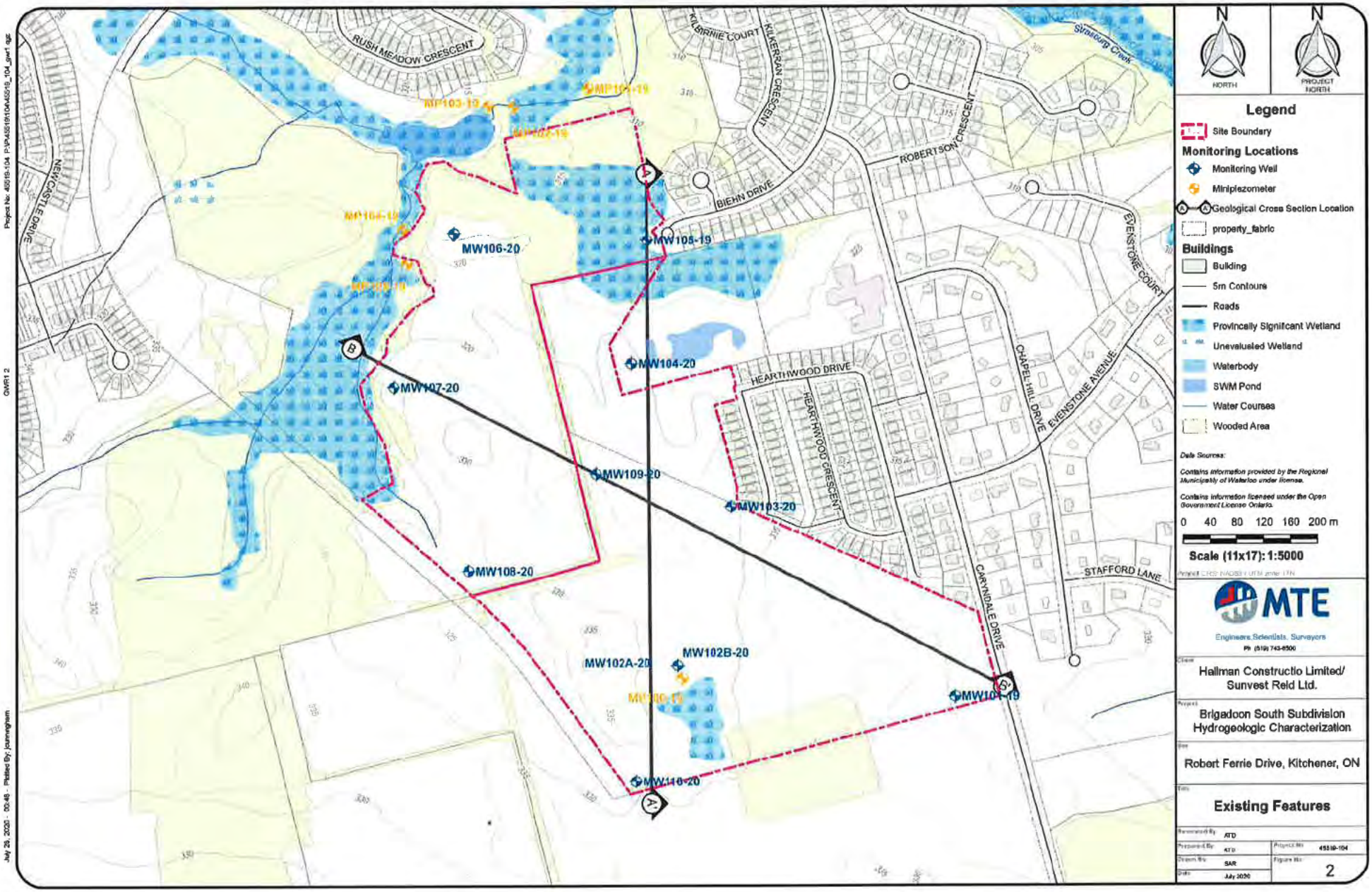
DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A



# Appendix C

# Borehole Logs (MTE Consultants)

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A



DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

**Table 1: Manual Water Levels**

| ID | MW101-19 | | MW102A-20 | | MW102B-20 | | MW103-20 | | MW104-20 | | MW105-19 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOC Elevation (mAMSL) | 334.27 | | 327.65 | | 327.01 | | 326.17 | | 322.15 | | 344.09 | |
| GS Elevation (mAMSL) | 333.48 | | 326.80 | | 326.21 | | 325.37 | | 321.58 | | 343.15 | |
| Date | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs |
| 10-Dec-19 | 16.57 | 15.64 | NI | - | NI | - | NI | - | NI | - | NI | #VALUE! |
| 4-Feb-20 | 16.61 | 15.68 | 9.79 | 8.76 | 2.96 | 2.02 | 10.60 | 9.60 | 6.09 | 5.01 | 1.55 | 0.61 |
| 11-Feb-20 | 16.51 | 15.58 | 9.80 | 8.77 | 2.96 | 2.02 | 10.57 | 9.57 | 6.09 | 5.01 | 1.60 | 0.66 |
| 2-Jun-20 | 16.27 | 15.34 | 9.67 | 8.63 | 2.94 | 2.00 | 10.46 | 9.46 | 6.09 | 5.01 | 1.67 | 0.73 |
| 1-Sep-20 | 16.68 | 15.75 | 10.04 | 9.01 | 4.60 | 3.65 | 10.77 | 9.77 | 6.44 | 5.36 | 1.89 | 0.95 |
| 27-Nov-20 | 17.03 | 16.10 | 10.40 | 9.37 | 5.09 | 4.15 | 11.14 | 10.14 | 6.68 | 5.60 | 1.99 | 0.85 |
| 5-Mar-21 | 17.28 | 16.35 | 10.81 | 9.58 | 4.55 | 3.60 | 11.34 | 10.34 | 6.80 | 5.72 | 1.64 | 0.70 |
| 3-Jun-21 | 17.26 | 16.33 | 10.60 | 9.57 | 4.04 | 3.10 | 11.36 | 10.36 | 6.80 | 5.72 | 1.79 | 0.85 |
| 10-Sep-21 | 17.55 | 16.62 | 10.81 | 9.78 | dry | | 11.57 | 10.57 | 7.02 | 5.94 | 1.82 | 0.88 |
| 17-Nov-21 | 17.48 | 16.55 | 10.81 | 9.78 | 4.66 | 3.72 | 11.55 | 10.55 | 6.93 | 5.85 | 1.65 | 0.71 |

| ID | MW106-20 | | MW107-20 | | MW108-20 | | MW109-20 | | MW110-20 | |
|---|---|---|---|---|---|---|---|---|---|---|
| TOC Elevation (mAMSL) | 331.08 | | 324.12 | | 324.02 | | 324.08 | | 320.43 | |
| GS Elevation (mAMSL) | 330.30 | | 323.29 | | 323.18 | | 323.06 | | 319.60 | |
| Date | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs |
| 10-Dec-19 | NI | - | NI | - | NI | - | NI | - | NI | - |
| 4-Feb-20 | 5.46 | 4.28 | 7.51 | 6.43 | 5.71 | 4.64 | 6.77 | 5.78 | 5.13 | 4.31 |
| 11-Feb-20 | 5.48 | 4.30 | 7.50 | 6.42 | damaged | | 6.76 | 5.77 | 5.12 | 4.30 |
| 2-Jun-20 | 5.50 | 4.32 | 7.48 | 6.40 | 5.98 | 4.91 | 6.70 | 5.71 | 5.24 | 4.42 |
| 1-Sep-20 | 5.62 | 4.44 | 7.78 | 6.70 | 6.40 | 5.33 | 7.03 | 6.04 | 5.84 | 5.02 |
| 27-Nov-20 | 5.53 | 4.35 | 8.05 | 6.97 | 6.60 | 5.73 | 7.35 | 6.36 | 6.24 | 5.42 |
| 5-Mar-21 | 5.55 | 4.37 | 8.19 | 7.11 | 6.93 | 5.86 | 7.51 | 6.52 | 6.28 | 5.46 |
| 3-Jun-21 | 5.59 | 4.41 | 8.18 | 7.10 | 6.86 | 5.79 | 7.50 | 6.51 | 6.07 | 5.25 |
| 10-Sep-21 | 5.65 | 4.47 | 8.37 | 7.29 | 7.16 | 6.09 | 7.71 | 6.72 | 6.50 | 5.68 |
| 17-Nov-21 | 5.59 | 4.41 | 8.33 | 7.25 | 7.09 | 6.02 | 7.69 | 6.70 | 6.34 | 5.52 |

| ID | MP101-19 - in | | MP101-19 - out | | MP102-19 | | MP102-19 - out | | MP103-19 | | MP103-19 - out | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOC Elevation (mAMSL) | | | | | 330.43 | | 330.40 | | 332.19 | | 331.79 | |
| GS Elevation (mAMSL) | - | | - | | 329.27 | | | | 331.40 | | | |
| Date | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs |
| 10-Dec-19 | 1.09 | -0.01 | 1.04 | -0.06 | 1.51 | 0.35 | 0.93 | -0.23 | 1.56 | 0.29 | 0.91 | -0.36 |
| 4-Feb-20 | - | - | - | - | - | - | - | - | - | - | - | - |
| 11-Feb-20 | 1.10 | 0.00 | 1.10 | 0.00 | 0.90 | -0.26 | 0.97 | -0.19 | 1.07 | -0.20 | frozen | - |
| 2-Jun-20 | destroyed | | destroyed | | 0.92 | -0.25 | 0.98 | -0.18 | 1.11 | -0.16 | 0.92 | -0.36 |
| 1-Sep-20 | destroyed | | destroyed | | 0.98 | -0.18 | 1.00 | -0.16 | 1.41 | 0.13 | 0.92 | -0.35 |
| 27-Nov-20 | destroyed | | destroyed | | 0.86 | -0.30 | 0.95 | -0.21 | 1.15 | -0.12 | 0.91 | -0.36 |
| 5-Mar-21 | destroyed | | destroyed | | 0.91 | -0.25 | 0.95 | -0.21 | 1.05 | -0.22 | frozen | |
| 3-Jun-21 | destroyed | | destroyed | | 0.95 | -0.21 | 0.99 | -0.17 | 1.13 | -0.14 | 0.90 | -0.37 |
| 10-Sep-21 | destroyed | | destroyed | | 0.93 | -0.23 | 0.97 | -0.19 | 0.78 | -0.49 | 0.47 | -0.80 |
| 17-Nov-21 | destroyed | | destroyed | | 0.84 | -0.32 | 0.94 | -0.22 | 0.78 | -0.49 | 0.55 | -0.72 |

| ID | MP104-19 | | MP104-19 - out | | MP105-19 | | MP105-19 - out | | MP106-19 | | MP106-19 - out | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOC Elevation (mAMSL) | 324.27 | | 324.27 | | 344.91 | | 345.04 | | 327.19 | | 327.19 | |
| GS Elevation (mAMSL) | 323.47 | | | | 343.97 | | | | 326.40 | | | |
| Date | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs | mbtoc | mbgs |
| 10-Dec-19 | 0.82 | -0.40 | 1.02 | -0.20 | 2.00 | 0.76 | 1.13 | -0.11 | 1.72 | 0.82 | 0.98 | -0.12 |
| 4-Feb-20 | - | - | - | - | - | - | - | - | - | - | - | - |
| 11-Feb-20 | 0.84 | -0.38 | 1.10 | -0.12 | frozen | | frozen | | frozen | | frozen | |
| 2-Jun-20 | 0.84 | -0.39 | 1.07 | -0.15 | 1.30 | 0.06 | 1.16 | -0.06 | 0.82 | -0.29 | 0.82 | -0.28 |
| 1-Sep-20 | 0.88 | -0.34 | 1.09 | -0.13 | 1.45 | 0.21 | dry | - | 1.75 | 0.65 | dry | |
| 27-Nov-20 | 0.82 | -0.40 | 1.01 | -0.21 | 1.14 | -0.10 | 1.16 | -0.08 | 1.66 | 0.56 | dry | |
| 5-Mar-21 | frozen | | 1.05 | -0.16 | frozen | | dry | | 1.71 | 0.61 | dry | |
| 3-Jun-21 | 0.86 | -0.36 | 1.07 | -0.15 | 1.25 | 0.01 | dry | | 1.69 | 0.59 | dry | |
| 10-Sep-21 | 0.89 | -0.33 | 1.08 | -0.14 | 1.24 | 0.00 | dry | | 1.76 | 0.66 | dry | |
| 17-Nov-21 | 0.85 | -0.37 | 1.05 | -0.16 | 1.15 | -0.09 | 1.16 | - | dry | | dry | |

***Notes:***
NM = not measured
NI = not installed
TOC = top of casing
GS = ground surface
N/A = not applicable
- in = groundwater level measured inside mini-piezometer
- out = surface water level measured outside mini-piezometer
mAMSL = meters above mean sea level
mbtoc = meters below top of casing
Monitoring well TOC and Ground Surface elevations surveyed May, 2020

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## Table 2: Manual Water Elevations

| ID | MW101-19 | MW102A-20 | MW102B-20 | MW103-20 | MW104-20 | MW105-19 | MW106-20 | MW107-20 | MW108-20 | MW109-20 | MW110-20 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOC Elevation (mAMSL) | 334.27 | 327.85 | 327.00 | 328.17 | 322.59 | 314.09 | 319.08 | 324.32 | 324.02 | 324.08 | 330.32 |
| GS Elevation (mAMSL) | 333.34 | 326.62 | 326.71 | 327.17 | 321.48 | 313.15 | 317.90 | 323.25 | 322.95 | 323.09 | 329.50 |
| 10-Dec-19 | 317.70 | NI | NI | NI | NI | NI | NI | NI | NI | NI | NI |
| 4-Feb-20 | 317.66 | 317.86 | 324.70 | 317.57 | 316.47 | 312.54 | 313.62 | 316.81 | 318.31 | 317.31 | 325.19 |
| 11-Feb-20 | 317.76 | 317.85 | 324.70 | 317.60 | 316.47 | 312.49 | 313.60 | 316.82 | NM | 317.32 | 325.20 |
| 2-Jun-20 | 318.00 | 317.98 | 324.72 | 317.71 | 316.47 | 312.42 | 313.58 | 316.84 | 318.04 | 317.38 | 325.08 |
| 1-Sep-20 | 317.59 | 317.61 | 323.06 | 317.40 | 316.12 | 312.20 | 313.46 | 316.55 | 317.62 | 317.05 | 324.48 |
| 27-Nov-20 | 317.24 | 317.25 | 322.57 | 317.03 | 315.88 | 312.50 | 313.55 | 316.27 | 317.22 | 316.73 | 324.08 |
| 5-Mar-21 | 316.99 | 317.04 | 323.11 | 316.83 | 315.76 | 312.45 | 313.53 | 316.13 | 317.09 | 316.57 | 324.04 |
| 3-Jun-21 | 317.01 | 317.05 | 323.62 | 316.81 | 315.76 | 312.30 | 313.49 | 316.14 | 317.16 | 316.58 | 324.25 |
| 10-Sep-21 | 316.72 | 316.84 | dry | 316.60 | 315.54 | 312.27 | 313.43 | 315.95 | 316.86 | 316.37 | 323.82 |
| 17-Nov-21 | 316.79 | 316.84 | 323.00 | 316.62 | 315.63 | 312.44 | 313.49 | 315.99 | 316.93 | 316.39 | 323.98 |

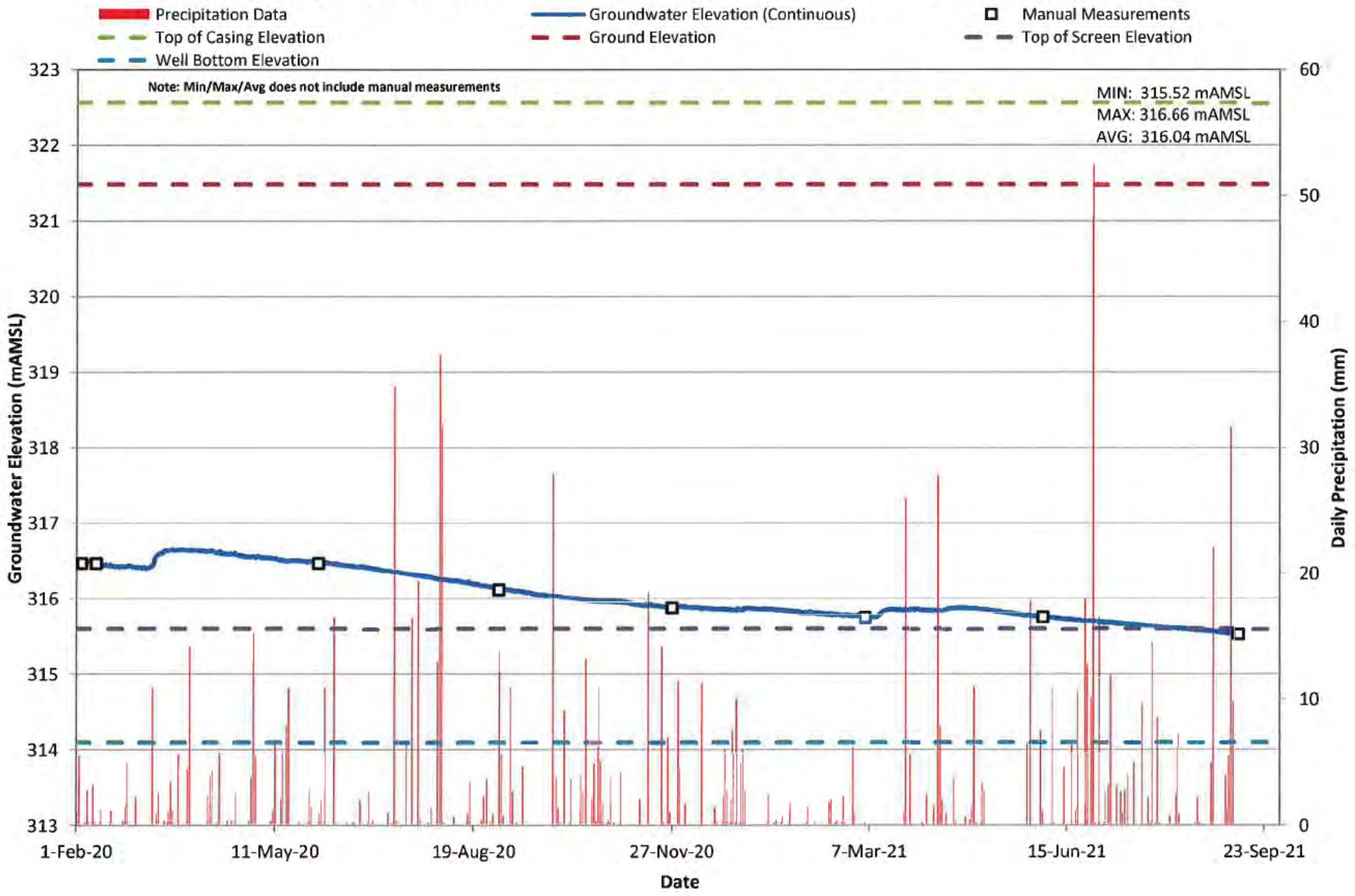
| ID | MP101-19-in | MP101-19-out | MP102-19-in | MP102-20-out | MP103-19-in | MP103-19-out | MP104-19-in | MP104-19-out | MP105-19-in | MP105-19-out | MP106-19-in | MP106-19-out |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOC Elevation (mAMSL) | 0.00 | 0.00 | 310.43 | 310.43 | 313.18 | 313.18 | 314.27 | 314.27 | 314.91 | 314.91 | 327.18 | 327.18 |
| GS Elevation (mAMSL) | 0.00 | - | 309.27 | - | 311.89 | - | 313.05 | - | 313.67 | - | 326.09 | - |
| 10-Dec-19 | -1.09 | -1.04 | 308.92 | 309.50 | 311.60 | 312.25 | 313.45 | 313.25 | 312.91 | 313.78 | 325.47 | 326.21 |
| 4-Feb-20 | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM | NM |
| 11-Feb-20 | -1.10 | -1.10 | 309.53 | 309.46 | 312.09 | Frozen | 313.43 | 313.17 | Frozen | Frozen | Frozen | Frozen |
| 2-Jun-20 | Destroyed | | 309.52 | 309.45 | 312.05 | 312.25 | 313.43 | 313.20 | 313.61 | 313.73 | 326.38 | 326.37 |
| 10-Sep-21 | Destroyed | | 309.45 | 309.43 | 311.76 | 312.24 | 313.39 | 313.18 | 313.46 | dry | 325.44 | dry |
| 27-Nov-20 | Destroyed | | 309.57 | 309.48 | 312.01 | 312.25 | 313.45 | 313.26 | 313.77 | 313.75 | 325.53 | dry |
| 5-Mar-21 | Destroyed | | 309.52 | 309.48 | 312.11 | frozen | frozen | 313.21 | frozen | dry | 325.48 | dry |
| 3-Jun-21 | Destroyed | | 309.48 | 309.44 | 312.03 | 312.26 | 313.41 | 313.20 | 313.66 | dry | 325.50 | dry |
| 10-Sep-21 | Destroyed | | 309.50 | 309.46 | 312.38 | 312.69 | 313.38 | 313.19 | 313.67 | dry | 325.43 | dry |
| 17-Nov-21 | Destroyed | | 309.57 | 309.48 | 312.01 | 312.25 | 313.45 | 313.26 | 313.77 | 313.75 | 325.53 | dry |

***Notes:***
NM = not measured
NI = not installed
TOC = top of casing
GS = ground surface
- in = groundwater level measured inside mini-piezometer
- out = surface water level measured outside mini-piezometer

mAMSL = meters above mean sea level
mbtoc = meters below top of casing
Monitoring well TOC and Ground Surface elevations surveyed May, 2020

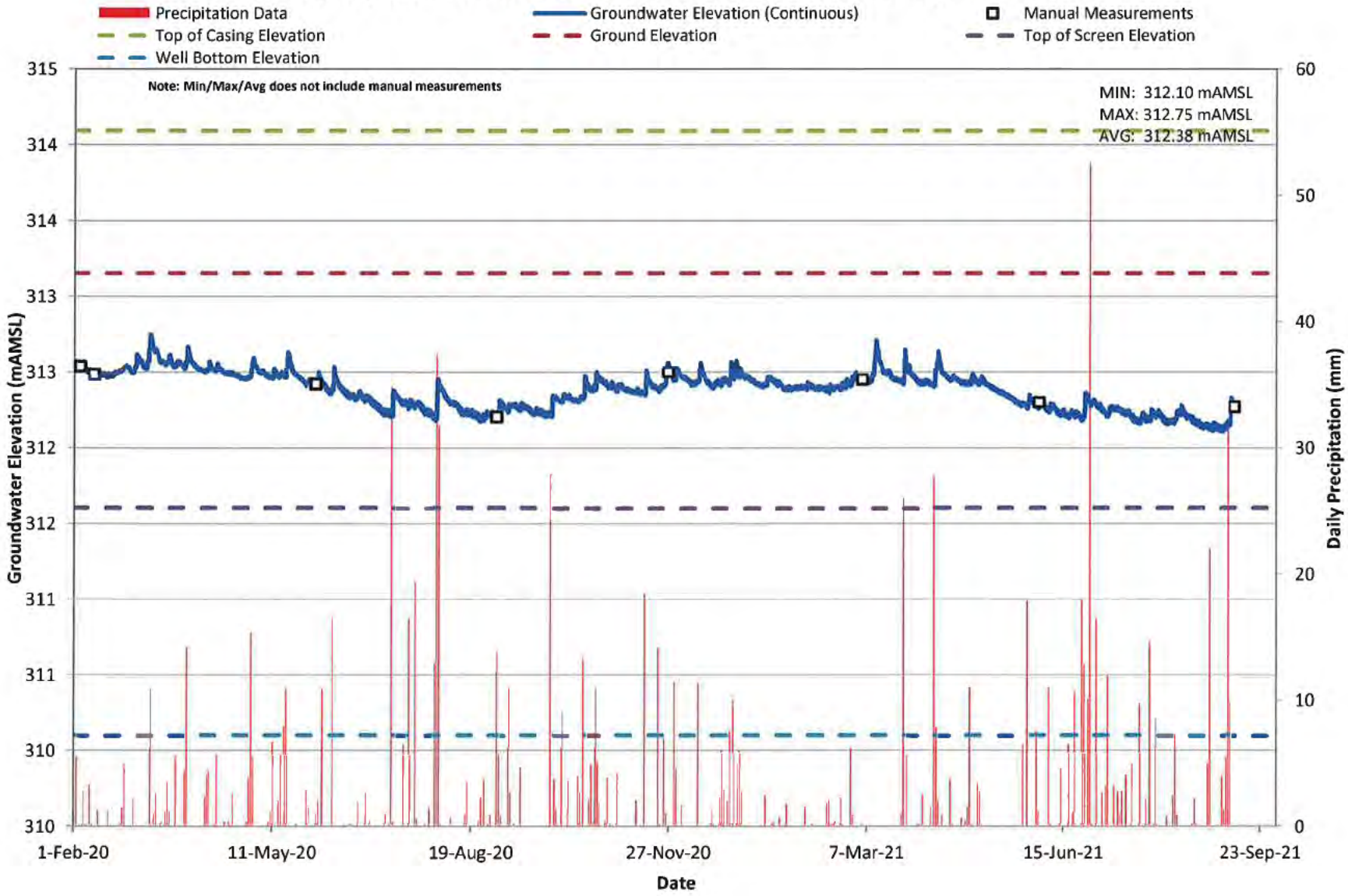
DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

# Hydrograph 5: Groundwater Elevations (mAMSL) - MW104-20



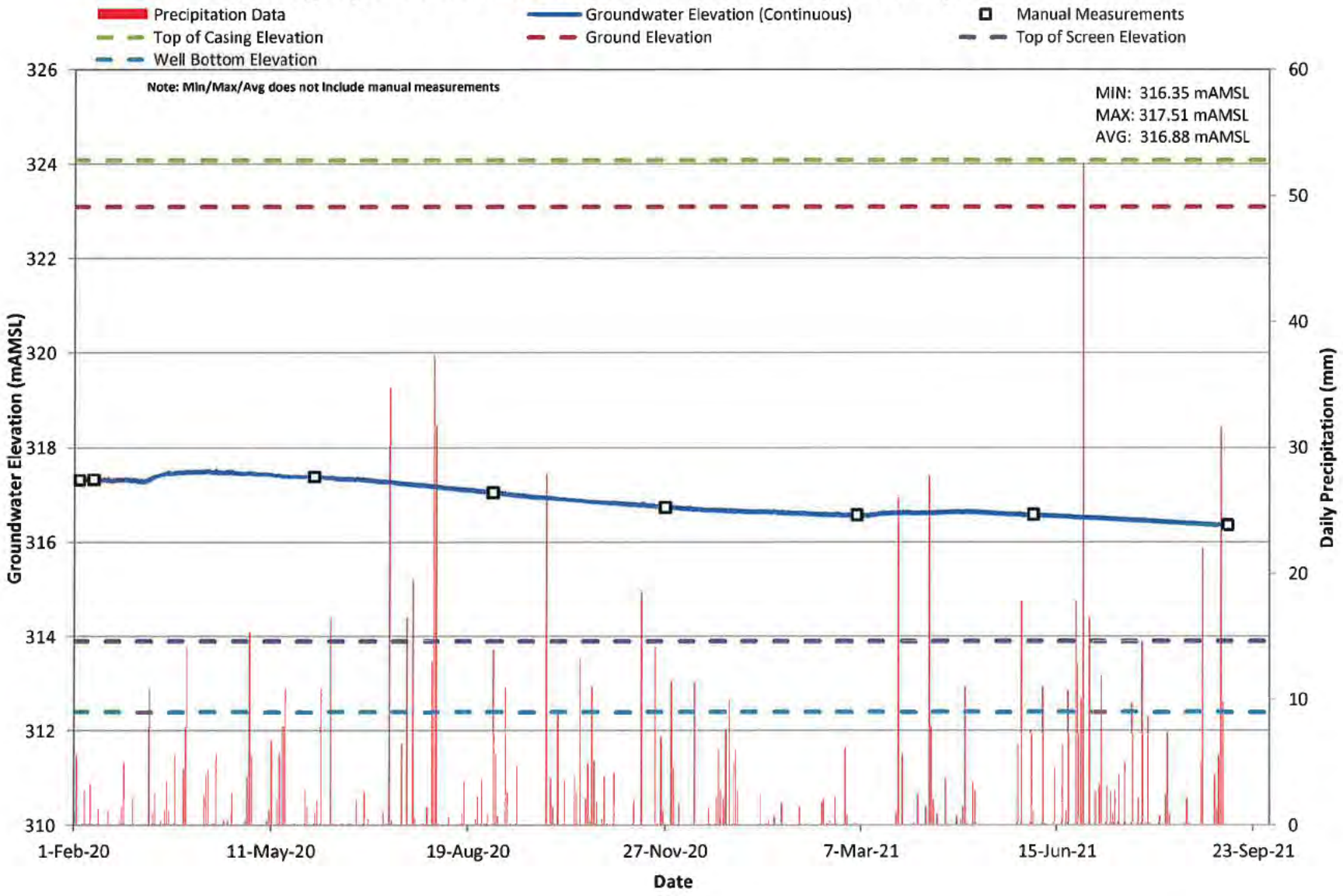
DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

# Hydrograph 6: Groundwater Elevations (mAMSL) - MW105-19



DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

# Hydrograph 10: Groundwater Elevations (mAMSL) - MW109-20



DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

## ID Number: MW104-20

**Project Name:** Brigadoon South

**Project No:** 45519-104

**Client:** Sunvest/Reid Ltd.

**Site Location:** Kitchener, Ontario

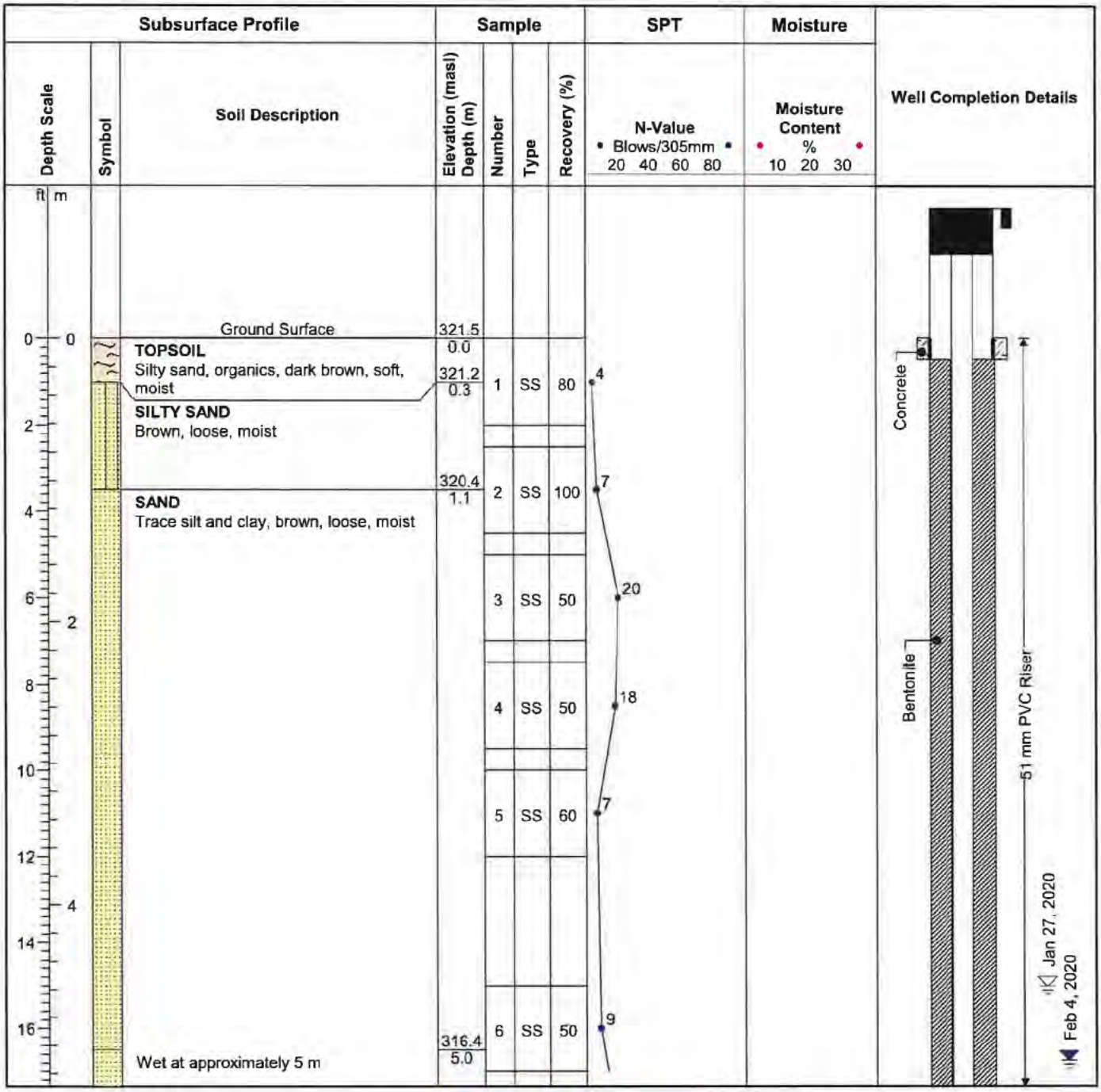
**Date Completed:** 1/27/2020

**Drilling Contractor:** Geo-Environmental

**Drill Rig:** CME M75-3

**Drill Method:** Hollow Stem Auger

**Protective Cover:** Monument




**Field Technician:** KNR

**Drafted by:** KNR

**Reviewed by:**

MTE

MOE Well Tag: A287241
Easting: 543796
Northing: 4803568

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

## ID Number: MW104-20

**Project Name:** Brigadoon South

**Project No:** 45519-104

**Client:** Sunvest/Reid Ltd.

**Site Location:** Kitchener, Ontario

**Date Completed:** 1/27/2020

**Drilling Contractor:** Geo-Environmental

**Drill Rig:** CME M75-3

**Drill Method:** Hollow Stem Auger

**Protective Cover:** Monument

| Subsurface Profile | | | Sample | | | | SPT | Moisture | |
|---|---|---|---|---|---|---|---|---|---|
| Depth Scale | Symbol | Soil Description | Elevation (masl) / Depth (m) | Number | Type | Recovery (%) | N-Value • Blows/305mm • 20 40 60 80 | Moisture Content % 10 20 30 | Well Completion Details |
| 18 | | | | | | | | | |
| 20 (6) | | | | 7 | SS | 100 | 31 | | |
| 22 | | | | | | | | | |
| 24 | | | | | | | | | |
| 26 (8) | | | | 8 | SS | 100 | 38 | | |
| | | | 313.2 / 8.2 | | | | | | |
| | | Drilling Terminated | | | | | | | |
| 28 | | | | | | | | | |
| 30 | | | | | | | | | |
| 32 | | | | | | | | | |
| 34 (10) | | | | | | | | | |
| 36 | | | | | | | | | |

Sand Pack

51mm Slotted Screen

**Field Technician:** KNR

**Drafted by:** KNR

**Reviewed by:**

MTE

MOE Well Tag: A287241
Easting: 543796
Northing: 4803568

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

## ID Number: MW105-19

**Project Name:** Brigadoon South

**Project No:** 45519-104

**Client:** Hallman Construction Ltd.

**Site Location:** Kitchener, Ontario

**Date Completed:** 12/2/2019

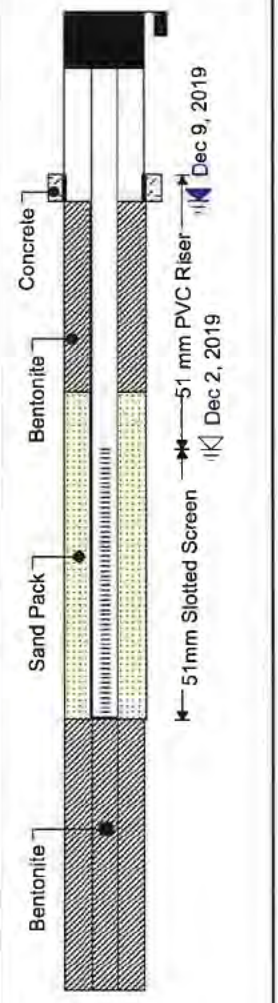
**Drilling Contractor:** Geo-Environmental

**Drill Rig:** CME M75-3

**Drill Method:** Hollow Stem Auger

**Protective Cover:** Monument

| Depth Scale (ft / m) | Symbol | Soil Description | Elevation (masl) / Depth (m) | Sample Number | Type | Recovery (%) | SPT N-Value (Blows/305mm) | Moisture Content (%) | Well Completion Details |
|---|---|---|---|---|---|---|---|---|---|
| | | Ground Surface | 313.2 | | | | | | |
| 0 / 0 | | **TOPSOIL** Silty sand, dark brown, loose, moist | 0.0 | | | | | | |
| | | **SAND** Brown, loose, moist | | 1 | SS | 25 | 8 | | |
| 2 | | | 312.2 | | | | | | |
| | | **SILTY SAND** Trace clay, brown, moist, loose | 0.9 | 2 | SS | 50 | 17 | | |
| 4 | | | 311.6 | | | | | | |
| | | Wet at approximately 1.5 m | 1.5 | 3 | SS | 90 | 12 | | |
| 6 / 2 | | | | | | | | | |
| 8 | | | | 4 | SS | 100 | 7 | | |
| 10 | | | 309.8 | | | | | | |
| | | **CLAYEY SILT** Trace sand, brown, soft, moist | 3.4 | 5 | SS | 100 | 7 | | |
| 12 | | | 309.3 | | | | | | |
| 4 | | **SAND** Brown, loose, wet | 3.8 | 6 | SS | 25 | 0 | | |
| 14 | | | 308.6 | | | | | | |
| | | Drilling Terminated | 4.6 | | | | | | |
| 16 | | | | | | | | | |




**Field Technician:** KNR

**Drafted by:** KNR

**Reviewed by:**

MTE

MOE Well Tag #A279204
Easting: 543819
Northing: 4803753

**Sheet:** 1 of 1

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

## ID Number: MW108-20

**Project Name:** Brigadoon South

**Project No:** 45519-104

**Client:** Hallman Construction Ltd.

**Site Location:** Kitchener, Ontario

**Date Completed:** 2/27/2020

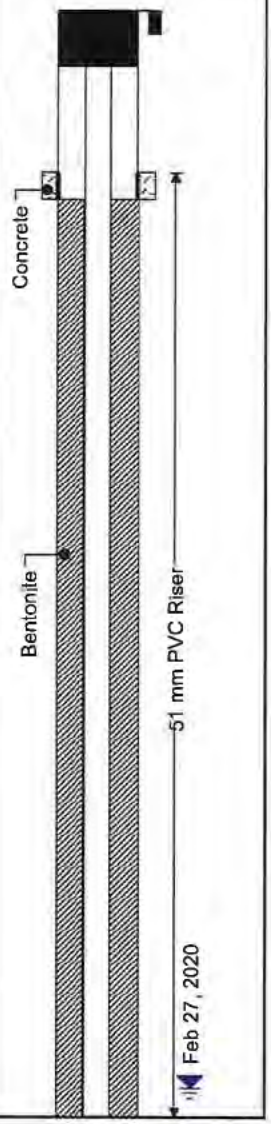
**Drilling Contractor:** Geo-Environmental

**Drill Rig:** CME M75-3

**Drill Method:** Hollow Stem Auger

**Protective Cover:** Monument

| Depth Scale (ft / m) | Symbol | Soil Description | Elevation (masl) / Depth (m) | Sample Number | Sample Type | Recovery (%) | SPT N-Value (Blows/305mm) | Moisture Content (%) | Well Completion Details |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | | Ground Surface | 323.0 | | | | | | |
| | | **TOPSOIL** Silty sand, organics, black, loose, moist | 0.0 | | | | | | |
| 2 / | | **SILTY SAND** Trace clay, brown, loose, moist | | 1 | SS | 50 | 7 | | |
| 4 / | | | | 2 | SS | 50 | 6 | | |
| 6 / 2 | | | | 3 | SS | 75 | 15 | | |
| 8 / | | | | 4 | SS | 75 | 14 | | |
| 10 / | | | | 5 | SS | 75 | 15 | | |
| 12 / 4 | | | | | | | | | |
| 14 / | | Wet at approximately 4.6 m | 318.4 / 4.6 | | | | | | |
| 16 / | | | | 6 | SS | 75 | 16 | | |




**Field Technician:** KNR

**Drafted by:** KNR

**Reviewed by:**

MTE

MOE Well Tag: A287234
Easting: 543553
Northing: 4803257

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

## ID Number: MW108-20

**Project Name:** Brigadoon South

**Project No:** 45519-104

**Client:** Hallman Construction Ltd.

**Site Location:** Kitchener, Ontario

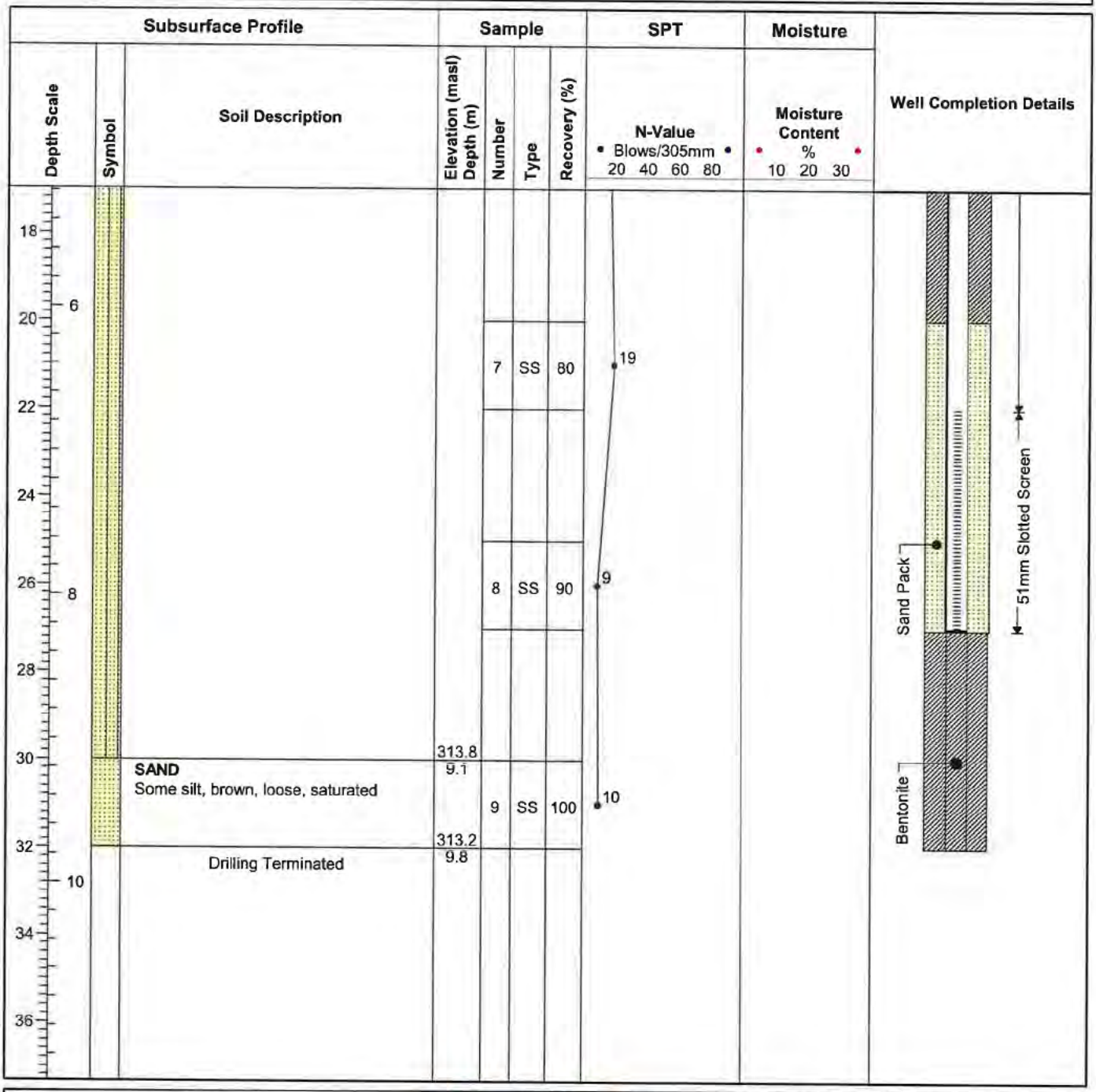
**Date Completed:** 2/27/2020

**Drilling Contractor:** Geo-Environmental

**Drill Rig:** CME M75-3

**Drill Method:** Hollow Stem Auger

**Protective Cover:** Monument




**Field Technician:** KNR

**Drafted by:** KNR

**Reviewed by:**

MTE

MOE Well Tag: A287234
Easting: 543553
Northing: 4803257

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

## ID Number: MW109-20

**Project Name:** Brigadoon South
**Project No:** 45519-104
**Client:** Sunvest/Reid Ltd.
**Site Location:** Kitchener, Ontario

**Date Completed:** 1/27/2020
**Drilling Contractor:** Geo-Environmental
**Drill Rig:** CME M75-3
**Drill Method:** Hollow Stem Auger
**Protective Cover:** Monument

| Depth Scale (ft / m) | Symbol | Soil Description | Elevation (masl) / Depth (m) | Sample Number | Sample Type | Recovery (%) | SPT N-Value (Blows/305mm) | Moisture Content (%) | Well Completion Details |
|---|---|---|---|---|---|---|---|---|---|
| 0 / 0 | | Ground Surface | 323.1 | | | | | | |
| | | **TOPSOIL** Silty sand, black, loose, moist | 0.0 | | | | | | |
| | | **SILTY SAND** Some clay, brown, soft, moist | | 1 | SS | 25 | 7 | | |
| 2 | | | | 2 | SS | 80 | 6 | | |
| 4 | | | 321.6 | | | | | | |
| | | **CLAYEY SILT** Trace sand, brown, soft, loose, wet | 1.5 | 3 | SS | 90 | 18 | | |
| 6 / 2 | | | 320.8 | | | | | | |
| 8 | | **SILTY SAND** Trace clay, brown, compact, moist | 2.3 | 4 | SS | 100 | 18 | | |
| 10 | | | | 5 | SS | 100 | 21 | | |
| 12 / 4 | | | | | | | | | |
| 14 | | | 318.5 | | | | | | |
| | | **CLAYEY SILT** Trace sand, grey, compact, moist | 4.6 | 6 | SS | 80 | 18 | | |
| 16 | | | | | | | | | |
| 18 | | | | | | | | | |

Concrete
Bentonite
51 mm PVC Riser
Jan 27, 2020

**Field Technician:** KNR
**Drafted by:** KNR
**Reviewed by:**

MTE

MOE Well Tag: A246045
Easting: 543743
Northing: 4803402

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

# ID Number: MW109-20

**Project Name:** Brigadoon South

**Project No:** 45519-104

**Client:** Sunvest/Reid Ltd.

**Site Location:** Kitchener, Ontario

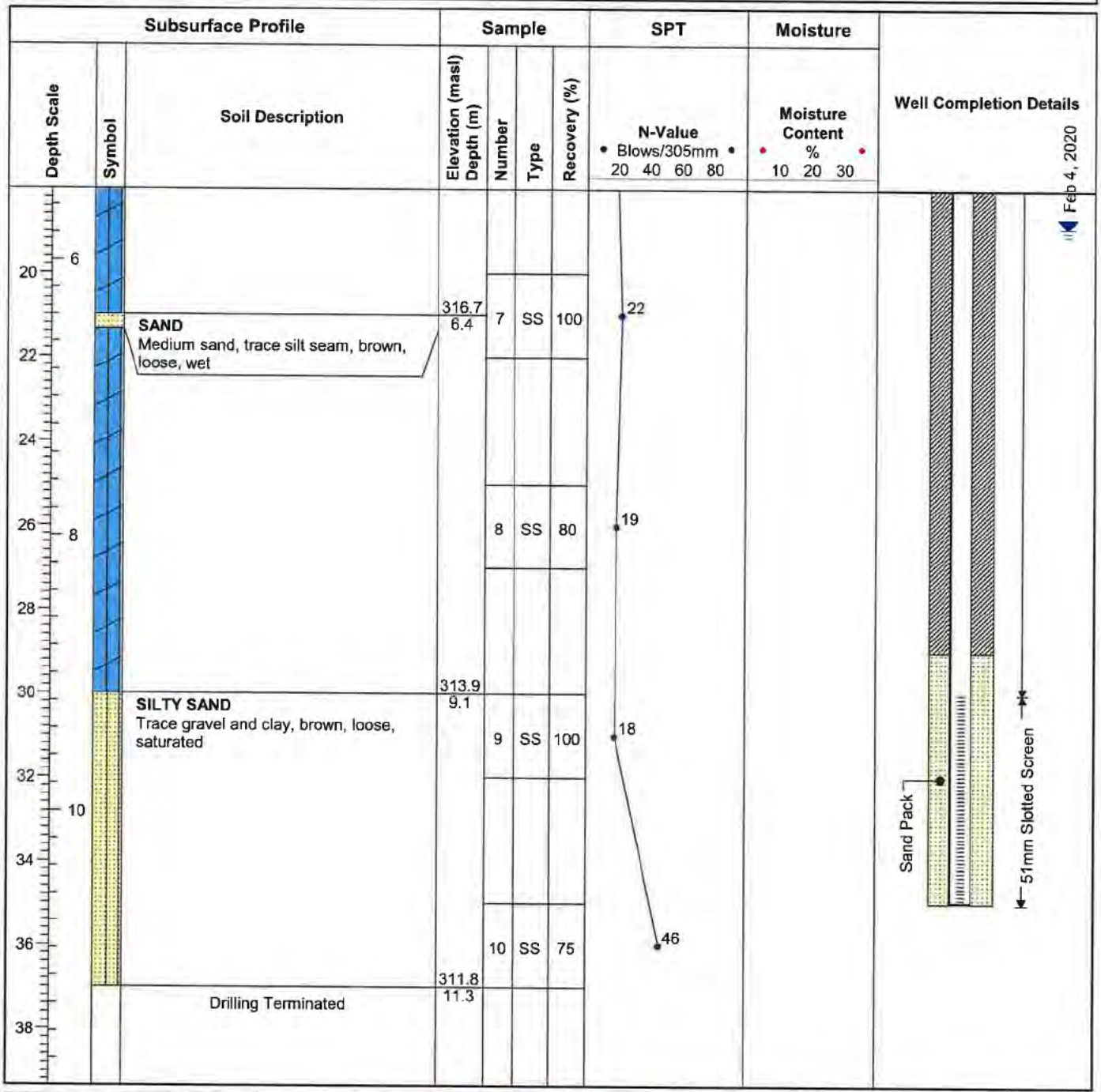
**Date Completed:** 1/27/2020

**Drilling Contractor:** Geo-Environmental

**Drill Rig:** CME M75-3

**Drill Method:** Hollow Stem Auger

**Protective Cover:** Monument




**Field Technician:** KNR

**Drafted by:** KNR

**Reviewed by:**

MTE

MOE Well Tag: A246045
Easting: 543743
Northing: 4803402

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A



# Appendix D

# Borehole Logs (Cambium)

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# HYDROGEOLOGICAL ASSESSMENT

CITY OF KITCHENER
Biehn Drive
Kitchener, Ontario

**LEGEND**

- Borehole
- Cross Section
- Site (approximate)

**Notes:**
- Base mapping features are © Queen's Printer of Ontario, 2019 (this does not constitute an endorsement by the Ministry of Natural Resources or the Ontario Government).
- Distances on this plan are in metres and can be converted to feet by dividing by 0.3048.
- Cambium Inc. makes every effort to ensure this map is free from errors but cannot be held responsible for any damages due to error or omissions. This map should not be used for navigation or legal purposes. It is intended for general reference use only.

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194 Sophia Street
Peterborough, Ontario, K9H 1E5
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## LINEAR INFRASTRUCTURE EXCAVATION AREA

| | | | |
|---|---|---|---|
| Project No.: 11969-001 | | Date: February 2022<br>Rev.: | |
| Scale: 1:3,000 | | Projection: NAD 1983 UTM Zone 17N | |
| Created by: ACS | Checked by: SK | Figure: | 4 |

O:\GIS\MXD\11969\11969-001 City of Kitchener - Hydrogeological Assessment - geological Assessment, Kitchener\2022-01-31 FIG 4 - Linear Infrastructure Excavation Area.mxd

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# Log of Borehole: BH101-22



| | | | | | |
|---|---|---|---|---|---|
| **Client:** | BT Engineering, London | **Project Name:** | Geotechnical Investigation | **Project No.:** | 11969-001 |
| **Contractor:** | Drilltech | **Method:** | Solid Stem Auger | **Date Completed:** | January 20, 2022 |
| **Location:** | Biehn Drive Extension | **UTM:** | 17T 543732 E, 4803683 N | **Elevation:** | 313.42 mASL |

| Elevation (m) / Depth | Lithology | Description | Number | Type | % Recovery | SPT (N) / DCPT | % Moisture (25 50 75) | SPT (N) / DCPT (10 20 30 40) | Well Installation | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 314 / 0 | | TOPSOIL: Dark brown silt topsoil, some organics, moist, loose | 1A | SS | | | | | Cap | |
| 313 / 1 | | SILTY SAND: Brown silty sand, moist, loose | 1B | SS | 50 | 6 | | | Monument; Water level at 0.41 mbgs on on Feb 04, 2022 | |
| | | SAND: Brown sand, some silt, trace gravel, wet, compact | 2 | SS | 65 | 19 | | | | |
| 312 / 2 | | SILTY SAND: Brown silty sand, some gravel, trace clay, APL, stiff | 3 | SS | 35 | 16 | | | PVC Riser; Bentonite Plug | GSA SS3: 19% Gravel 52% Sand 26% Silt 3% Clay |
| 311 / 3 | | | 4 | SS | 50 | 14 | | | | |
| 310 / 4 | | | 5 | SS | 80 | 14 | | | | |
| 309 / 5 | | SAND: Reddish brown sand, moist, compact | 6 | SS | 100 | 14 | | | | |
| 308 / 6 | | -Wet, loose | 7 | SS | 80 | 8 | | | Sand Pack; PVC Screen | |
| 307 / 7 | | | | | | | | | | |
| 306 / 8 | | | 8 | SS | 50 | 9 | | | Cap | Water level at 2.1 mbgs upon completion |
| 305 | | Borehole terminated at 8.2 mbgs in SAND | | | | | | | | |

**Logged By:** TA **Input By:** KL

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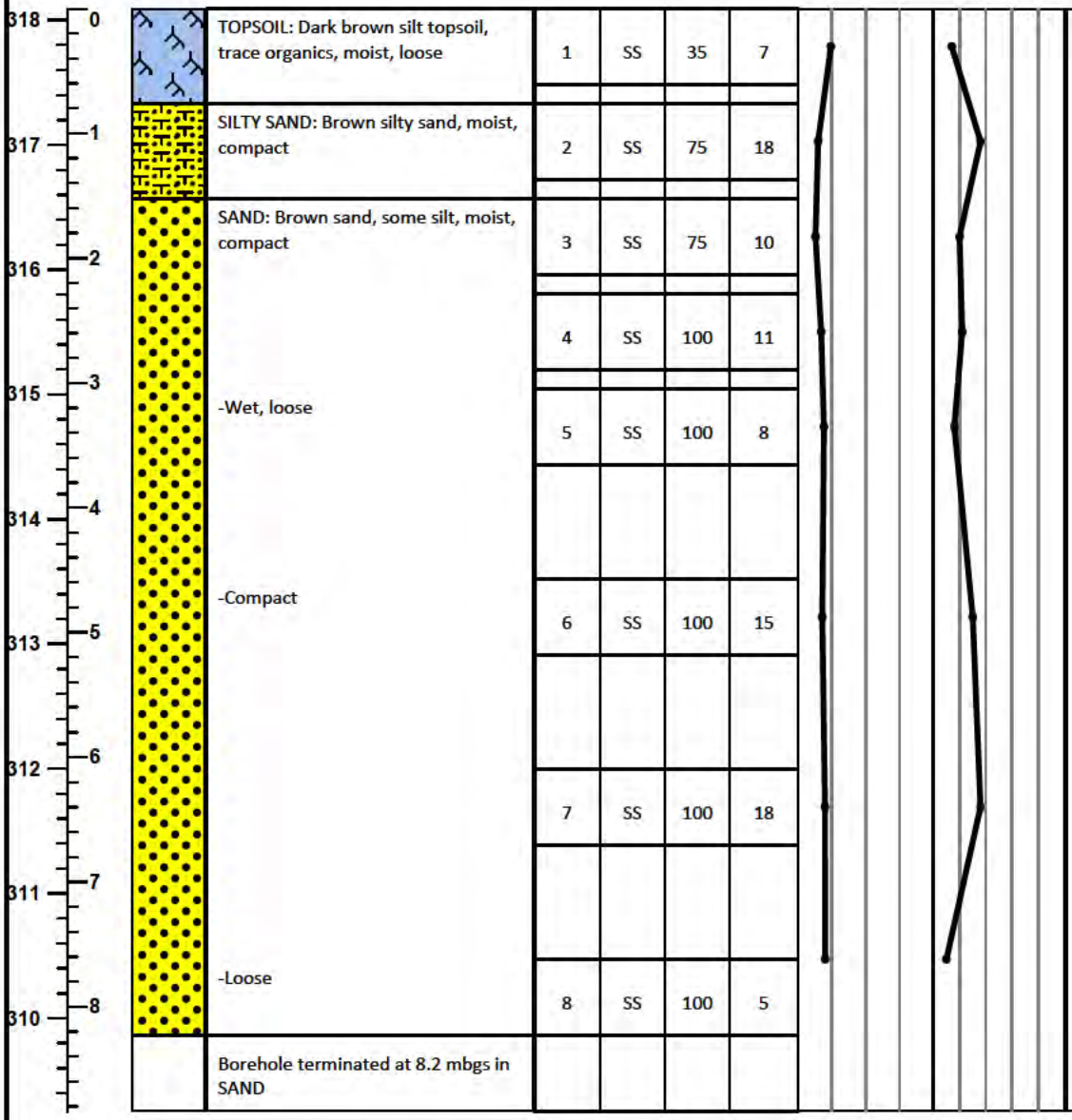
# Log of Borehole: BH102-22



| | | | | | |
|---|---|---|---|---|---|
| **Client:** | BT Engineering, London | **Project Name:** | Geotechnical Investigation | **Project No.:** | 11969-001 |
| **Contractor:** | Drilltech | **Method:** | Solid Stem Auger | **Date Completed:** | January 20, 2022 |
| **Location:** | Biehn Drive Extension | **UTM:** | 17T 543728 E, 4803615 N | **Elevation:** | 318.09 mASL |

| Elevation (m) | Depth | Description | Number | Type | % Recovery | SPT (N) / DCPT | Well Installation | Remarks |
|---|---|---|---|---|---|---|---|---|
| 318 | 0 | TOPSOIL: Dark brown silt topsoil, trace organics, moist, loose | 1 | SS | 35 | 7 | | |
| 317 | 1 | SILTY SAND: Brown silty sand, moist, compact | 2 | SS | 75 | 18 | | |
| | | SAND: Brown sand, some silt, moist, compact | 3 | SS | 75 | 10 | | |
| 316 | 2 | | 4 | SS | 100 | 11 | | |
| 315 | 3 | -Wet, loose | 5 | SS | 100 | 8 | | |
| 314 | 4 | | | | | | | |
| | | -Compact | 6 | SS | 100 | 15 | | |
| 313 | 5 | | | | | | | |
| 312 | 6 | | 7 | SS | 100 | 18 | | |
| 311 | 7 | | | | | | | |
| | | -Loose | 8 | SS | 100 | 5 | | Water level at 3.0 mbgs upon completion |
| 310 | 8 | Borehole terminated at 8.2 mbgs in SAND | | | | | | |

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# Log of Borehole: BH103-22



| | | | | | |
|---|---|---|---|---|---|
| **Client:** | BT Engineering, London | **Project Name:** | Geotechnical Investigation | **Project No.:** | 11969-001 |
| **Contractor:** | Drilltech | **Method:** | Solid Stem Auger | **Date Completed:** | January 21, 2022 |
| **Location:** | Biehn Drive Extension | **UTM:** | 17T 543729 E, 4803568 N | **Elevation:** | 318.67 mASL |

| Elevation (m) / Depth | Lithology | Description | Number | Type | % Recovery | SPT (N) / DCPT | % Moisture (25 50 75) | SPT (N) / DCPT (10 20 30 40) | Well Installation | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 318 / 0 | | TOPSOIL: Dark brown silty topsoil, some organics, moist, loose | 1 | SS | 100 | 8 | | | | |
| | | | 2A | SS | 75 | 7 | | | | |
| 317 / 1 | | SAND: Light brown sand, moist, loose | 2B | SS | | | | | | |
| | | -Trace gravel, compact | 3 | SS | 100 | 30 | | | | |
| 316 / 2 | | -some gravel, dense | 4 | SS | 75 | 44 | | | | |
| | | -Wet, compact | 5 | SS | 50 | 29 | | | | |
| 315 / 3 | | | | | | | | | | |
| 314 / 4 | | -trace gravel | 6 | SS | 100 | 29 | | | | |
| 313 / 5 | | | | | | | | | | |
| 312 / 6 | | -Saturated, dense | 7 | SS | 100 | 44 | | | | |
| 311 / 7 | | | | | | | | | | |
| 310 / 8 | | -Grey | 8 | SS | 100 | 33 | | | | Water level at 4.6 mbgs upon completion |
| | | Borehole terminated at 8.2 mbgs in SAND | | | | | | | | |

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# Log of Borehole: BH104-22



| | | | | | |
|---|---|---|---|---|---|
| **Client:** | BT Engineering, London | **Project Name:** | Geotechnical Investigation | **Project No.:** | 11969-001 |
| **Contractor:** | Drilltech | **Method:** | Solid Stem Auger | **Date Completed:** | January 20, 2022 |
| **Location:** | Biehn Drive Extension | **UTM:** | 17T 543741 E, 4803522 N | **Elevation:** | 319.86 mASL |

| Elevation (m) | Depth | Lithology | Description | Number | Type | % Recovery | SPT (N) / DCPT | % Moisture (25 50 75) | SPT (N) / DCPT (10 20 30 40) | Well Installation | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | -1 | | | | | | | | | | |
| 320 | 0 | | TOPSOIL: Dark brown silt topsoil, trace organics, trace brick, moist, loose | 1 | SS | 100 | 9 | | | Cap<br>Monument | |
| 319 | 1 | | SAND: Dark brown to brown sand, moist, loose | 2 | SS | 100 | 2 | | | | |
| 318 | 2 | | | 3 | SS | 100 | 10 | | | PVC Riser<br>Bentonite Plug | |
| | | | | 4 | SS | 100 | 9 | | | | |
| 317 | 3 | | -compact | 5 | SS | 100 | 24 | | | | |
| 316 | 4 | | | | | | | | | Water level at 4.15 mbgs on Feb 04, 2022 | |
| 315 | 5 | | -Brown, some gravel, trace silt and clay, wet, very dense | 6 | SS | 100 | 51 | | | Sand Pack<br>PVC Screen | GSA SS6:<br>16% Gravel<br>73% Sand<br>9% Silt<br>2% Clay |
| 314 | 6 | | -Dense | 7 | SS | 100 | 30 | | | | |
| 313 | 7 | | | | | | | | | | |
| 312 | 8 | | -Saturated | 8 | SS | 100 | 36 | | | Cap | Borehole open and dry upon completion |
| | | | Borehole terminated at 8.2 mbgs in SAND | | | | | | | | |

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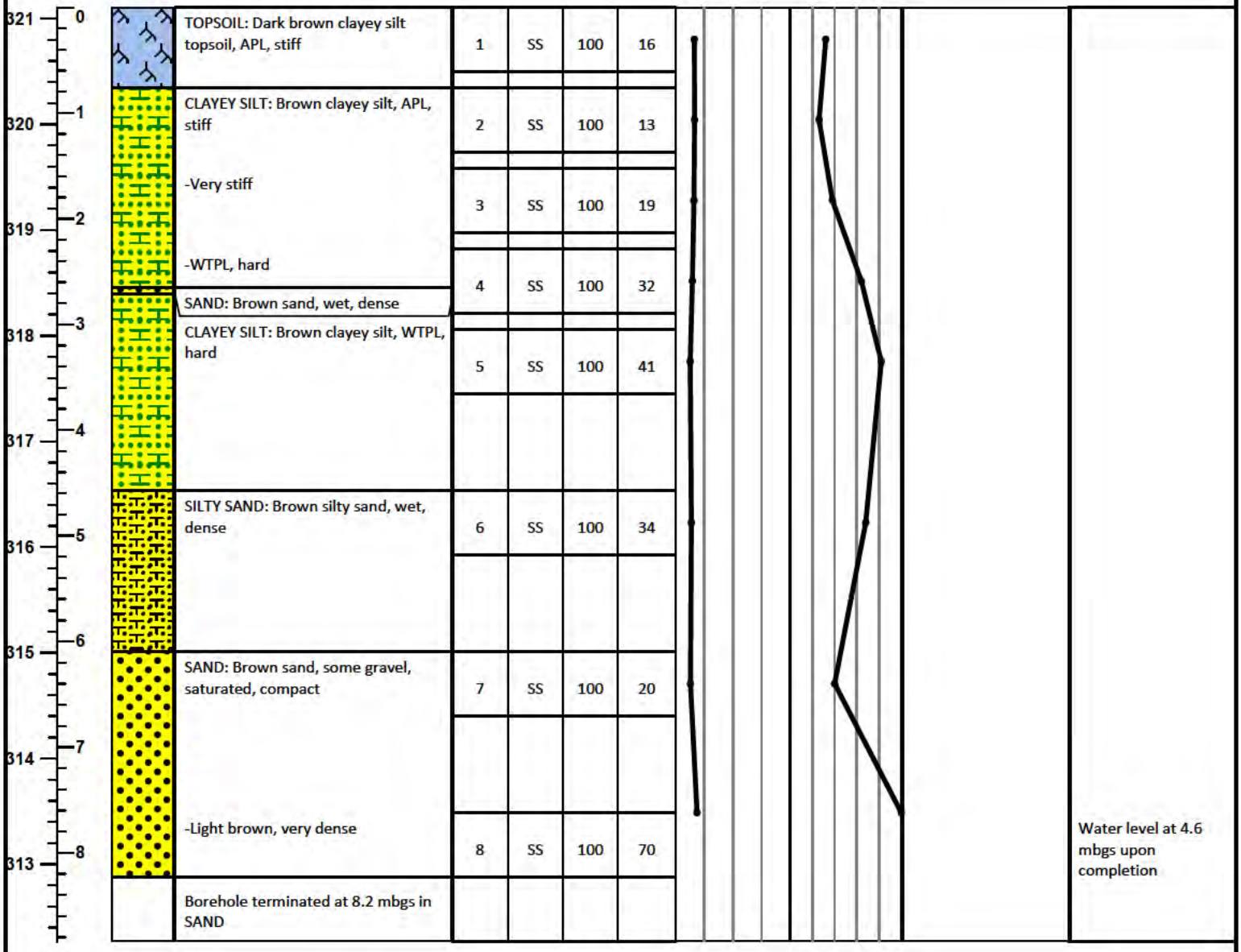
# Log of Borehole: BH105-22



| | | | | | |
|---|---|---|---|---|---|
| **Client:** | BT Engineering, London | **Project Name:** | Geotechnical Investigation | **Project No.:** | 11969-001 |
| **Contractor:** | Drilltech | **Method:** | Solid Stem Auger | **Date Completed:** | January 21, 2022 |
| **Location:** | Biehn Drive Extension | **UTM:** | 17T 543758 E, 4803444 N | **Elevation:** | 321.11 mASL |

| Elevation (m) | Depth | Description | Number | Type | % Recovery | SPT (N) / DCPT | Well Installation | Remarks |
|---|---|---|---|---|---|---|---|---|
| 321 | 0 | TOPSOIL: Dark brown clayey silt topsoil, APL, stiff | 1 | SS | 100 | 16 | | |
| 320 | 1 | CLAYEY SILT: Brown clayey silt, APL, stiff | 2 | SS | 100 | 13 | | |
| | | -Very stiff | 3 | SS | 100 | 19 | | |
| 319 | 2 | -WTPL, hard | 4 | SS | 100 | 32 | | |
| | | SAND: Brown sand, wet, dense | | | | | | |
| 318 | 3 | CLAYEY SILT: Brown clayey silt, WTPL, hard | 5 | SS | 100 | 41 | | |
| 317 | 4 | | | | | | | |
| 316 | 5 | SILTY SAND: Brown silty sand, wet, dense | 6 | SS | 100 | 34 | | |
| 315 | 6 | | | | | | | |
| | | SAND: Brown sand, some gravel, saturated, compact | 7 | SS | 100 | 20 | | |
| 314 | 7 | | | | | | | |
| 313 | 8 | -Light brown, very dense | 8 | SS | 100 | 70 | | Water level at 4.6 mbgs upon completion |
| | | Borehole terminated at 8.2 mbgs in SAND | | | | | | |

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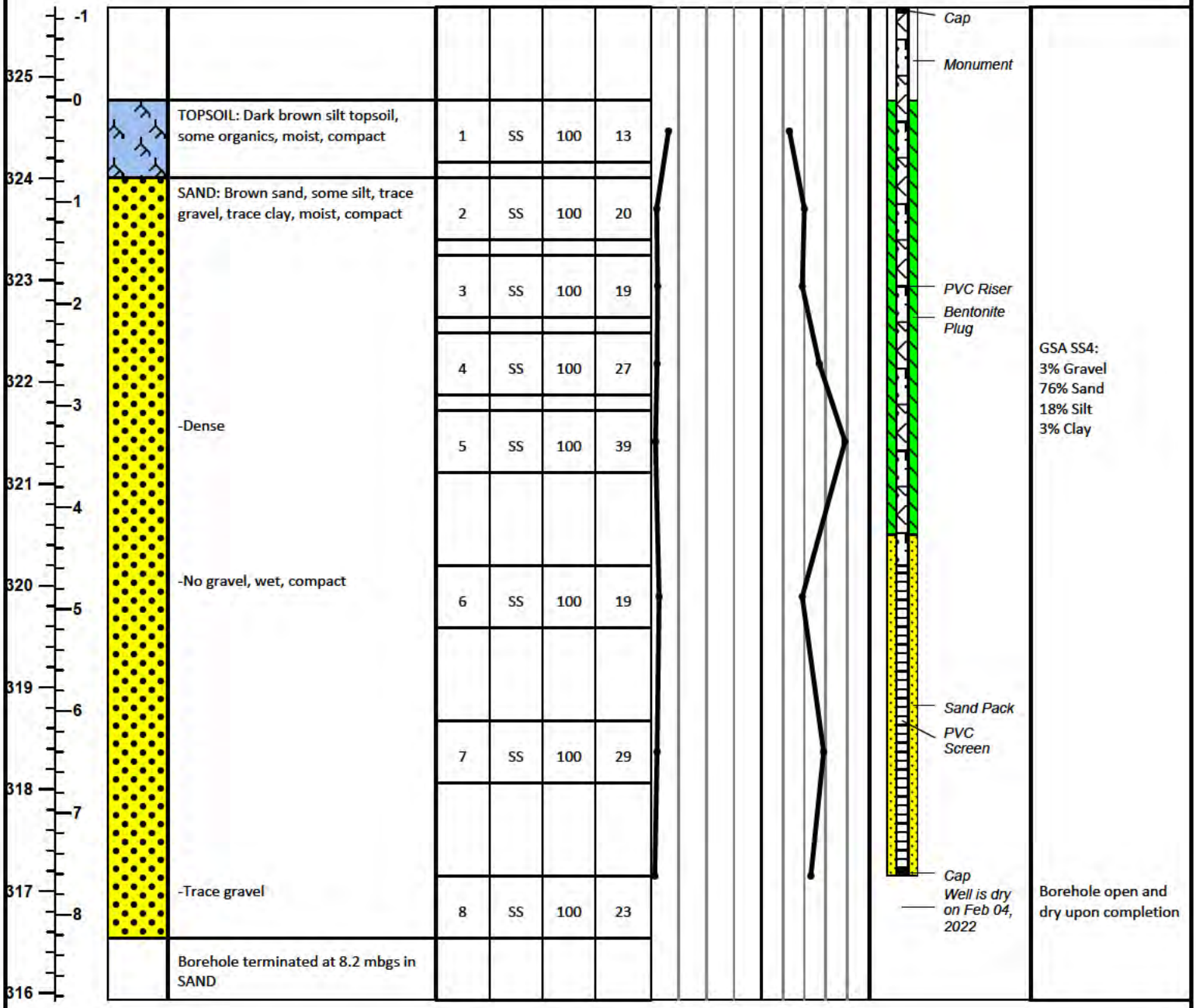
# Log of Borehole: BH106-22



| | | | | | |
|---|---|---|---|---|---|
| **Client:** | BT Engineering, London | **Project Name:** | Geotechnical Investigation | **Project No.:** | 11969-001 |
| **Contractor:** | Drilltech | **Method:** | Solid Stem Auger | **Date Completed:** | January 21, 2022 |
| **Location:** | Biehn Drive Extension | **UTM:** | 17T 543750 E, 4803369 N | **Elevation:** | 324.77 mASL |

| Elevation (m) | Depth | Description | Number | Type | % Recovery | SPT (N) / DCPT | Well Installation | Remarks |
|---|---|---|---|---|---|---|---|---|
| 325 | 0 | TOPSOIL: Dark brown silt topsoil, some organics, moist, compact | 1 | SS | 100 | 13 | Cap; Monument | |
| 324 | 1 | SAND: Brown sand, some silt, trace gravel, trace clay, moist, compact | 2 | SS | 100 | 20 | | |
| 323 | 2 | | 3 | SS | 100 | 19 | PVC Riser; Bentonite Plug | |
| 322 | 3 | -Dense | 4 | SS | 100 | 27 | | GSA SS4: 3% Gravel 76% Sand 18% Silt 3% Clay |
| 321 | 4 | | 5 | SS | 100 | 39 | | |
| 320 | 5 | -No gravel, wet, compact | 6 | SS | 100 | 19 | | |
| 319 | 6 | | 7 | SS | 100 | 29 | Sand Pack; PVC Screen | |
| 318 | 7 | | | | | | | |
| 317 | 8 | -Trace gravel | 8 | SS | 100 | 23 | Cap; Well is dry on Feb 04, 2022 | Borehole open and dry upon completion |
| 316 | | Borehole terminated at 8.2 mbgs in SAND | | | | | | |




**Logged By:** TA **Input By:** KL

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CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.8 mASL
**UTM:** 17T **N:** 4803760 **E:** 543814

**Log of Borehole:** BH201-23
Page: 1 of 2
**Date Completed** September 29, 2023

| Elevation (m) / Depth | Lithology | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.8 — 0 | | **FILL:** (SP) SAND, some gravel; brown (FILL); non-cohesive, moist, loose | | 1 | SS | 50 | 8 | 4.9% | 8 | | |
| 312.3 — 0.5 | | | | | | | | | | | |
| 311.8 — 1 | | | | 2 | SS | 0 | 13 | | 13 | | Borehole caved to ~0.9 mbgs upon completion of drilling |
| | | | 311.35 | | | | | | | | |
| 311.3 — 1.5 | | **(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact | 1.45 | 3 | SS | 100 | 16 | 14.2% | 16 | | Borehole caved multiple times at ~1.5 mbgs during drilling. |
| 310.8 — 2 | | | | | | | | | | | |
| 310.3 — 2.5 | | | | 4 | SS | 75 | 13 | 16.9% | 13 | | Groundwater level first encountered at ~2.3 mbgs during drilling |
| | | | 309.83 | | | | | | | | |
| 309.8 — 3 | | **(ML) sandy SILT:** (ML) Sandy SILT, trace clay; brown; non-cohesive, wet, compact | 2.97 | 5 | SS | 75 | 10 | 20.5% | 10 | | |
| | | | 309.29 | | | | | | | | |
| 309.3 — 3.5 | | **(ML) SILT:** (CL/ML) CLAY and SILT, trace sand, trace gravel; grey; cohesive, W~PL, stiff to firm | 3.51 | | | | | | | | |
| 308.8 — 4 | | | | | | | | | | | |
| 308.3 — 4.5 | | Cobbles removed during augering | | 6 | SS | 10 | 7 | 26.0% | 7 | | |
| 307.8 — 5 | | | | | | | | | | | |
| 307.3 — 5.5 | | | 307.16 | | | | | | | | |
| | | **(SM) SILTY SAND:** (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact | 5.64 | | | | | | | | |
| 306.8 — 6 | | | | | | | | | | | |
| 306.3 — 6.5 | | | | 7 | SS | 50 | 9 | 15.5% | 9 | | |
| | | Cobbles removed during augering | | | | | | | | | |
| 305.8 — 7 | | | | | | | | | | | |
| 305.3 | | | 305.3 | | | | | | | | |
| | | | 7.5 | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 1 | 6 | 46 | 47 |

1m = 24 units

**Logged By:** EC **Input By:** EC

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CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.8 mASL
**UTM:** 17T **N:** 4803760 **E:** 543814

**Log of Borehole:** BH201-23
Page: 2 of 2
**Date Completed** September 29, 2023

| SUBSURFACE PROFILE | | | SAMPLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.) 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
| 305.3 / 7.5 | | **(SM) SILTY SAND:** (SM) SILTY SAND, some clay; grey; non-cohesive, saturated to wet, loose to compact — 304.57 | 8 | SS | 0 | 12 | 16.9% | 12 | | |
| 304.8 / 8 | | | | | | | | | | |
| | | Borehole terminated @ 8.2 mbgs due to target depth achieved. — 8.23 | | | | | | | | |
| 304.3 / 8.5 | | | | | | | | | | |
| 303.8 / 9 | | | | | | | | | | |
| 303.3 / 9.5 | | | | | | | | | | |
| 302.8 / 10 | | | | | | | | | | |
| 302.3 / 10.5 | | | | | | | | | | |
| 301.8 / 11 | | | | | | | | | | |
| 301.3 / 11.5 | | | | | | | | | | |
| 300.8 / 12 | | | | | | | | | | |
| 300.3 / 12.5 | | | | | | | | | | |
| 299.8 / 13 | | | | | | | | | | |
| 299.3 / 13.5 | | | | | | | | | | |
| 298.8 / 14 | | | | | | | | | | |
| 298.3 / 14.5 | | | | | | | | | | |
| 297.8 | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 1 | 6 | 46 | 47 |

1m = 24 units

**Logged By:** EC **Input By:** EC

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Tricone
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803766 **E:** 543859

**Log of Borehole:** BH202-23
Page: 1 of 2
**Date Completed:** August 1, 2023

| Elevation (m) | Depth | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.6 | 0 | **ASPHALT:** ~70 mm thick | 312.52 / 0.08 | 1 | SS | 45 | 25 | 4.9% | 25 | Cap | |
| 312.1 | 0.5 | **FILL:** (SP/GP) SAND and GRAVEL; brown (Granular Fill); non-cohesive, moist, compact to very loose | | | | | | | | | |
| 311.6 | 1 | | | 2 | SS | 90 | 42 | 5.4% | 42 | Bentonite Plug | Groundwater level measured in monitoring well at a depth of ~0.95 mbgs on October 13, 2023 |
| 311.1 | 1.5 | | | 3 | SS | 45 | 20 | 6.8% | 20 | | |
| 310.6 | 2 | | | | | | | | | | |
| 310.1 | 2.5 | **(SM) SILTY SAND:** (SM) SILTY SAND; light brown; non-cohesive, wet, very loose | 310.16 / 2.44 | 4 | SS | 90 | 3 | 34.5% | 3 | Riser | Groundwater level first encountered at a depth of ~2.3 mbgs during drilling |
| 309.6 | 3 | **(SW) SAND:** (SP) SAND, trace to some silt, trace clay, none to trace gravel/cobble; brown to light brown; non-cohesive, wet, loose to compact | 309.7 / 2.9 | 5 | SS | 35 | 10 | 18.9% | 10 | | |
| 309.1 | 3.5 | | | | | | | | | | |
| 308.6 | 4 | | | | | | | | | | |
| 308.1 | 4.5 | | | 6 | SS | 65 | 22 | 15.4% | 22 | Sand Pack | |
| 307.6 | 5 | | | | | | | | | | |
| 307.1 | 5.5 | | | | | | | | | | |
| 306.6 | 6 | | | | | | | | | | |
| 306.1 | 6.5 | | | 7 | SS | 100 | 11 | 16.8% | 11 | PVC Screen | |
| 305.6 | 7 | | 305.51 | | | | | | | | |
| 305.1 | | **(ML) SILT:** (ML) SILT, some sand; brown; non-cohesive, wet, compact | 7.09 / 305.1 / 7.5 | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 5 | 0 | 80 | 17 | 3 |

1m = 24 units

**Logged By:** SN **Input By:** EC

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Tricone
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803766 **E:** 543859

**Log of Borehole:** BH202-23
Page: 2 of 2
**Date Completed:** August 1, 2023

| SUBSURFACE PROFILE | | | SAMPLE | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI; % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.); SPT (N) 20 40 60 80 | Well Installation | Log Notes |
| 305.1 / 7.5 | | **(ML) SILT:** (ML) SILT, some sand; brown; non-cohesive, wet, compact — 304.52 | 8 | SS | 100 | 13 | 23.8% | 13 | Sand Pack, PVC Screen | |
| 304.6 / 8 | | Borehole terminated @ 8.1 mbgs due to target depth achieved. — 8.08 | | | | | | | | |
| 304.1 / 8.5 | | | | | | | | | | |
| 303.6 / 9 | | | | | | | | | | |
| 303.1 / 9.5 | | | | | | | | | | |
| 302.6 / 10 | | | | | | | | | | |
| 302.1 / 10.5 | | | | | | | | | | |
| 301.6 / 11 | | | | | | | | | | |
| 301.1 / 11.5 | | | | | | | | | | |
| 300.6 / 12 | | | | | | | | | | |
| 300.1 / 12.5 | | | | | | | | | | |
| 299.6 / 13 | | | | | | | | | | |
| 299.1 / 13.5 | | | | | | | | | | |
| 298.6 / 14 | | | | | | | | | | |
| 298.1 / 14.5 | | | | | | | | | | |
| 297.6 | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 5 | 0 | 80 | 17 | 3 |

1m = 24 units

**Logged By:** SN **Input By:** EC

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 313 mASL
**UTM:** 17T **N:** 4803744 **E:** 543791

**Log of Borehole:** BH203-23
Page: 1 of 2
**Date Completed** September 29, 2023

| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V. / rem V.) 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 313 / 0 | | **(PT) PEAT:** PEAT, none to trace sand; black; non-cohesive, moist, very loose | 1 | SS | 5 | 2 | 31.6% | 2 | Cap | Groundwater level measured in monitoring well at a depth of ~0.26 mbgs on October 13, 2023 |
| 312.5 / 0.5 | | | | | | | | | | |
| 312 / 1 | | | 2 | SS | 40 | 2 | 33% | 2 | | Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling |
| 311.5 / 1.5 | | 311.55 / 1.45 **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet, loose to compact | 3 | SS | 60 | 9 | 16.9% | 9 | Bentonite Plug, Riser | |
| 311 / 2 | | | | | | | | | | |
| 310.5 / 2.5 | | | 4 | SS | 60 | 19 | 14.6% | 19 | | Borehole caved to a depth of ~2.1 mbgs upon completion of drilling |
| 310 / 3 | | 310.03 / 2.97 **(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact | 5 | SS | 50 | 13 | 15.2% | 13 | | Groundwater first encountered at a depth of ~3.0 mbgs during drilling |
| 309.5 / 3.5 | | | | | | | | | | |
| 309 / 4 | | | | | | | | | | |
| 308.5 / 4.5 | | | 6 | SS | 60 | 13 | 16.9% | 13 | Sand Pack, PVC Screen | |
| 308 / 5 | | | | | | | | | | |
| 307.5 / 5.5 | | | | | | | | | | |
| 307 / 6 | | | | | | | | | | |
| 306.5 / 6.5 | | | 7 | SS | 50 | 11 | 17.7% | 11 | | |
| 306 / 7 | | | | | | | | | | |
| 305.5 / 7.5 | | 305.5 | | | | | | | Cap | |

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 313 mASL
**UTM:** 17T **N:** 4803744 **E:** 543791

**Log of Borehole:** BH203-23
Page: 2 of 2
**Date Completed** September 29, 2023

| SUBSURFACE PROFILE | | | SAMPLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.) — 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
| 305.5 / 7.5 | | | | | | | | | | |
| 305 / 8 | | **(SM) SILTY SAND:** (SM) SILTY SAND; brown; non-cohesive, wet, compact — 304.77 | 8 | SS | 60 | 12 | 15.6% | 12 | | |
| | | Borehole terminated @ 8.2 mbgs due to target depth achieved. — 8.23 | | | | | | | | |
| 304.5 / 8.5 | | | | | | | | | | |
| 304 / 9 | | | | | | | | | | |
| 303.5 / 9.5 | | | | | | | | | | |
| 303 / 10 | | | | | | | | | | |
| 302.5 / 10.5 | | | | | | | | | | |
| 302 / 11 | | | | | | | | | | |
| 301.5 / 11.5 | | | | | | | | | | |
| 301 / 12 | | | | | | | | | | |
| 300.5 / 12.5 | | | | | | | | | | |
| 300 / 13 | | | | | | | | | | |
| 299.5 / 13.5 | | | | | | | | | | |
| 299 / 14 | | | | | | | | | | |
| 298.5 / 14.5 | | | | | | | | | | |
| 298 | | | | | | | | | | |

GRAINSIZE DISTRIBUTION: SAMPLE | GRAVEL | SAND | SILT | CLAY

1m = 24 units

**Logged By:** EC **Input By:** EC

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803730 **E:** 543781

**Log of Borehole:** BH204-23
Page: 1 of 2
**Date Completed** September 28, 2023

| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| 312.6 / 0 | | **(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose — 311.91 / 0.69 | 1 | SS | 5 | 3 | 21% | 3 | | Groundwater level measured at a depth of ~0.6 mbgs upon completion of drilling |
| 312.1 / 0.5 | | **(ML) SILT:** (ML) SILT and ASH; white to light grey, trace organic matter; cohesive, W~PL, very soft — 311.58 / 1.02 | 2 | SS | 60 | 2 | 50.4% | 2 | | |
| 311.6 / 1 | | **(SW) SAND:** (SP) SAND, trace silt; grey; non-cohesive, wet, very loose — 311.15 / 1.45 | | | | | | | | |
| 311.1 / 1.5 | | **(SM) SILTY SAND:** (SM) SILTY SAND; brown, trace organics, oxidation stains; non-cohesive, moist, stiff — 310.39 / 2.21 | 3 | SS | 65 | 10 | 17.6% | 10 | | |
| 310.6 / 2 | | **(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey; cohesive, W<PL, stiff — 309.86 / 2.74 | 4 | SS | 75 | 9 | 17.6% | 9 | | |
| 310.1 / 2.5 | | **(ML) sandy SILT:** (ML) Sandy SILT, some clay; brown; non-cohesive, wet, loose | 5 | SS | 75 | 7 | 19.8% | 7 | | Groundwater first encountered at a depth of ~3.0 mbgs during drilling |
| 309.6 / 3 | | | | | | | | | | |
| 309.1 / 3.5 | | | | | | | | | | |
| 308.6 / 4 | | | | | | | | | | |
| 308.1 / 4.5 | | | 6 | SS | 60 | 13 | 20.3% | 13 | | Borehole caved to a depth of ~4.6 mbgs upon completion of drilling |
| 307.6 / 5 | | | | | | | | | | |
| 307.1 / 5.5 | | | | | | | | | | |
| 306.6 / 6 | | | | | | | | | | |
| 306.1 / 6.5 | | | 7 | SS | 50 | 8 | 14.5% | 8 | | |
| 305.6 / 7 | | 305.44 | | | | | | | | |
| 305.1 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact — 305.1 / 7.16 / 7.5 | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 0 | 24 | 62 | 14 |

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803730 **E:** 543781

**Log of Borehole:** BH204-23
Page: 2 of 2
**Date Completed** September 28, 2023

| SUBSURFACE PROFILE | | | | SAMPLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI; % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.); SPT (N) 20 40 60 80 | Well Installation | Log Notes |
| 305.1 / 7.5 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, moist, compact | 304.37 | 8 | SS | 25 | 19 | 15.3% | 19 | | |
| 304.6 / 8 | | | | | | | | | | | |
| | | Borehole terminated @ 8.2 mbgs due to target depth achieved. | 8.23 | | | | | | | | |
| 304.1 / 8.5 | | | | | | | | | | | |
| 303.6 / 9 | | | | | | | | | | | |
| 303.1 / 9.5 | | | | | | | | | | | |
| 302.6 / 10 | | | | | | | | | | | |
| 302.1 / 10.5 | | | | | | | | | | | |
| 301.6 / 11 | | | | | | | | | | | |
| 301.1 / 11.5 | | | | | | | | | | | |
| 300.6 / 12 | | | | | | | | | | | |
| 300.1 / 12.5 | | | | | | | | | | | |
| 299.6 / 13 | | | | | | | | | | | |
| 299.1 / 13.5 | | | | | | | | | | | |
| 298.6 / 14 | | | | | | | | | | | |
| 298.1 / 14.5 | | | | | | | | | | | |
| 297.6 | | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 6 | 0 | 24 | 62 | 14 |

1m = 24 units

**Logged By:** EC **Input By:** EC

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.7 mASL
**UTM:** 17T **N:** 4803712 **E:** 543759

**Log of Borehole:** BH205-23
Page: 1 of 2
**Date Completed** September 28, 2023

| Elevation (m) / Depth | Lithology | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI — 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V. + rem V.) 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.7 — 0 | | **(PT) PEAT:** PEAT; black; non-cohesive, moist, loose | 312.4 / 0.3 | 1 | SS | 10 | 3 | 77.8% | 3 | | |
| 312.2 — 0.5 | | **(CL) sandy SILTY CLAY:** (CL) Sandy SILTY CLAY; grey to dark grey, some organic matter; cohesive, W<PL, very soft | 312.01 / 0.69 | | | | | | | | |
| 311.7 — 1 | | **(SM) SILTY SAND:** (SM) SILTY SAND, trace clay, trace gravel; brown; non-cohesive, wet compact to loose | | 2 | SS | 70 | 13 | 14.5% | 13 | | Groundwater level at ~0.9 mbgs upon completion of drilling |
| 311.2 — 1.5 | | | 310.92 / 1.78 | 3 | SS | 50 | 9 | 13.4% | 9 | | |
| 310.7 — 2 | | **(ML) SILT:** (ML/SP) SILT and SAND, some clay; brown to light brown; non-cohesive, moist, stiff | | | | | | | | | Borehole caved to ~2.1 mbgs upon completion of drilling |
| 310.2 — 2.5 | | | | 4 | SS | 60 | 8 | 16.9% | 8 | | |
| 309.7 — 3 | | **(SM) SILTY SAND:** (SM) SILTY SAND, trace to some clay; light brown to brown; non-cohesive, wet, compact | 309.73 / 2.97 | 5 | SS | 85 | 11 | 17.9% | 11 | | Groundwater first encountered at a depth of ~3.0 mbgs during drilling |
| 309.2 — 3.5 | | | | | | | | | | | |
| 308.7 — 4 | | | | | | | | | | | |
| 308.2 — 4.5 | | | | 6 | SS | 50 | 19 | 19.5% | 19 | | |
| 307.7 — 5 | | | | | | | | | | | |
| 307.2 — 5.5 | | | | | | | | | | | |
| 306.7 — 6 | | | | 7 | SS | 50 | 11 | 21% | 11 | | |
| 306.2 — 6.5 | | | | | | | | | | | |
| 305.7 — 7 | | | 305.54 / 7.16 | | | | | | | | |
| 305.2 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense | 305.2 / 7.5 | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 4 | 0 | 38 | 44 | 18 |

1m = 24 units

**Logged By:** EC **Input By:** EC

**Peterborough, Barrie, Oshawa, Kingston, Ottawa**

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.7 mASL
**UTM:** 17T **N:** 4803712 **E:** 543759

**Log of Borehole:** BH205-23
Page: 2 of 2
**Date Completed** September 28, 2023

| SUBSURFACE PROFILE | | | SAMPLE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Elevation (m) / Depth | Lithology | Description (Elevation / Depth) | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) LL PL PI; % Moisture 25 50 75 | Shear Strength Cu, kPa (nat V., rem V.); SPT (N) 20 40 60 80 | Well Installation | Log Notes |
| 305.2 / 7.5 | | **(SW) SAND:** (SP) SAND, trace silt; brown; non-cohesive, wet to moist, loose to dense | | | | | | | | |
| 304.7 / 8 | | | 8 | SS | 50 | 9 | 14.6% | 9 | | |
| 304.2 / 8.5 | | | | | | | | | | |
| 303.7 / 9 | | | | | | | | | | |
| 303.2 / 9.5 | | | 9 | SS | 0 | 34 | 14.8% | 34 | | Second spoon completed in this sample depth due to low recovery |
| 302.95 / 9.75 | | Borehole terminated @ 9.8 mbgs due to target depth achieved. | | | | | | | | |
| 302.7 / 10 | | | | | | | | | | |
| 302.2 / 10.5 | | | | | | | | | | |
| 301.7 / 11 | | | | | | | | | | |
| 301.2 / 11.5 | | | | | | | | | | |
| 300.7 / 12 | | | | | | | | | | |
| 300.2 / 12.5 | | | | | | | | | | |
| 299.7 / 13 | | | | | | | | | | |
| 299.2 / 13.5 | | | | | | | | | | |
| 298.7 / 14 | | | | | | | | | | |
| 298.2 / 14.5 | | | | | | | | | | |
| 297.7 | | | | | | | | | | |

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 4 | 0 | 38 | 44 | 18 |

1m = 24 units

**Logged By:** EC **Input By:** EC

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

CAMBIUM

**Client:** BT Engineering
**Contractor:** DrillTech Drilling
**Project No.:** 11969-002
**Location:** Biehn Drive, Kitchener

**Project Name:** Biehn Drive Trunk Sewer, Kitchener
**Method:** Track Mounted Solid Stem Auger
**Elevation:** 312.6 mASL
**UTM:** 17T **N:** 4803696 **E:** 543750

**Log of Borehole:** BH206-23
Page: 1 of 1
**Date Completed** September 30, 2023

| Elevation (m) | Depth | Description | Elevation / Depth | Number | Type | % Recovery | SPT (N) | Atterberg Limits (%) 25 50 75 / % Moisture 25 50 75 | Shear Strength Cu, kPa 20 40 60 80 / SPT (N) 20 40 60 80 | Well Installation | Log Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 312.6 | 0 | **(PT) PEAT:** PEAT; black; non-cohesive, moist, very loose | 311.99 | 1 | SS | 5 | 2 | 65% | 2 | Cap | Groundwater level measured in monitoring well at a depth of ~0.19 mbgs on October 13, 2023 |
| 312.1 | 0.5 | | | | | | | | | | |
| 311.6 | 1 | **(ML) SILT:** (ML) SILT, some clay, some sand; dark grey to grey, trace to no organics; cohesive, W~PL to W>PL, very soft to firm | 0.61 | 2 | SS | 10 | 2 | 18.9% | 2 | Bentonite Plug | Groundwater level at a depth of ~0.6 mbgs upon completion of drilling |
| 311.1 | 1.5 | | | | | | | | | Riser | |
| 310.6 | 2 | | | 3 | SS | 20 | 1 | 27.7% | 1 | | |
| 310.1 | 2.5 | | 309.91 | 4 | SS | 50 | 5 | 15.8% | 5 | | Groundwater level at a depth of ~2.3 mbgs during drilling |
| 309.6 | 3 | **(SM) SILTY SAND:** (SM) SILTY SAND, some clay; brown; non-cohesive, wet, loose | 2.69 / 309.63 | | | | | | | | Borehole caved to a depth of ~3.0 mbgs upon completion of drilling |
| 309.1 | 3.5 | **(SW) SAND:** (SP) SAND, some clay; brown; non-cohesive, very saturated, loose | 2.97 | 5 | SS | 20 | 6 | 12% | 6 | | |
| 308.6 | 4 | | | | | | | | | Sand Pack | |
| 308.1 | 4.5 | | | | | | | | | PVC Screen | |
| 307.6 | 5 | | | 6 | SS | 0 | 9 | 18.1% | 9 | | |
| 307.1 | 5.5 | | 306.96 | | | | | | | | |
| 306.6 | 6 | **(SW) SAND:** (SP/ML) SAND and SILT, trace clay, trace gravel; brown; non-cohesive, wet, compact | 5.64 | | | | | | | | |
| 306.1 | 6.5 | | 305.89 | 7 | SS | 50 | 15 | 19% | 15 | | |
| 305.6 | 7 | Borehole terminated @ 6.7 mbgs due to target depth achieved. | 6.71 | | | | | | | Cap | |
| 305.1 | | | | | | | | | | | |

1m = 24 units

GRAINSIZE DISTRIBUTION

| SAMPLE | GRAVEL | SAND | SILT | CLAY |
|---|---|---|---|---|
| SS 7 | 5 | 45 | 41 | 9 |
| SS3 | 0 | 11 | 75 | 14 |

**Logged By:** EC **Input By:** EC

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

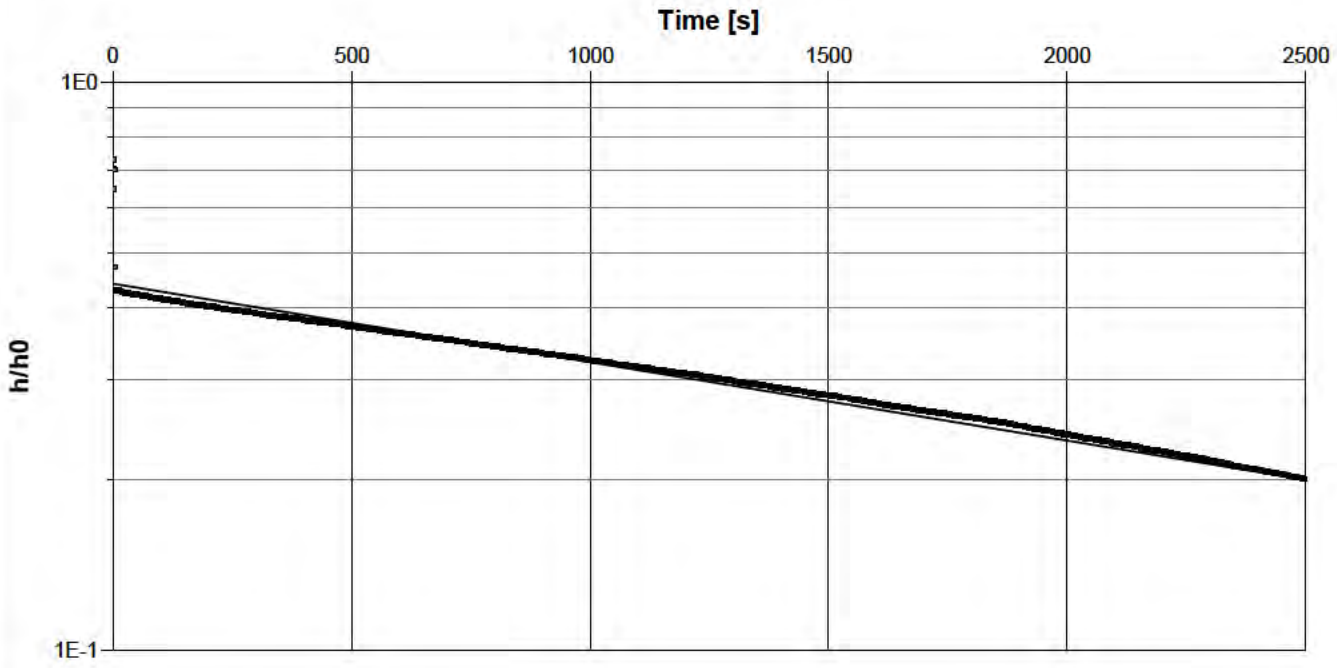


# Appendix E
# SWHT Results

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

| Cambium Inc.<br>135 Bayfield St #102, Barrie, ON L4M 3B3 | Slug Test Analysis Report |
|---|---|
| | Project: Dewatering Assessment- Biehn Dr. Ext. |
| | Number: 11969-001 |
| | Client: BT Engineering |

| | | |
|---|---|---|
| Location: Biehn Drive, City of Kitchener | Slug Test: MW101-22 | Test Well: MW101-22 |
| Test Conducted by: Chris Malliaros | | Test Date: 2/4/2022 |
| Analysis Performed by: | Hvorslev | Analysis Date: 2/9/2022 |
| Aquifer Thickness: 7.04 m | | |



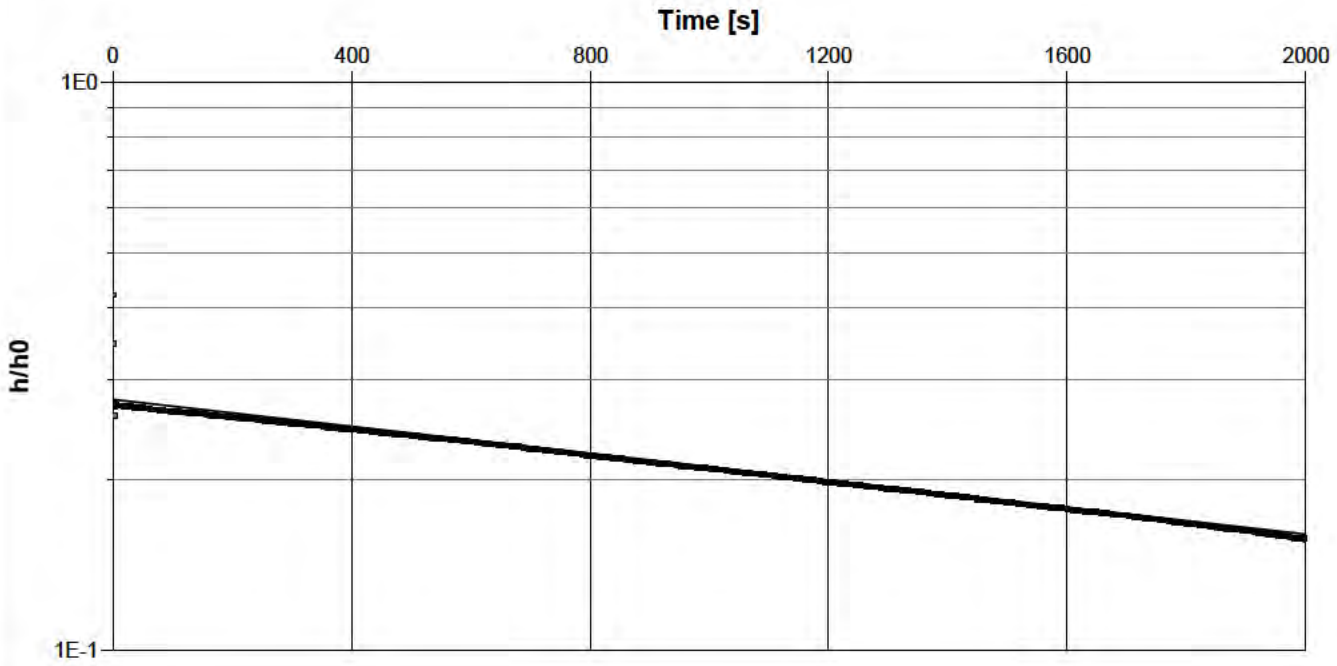

Calculation using Hvorslev

| Observation Well | Hydraulic Conductivity [m/s] | |
|---|---|---|
| MW101-22 | $3.59 \times 10^{-6}$ | |

DocuSign Envelope ID: 837277D7-FD19-45EE-9A52-C1575E4E0B2A

| Cambium Inc.<br>135 Bayfield St #102, Barrie, ON L4M 3B3 | Slug Test Analysis Report |
|---|---|
| | Project: Dewatering Assessment- Biehn Dr. Ext. |
| | Number: 11969-001 |
| | Client: BT Engineering |

| | | |
|---|---|---|
| Location: Biehn Drive, City of Kitchener | Slug Test: MW104-22 | Test Well: MW104-22 |
| Test Conducted by: Chris Malliaros | | Test Date: 2/4/2022 |
| Analysis Performed by: Sudhakar Kurli | Hvorslev | Analysis Date: 2/9/2022 |
| Aquifer Thickness: 2.00 m | | |




Calculation using Hvorslev

| Observation Well | Hydraulic Conductivity [m/s] | |
|---|---|---|
| MW104-22 | $3.08 \times 10^{-6}$ | |

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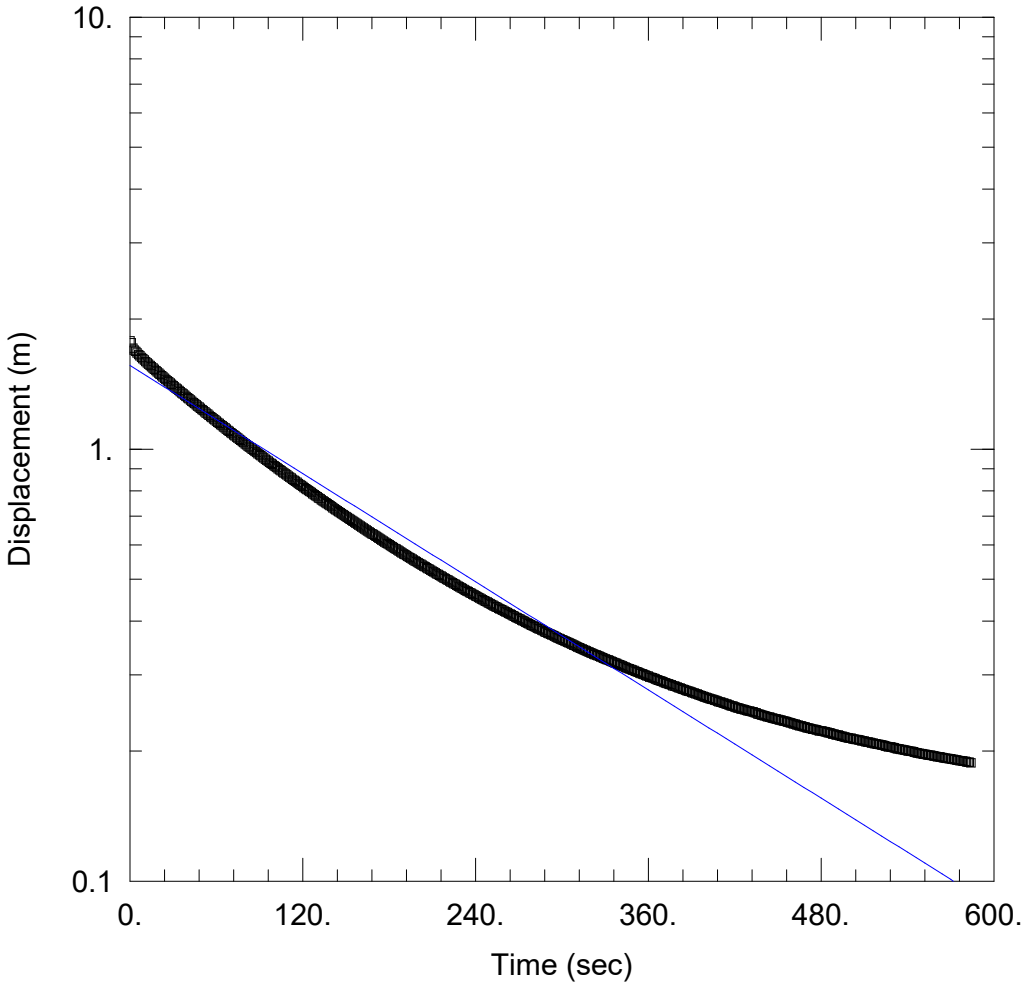


## RISING HEAD TEST

Data Set:
Date: 10/23/23 Time: 13:11:09

## PROJECT INFORMATION

Company: BT Engineering
Client: City of Kirchener
Project: 11969-002
Location: Biehn Dr, South Extension
Test Well: BH202-23
Test Date: 2023-10-11

## AQUIFER DATA

Saturated Thickness: 7.06 m Anisotropy Ratio (Kz/Kr): 1.

## WELL DATA (BH202-23)

Initial Displacement: 1.78 m
Total Well Penetration Depth: 7.06 m
Casing Radius: 0.05 m
Static Water Column Height: 7.06 m
Screen Length: 3. m
Well Radius: 0.025 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.097E-5 m/sec y0 = 1.562 m

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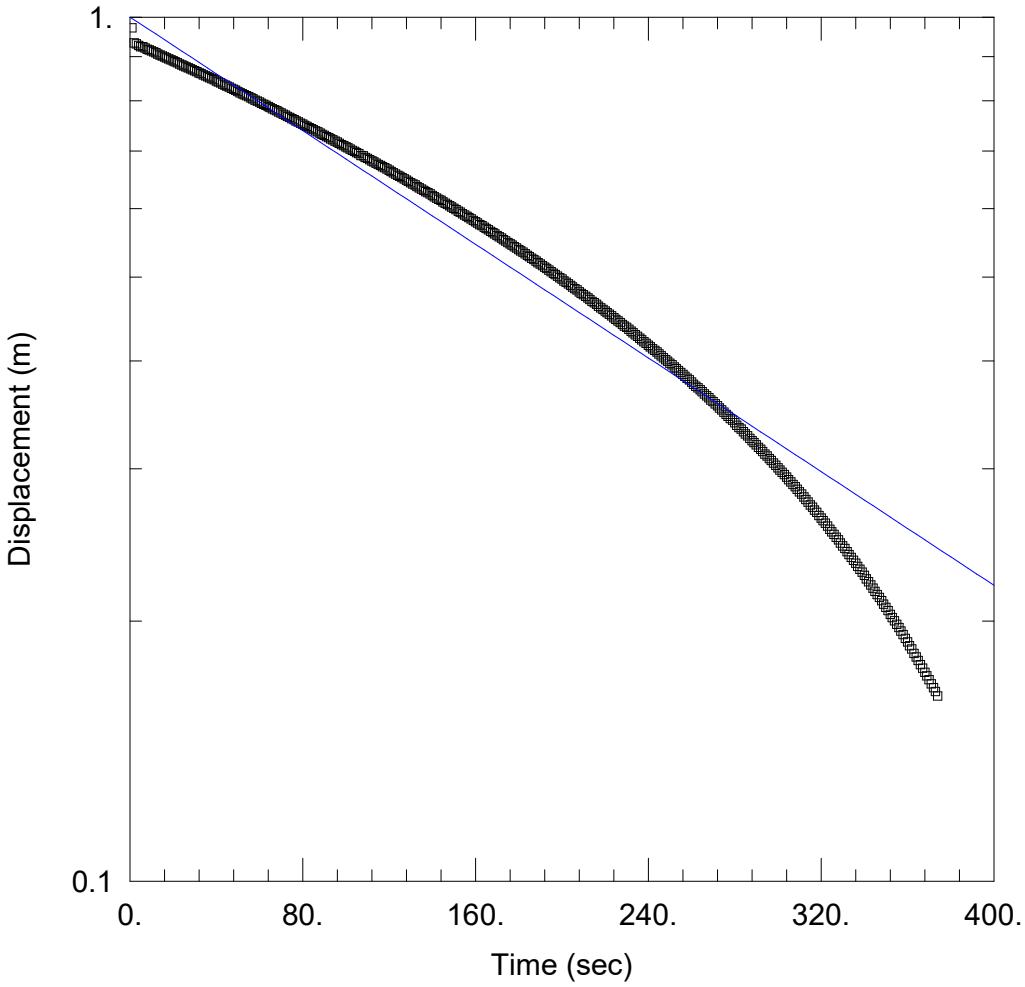


## WELL TEST ANALYSIS

Data Set:
Date: 10/23/23 Time: 13:19:43

## PROJECT INFORMATION

Company: BT Engineering
Client: City of Kirchener
Project: 11969-002
Location: Biehn Dr, South Extension
Test Well: BH203-23
Test Date: 2023-10-11

## AQUIFER DATA

Saturated Thickness: 6.23 m Anisotropy Ratio (Kz/Kr): 1.

## WELL DATA (BH203-23)

Initial Displacement: 1.36 m
Total Well Penetration Depth: 7.4 m
Casing Radius: 0.05 m
Static Water Column Height: 6.23 m
Screen Length: 3. m
Well Radius: 0.025 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 8.647E-6 m/sec y0 = 1. m

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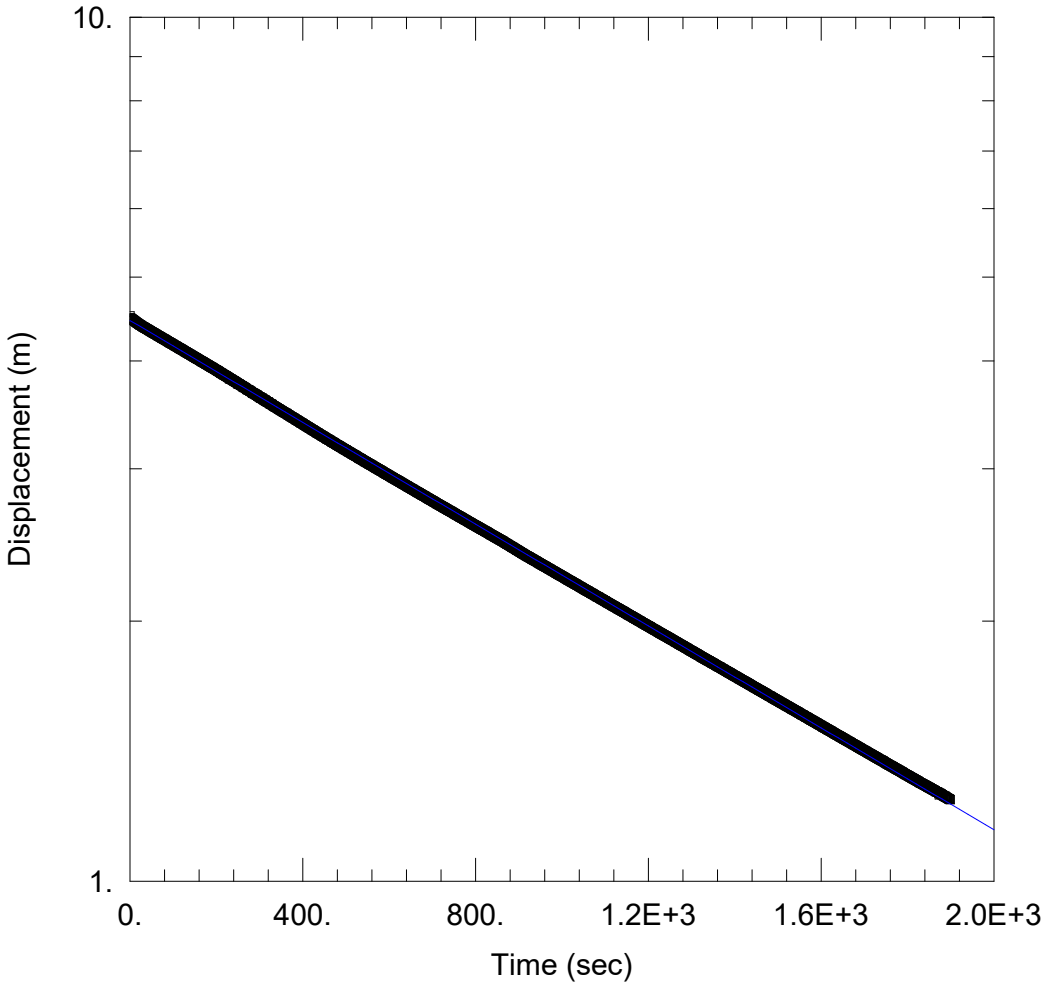


## RISING HEAD TEST

Data Set:
Date: 10/23/23 Time: 13:43:13

## PROJECT INFORMATION

Company: BT Engineering
Client: City of Kirchener
Project: 11969-002
Location: Biehn Dr, South Extension
Test Well: BH206-23
Test Date: 2023-10-11

## AQUIFER DATA

Saturated Thickness: 5.59 m Anisotropy Ratio (Kz/Kr): 1.

## WELL DATA (BH206-23)

Initial Displacement: 4.51 m
Total Well Penetration Depth: 5.59 m
Casing Radius: 0.05 m
Static Water Column Height: 5.59 m
Screen Length: 3. m
Well Radius: 0.025 m

## SOLUTION

Aquifer Model: Unconfined Solution Method: Hvorslev

K = 1.55E-6 m/sec y0 = 4.455 m

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# Appendix F
# Dewatering Estimates

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# DEWATERING CALCULATIONS - 50 m TRENCH SEGMENT

**Modified Dupuit-Forchheimer Equation: unconfined flow into a linear excavation.**
**Calculations assume no flow boundary at aquifer base**

| Excavation Area | | Initial depth to groundwater | Target Depth to groundwater | Depth to Base of Aquifer | Unit length of trench (a) | Width of Trench (b) | Hydraulic Conductivity (K) | s | $R_o$ | $L = R_o/2$ | $r_s = b/2$ | $\ln(R_o/r_s)$ [If $r_s<R_o$] or $\ln((R_o+r_s)/r_s)$ [If $r_s>=R_o$] | H | h = H-s | $Q_{ends}$ | $Q_{trench}$ | $Q_{total}$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | mbgs | mbgs | mbgs | m | m | m/s | m | m | m | m | - | m | m | $m^3/s$ | $m^3/s$ | $m^3/s$ | L/s | L/d |
| Elongated Trench @ 50 m Increments | Min | 4.04 | 11.5 | 12.0 | 50 | 2 | 1.15E-06 | 7.45 | 23.97 | 11.98 | 1.00 | 3.18 | 7.96 | 0.51 | 0.000072 | 0.000303 | **0.000375** | **0.37** | **32,360** |
| | Max | 4.04 | 11.5 | 12.0 | 50 | 2 | 1.10E-05 | 7.45 | 74.13 | 37.06 | 1.00 | 4.31 | 7.96 | 0.51 | 0.000506 | 0.000936 | **0.001443** | **1.44** | **124,661** |
| | Avg | 4.04 | 11.5 | 12.0 | 50 | 2 | 4.39E-06 | 7.45 | 46.83 | 23.41 | 1.00 | 3.85 | 7.96 | 0.51 | 0.000226 | 0.000592 | **0.000818** | **0.82** | **70,658** |

s = target drawdown (initial - target depth to groundwater) (m)
$R_o$ = radius of influence of construction dewatering/pumping (m)
L = distance to line source (m)
$r_s$ = equivalent single well radius (m)
H = Initial hydraulic head in aquifer (m)
h = hydraulic head at radius of well (m)
Q = construction dewatering rate ($m^3/s$)

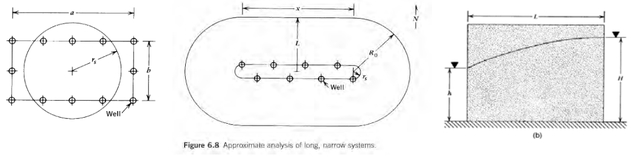


Figure 6.8 Approximate analysis of long, narrow systems.

$$Q = \frac{\pi K(H^2 - h^2)}{\ln R_0/r_s} + 2\left[\frac{xK(H^2 - h^2)}{2L}\right] \quad (6.10b)$$

x = unit length of trench

$R_o = 3000*s*\sqrt{K}$

*Source: Kyrieleis, W. and Sichardt, W. "Grundwasserabsenkung bei Fundierungsarbeiten" Springer, Berlin, 1930*

*Source: Powers, J. Patrick, et al. "Construction dewatering and groundwater control." (2007)*

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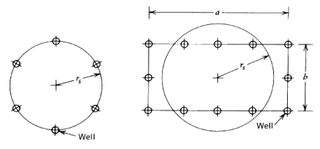
# DEWATERING CALCULATIONS - RECEIVING PIT

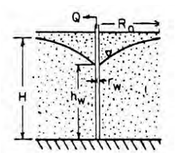
**Modified Dupuit-Forchheimer Equation: unconfined flow into a rectangular excavation.**
**Calculations assume no flow boundary at aquifer base**

| Excavation Area | | Initial depth to groundwater | Target Depth to groundwater | Depth to Base of Aquifer | Trench Length (a) | Trench Width (b) | Hydraulic Conductivity (K) | s | $R_o$ | $r_s = \sqrt{(ab/\pi)}$ | $\ln(R_o/r_s)$ [If $r_s<R_o$] or $\ln((R_o+r_s)/r_s)$ [If $r_s>=R_o$] | H | $h_w = H-s$ | $Q_{total}$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | mbgs | mbgs | mbgs | m | m | m/s | m | m | m | - | m | m | $m^3/s$ | L/s | L/d |
| Rectangular trench with dimensions 6 m x 6 m | Minimum K | 0 | 7.0 | 12.0 | 6 | 6 | 1.15E-06 | 7.00 | 22.52 | 3.39 | 1.90 | 12.00 | 5.00 | **0.000227** | **0.23** | **19,602** |
| | Maximum K | 0 | 7.0 | 12.0 | 6 | 6 | 1.10E-05 | 7.00 | 69.65 | 3.39 | 3.02 | 12.00 | 5.00 | **0.001360** | **1.36** | **117,493** |
| | Geometric mean K | 0 | 7.0 | 12.0 | 6 | 6 | 4.39E-06 | 7.00 | 44.00 | 3.39 | 2.56 | 12.00 | 5.00 | **0.000640** | **0.64** | **55,287** |

s = target drawdown (initial - target depth to groundwater) (m)
$R_o$ = radius of influence of construction dewatering/pumping (m)
$r_s$ = equivalent single well radius (m)
H = Initial hydraulic head in aquifer (m)
h = hydraulic head at radius of well (m)
Q = construction dewatering rate ($m^3/s$)




$$r_s = \sqrt{\frac{ab}{\pi}}$$




Radial flow, water table aquifer

$$Q_w = \frac{\pi K(H^2 - h_w^2)}{\ln R_o / r_w}$$

(from Table 6.1, pg 67)

*Use $r_w = r_s$ for rectangular excavations

$R_o = 3000*s*\sqrt{K}$

*Source: Kyrieleis, W. and Sichardt, W. "Grundwasserabsenkung bei Fundierungsarbeiten" Springer, Berlin, 1930*

*Source: Powers, J. Patrick, et al. "Construction dewatering and groundwater control." (2007)*

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# Appendix G

# Laboratory Certificate of Analysis

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# CERTIFICATE OF ANALYSIS

## Final Report

**C.O.C.: ---**

**REPORT No. B22-03453**

**Report To:**

**Cambium Environmental**
135 Bayfield Street, Unit 102
Barrie ON L4M 3B3
**Attention:** Sudhakar Kurli

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 04-Feb-22
DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:

P.O. NUMBER: 11969-001
WATERWORKS NO.

| Parameter | Qty | Site Analyzed | Analyst Initials | Date Analyzed | Lab Method | Reference Method |
|---|---|---|---|---|---|---|
| Alkalinity (as CaCO3) | 1 | Holly Lane | SYL | 07-Feb-22 | A-ALK-03 (o) | SM 2320B |
| Anions | 1 | Holly Lane | VK | 08-Feb-22 | A-IC-01 (o) | SM4110C |
| pH | 1 | Holly Lane | SYL | 07-Feb-22 | A-PH-01 (o) | SM 4500H |
| A - Wet Chem | 1 | Kingston | ach | 07-Feb-22 | A-TPTKN-001 (P)(k) | E3516.2 |
| BOD | 1 | Kingston | bbr | 07-Feb-22 | C-BOD-001 (k) | SM 5210B |
| Metals - ICP-OES | 1 | Holly Lane | AHM | 09-Feb-22 | D-ICP-01 (o) | SM 3120 |
| Metals - ICP-MS | 1 | Holly Lane | TPR | 08-Feb-22 | D-ICPMS-01 (o) | EPA 200.8 |

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

The analytical results reported herein refer to the samples as received. Reproduction of this analytical report in full or in part is prohibited without prior consent from Caduceon Environmental Laboratories.

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**Attention:** Sudhakar Kurli

**Caduceon Environmental Laboratories**
112 Commerce Park Drive
Barrie ON L4N 8W8
Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 04-Feb-22
DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11969-001
WATERWORKS NO.

| | Client I.D. | | BH101-22 | | | | PWQO | |
|---|---|---|---|---|---|---|---|---|
| | Sample I.D. | | B22-03453-1 | | | | Interim PWQO | PWQO |
| | Date Collected | | 04-Feb-22 | | | | | |
| **Parameter** | **Units** | **R.L.** | | | | | | |
| pH @25°C | pH Units | | 7.94 | | | | | 8.5 |
| Alkalinity(CaCO3) to pH4.5 | mg/L | 5 | 241 | | | | | |
| Hardness (as CaCO3) | mg/L | 1 | 2990 | | | | | |
| BOD(5 day) | mg/L | 3 | < 3 | | | | | |
| Chloride | µg/L | 500 | 11700 | | | | | |
| Nitrite (N) | µg/L | 50 | 320 | | | | | |
| Nitrate (N) | µg/L | 50 | 2610 | | | | | |
| Nitrate + Nitrite (N) | µg/L | 50 | 2900 | | | | | |
| Phosphorus-Total | µg/L | 10 | **4890** | | | | 10 | |
| Arsenic | µg/L | 0.1 | **26.6** | | | | 5 | 5 |
| Cadmium | µg/L | 0.015 | **1.64** | | | | 0.1 | 0.2 |
| Calcium | µg/L | 20 | 976000 | | | | | |
| Cobalt | µg/L | 0.1 | **66.5** | | | | 0.9 | |
| Copper | µg/L | 0.1 | **207** | | | | 5 | |
| Iron | µg/L | 5 | **130000** | | | | | 300 |
| Lead | µg/L | 0.02 | **153** | | | | 1 | 5 |
| Magnesium | µg/L | 20 | 135000 | | | | | |
| Nickel | µg/L | 0.2 | **127** | | | | | 25 |
| Silver | µg/L | 0.1 | **0.4** | | | | | 0.1 |
| Sodium | µg/L | 200 | 7200 | | | | | |
| Thallium | µg/L | 0.05 | **0.80** | | | | 0.3 | 0.3 |
| Uranium | µg/L | 0.05 | 4.24 | | | | 5 | |
| Vanadium | µg/L | 0.1 | **120** | | | | 6 | |

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 04-Feb-22
DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11969-001
WATERWORKS NO.

| | Client I.D. | | BH101-22 | | | | PWQO | |
|---|---|---|---|---|---|---|---|---|
| | Sample I.D. | | B22-03453-1 | | | | Interim PWQO | PWQO |
| | Date Collected | | 04-Feb-22 | | | | | |
| **Parameter** | **Units** | **R.L.** | | | | | | |
| Zinc | µg/L | 5 | **856** | | | | 20 | 30 |
| Zirconium | µg/L | 3 | **19** | | | | 4 | |

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

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Tel: 705-252-5743
Fax: 705-252-5746

DATE RECEIVED: 04-Feb-22
DATE REPORTED: 14-Feb-22
SAMPLE MATRIX: Groundwater

JOB/PROJECT NO.:
P.O. NUMBER: 11969-001
WATERWORKS NO.

## Summary of Exceedances

**Interim PWQO**

| BH101-22 | Found Value | Limit |
|---|---|---|
| Zirconium (µg/L) | 19 | 4 |
| Zinc (µg/L) | 856 | 20 |
| Vanadium (µg/L) | 120 | 6 |
| Thallium (µg/L) | 0.80 | 0.3 |
| Phosphorus-Total (µg/L) | 4890 | 10 |
| Lead (µg/L) | 153 | 1 |
| Copper (µg/L) | 207 | 5 |
| Cobalt (µg/L) | 66.5 | 0.9 |
| Cadmium (µg/L) | 1.64 | 0.1 |
| Arsenic (µg/L) | 26.6 | 5 |

**Provincial Water Quality Objectives**

| BH101-22 | Found Value | Limit |
|---|---|---|
| Zinc (µg/L) | 856 | 30 |
| Thallium (µg/L) | 0.80 | 0.3 |
| Lead (µg/L) | 153 | 5 |
| Nickel (µg/L) | 127 | 25 |
| Iron (µg/L) | 130000 | 300 |
| Cadmium (µg/L) | 1.64 | 0.2 |
| Arsenic (µg/L) | 26.6 | 5 |
| Silver (µg/L) | 0.4 | 0.1 |

PWQO - Provincial Water Quality Objectives
Interim PWQO - Interim PWQO
PWQO - Provincial Water Quality Objectives

Christine Burke
Lab Manager

R.L. = Reporting Limit
Test methods may be modified from specified reference method unless indicated by an *
Site Analyzed=K-Kingston,W-Windsor,O-Ottawa,R-Richmond Hill,B-Barrie

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# Appendix K

Biehn Drive Trunk Sanitary Sewer Extension
Technical Memorandum

BT ENGINEERING
BTE

# TECHNICAL MEMORANDUM

| | | | |
|---|---|---|---|
| **TO:** | Steve Taylor, P.Eng. | **OUR REF.:** | SN0447 |
| **FROM:** | Leonardo Sanchez, P.Eng. | **DATE:** | March 31, 2022 |
| **COPY:** | Katherine Scott, P.Eng. | | |

**RE:** **City of Kitchener**
**Biehn Drive Trunk Sanitary Sewer Extension**

The purpose of this Technical Memorandum is to present the initial design of the proposed trunk sanitary sewer extension of the existing sanitary trunk sewer on Biehn Drive.

## Existing Sanitary Sewer

The original drainage area for the entire system was defined in the City's GIS system and is shown on Figure 1. The Strasburg-Biehn drainage area is part of the Schneider sanitary system and includes 209.1 ha. The undeveloped portion of the drainage area that is denoted as tributary to the existing sanitary trunk sewer at the proposed extension covers 128.9 ha.

The existing Biehn Drive trunk sanitary sewer is a 525 mm diameter pipe at the current end of the system. The existing pipe has capacity for 186 litres per second (l/s) flowing half-full, which corresponds to the peak flow that would be produced by the undeveloped tributary area if it was developed as low density residential.

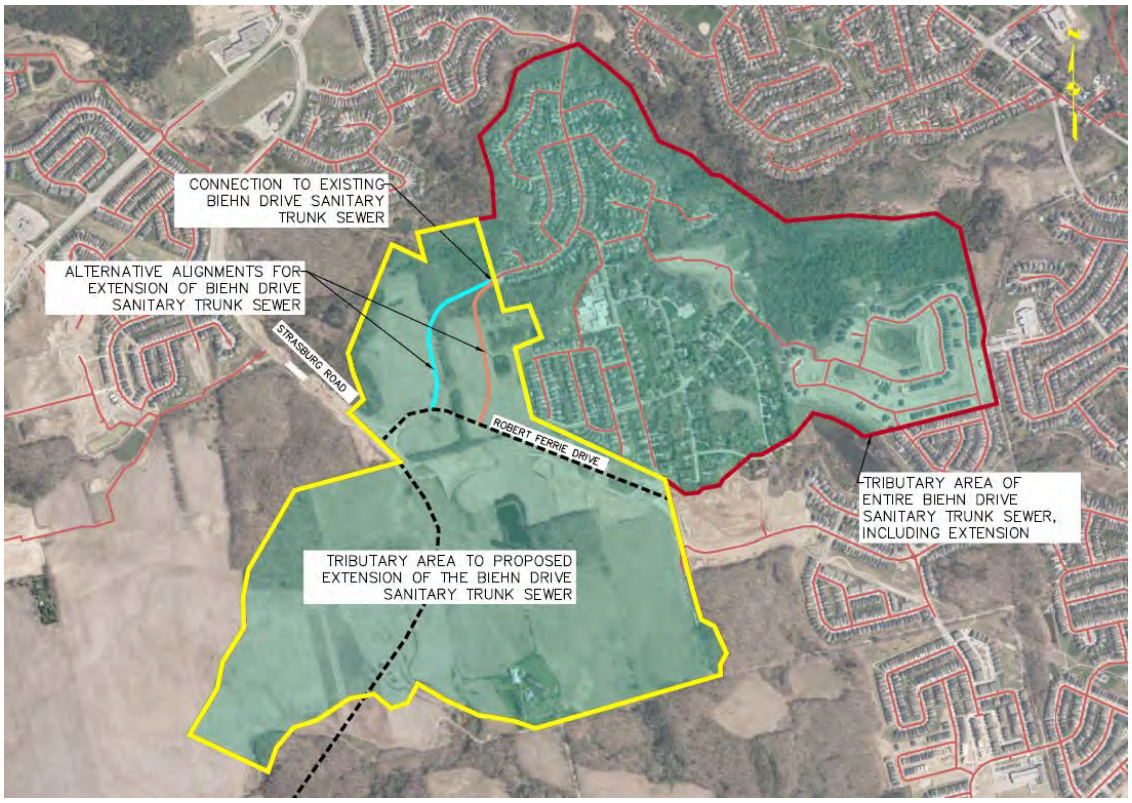


**Figure 1 - Original Sanitary Sewer Tributary Area**

The City's Official Plan designates the lands within the original drainage area as shown on Figure 2. The lands designated as Rural and Agricultural drain naturally to the adjacent watershed and will not be connected to the sanitary trunk sewer. Therefore, these lands can be considered to be non-tributary.

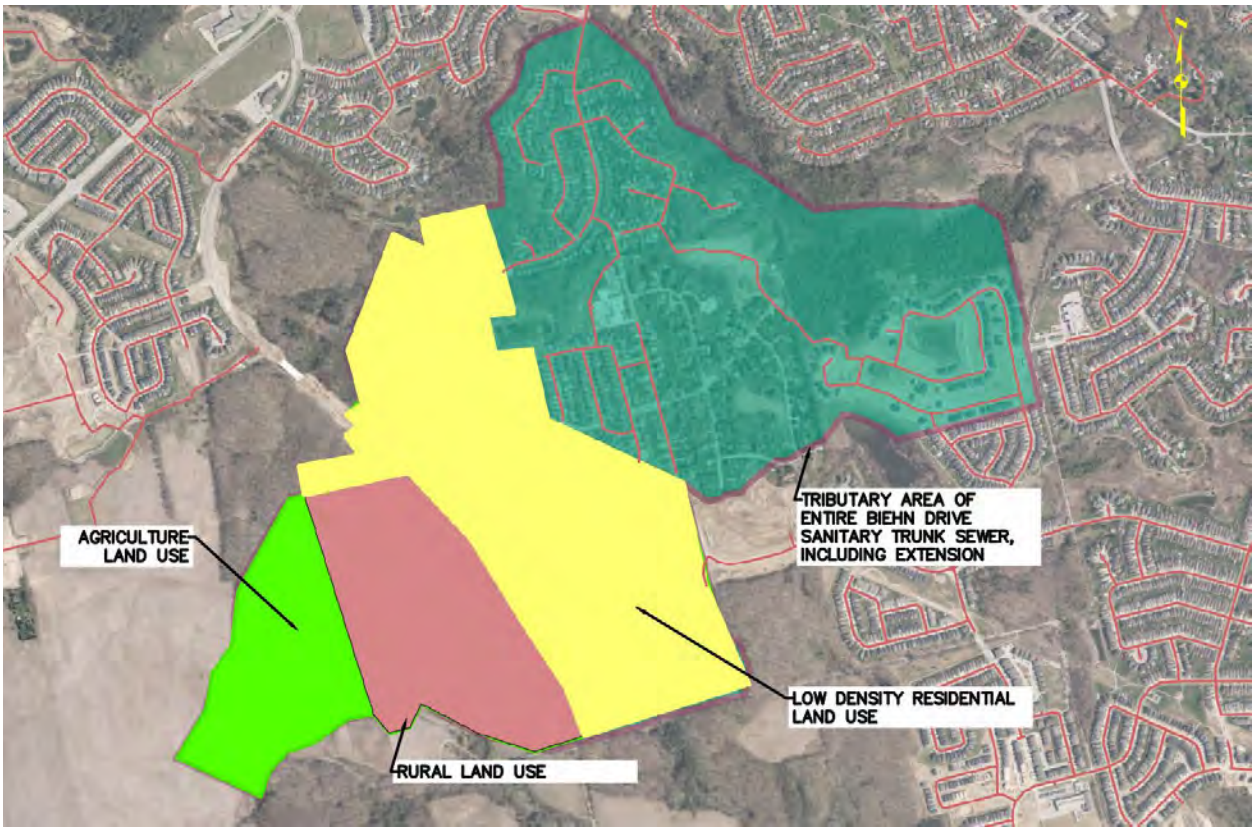


**Figure 2 - Land Uses per Official Plan**

Therefore, the revised sanitary drainage area was modified to include only the lands that are designated for urban development. The revised sanitary trunk sewer drainage area, shown on Figure 3, includes 72.0 ha.

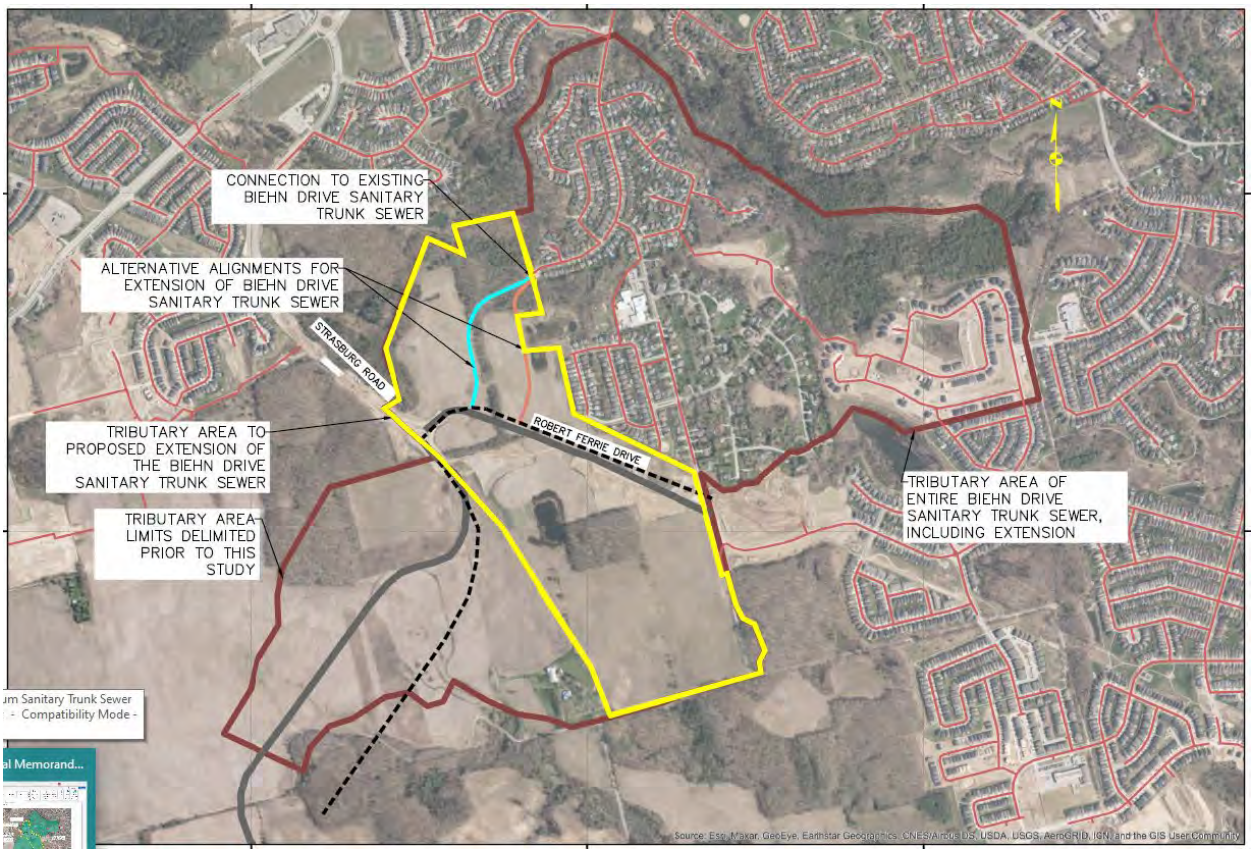


**Figure 3 - Revised Sanitary Trunk Sewer Drainage Area**

## Population Estimate

The Official Plan designates the urban areas within the sanitary trunk sewer drainage area as Low Density Residential, which allows for a maximum of 30 dwellings per hectare. Based on the drainage area of 72.0 ha, the total number of dwellings is 1920. This is a conservative estimate, given that it does not subtract the area required for roadways, parks, and schools. However, given that the proposed development is not fully defined, it represents a reasonable estimate.

Statistics Canada 2016 Census data show that the average number of persons per dwelling in the Region is 2.6 persons. On this basis, the population of the revised drainage area is 5016 persons.

## Estimated Sanitary Sewage Flow

The 2021 Development Manual of the City of Kitchener provides the design criteria for sanitary servicing. Based on the Kitchener Development Manual, the average flow per capita for new sanitary sewers is 305 litres per day (305 l/cap/day). The peak flow in the sanitary sewer must be calculated using a Peaking Factor Formula (the Harmon Formula) related to the serviced population.

In addition to the average sewage flow, the sanitary sewer must have hydraulic capacity to accommodate a minimum flow resulting from inflow and infiltration (I/I flow). The required I/I flow is 0.15 l/s/ha.

On this basis, the peak flowrate at the junction of the trunk sewer extension and the existing sewer is 67 l/s.

It should be noted that the existing sanitary trunk sewer has a hydraulic capacity of 168 l/s, which is appropriate for the larger drainage area of 127.3 ha.

## Alternative Sanitary Trunk Sewer Alignments

Two Sanitary Sewer Alignment Alternatives were considered, as shown on Figure 4.

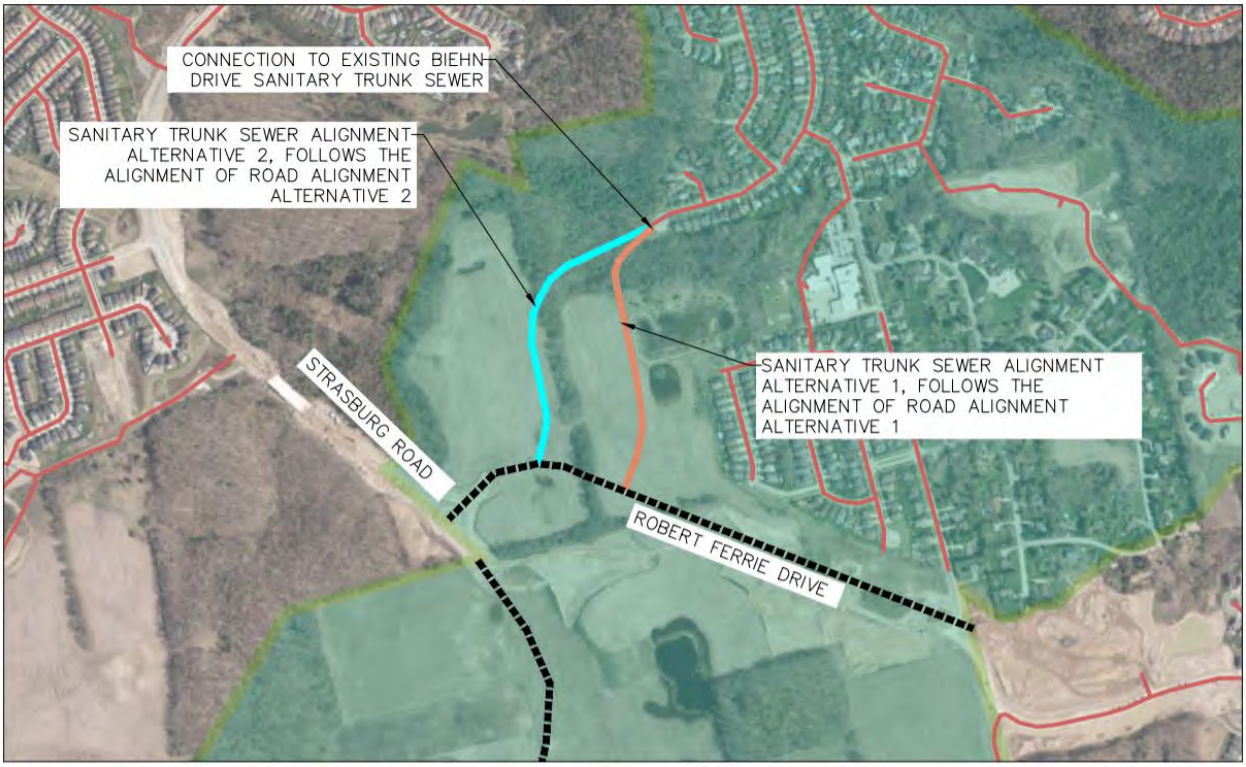


**Figure 4 - Sanitary Sewer Alignment Alternatives**

The two alternative alignments were evaluated in conjunction with the analysis and evaluation of the road alignment alternatives, as discussed in the Environmental Study Report. Based on the evaluation of alternatives, the Technically Preferred Sanitary Sewer Alignment Alternative is Sanitary Sewer Alignment 1.

## New Sanitary Trunk Sewer

The new trunk sanitary sewer will follow the alignment of the Biehn Drive extension to Robert

Ferrie Drive. Based on the sanitary drainage area, the new trunk sewer will be designed for a peak flow of 67 l/s, and will be installed at a grade of 0.50% to allow connection of the areas of the sewershed located south of Robert Ferrie Drive. The required trunk sanitary sewer pipe will be a 500 mm diameter HDPE pipe or a 525 mm diameter pipe. The type of pipe will be confirmed in the preliminary design.

Figure 5 shows an approximate alignment of a future sanitary sewer that would serve the southern portion of the sewershed. Figure 6 shows the ground and sewer profiles along the same alignment. The maximum depths could be up to 21 m.

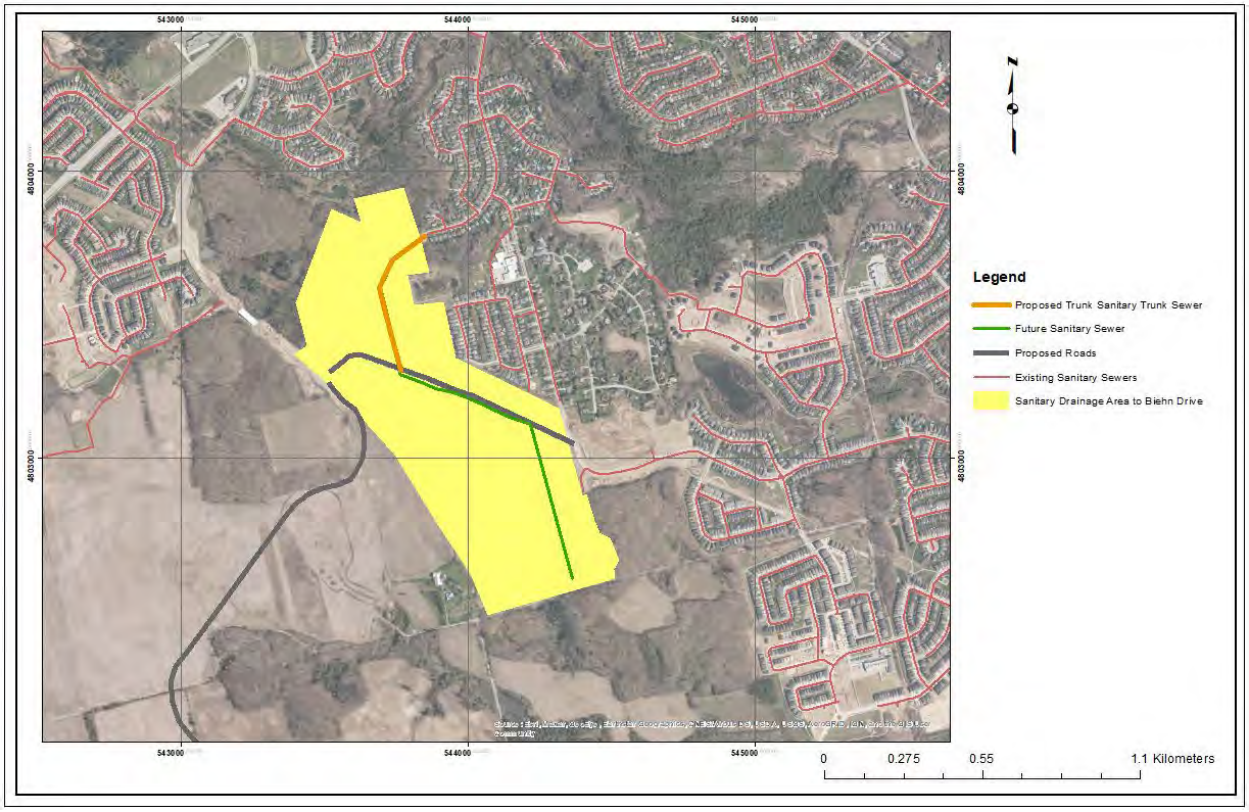


**Figure 5 - Future Sanitary Sewer**

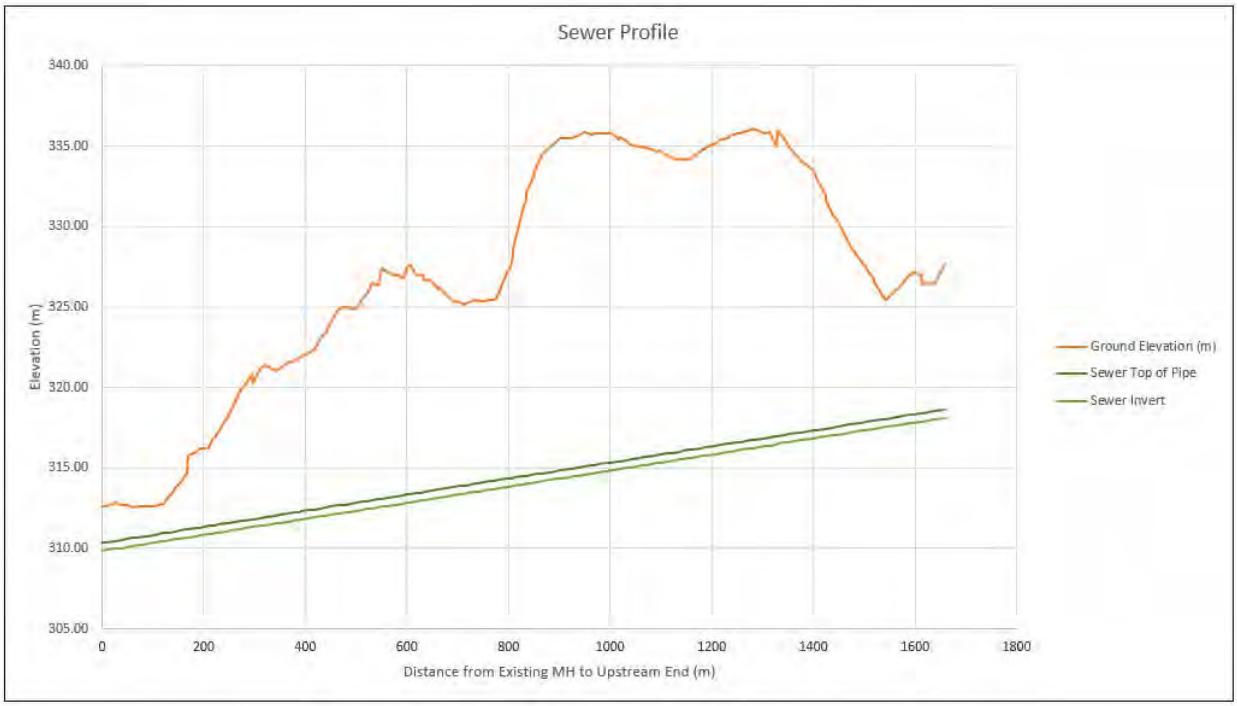


**Figure 6 - Future Sewer Profile**

Although it is possible to install the pipe at the depth shown, other options may be more appropriate to serve this area in the future. For example, the southern half of the tributary area may require a pumping station and forcemain. Alternatively, the City may wish to consider draining the southern portion to the adjacent New Dundee sewershed, if the hydraulic capacity of that system permits. However, to provide for the possibility that the entire system connects to the proposed Biehn Drive trunk sanitary sewer extension, the sewer needs to set at the lowest feasible grade.

Additional details will be provided in the preliminary design.

Prepared by,

Leonardo Sanchez, P.Eng.

# Appendix L

Analysis and Evaluation Report

BT ENGINEERING

# Updated Analysis and Evaluation Report

City of Kitchener
Biehn Drive Extension Environmental Assessment Study
Municipal Class Environmental Assessment

August 2024, Revision 1

**Submitted by:**
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# 1.0 INTRODUCTION

This report supersedes the original Analysis and Evaluation Report REV. 3 February 28, 2023.

The City of Kitchener (City) is undertaking a Class Environmental Assessment (EA) Study of the extension of Biehn Drive southerly to the proposed extension of Robert Ferrie Drive. The extension of Biehn Drive will include a trunk sanitary sewer and a watermain. The Study involves evaluation of alternatives for the alignment of the Biehn Drive extension, the location and design of intersections, and municipal services, while minimizing natural, social, cultural and land use impacts. This report describes the revised evaluation of the Preliminary Alignment Alternatives carried forward following Public Information Centre (PIC) No. 2 and the additional studies carried out by the City of Kitchener.

## 1.1 Problem and Opportunity Statement

The planned extensions of Strasburg Road and Robert Ferrie Drive combined with new development will result in changes to the traffic demands and patterns within the Doon South and Brigadoon communities. To address those changes, the City of Kitchener Transportation Master Plan and Official Plan have identified an extension of Biehn Drive from its current terminus to Robert Ferrie Drive. The Study has revisited the need for an extension of Biehn Drive and evaluated potential alignment alternatives if an extension of Biehn Drive is still recommended. The Study has considered the natural, social environments and the future land use in the Study Area. The study is assessing the road network to provide safe, reliable transportation access to communities within Doon South and Brigadoon considering vehicular, pedestrian, cycling and truck routes. The road project is being completed as a Schedule C undertaking.

The Project provides the opportunity to:

- Improve accessibility to the local community by providing additional network links;
- Define a multi-modal transportation plan to support travel within the local neighbourhoods; and
- Allow development to proceed on lands that currently require the infrastructure requirements to be defined prior to developing the land use plan.

In parallel, the City is planning for new municipal services that are required to serve future development to the south. The future watermain and sanitary trunk sewer crossing of the Provincially Significant Wetland (PSW) from the existing services at the end of Biehn Drive are being completed as a Schedule B project.

## 1.2 Study Area

The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension.

Comments received from the public at the combined Community Café and PIC No. 1, indicated that the Study Area should be expanded to include a Broader Study Area and consider traffic effects in adjacent neighbourhoods. The Study Area is illustrated in **Figure 1.**

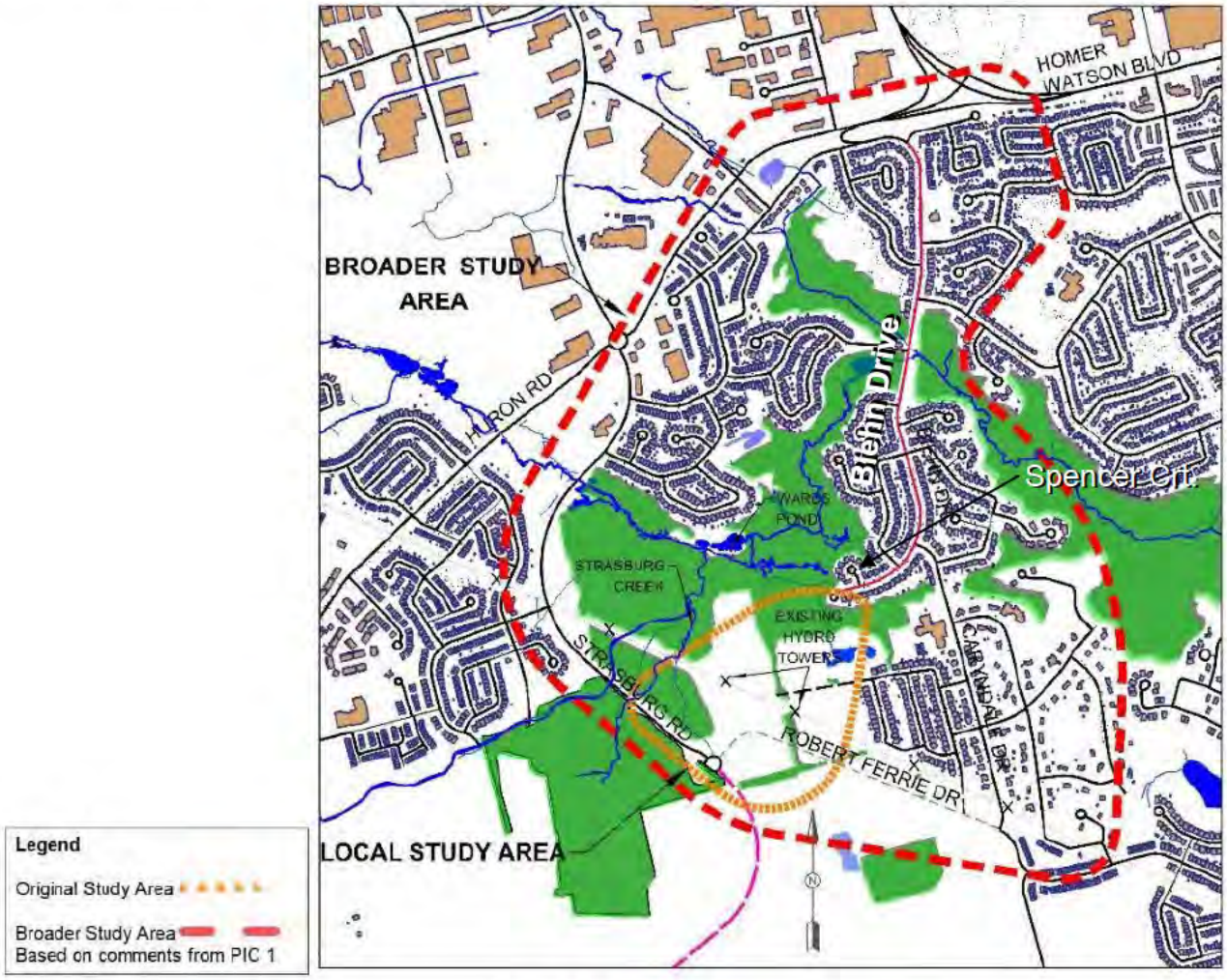



**Figure 1: Study Area**

## 1.3 Study Introduction

This study was initiated as a Municipal Schedule C project as defined by the Municipal Class Environmental Assessment (MCEA). The Study involves evaluating alternative alignments for Biehn Drive to serve the Brigadoon Community located in the southwest portion of the City of Kitchener. The extension of Biehn Drive has long been a part of the integrated land use and transportation plan for the larger community. The City of Kitchener Official Plan (November 2014) identifies Biehn Drive as a Major Community Collector Street, shown in orange, refer to **Figure 2**. Collector streets function to collect traffic from local streets and provide access to arterial streets, shown in orange.

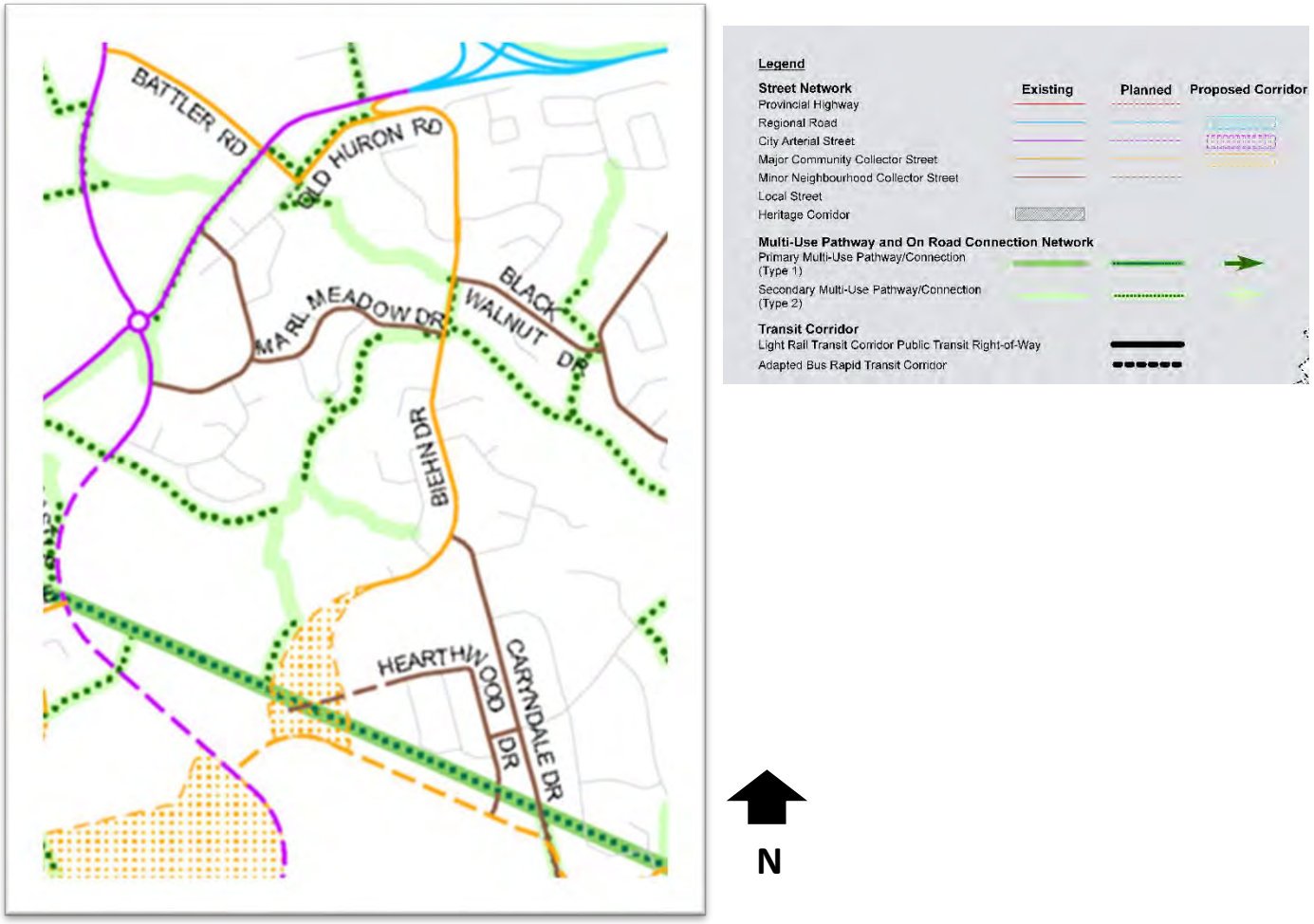



**Figure 2: Future Road Network**

Source: City of Kitchener Official Plan: A Complete & Healthy Kitchener November 19, 2014 OP Map 11 - Integrated Transportation System.

## 1.4 Background

Since the mid-2000's, the road network and municipal servicing for the Doon South and Brigadoon areas in the City of Kitchener involved plans for area development and evolving transportation needs. The 2014 Official Plan and the (add date) Transportation Master Plan (TMP) identified the need to extend Biehn Drive westerly to the Robert Ferrie Drive extension and ultimately to Strasburg Road. The Biehn Drive Extension would be a major collector road, as identified in Schedule B of the City of Kitchener's Official Plan Amendment. This link would accommodate vehicles to and from the Brigadoon community and would help mitigate cut-through traffic on local streets within the community. A collector road would collect traffic from local roads within the community and provide connectivity to high tier arterial roads including Strasburg Road.

## 1.5 Additional Studies

Following PIC 2 in November 15 to 29, 2021, three additional studies were carried out to fully understand the traffic and natural heritage impacts anticipated with the extension of Biehn Drive. These studies included an updated traffic analysis of the Doon South and Brigadoon communities, a survey for Black Ash trees which were listed as a Species at Risk in January 2024 and a dewatering assessment for constructing municipal services beneath the Strasburg Creek Wetland. These three studies significantly altered the evaluation methodology and added significant criteria which was not considered in the original evaluation of road alignments carried out in October 2021. The Analysis and Evaluation Report has been updated to reflect the recent findings. This report documents the revised evaluation of the Preliminary Design Alternatives.

### 1.5.1 City of Kitchener Doon South Community Area Transportation Study

The purpose of this study was to confirm the need and justification for the Biehn Drive extension and the implications of not proceeding with this project.[1] The findings and conclusion are briefly listed as follows:

- Caryndale Drive functions as a major neighborhood community collector. It provides the only westerly connection between Biehn Drive and Robert Ferrie Drive.
- Caryndale Drive in combination with Biehn Drive and Robert Ferrie Drive provides the only continuous route through the western area of the Doon South neighbourhood between New Dundee Road and Huron Road.
- The future extension of Robert Ferrie Drive west to Strasburg Road, and the extension of Strasburg Road south to New Dundee Road is likely to redistribute (and increase) traffic volumes on Caryndale Drive by providing a new link to Caryndale Drive from Strasburg Road (if Biehn Drive is not connected to Robert Ferrie Drive).
- The extension of Biehn Drive to Robert Ferrie Drive will ensure Carnydale Dive functions as a minor neighbourhood collector street, as described in the City of Kitchener Official Plan and will provides an alternate route to the Caryndale Drive corridor.

The Doon South Community Area is shown in **Figure 3.**

[1] City of Kitchener Doon South Community Area Transportation Study, by Paradigm Transportation Solutions Limited 02/2024.

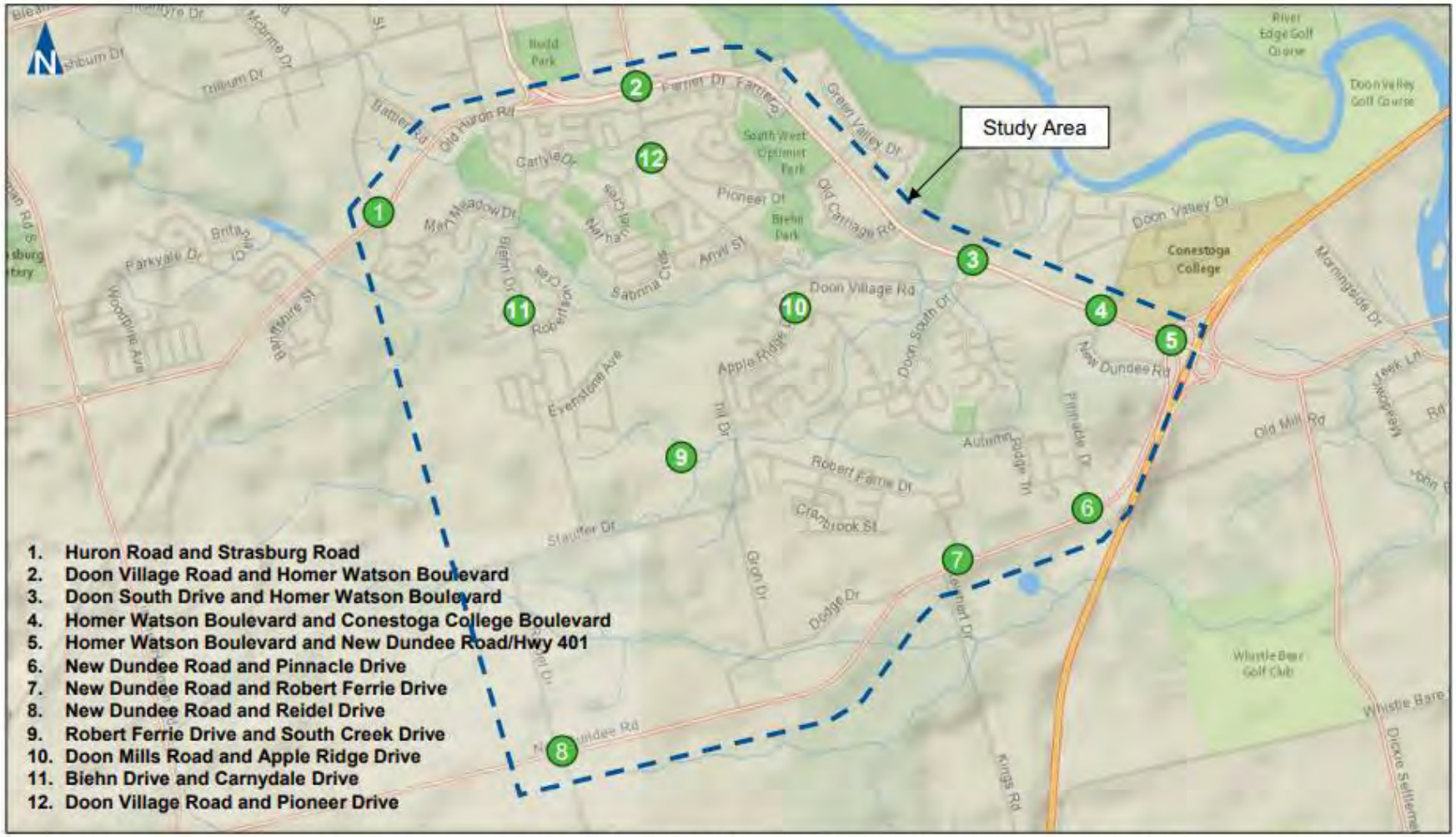



**Figure 3: City of Kitchener Doon South Study Area and Intersections**

### 1.5.2 Black Ash Tree Identification

A Site Reconnaissance of the portion of the Strasburg Creek Provincially Significant Wetland (PSW) within the Study Area was undertaken on October 23, 2024, to identify Black Ash trees.[2] Six trees are considered potential Black Ash within the preferred road alignment, four were classified as potential Black Ash due to the absence of leaves, which limits identification, and two exhibit stronger potential based on distinct bark characteristics. .

The *Endangered Species Act*, 2007 (ESA) protections for Black Ash came into force on January 26, 2024. Ontario's new regulations apply to healthy Black Ash that appear to have survived exposure to the Emerald Ash Borer (EAB). These regions encompass various municipalities, counties, townships, and cities, including Kitchener in the region of Waterloo. Ontario's habitat protection prohibitions are applicable to a radial distance of 30 metres around Black Ash.

### 1.5.3 Hydrogeology Assessment

A trenchless installation method is suitable for the placement of sewer and watermain infrastructure beneath the Strasburg Creek Wetland, based on hydrogeologic conditions assessed across the area.[3]

[2] Black Ash Tree Identification Update - October 23, 2024

[3] Geotechnical Investigation – Proposed Trunk Sewer, Biehn Drive South Extension, Kitchener, by Cambium December 20, 2023

# 2.0 ALTERNATIVES TO THE UNDERTAKING – PLANNING ALTERNATIVES

## 2.1 Description of Planning Alternatives

Planning Alternatives represent alternative ways or methods of addressing the Problem and Opportunity Statement specific to this study. These reflect different strategies and include the "Do Nothing" approach (maintaining the status quo, i.e. not addressing the Problem and Opportunity Statement). The consideration of all reasonable alternatives is a guiding principle for EA studies.

The analysis and evaluation process involves a 2-step decision-making process. Initially the evaluation of Planning Alternatives (alternative project types or alternative strategies to address the problem) are identified followed by the subsequent evaluation of preliminary design alternatives. The preliminary design alternatives include the Biehn Drive extension alignment, sanitary sewer alignment, cross section, and intersection alternatives.

The Planning alternatives were previously considered in the City of Kitchener Transportation Master Plan, 2013, which identified the extension of Biehn Drive as a City Street Capacity Improvement. The TMP was developed following Phases 1 and 2 of the Class EA process, including the evaluation of Alternative Planning Solutions. The TMP includes recommendations for the "implementation of new streets in southwest Kitchener Urban Areas Study Community Master Plan, including the extension of Biehn Drive between Biehn Drive and Robert Ferrie Drive".

In reviewing the TMP recommendations, the following Planning Alternatives were assessed:

- Do Nothing: This alternative would maintain the existing road network and would not extend Biehn Drive and not provide a bundled sanitary and municipal service corridor.
- Transportation Demand Management (TDM): Reduces vehicular traffic demand (encourages alternative work hours, work at home and active modes of transportation). Does not address the need for a municipal service corridor. TDM will be accomplished by the inclusion of a multi-use path adjacent to the roadway.
- Use of Local Roads: Encourage the use of other local roads to reduce the need to extend Biehn Drive. Local roads are generally not designed or maintained to accommodate high traffic volumes. This alternative does not address the parallel requirement for a municipal services corridor.
- Limit Land Use Development: Limit any new residential, commercial or industrial development and therefore reduce the generation of new trips. This does not achieve the Provincial mandate of the Places to Grow Act which directs the Region and City to create future development lands with specific targets to be achieved.
- Extend Biehn Drive: Provides a long-term solution for improved traffic operations for all modes of travel (pedestrians, cyclists, transit and local community traffic) and safety. It allows a bundling of municipal services in a common corridor which is required to service the expansion areas to the south to meet the Provincial Places to Grow Act mandate.

Based on the preliminary review of Alternative Planning Solutions, "Transportation Demand Management" and "Extend Biehn Drive" (including the bundling of the proposed trunk sanitary

sewer, maintenance roadway/multi-use path and watermain from Biehn Drive to Robert Ferrie Drive) are recommended. The Use of Local Roads was not a standalone solution but based on community input was carried forward as a modified approach of using two corridors (Alternative 4 carried forward using Caryndale Drive for traffic and using a municipal servicing corridor across the PSW). This approach validates and supports the previous TMP recommendations.

The evaluation of the Alternatives to the Undertaking (Planning Alternatives) for this Study is shown in **Table 1.**

The long list of alternatives and the coarse screening evaluation of alternatives was presented to the public at PIC No. 1 in early 2021. Following PIC No. 1 and the public's opportunity to comment, the Preliminary Alignment Alternatives were coarse screened, and the recommended alternatives were carried forward for a detailed evaluation. The coarse screening of the long list of alternatives and a description of the evaluation results will be documented in the final Environmental Study Report (ESR).

The Preliminary Alignment Alternatives (Alternative Methods of implementing the Preferred Planning Alternative) that are proposed to be considered for the recommended Planning Solution are: TDM; Use Existing Roads; and Extend Biehn Drive.

**Table 1: Planning Alternatives**

| Screening Criteria | Do Nothing | TDM | Use of Existing Local Roads | Limit Development | Extend Biehn Drive (Road and servicing corridor) |
|---|---|---|---|---|---|
| **Transportation** | Does not address forecast traffic demand. Results in increased volumes on local roads. | May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure. | Local roads not designed to accommodate increased volumes. Caryndale Drive is not designated as a major collector and as such should not be expected to carry additional traffic. | May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth. | Accommodates all modes of transportation. |
| **Municipal Services (Water and Trunk Sanitary Sewer for future development)** | Does not accommodate future development. | Does not accommodate future development. | Does not accommodate future development. | Does not accommodate future development. | Accommodates future development. |
| **Environmental** | No impacts. | No or low impacts.<br>Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes). | Low impacts.<br>Creates disruption to properties on local roads that would experience an increase in traffic. | No impacts. | Low to High<br>Servicing: Low<br>Roadway: High environmental effect possible with new corridor. Magnitude of effects will depend impact on PSW and SAR tree species. |

| Screening Criteria | Do Nothing | TDM | Use of Existing Local Roads | Limit Development | Extend Biehn Drive (Road and servicing corridor) |
|---|---|---|---|---|---|
| **City Planning Objectives** | Does not meet objectives/ recommendations in City Planning document or support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services). | Supports objective to encourage active transportation and alternate modes.<br>Does not support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services). | Does not meet objectives/ recommendations in City Planning documents.<br>Does not support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services). | Does not meet objectives/ recommendations in City Planning documents.<br>Does not support the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services). | Supports the recommendations for the extension of Biehn Drive in OP and TMP.<br>Supports the Provincial *Places to Grow Act* requirement to create additional development areas (including municipal services). |
| **Recommendations** | Not recommended but carried forward as a baseline to compare other alternatives. ✓ | Recommended as a complementary solution. This is not a standalone solution. ✓ | Following PIC No. 1 there was public support to carry forward this alternative. This is not a standalone solution. See Extend Biehn Drive which is a combination of Use of Local Roads and a New Municipal Servicing Corridor. ✓ | Not recommended. ✗ | Recommended to be carried forward for further study, for both municipal services and a transportation connection. ✓ |

✓ **Recommended Planning Solutions for further evaluation**

# 3.0 EVALUATION METHODOLOGY

## 3.1 Alignment Alternatives Evaluation Methodology

For the evaluation of the alignment alternatives, the study utilized a formal quantitative evaluation methodology described as the Multi Attribute Trade-off System (MATS). The use of this multi-criteria decision analysis involves establishing utility scores for each alternative on each criterion. The utility scores allow a translation of units of measure to a non-dimensional number that allows scores to be added between factor groups/sub-factors. The scores are then totalled using a system of weights to determine an overall ranking for each alternative.

A detailed description of the evaluation methodology used in this study for selecting the Technically Preferred Alignment is provided in **Appendix A**.

The quantitative approach for the evaluation of Alignment Alternatives is consistent with the Ministry of Environment, Conservation and Parks (MECP) practices for the evaluation of numerous and complex alternatives. This approach uses an analytical approach that measures scores based on a mathematical relationship, i.e., the degree of subjectivity by the evaluation team is minimized. This traceable process allows the evaluation team and the opportunity to assess trade-offs involved in the evaluation and use this information to support the decision-making process. The evaluation criteria include:

- Factor Groups: Traffic and Transportation; Natural Environment; Cultural Environment; Social Environment; Economic Environment; Land Use and Property; and Cost.
- Sub-factor Criteria (under each Factor Group) may include temporary or permanent property impacts; loss of fish habitat; noise; built heritage resource impacts; emergency response; and capital cost.

# 4.0 EVALUATION OF ALTERNATIVES

## 4.1 Coarse Screening Alignment Evaluation

### 4.1.1 Preliminary Alignment Alternatives

The Preliminary Alignment Alternatives presented to the public at PIC No. 1 are shown in **Figure 4**. An additional Alignment, Alternative 4 using existing roadways, was added following input from PIC No. 2. All the alternatives were carried forward to the detailed evaluation were considered by the Study Team to be reasonable alternatives to the Planning Solution and are listed in **Table 2**.

**Table 2: Preliminary Alignment Alternatives**

| Alternative | Description |
|---|---|
| Do Nothing | Existing - Caryndale Drive |
| Alternative 1 | Connect Biehn Drive to Robert Ferrie Drive - East Alignment |
| Alternative 2 | Connect Biehn Drive to Robert Ferrie Drive - Central Alignment |
| Alternative 3 | Connect Biehn Drive to Strasburg Road - West Alignment |
| Alternative 4 | Existing - Caryndale Drive<br>Provide an Active Transportation Link<br>Municipal Trunk Sewer to follow Alternative 1 |

The coarse screening of Alignment Alternatives is shown in **Table 3.**

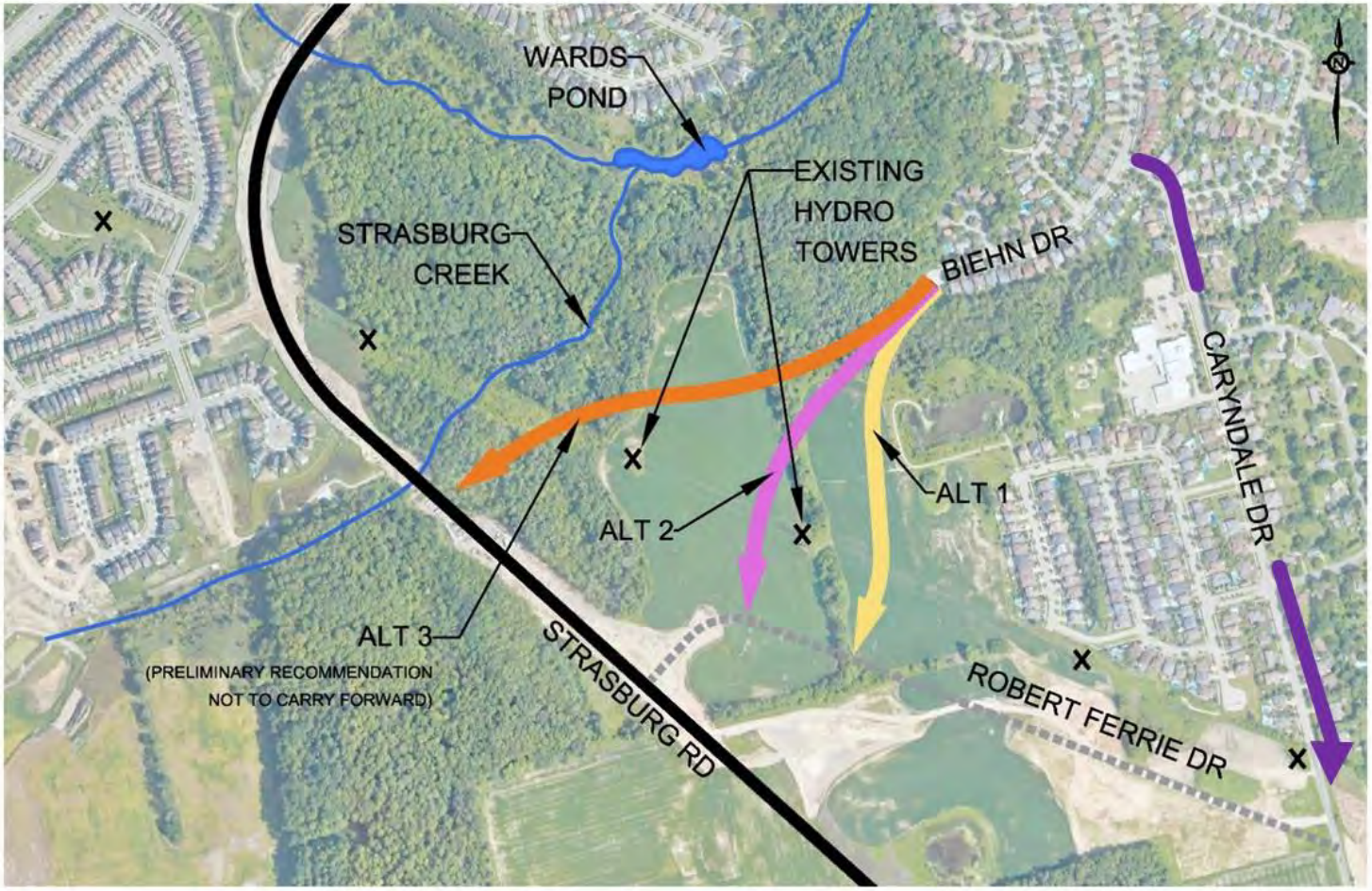
The preliminary alignment alternatives will include a trunk sanitary sewer in conjunction with the alternative road extension alternatives. It is noted that some of the alternative alignments for the trunk sewer may diverge from the road alignment alternatives. The Class EA process for extension of the sanitary sewer is a Schedule B process. However, the EA for the road and sanitary sewer will be combined into a single document and will be documented in an ESR. This EA is being undertaken concurrently with the Sanitary Sewer Master Plan.

In addition, following PIC No. 2, Alternative 4 was revised and no longer had a proposed Multi Use Pathway linking Biehn Drive to Robert Ferrie Drive to limit impacts to the PSW.

### 4.1.2 Short Listed Alignment Alternatives Evaluation

**Figure 5** illustrates the three (3) alignment alternatives that were carried forward following the coarse screening. The short-listed Alignment Corridor Alternatives are shown in **Appendix B**. Alternative 4 was added following public comments received at PIC No.1 and the Do Nothing was included as a baseline to compare other alternatives.

**Figure 4: Preliminary Alignment Alternatives**




**NTS**

**Legend**

**Future Roadway Alignment**

**Table 3: Coarse Screening of Alignment Alternatives**

| Screening Criteria | Do Nothing | Alternative 1: Extend Biehn Dr. to Robert Ferrie Drive east of Hydro Tower | Alternative 2: Extend Biehn Dr. to Robert Ferrie Drive west of Hydro Tower | Alternative 3: Strasburg Road Connection | Alternative 4: Existing - Caryndale Drive |
|---|---|---|---|---|---|
| **Does this alternative satisfy forecast traffic demand, improve safety, and address all modes of transportation?** | Does not meet forecast traffic demand, improve safety nor address all modes of transportation. | Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive. | Provides a north-south connection to Robert Ferrie Drive. Accommodates all modes. Reduces cut-through traffic on Biehn Drive. | Provides a north-south connection to Strasburg Road. Accommodates all modes. | Provides a north-south connection to Strasburg Road. Accommodates all modes. However, there are increased levels of traffic on local roads. |
| **Does the approach result in significant impacts to the natural environment?** | No impacts. | Minor impacts to the woodlot/PSW (~0.3 ha). | Minor impacts to the woodlot/PSW (~0.3 ha). | Significant impacts to the woodlot/PSW (~1.3 ha). | No impacts. |
| **Is the approach affordable for the City to implement?** | Affordable alternative. | No significant difference. | No significant difference. | Higher cost - requires an intersection onto Strasburg Road (arterial). | Affordable alternative. |
| **Does this alternative comply with the recommendations of the City's planning documents (I.e., TMP, OP, KGMP)** | This alternative does not comply with the recommendations of the City's planning documents. | This alternative complies with the recommendations of the City's planning documents. | This alternative complies with the recommendations of the City's planning documents. | Does not comply with the recommendations of the Official Plan or Growth Management Plan. Based on the previous design and construction of the Strasburg Road and roundabout within the Study Area, this previous alternative is no longer considered feasible. | This alternative does not comply with the recommendations of the City's planning documents. |
| **Recommendation:** | Carry forward as a base line to compare alternatives. ✓ | Carry forward for further evaluation. ✓ | Carry forward for further evaluation ✓ | Do not carry forward ✗ | Carry forward for further evaluation ✓ |

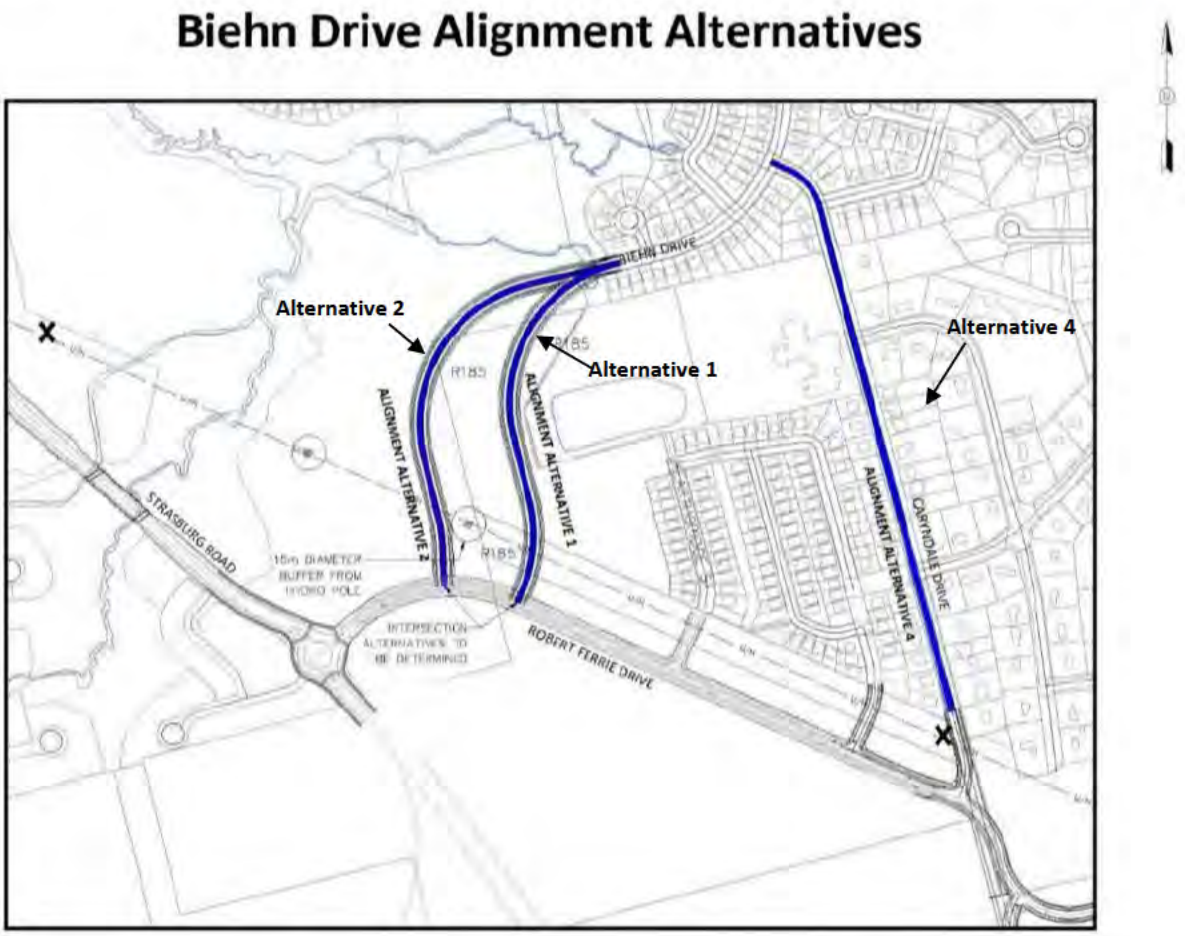



**Figure 5: Short Listed Alignment Alternatives**

### 4.1.3 Long List of Criteria - Alignment

A long list of sub-factors was established for each of the main factor categories to allow for the identification of all potential benefits and impacts. The relative measured effect of each criterion is also defined to ensure that the significance of each criterion (factor group or sub-factor) is recognized in the evaluation process.

Sub-factors are measurable criteria under a factor group. For example, under the category/factor group "Transportation", sub-factors relate to measurable transportation differences among alternatives. Using the Transportation factor group as an example, sub-factors may relate to safety or traffic operations measures for the identification of benefits and impacts.

Six categories or factors were selected which were used for each evaluation. Within each of these factor groups are sub-criteria, described as sub-factors, which define the measure and the relative differences of magnitude of impact or benefit. The factor groups include:

- Traffic and Transportation
- Natural Environment
- Cultural Environment

- Socio-Economic Environment
- Land Use and Property
- Cost

Within each of these categories (factor groups) are sub-factors which define the measure and the relative differences of magnitude of impact. The sub-factors were developed from a long list created by the Study Team (Consultants and City Staff). Where there were no measurable or meaningful differences between alternatives, and it is agreed that the alternatives are generally equal with respect to this criterion, then the sub-factor is not carried forward. When the Evaluation Team (Consultants and City Staff) considered the impacts were double counted among one or more criteria, then only one criterion was selected to be carried forward.

The long list of evaluation criteria that will not be carried forward are found in **Appendix C**. For a sub-factor to be carried forward, the sub-factor must:

- Be a measure of a meaningful difference among alternatives.
- Capture a measurable difference among alternatives.
- Not "double count" the effect that was measured under another sub-factor.
- Describe a difference in performance or an effect on the natural or social environment that the Technical Advisory Committee (Consultants and City Staff) considered necessary to be included in the decision-making process.

The selection of the sub-factors to address the goal of the study, are comprehensive enough to describe all aspects of the effects of the project, and do not double-count sub-factors.

#### 4.1.4 Short Listed Criteria

Sub-factors selected to evaluate the alternatives including their definitions and scores are described in **Appendix D**.

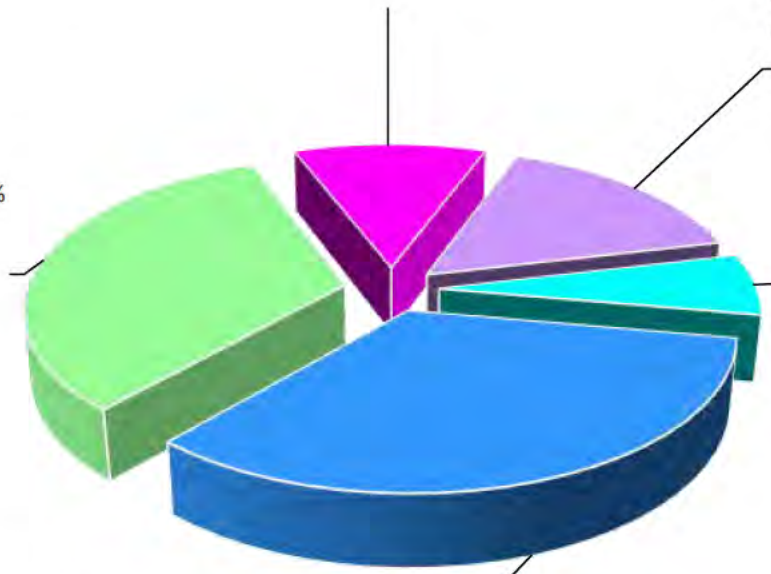
#### 4.1.5 Preferred Alignment Alternatives

The Evaluation Team members were responsible for completing separate weighting exercises which provided independent perspectives of the relative importance of factor groups and sub-factors for each specific evaluation. The results of the weighting exercise are illustrated in **Figure 6** and **Figure 7.**

### 4.2 Technically Recommended Plan

Alternative 1 is the best-balanced solution, refer to **Table 4**. It provides the best transportation performance while minimizing natural and social environmental impacts. A limited number of Black Ash trees have been identified along the corridor however the city's best efforts to combat the Emerald Ash Borer has had limited success. The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors.

Alternative 1 is recommended as the Technically Preferred Plan and is shown in **Figure 8**. This recommendation minimizes the impacts to the PSW and provides a direct connection to Robert Farrie Drive. The trunk sewer and municipal water services will be extended southerly from Biehn Drive.



**Socio - Economic Environment 10.3%**
- Community Disruption to Biehn Drive North 21.0%
- Community Disruption to Biehn Drive South 50.0%
- Community Disruption to Caryndale 29.0%

**Land Use and Property 14.2%**
- Supports the City of Kitchener's Official Plan 56.0%
- Efficient Utilization of Land 29.5%
- Crossing of the Hydro Corridor 14.5%

**Natural Environment 29.7%**
- Wildlife Habitat 15.1%
- Accommodating Wildlife Movement 11.9%
- Provincially Significant Wetlands (PSW) Removed 24.8%
- Potential Black Ash Impacted 24.8%
- Groundwater Infiltration 23.5%

**Cost 5.9%**
- Capital Costs 100.0%

**Transportation 30.5%**
- Supports Urban Transit Service 8.5%
- Improved Emergency Response 7.1%
- Roadway Safety – Supports Area Traffic Calming Measures 17.5%
- Efficiency of Travel 19.9%
- Compatibility with Integrated Transportation Master Plan 8.3%
- Safety of School Zone 14.7%
- Personal Security of Pedestrians and Cyclists 7.3%
- Intersection Spacing/Safety 16.6%

Note:

Weights have been adjusted to account for updates to sub-factors.

**Figure 6: Global Factor and Sub-factor Weights**

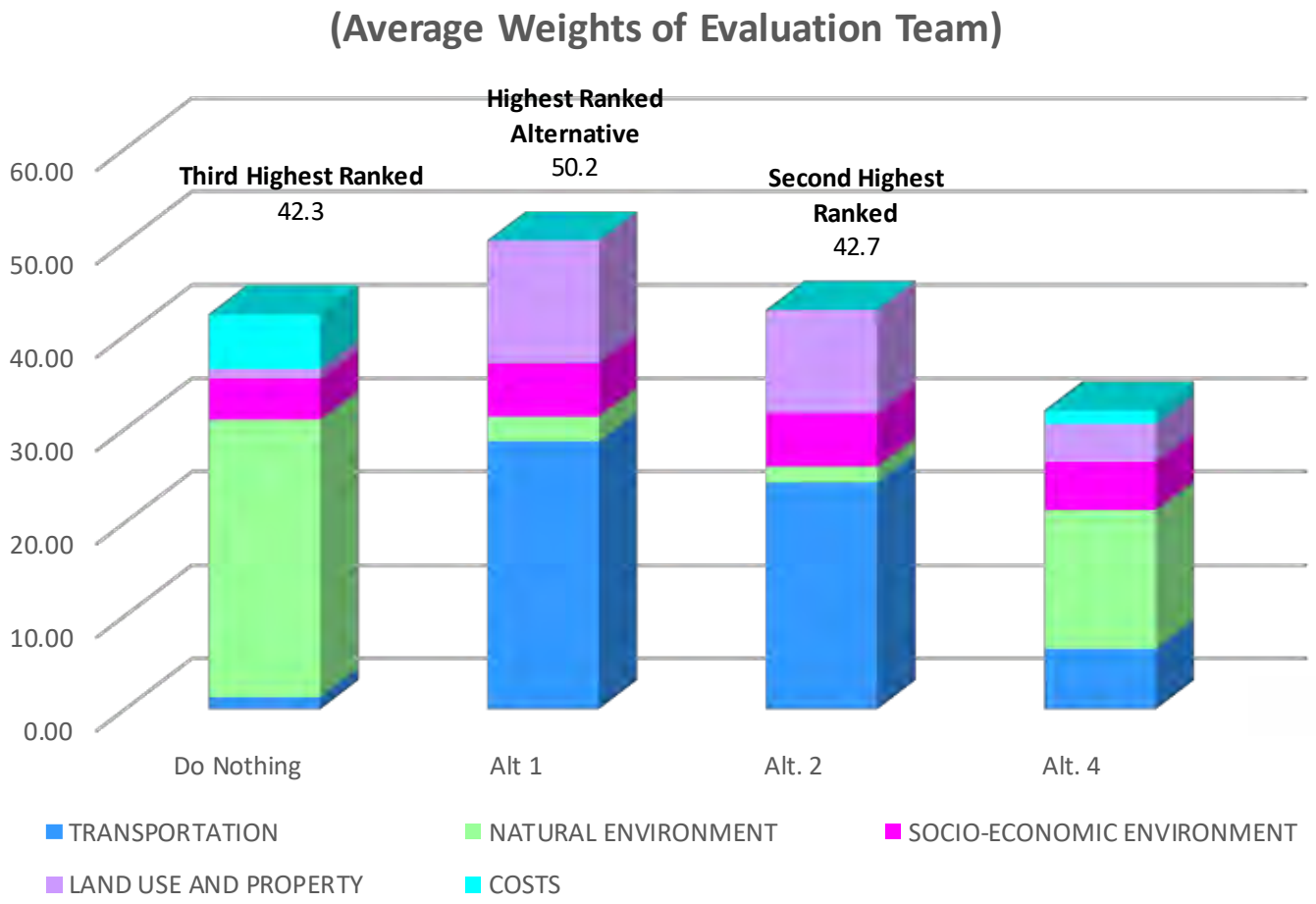



**Figure 7: Alternative Totals**

**Table 4: Summary of Technical Recommendations**

| Do Nothing | Alternative 1: Extend Biehn Drive to Robert Ferrie Drive east of Hydro Tower | Alternative 2: Extend Biehn Drive to Robert Ferrie Drive west of Hydro Tower | Alternative 4: Existing Caryndale Drive and a Multi-Use Path crossing the PSW |
|---|---|---|---|
| Not recommended.<br><br>The Do Nothing alternative fails to address the traffic volume and safety concerns along Caryndale Drive which should be expected to increase when the extension of Strasburg Road to New Dundee Road provides an alternative access to Highway 401. Caryndale Drive will continue to accommodate a higher volume of traffic and forced to function as a major collector street.<br><br>The limited number of Black Ash trees in the PSW will continue to decline due to the Emerald Ash Borer. ✗ | Recommended as the **Preferred Transportation Solution**.<br><br>Alternative 1 is the best-balanced solution. It provides the best transportation performance while minimizing natural and social environmental impacts. A limited number of Black Ash trees have been identified along the corridor however the city's best efforts to combat the Emerald Ash Borer has had limited success. The crossing of a PSW is accepted by the Provincial Policy Statement for transportation and utility corridors. ✓ | Not recommended.<br><br>Although this alternative provides comparable transportation performance to Alternative 1 the environmental impacts are much greater. ✗ | Not recommended.<br><br>Caryndale Drive, classified as a minor neighbourhood collector street, will be forced to function as a major collector street. The neighbourhood was not designed for Caryndale Drive to continue to carry increasing volumes of vehicle traffic. ✗ |

### 4.2.1 Corridor Sensitivity Testing

To validate the weighting exercise, a sensitivity testing program was undertaken to determine whether the Technically Preferred Alternative (TPA) would have changed if a particular factor group was assigned a higher or lower importance than the group average. This ensures greater confidence in the selection process. The results of the sensitivity testing are shown in **Table 5**.

**Table 5: Summary of Sensitivity Tests**

**Summary of Sensitivity Tests**

| Alternatives | | | Do Nothing | Alt 1 | Alt. 2 | Alt 4 |
|---|---|---|---|---|---|---|
| | WEIGHT | Score: | 42.3 | 50.2 | 42.7 | 32.0 |
| **Ranking** | | | 3 | 1 | 2 | 4 |
| | | | | | | |
| TRANSPORTATION | High | 45.00% | 3 | 1 | 2 | 4 |
| | Low | 20.00% | 1 | 2 | 3 | 4 |
| NATURAL ENVIRONMENT | High | 40.00% | 1 | 2 | 3 | 4 |
| | Low | 20.00% | 3 | 1 | 2 | 4 |
| SOCIO-ECONOMIC ENVIRONMENT | High | 15.00% | 2 | 1 | 3 | 4 |
| | Low | 10.00% | 2 | 1 | 3 | 4 |
| LAND USE AND PROPERTY | High | 20.00% | 3 | 1 | 2 | 4 |
| | Low | 10.00% | 2 | 1 | 3 | 4 |
| COST | High | 10.00% | 2 | 1 | 3 | 4 |
| | Low | 2.00% | 3 | 1 | 2 | 4 |

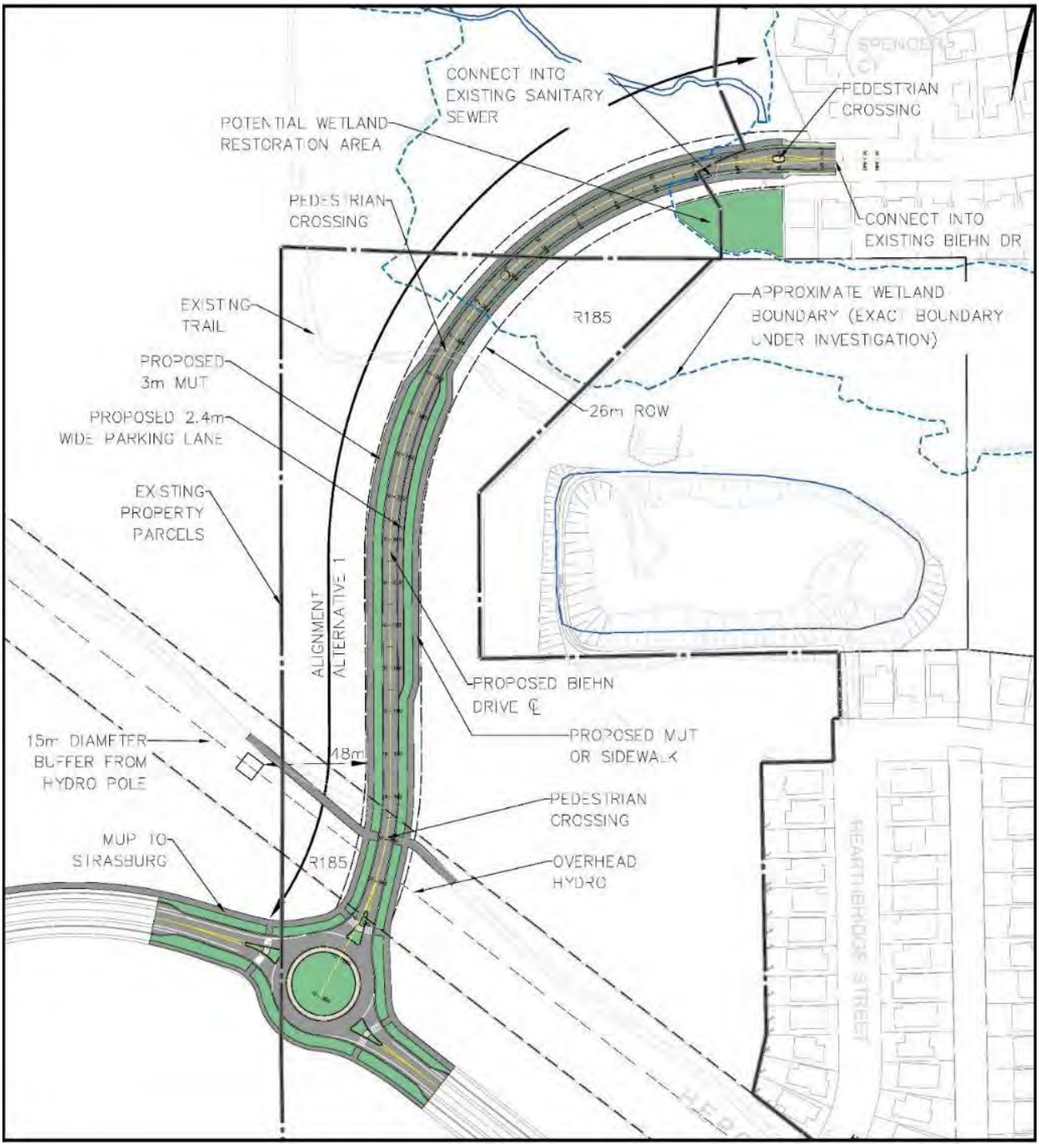



**Figure 8: Technically Preferred Alternative**

### 4.3 Cross Section Alternatives

Two (2) cross section alternatives were considered for Biehn Drive outside the limits of the wet-land.

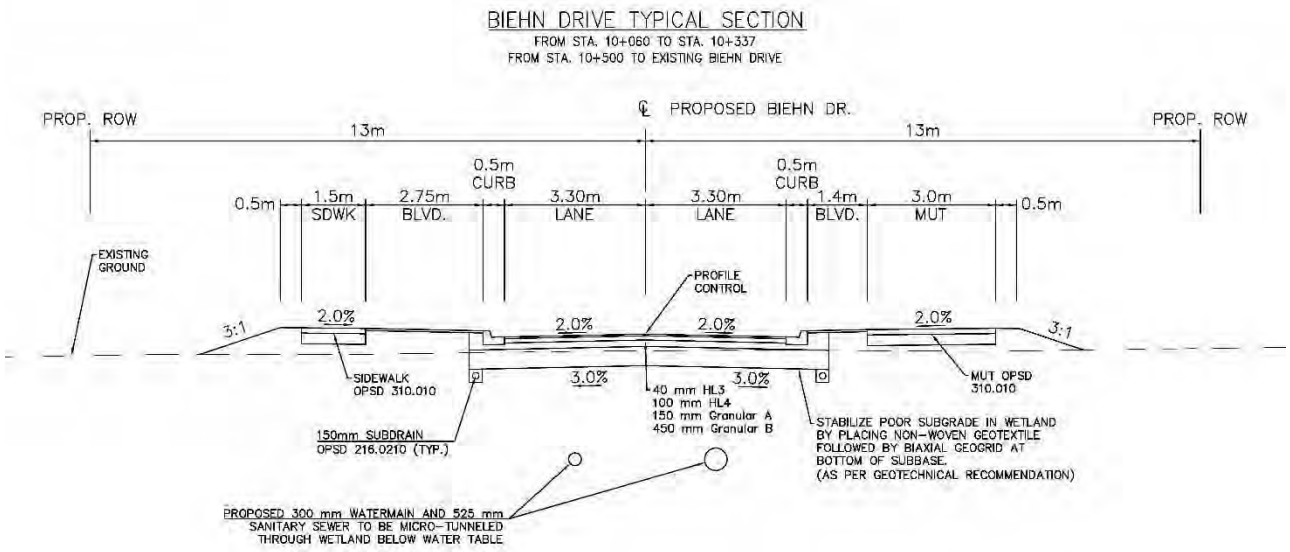
1. Alternative 1 – 26 m Major Collector with In-boulevard Cycling Facilities; and
2. Alternative 2 - 26 m Major Collector with Bike Lanes.

### 4.4 Technically Recommended Cross Section

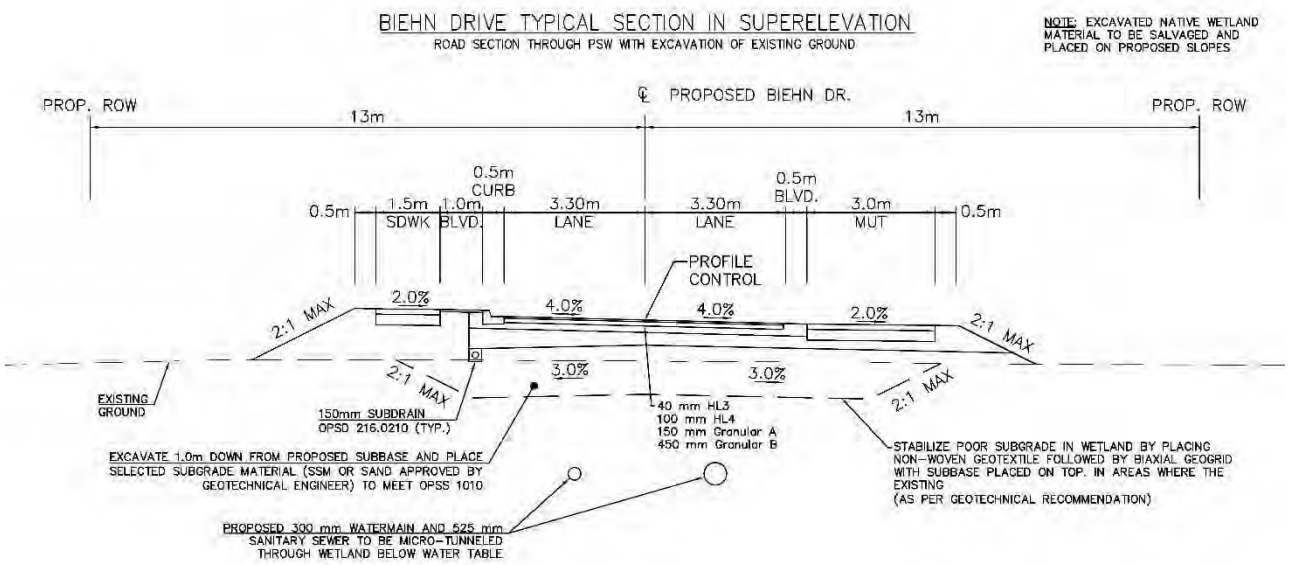
The preliminary evaluation of the cross section alternatives is shown in **Table 6**. Alternatives were developed to reflect the City of Kitchener's Complete Streets guidelines. The recommended cross section is Alternative 1 with multi-use trails as shown in **Figure 9**.

**Table 6: Cross Section Evaluation**

| Evaluation Criteria | Alternative 1 – 26 m ROW with Multi-use Trail | Alternative 2 – 26 m ROW with Bike Lanes |
|---|---|---|
| Active Transportation | MUTs are preferred by the greatest proportion of cyclists (interested but concerned).<br>Greater network continuity for cyclists with the future MUT along the Hydro corridor and potential to connect to the MUTs along Strasburg Road. ✓ | Better accommodates pedestrians by separating pedestrians and cyclists.<br>Increased conflict between cyclists and access to/from parked vehicles. ✗ |
| Traffic Calming | The reduced pavement width would better promote lower travel speeds. ✓ | Wider asphalt surface would be less effective in reducing travel speeds. ✗ |
| Impacts to Natural Environment / Storm Water Quality | All alternatives considered equal. | All alternatives considered equal. |
| Impacts to Developable Lands | All alternatives considered equal. | All alternatives considered equal. |
| Cost | MUTs are more cost effective to construct with reduced pavement thickness and granulars. ✓ | Wider roadway pavement structure increases construction cost. ✗ |
| **Recommendation:** | Carry Forward **Alternative 1** ✓ | |




**Typical Cross Section Outside the Wetland**




**Typical Cross Section Through Wetland**

**Figure 9: Recommended Cross Sections**

## 4.5 Conclusions and Recommendations

The following are updated 2024 preliminary recommendations from the EA based on new data sources that included, the geotechnical investigation, the 2023 field inventory of ash trees, an analysis of the long-term Emerald Ash borer impacts on ash tree mortality in North America and City of Kitchener as well as the 2024 Doon South Community Area Transportation Study.

- Based on the 2023 geotechnical investigations it is feasible for the sanitary sewer and watermain without surficial construction to cross the PSW.
- The 2024 Doon South Community Area Transportation Study confirmed the recommendations of the current Transportation Master Plan, 2013 reflected in the Official Plan, 2019, for the long-term use of Biehn Drive and its extension as a major collector in the City.
- The 2024 provincial designation of the Black Ash trees as a Species at Risk (SAR) is now reflected in the recommendations.

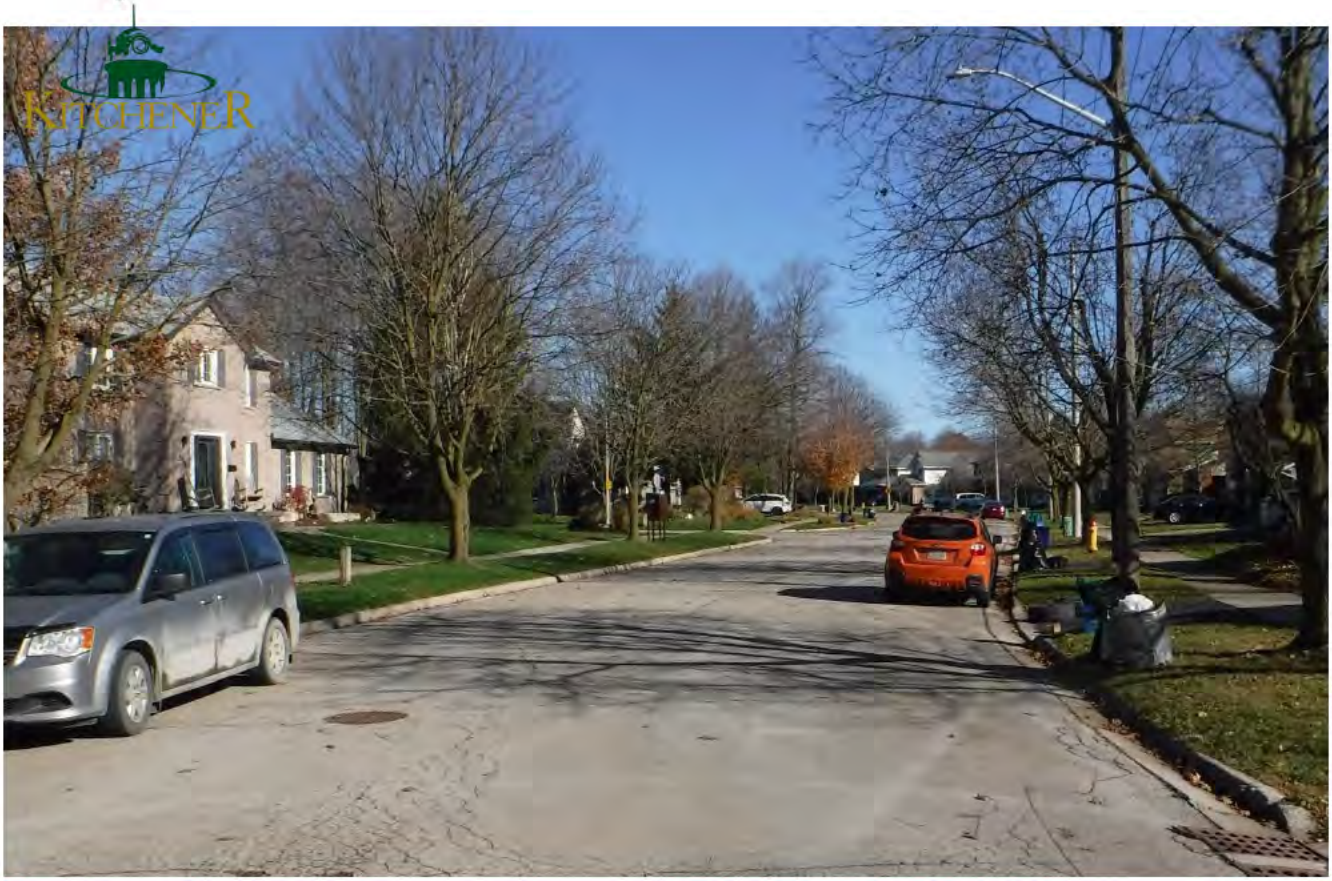
The following is the preferred approach for the planned improvements:

- Caryndale Drive will continue to be utilized until the extension of the Biehn Drive link is constructed.
- The health of the Black Ash trees are to be monitored.
- Development south of the PSW be permitted to proceed.
- That a right-of-way continue to be protected at the intersection of Biehn Drive and Robert Ferrie Drive for a future roundabout.
- The land acquisition should include the Right-of-Way required for municipal services and a road corridor.
- The alignment of the servicing corridor for the trunk sanitary sewer and watermain to follow the alignment for the road corridor.
- If Black Ash trees are impacted due to construction, the City will compensate for the loss. Compensation to be determined by Ministry of Environment Conservation and Parks.

# Appendix A

Evaluation Methodology

BT ENGINEERING
BTE



# Evaluation Methodology Report

## Biehn Drive Municipal Class Environmental Assessment Study

August 2024, Revision 3

**Submitted by:**
BT Engineering Inc.
509 Talbot Street
London, ON N6A 2S5

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# 1.0 INTRODUCTION

The City of Kitchener (City) has initiated a Class Environmental Assessment (EA) Study to develop a transportation plan for the extension of Biehn Drive westerly to the Robert Ferrie Drive extension. The Biehn Drive extension will include municipal services including a trunk sanitary sewer, storm sewer/ditches and watermain. The focus of the Study will be to consider alternatives for the alignment of the Biehn Drive extension, intersection locations and designs and municipal services while minimizing environmental, social, and cultural impacts of the project.

# 1.0 STUDY PROCESS

This Study will complete the remaining phases of the Municipal Schedule C Class EA Study which was initiated by the TMP. The Study will meet all requirements of the Municipal Class EA by establishing the need and justification for the project, considering all reasonable alternatives with acceptable effects on the natural, social and cultural environments, and proactively involving the public in defining a Recommended Plan. The study will culminate in the filing of an Environmental Study Report (ESR) and provide environmental clearance to the City to proceed with the project, subject to permits and approvals that will occur during the future detail design stage of the project.

The Analysis and Evaluation process is a requirement of the EA process, based on the Ministry of the Environment, Conservation and Park's (MECP) Evaluation Methods in Environmental Assessment. [1]

This document describes the qualitative and quantitative methods of evaluation and which approaches will be utilized for different groups of alternatives for this study.

An evaluation method may be defined as a formal procedure for establishing an order of preference among alternatives. The use of a formal evaluation method has two main advantages: it provides a better basis for decision-making than would otherwise exist and it results in reasons for decisions that, on examination, can be traced.

The selection of an evaluation method should consider the following generic factors:

- Various evaluation methods have different capabilities which support different planning processes that may be better suited to a particular project or stage of the EA.
- With any particular planning process, all the steps (such as identifying alternatives, selecting criteria, consulting and involving interested parties, as well as evaluating) must be reasonable and provide a systematic assessment of the net effects of the project.

[1] Evaluation Methods in Environmental Assessment, Ministry of Environment, 1990.

The selection of the appropriate evaluation methodology depends upon the:

- Complexity of the decision-making;
- Number of alternatives;
- Number of criteria; and
- Sensitivity of the decision.

These issues are described in the following sections which explain the rationale for utilizing the most appropriate evaluation methodology in each stage of the EA study.

## 2.0 STUDY AREA

The Study Area is located in the City of Kitchener and is illustrated on **Figure 1**.

The Local Study Area extends from the current terminus of Biehn Drive, approximately 60 m west of Spencer Court, southerly to the future Robert Ferrie Drive Extension.

Based on comments from the public at the Community Café and Public Information Centre No. 1, the Study Area was expanded to a Broader Study Area to consider traffic effects in adjacent neighbourhoods.

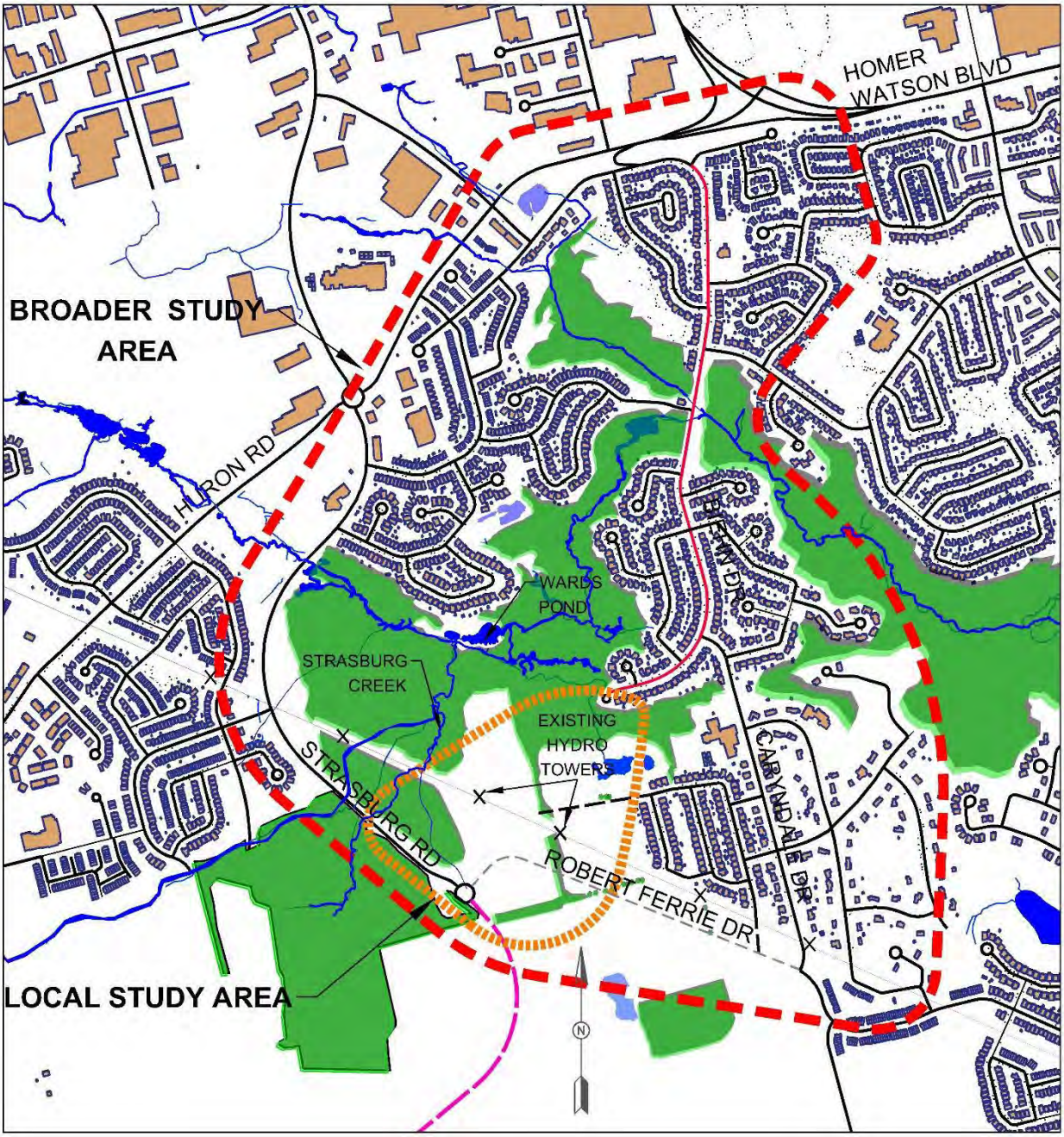



**Figure 1: Study Area**

## 3.0 PARTICIPATION

Public participation is a key component to the success of this project. Early public involvement is encouraged to establish a sound understanding of the public's concerns and views, to identify areas of concern and major study issues, and to establish a working relationship with the public that is amicable and cooperative rather than adversarial.

The City of Kitchener has a constitutional duty to consult with Indigenous Communities with traditional land use or interests within the Study Area. Clear, effective and timely consultation with Indigenous Communities is essential to ensure the success of the project.

### 3.1 Public, Property Owner, and Stakeholder Consultation

The public will be engaged through the use of three Public Information Centres (PIC) meetings and one-on-one meetings with directly affected property owners. This includes meetings and consultation with utilities, businesses and stakeholders that have an interest in providing comments on the design.

### 3.2 Indigenous Peoples Consultation

MECP has identified the Indigenous Peoples communities to be consulted during this study. Indigenous Peoples will be sent invitations by way of a notice to all public events such as the Community Café and PICs and will also be extended the offer to be met separately, if desired.

## 4.0 QUALITATIVE EVALUATION METHODOLOGY

A qualitative evaluation method involves describing impacts in narrative terms, or through qualitative measures, without the explicit specification of criteria, ratings or weights. This method, also known as “professional judgment” is widely used in EA’s to assess “Alternative Planning Solutions”. For example, an EA involving the selection of a corridor might evaluate alternative routes in considerable detail using a formal quantitative evaluation, but the evaluation of “Alternatives To” might be done using a simpler qualitative approach. See Error! Reference source not found. for a sample qualitative evaluation.

A challenge of the qualitative approach is the difficulty in recognizing when a comparison will have intuitive choice or universal support (public), i.e. a simple decision easily accepted. A qualitative approach may also be less defensible and could be subject to criticism. Should the public or stakeholders question these early decisions, additional information may be required to substantiate or detail the rationale for the early decisions. When alternatives are not systematically compared against a specified set of criteria, it may be difficult to follow how the decision was made and what evidence supports it.

Some advantages of using a qualitative approach over a quantitative approach include greater simplicity, reduced time and cost, and ease of presentation to the public. A qualitative approach is often used to evaluate alternatives where there is a straightforward conclusion and low public concern. The qualitative approach is also suitable where there are few alternatives and few criteria where there are measurable and meaningful differences between alternatives being considered.

**Table 1: Planning Alternatives**

| Screening Criteria | Do Nothing | TDM | Use of Existing Local Roads | Limit Development | Extend Biehn Drive |
|---|---|---|---|---|---|
| **Transportation** | Does not address forecast traffic demand. Results in increased volumes on local roads. | May reduce vehicular demand by mode shift or work at home but will not eliminate need for new or improved infrastructure. | Local roads not designed to accommodate increased volumes. Caryndale Drive is not designated as a major collector and as such should not be expected to carry additional traffic. | May reduce vehicular demand by reducing the number of trips generated by development but does not address existing demands and/or background growth. | Accommodates all modes of transportation. |
| **Environmental** | No impacts. | No or low impacts.<br>Low impacts may be associated with active transportation projects/ improvements (i.e. sidewalks, bike lanes). | Low impacts.<br>Creates disruption to properties on local roads that would experience an increase in traffic. | No impacts. | Low to medium Environmental effect possible with new corridor. Magnitude of effects will depend on environmental mitigation. |
| **City Planning Objectives** | Does not meet objectives/ recommendations in City Planning document or support the Provincial *Places to Grow Act* | Supports objective to encourage active transportation and alternate modes.<br>Does not support the Provincial *Places to Grow Act* requirement to create | Does not meet objectives/ recommendations in City Planning documents.<br>Does not support the Provincial *Places to Grow Act* | Does not meet objectives/ recommendations in City Planning documents.<br>Does not support the Provincial *Places to Grow Act* | Supports the recommendations for the extension of Biehn Drive in OP and TMP.<br>Supports the Provincial *Places to Grow Act* |

| Screening Criteria | Do Nothing | TDM | Use of Existing Local Roads | Limit Development | Extend Biehn Drive |
|---|---|---|---|---|---|
| | requirement to create additional development areas (incuding municipal services). | additional development areas (including municipal services). | requirement to create additional development areas (including municipal services). | requirement to create additional development areas (including municipal services). | requirement to create additional development areas (including municipal services). |
| **Recommendations** | Not recommended but carried forward as a baseline to compare other alternatives. ✓ | Recommended as a complementary solution. This is not a standalone solution. ✓ | Following PIC No. 1 there was public support to carry forward this alternative. This is not a standalone solution. See Extend Biehn Drive which is a combination of Use of Local Roads and a New Municipal Servicing Corridor. ✓ | Not recommended. ✗ | Recommended to be carried forward for further study. ✓ |

✓ **Recommended Planning Solutions for further evaluation**

Where there are few criteria, such as in Error! Reference source not found., it is generally a cceptable to use a qualitative analysis because the trade-offs are clear and understandable. The more rigorous definition of the attributes of each alternative, as would be possible using a quantitative approach, is not required because there are a limited number of evaluation factors.

For this study, the qualitative approach will be used to assess Alternatives to the Undertaking and for the Coarse Screening of the initial long list of Preliminary Design Alternatives.

The use of a more comprehensive evaluation technique becomes necessary as the complexity increases (i.e. number of alternatives and number of criteria). In these situations, as described in **Section 5.0**, this study will utilize a quantitative approach.

## 5.0 QUANTITATIVE EVALUATION METHODOLOGY

Key principles of the EA Act and MECP's Guidelines on Environmental Assessment Planning and Approval are that there be accountability and traceability. A quantitative evaluation method allows both of these key principles to be addressed. A quantitative method based on the "Weighted Additive Method" utilizing utility measurements based on the "Likert Scale" will be used for this study and is also referred to as the "Multi-Attribute Trade-off System" (MATS).

The Weighted Additive Method has proven to be well suited for the evaluation of complex groups of alternatives. The methodology allows for sensitivity testing and the ability to answer "what if" questions. It is used on projects where the decision-making process is faced with either a large number of alternatives or a large number of competing criteria for the alternatives being evaluated.

The Weighted Additive Method is consistent with MECP practices for the evaluation of alternatives. It avoids many of the pitfalls associated with qualitative assessments by using an analytical approach that measures scores based on a mathematical relationship, i.e. the degree of subjectivity by the evaluators (i.e. the Technical Advisory Committee (TAC)) is minimized. A traceable process allows the TAC and public an opportunity to assess trade-offs involved in the evaluation and use this information in the decision-making process. In addition, this quantitative method allows sensitivity tests to be performed to determine if the highest ranked alternative is affected by changing the weights (perspective of importance) of the assessment factors.

For this study, preliminary design alternatives will be compared and scores assigned to each of the various assessment factors, and a sensitivity-testing program will be completed in consultation with the public and external agency interaction.

When using the Weighted Additive Method, each member of the TAC assigns a weight to the global factors and sub-factors. The Average TAC Weight is assigned to each of the

alternatives. The alternative with the highest score is selected as the Technically Preferred Alternative (TPA). The steps followed to arrive at an overall score for each alternative are shown in **Figure 2**.

This systematic approach includes the following steps:

- Collection of data/environmental inventories
- Development of a long list of reasonable alternatives (including coarse screening alternatives that are not feasible or unreasonable in comparison to those being carried forward)
- Public Information Centre (PIC) / Community Café No. 1
- Development of a long list of global evaluation criteria/performance sub-factors
- Short listing of sub-factors to those where there are meaningful differences among the alternatives to be compared
- Establishing Social Utility Functions (Performance Factors or Function Forms) for the short-listed sub-factors
- Weighting of Evaluation Criteria (assigning importance based on the specific set of alternatives)
- Rating of Alternatives
- Sensitivity Testing
- Selection of TPAs
- Public Information Centre No. 2
- Preliminary Design Alternatives for the Preferred Corridor Alternative
- Quantitative evaluation of the Preliminary Design Alternatives
- Public Information Centre No. 3
- Refinements to the Technically Preferred Plan (TPP)
- Recommended Plan

These steps, as they relate to this project, are briefly described in the following sections.

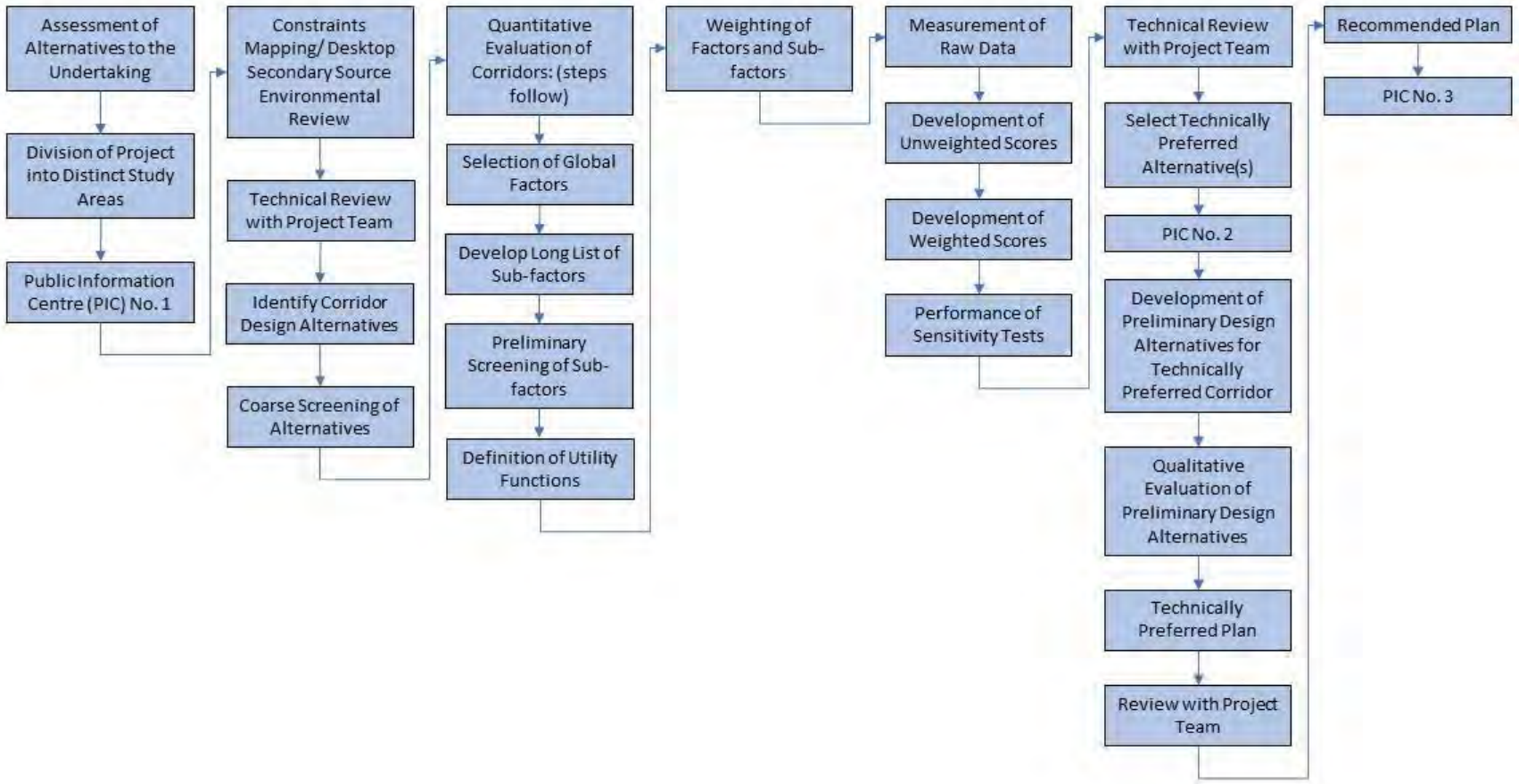



**Figure 2: Study Evaluation Process**

## 5.1 Evaluation Criteria – Factors

The initial step in the evaluation is to develop evaluation criteria from which alternatives will be assessed. This is a two-step process that involves the selection of a "global" group of factors and a number of "local" sub-factors under the global groups.

The global factors groups will be presented to the public and, following this consultation, will be accepted as describing the broad definition of the environment to be evaluated. Global factors considered for this study may include:

- Traffic and Transportation;
- Natural Environment;
- Cultural Environment;
- Socio-Economic Environment;
- Land Use and Property; and
- Cost.

While these factor groups are the starting point for the evaluation, one or more factors may be removed if it is determined that there is no sub-factor in this category i.e. there is not a meaningful and measurable difference between the alternatives being assessed in this category. When a particular factor is carried forward, then one or more sub-factors are considered under this group. These sub-factors are the individual descriptors for the evaluation. The selection of the sub-factors is very important to the decision-making process because they must adequately describe the issue to be evaluated and the alternatives being compared. See **Table 2** for a sample preliminary listing of sub-factors for Transportation. Any information regarding an alternative, where there are differences among alternatives, is incorporated into the decision-making process by including it as a sub-factor. The benefit to incorporating two levels of evaluation criteria (global factors and local sub-factors) is the prevention of the unbalancing of the evaluation (that could occur by adding more criteria under one group). Weights are assigned to the global factors to eliminate any possibility of skewing the results by selecting a large number of sub-factors in one particular factor group.

**Table 2: Long List of Sub-factors**

| Factors and Sub-Factors | Carried Forward? |
|---|---|
| **Transportation** | |
| Delays (during construction) | ✗ |
| Supports Urban Transit Service | ✓ |
| Improved Emergency Response | ✓ |
| Fuel Consumption | ✗ |
| Road User Costs | ✗ |

| Factors and Sub-Factors | Carried Forward? |
|---|---|
| Roadway Operation and Safety – Supports Area Traffic Calming Measures | ✓ |
| Roadway Safety - Collision Potential at Intersections | X |
| Active Transportation Connectivity – Conflicts through Communities | X |
| Active Transportation – Proximity to Community Facilities | X |
| Bicycle – Conflicts with Existing Bicycle Routes | X |
| Flexibility for Future Expansion | X |
| Horizontal Curvature | X |
| Vertical Curves | X |
| Minimum Radius of Curves | X |
| Skewed Intersections / Angle of Skewed Intersections | X |
| Level of Service on Local Roads | X |
| Efficiency of Travel | ✓ |
| Compatibility with Integrated Transportation Master Plan | ✓ |
| Safety of School Zone | ✓ |
| Ability to Maintain Existing Roadway Classification | X |
| Bicycle and Pedestrian Safety – Conflicts with Planned Hydro Corridor Multi-Use Trail | ✓ |
| Personal Security of Pedestrians and Cyclists | ✓ |
| Intersection Spacing | X |
| Robert Ferrie Drive Intersection Location to Accommodate Future Development | ✓ |

Generally, the process begins by establishing a long list of potential sub-factors through discussions with the public, community associations, the TAC and interest groups or from previous studies of the same nature. Then, for each group of alternatives being evaluated, the sub-factors are reviewed and screened by eliminating those that are considered equal

among alternatives being considered as well as those that do not apply to the Study Area, based on the site inventories carried out.

**Table 3** provides a sample of a typical Global Factor, Sub-Factor, Unit and Utility Function Type from a Transportation Study. Similar Global Factor, Sub-factor and Utility functions will be developed for this study.

**Table 3: Typical Evaluation Factor and Sub-Factors**

| Global Factor | Sub-Factor | Unit | Utility Function Type |
|---|---|---|---|
| **Natural Environment** | Wildlife Habitat | ha | Linear |
| | Accommodating Wildlife Movement | Preferred/Not Preferred | Stepped Function |
| | Provincially Significant Wetlands (PSW) Removed | ha | Linear |
| | Groundwater Infiltration | ha | Linear |

### 5.2 Factor and Sub-factor Weights

The selection of weights for the factors and the sub-factors is based on assessments by the TAC of their relative importance. Within a group of factors, inevitably there is an ordering, with some factors having more importance than others. This is accounted for by each individual assigning a weight to each factor, which is reflected in the "Factor Weight" and "Sub-Factor Weight" columns. An example of typical results is shown in **Table 4**.

**Table 4: Sample TAC Average Weights for a Factor Group and Sub-Factors in that Group**

| Factors | TAC | |
|---|---|---|
| | Factor Weight | Sub-Factor Weight |
| **Traffic and Transportation** | 30.50% | |
| Supports Urban Transit Service | | 7.90% |
| Improved Emergency Response | | 6.50% |
| Roadway Safety – Supports Area Traffic Calming Measures | | 16.90% |
| Efficiency of Travel | | 19.30% |

| Table 4: Sample TAC Average Weights for a Factor Group and Sub-Factors in that Group | | |
|---|---|---|
| **Factors** | **TAC** | |
| | **Factor Weight** | **Sub-Factor Weight** |
| Compatibility with Integrated Transportation Master Plan | | 7.70% |
| Safety of School Zone | | 14.10% |
| Bicycle and Pedestrian Safety - Conflicts with Planned Hydro Corridor Multi-Use Trail | | 4.90% |
| Personal Security of Pedestrians and Cyclists | | 6.70% |
| Intersection Spacing | | 16.00% |
| | **Total** | **100%** |

As shown in **Table 4**, the group of evaluators judged the Traffic and Transportation Factor Group to be valued at 30.5% of the overall importance of the decision between the alternatives being considered.

Within each Factor Group the sum of the percentage weights of all sub-factors listed under each factor totals 100%. As shown in **Table 4** several of the sub-factors were judged to be more important/less important when compared to each other for this specific evaluation of alternatives being considered.

The weights for each factor and sub-factor are determined by averaging the weights assigned by the TAC (Evaluation Committee). Each member gives a judgement of the importance of each global factor and local sub-factor (a percentage value) based on his or her personal assessment and professional judgement, considering the net effects and input of stakeholders and the public.

There is usually a range of perspectives in deciding the weights (importance) of factors and sub-factors. Every person assigning weights has a personal perspective and understanding of the scope of the project. Hence, there is an advantage to having a diversified team of professionals with varied backgrounds performing the evaluation.

The weighting of each of the global factors is shown in **Figure 3**. The weighting of sub-factors within each factor group would be a similar distribution among the available sub-factors.

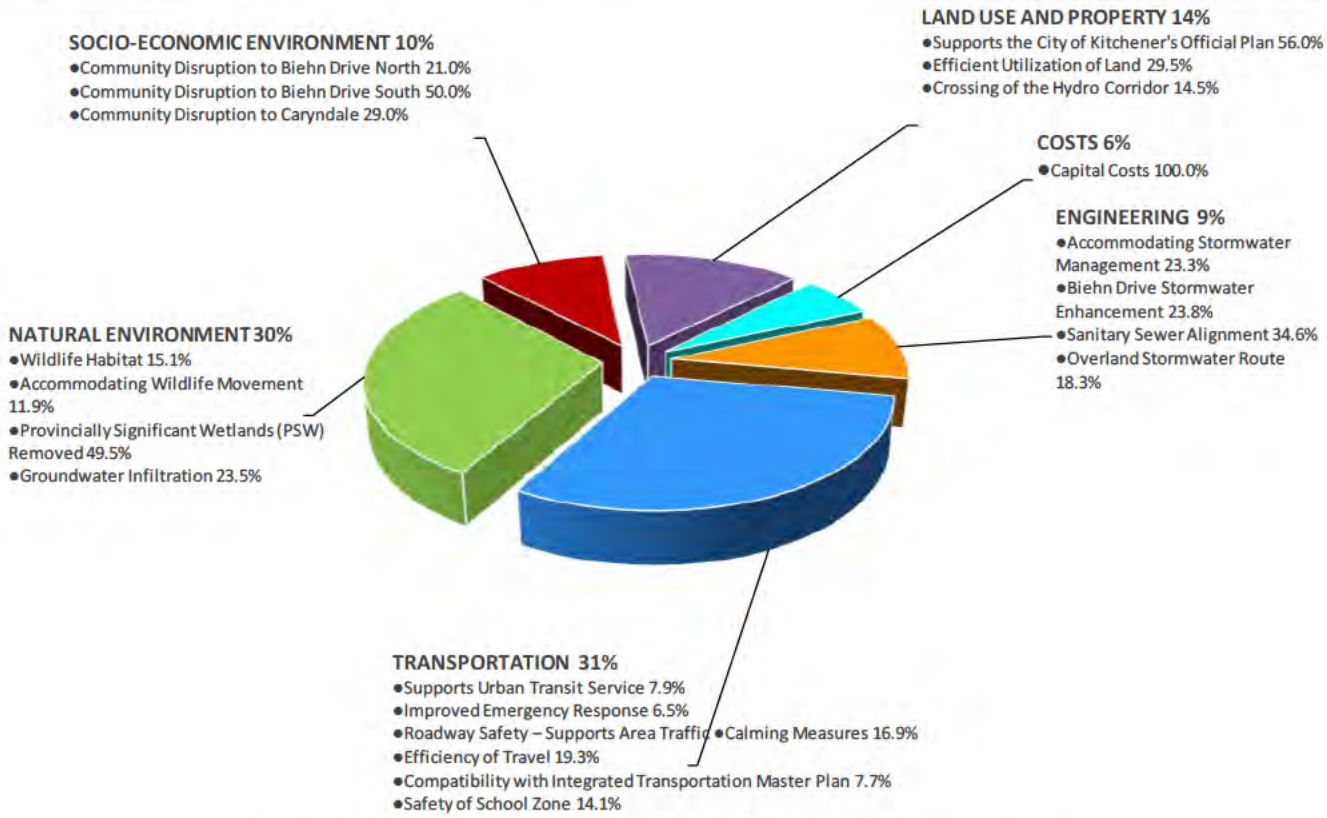



**Figure 3: Sample Weighting of Global Factors**

## 5.3 Social Utility Functions

The Weighted Additive Method used to evaluate alternatives relates the performance or attractiveness of alternatives using a mathematical relationship. This includes two variables: the first is the raw data or measured or modelled data, and the second is the utility or utility score, which is the measure of attractiveness of the alternative.

For this project, the relationship between these two variables is described, as shown in **Figure 4**, by either a dichotomous, stepped, or linear social utility function. A dimensionless utility score between zero (0) and 1 is assigned to an alternative for each sub-factor. The shape of this function can vary from linear to stepped or exponential and is defined by a subject area specialist.

The use of utility curves or functions is a step that transforms each of the measured effects to a dimensionless number and measure of utility. This step is required because the effects of each sub-factor are measured in different units (length, area, time, volume, dollars etc.). To produce a mathematical measure of the performance, each effect is translated to a measure of utility. The combined effect or performance of each alternative is a measure of utility (attractiveness) which is a dimensionless measure. The utility function (also commonly described as performance factor or function form) defines the relationship of effect to the

attractiveness (utility). These utility functions are defined by subject area specialists in their field of study.

Examples of Social Utility Functions for the “Community Disruption to Biehn Drive North” and “Improved Emergency Response“ sub-factor definitions are shown in **Figure 5.**

A dichotomous utility function enables the decision-maker to establish criteria that presents an “either–or” situation (desirable or undesirable, negative or positive, present or absent). If it is decided beforehand that a “yes” answer is desirable, then a utility score of one would be assigned to this criterion, otherwise zero would be assigned. One or zero are the available alternatives; no other utility score is available.

A linear function is used to convert scores for sub-factors that have varying measurements. Given a measurement, a unique utility score between zero and one can be assigned to a sub-factor. The slope of the linear utility function can be negative or positive depending on the desirability of the impact.

**Figure 4: Sample Utility Functions**

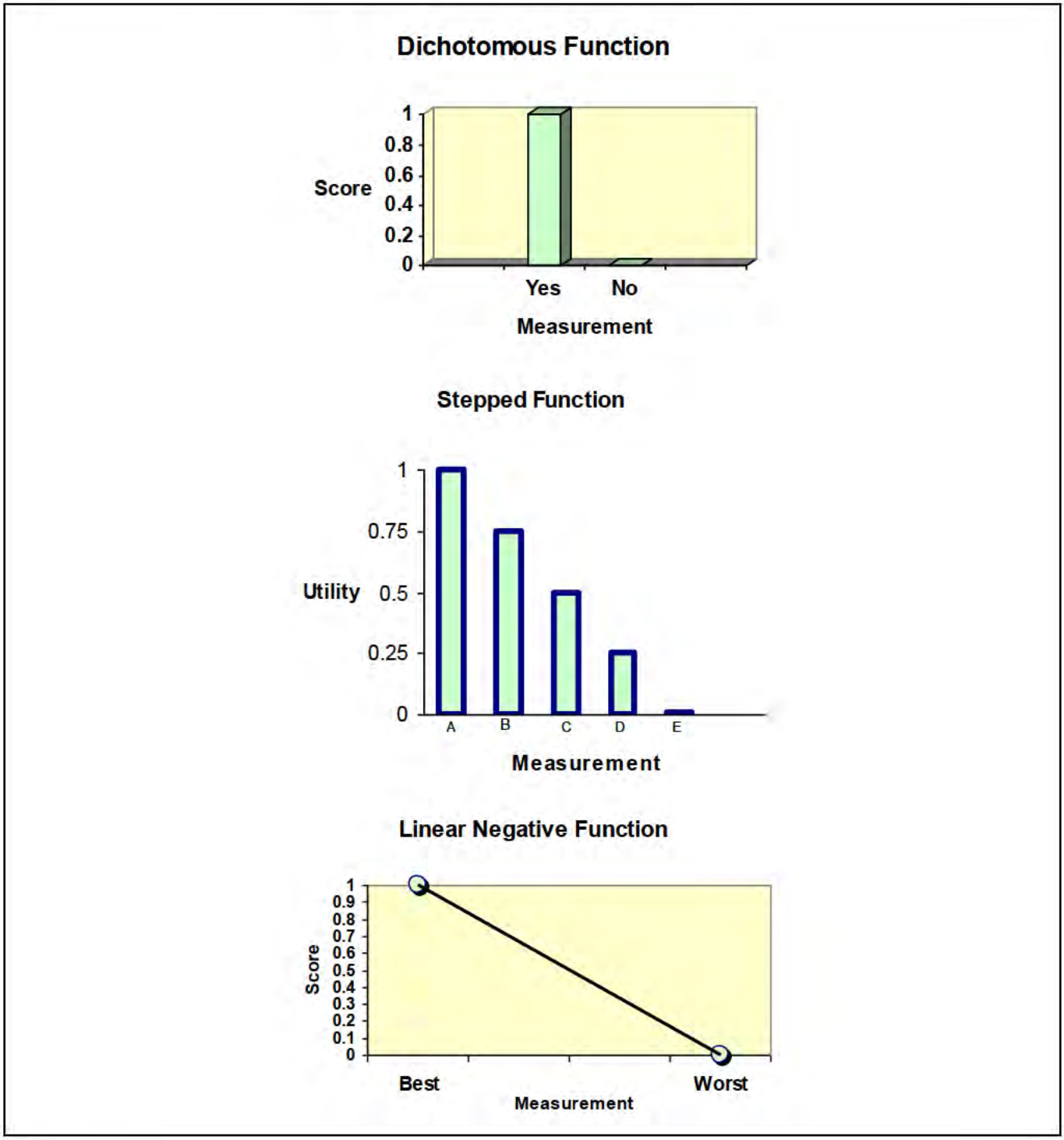
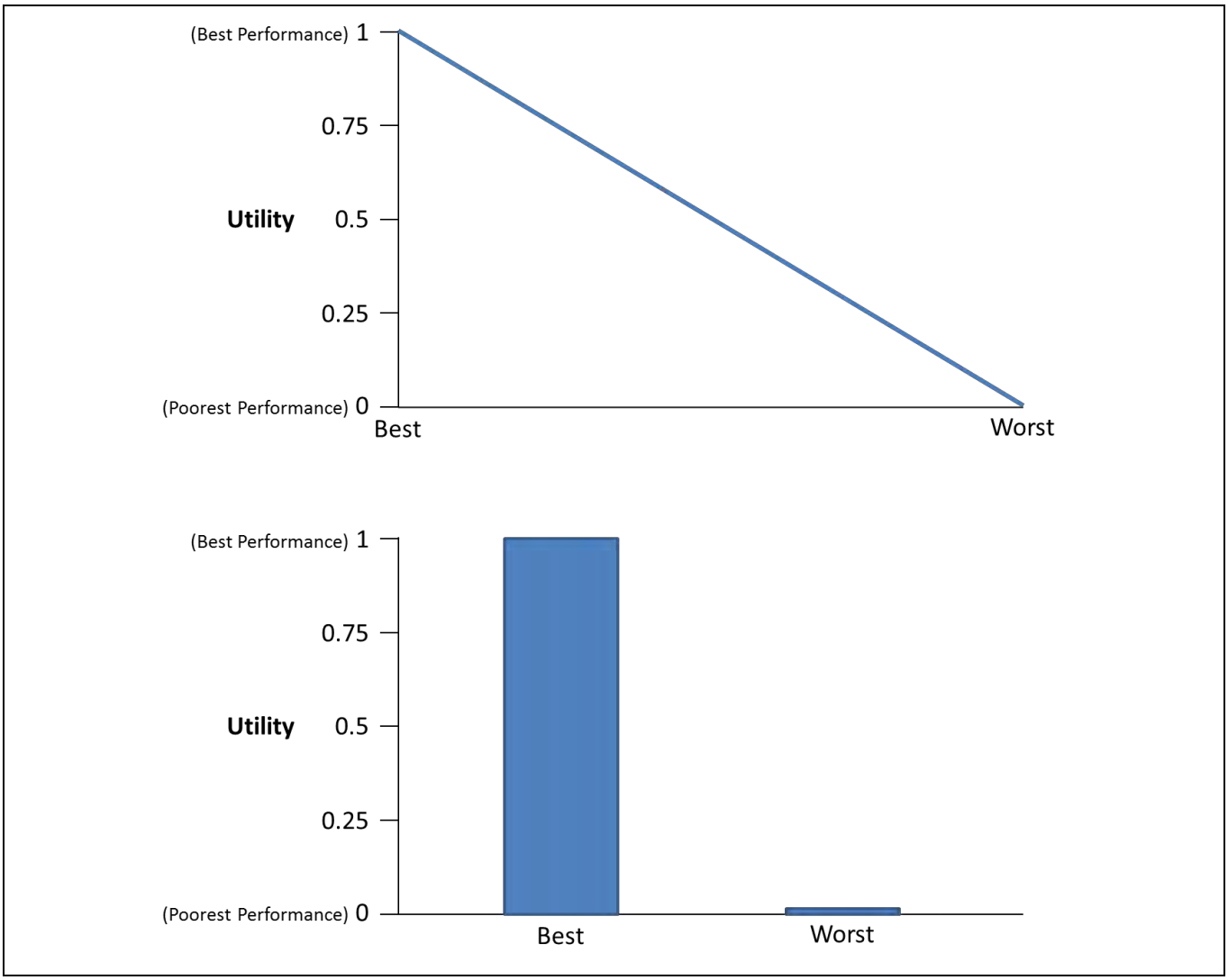


**Figure 5: Social Utility Function**



## 5.4 Weighted Score

The total un-weighted utility score of a given alternative can be expressed as:

**$U$ (Alternative A) = $\varnothing_1 X_1 + \varnothing_2 X_2 \ldots\ldots + \varnothing_n X_n$, where**

**$U$ (A) = Total un-weighted utility score for Alternative A**

**$\varnothing_1$ = attractiveness with respect to parameters**

**$X_1$ = measurement of parameter X**

Weighted scores are computed using the weights selected by the TAC. The weighted score for each alternative under a specific sub-factor is calculated as follows:

**(weighted score) = (utility score x [(factor weight) x (sub-factor weight)])**

Using this approach, a generic weighted attractiveness function can be expressed as:

**$U_w$ (Alternative A) = $U_1 W_1 + U_2 W_2 + \ldots. + U_n W_n$**

**OR**

**$U_w$ (Alternative A) = $W_1 \varnothing_1 X_1 + W_2 \varnothing_2 X_2 \ldots. + W_n \varnothing_n X_n$**

Where: $U$ = Total un-weighted utility score for Alternative A

$U_w$ (A) = Total weighted utility score for Alternative A

$W_1$= Weighted parameter (factor weight x sub-factor weight)

$\varnothing_1$ = Attractiveness with respect to parameter 1

$X_1$ = Measurement of parameter

The weighted scores of all the sub-factors are then added to give total score for each alternative.

$$U_w(A) = \sum_{X=1}^{n} W_n \varnothing_n X_n$$

## 5.5 Rating Alternatives

Following the selection of evaluation factors and sub-factors, measurements of the impacts are made using topographic plans, field surveys, and numerical modelling. These

measurements result in data being available under each of the evaluation criteria from which ratings are made for each alternative.

The Weighted Additive Method focuses on the differences of the alternative, addresses the complexity of the base data collected and provides a traceable and defensible decision-making process. This process is a numerical calculation where alternative scores are determined through the use of a mathematical relationship to equate impacts to scores. It eliminates any possible subjective opinions of scores for alternatives because the team does not estimate the score for an alternative.

The scores for each alternative under each of the respective sub-factors are normalized based on measured impacts. Social utility functions are defined to relate impacts to the attractiveness of an alternative. This means that under each sub-factor, the alternative receives an un-weighted rating of between zero and one based on these measurements. The mathematical relationships for calculating scores are developed in consultation with the TAC.

### 5.6 Sensitivity Testing Program

It should be recognized that the scope of the evaluation and determination of weights for the evaluation criteria are a matter of personal and professional judgement. Accordingly, it is considered essential to conduct sensitivity testing to determine the effect of changing weights assigned to each criterion.

To test how sensitive the outcome of the evaluation is with respect to the assigned weights (i.e. would the result have changed if different weights were used), a sensitivity testing program is undertaken. This results in greater confidence in the selection process and reduces the potential that the average weights bias the outcome of the evaluation.

Often, there is a diversity of opinion in the group as to what weight is appropriate for a factor or sub-factor. When an average weight is used to capture the preferences of the group it loses valuable information on the range of values of the group. To test the range of perspective of the TAC, the highest and lowest weights suggested by anyone in the group are defined as a reasonable range of weights to test. A series of sensitivity tests are performed for the evaluation of alternatives. This allows the team an opportunity to assess the outcome of the evaluation if different weights (different perspectives of importance) are assigned to the factors and sub-factors from the average weights defined by the TAC members. In this way, trade-offs can be identified, credibility can be achieved with the public, and “what if” questions can be answered quickly. See **Figure 6** for an example of the typical range of project team weights and **Table 5** for the ranking of alternatives.

Following the above methodology, a series of tests can be performed varying the weights for each global factor. These tests include:

- Average TAC Team Weight
- Highest Weight by any Team Member
- Lowest Weight by any Team Member

Following this series of tests, the results can be reviewed to assess whether the preferred alternative changes when the weights are varied.

Using this information alone is not the only justification for selecting a particular alternative, but it does provide a level of confidence in the selection. This information is used in the decision-making process before the TPAs are recommended to be carried forward.

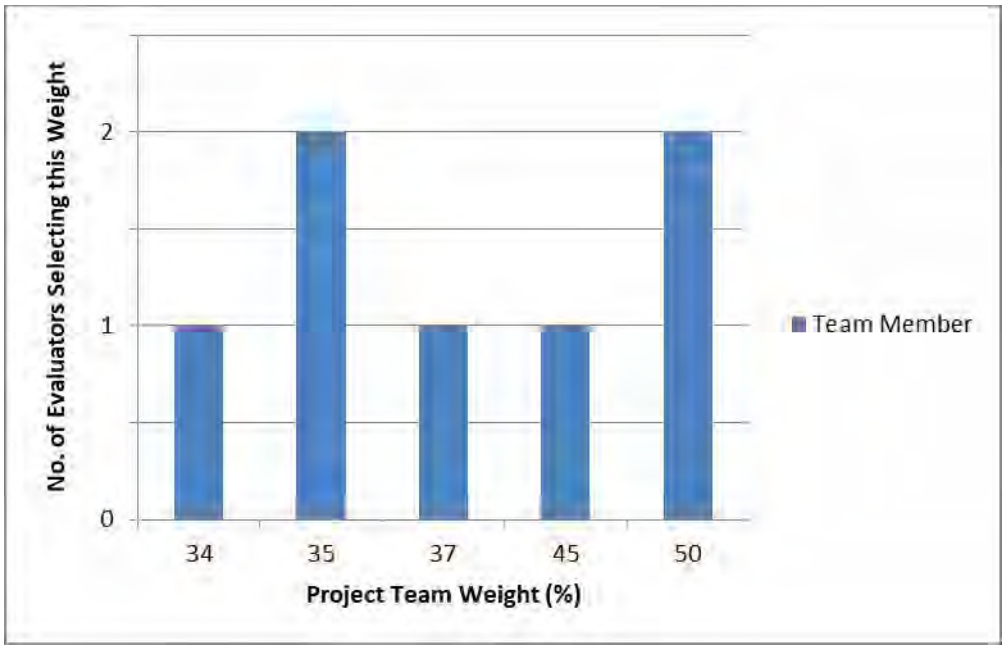



**Figure 6: Sample Range of Weights for Traffic and Transportation**

**Table 5: Sensitivity Test Results**

| Alternatives | | | Alt 1 | Alt. 2 | Alt. 4 |
|---|---|---|---|---|---|
| FACTORS | WEIGHT | Score: | 76.40 | 45.02 | 48.88 |
| **Ranking** | | | **1** | **3** | **2** |
| | | | | | |
| TRANSPORTATION | High | 45.00% | 1 | 2 | 3 |
| | Low | 20.00% | 1 | 3 | 2 |
| NATURAL ENVIRONMENT | High | 40.00% | 1 | 3 | 2 |
| | Low | 20.00% | 1 | 2 | 3 |
| SOCIO-ECONOMIC ENVIRONMENT | High | 15.00% | 1 | 3 | 2 |
| | Low | 10.00% | 1 | 3 | 2 |
| LAND USE AND PROPERTY | High | 20.00% | 1 | 2 | 3 |
| | Low | 10.00% | 1 | 3 | 2 |
| COST | High | 10.00% | 1 | 3 | 2 |
| | Low | 2.00% | 1 | 2 | 3 |
| ENGINEERING | High | 15.00% | 1 | 3 | 2 |
| | Low | 5.00% | 1 | 3 | 2 |

## 5.7 Selection of Technically Preferred Alternative (TPA)

The TPA identifies the preferred solution by considering the technical analysis, environmental considerations and comments of all study participants.

The TPA is then presented to the public and external stakeholders. This allows for any comments or questions regarding the proposed design.

It should be recognized that the information and conclusions obtained using the evaluation method are only tools used to assist in the evaluation process and identifying trade-offs. In the end, it is the TAC (Evaluation Committee) which makes the final decision on the selection of the TPA, using both the information obtained throughout the evaluation process and their individual experience and expertise, and through additional input from senior management on funding availability or other program constraints.

The findings of the analysis and evaluation process will be included as a component of the EA Process and documented in the Environmental Study Report. The principles and methodology of the EA process assist the TAC in the analysis and evaluation of alternatives and the selection of the TPA. The public and government agencies have the opportunity to provide input throughout the course of the study.

## Glossary of Terms

| | |
|---|---|
| **AASHTO** | American Association of State and Highway Transportation Officials |
| **Adjacent** | Adjacent indicates lying near MTO or Municipal roadway rights-of-way, although not necessarily contiguous to them. |
| **Aesthetics** | Methods of providing visual relief and appealing characteristics to planned noise barriers thorough the application of landscaping designs. |
| **Alternative** | Well-defined and distinct course of action that fulfils a given set of requirements. The EA Act distinguishes between "Alternatives to the Undertaking" and "Alternative Methods of Carrying out the Undertaking". |
| **Coarse Screening** | Initial screening of a group of alternatives. Also see Screening. |
| **COH** | Community Open House |
| **Criterion (Criteria)** | Explicit feature or consideration used for comparison of alternatives. |
| **Dichotomous Utility Function** | A utility function that represents a desirable or undesirable response from a criterion (yes/no, present/absent, true/false). |
| **Dimensionless Number** | A number that does not have a unit of measurement, such as length (m), time (s), mass (kg) associated with it. Examples include Utility Score and Overall Score. |
| **Do Nothing Alternative** | This alternative is a mandatory requirement of the Class EA. This alternative is the null or no action alternative and it becomes the baseline to which all alternatives are compared. |
| **Double Counting** | Unintentional accounting for a particular factor or attribute more than once in the evaluation. |
| **EA** | Environmental Assessment |
| **Environmental Study Report (ESR)** | This report is prepared in compliance with the EA Act requirements and the Ministry of the Environment and Climate Change for acceptance, approval, informational or monitoring purposes and the public record. |
| **Evaluation** | The outcome of a process that appraises the advantages and disadvantages of alternatives. |
| **Evaluation Criteria** | See Criteria. |

| | |
|---|---|
| **Evaluation Process** | The process involving the identification of criteria, rating of predicted impacts, assignment of weights to criteria, aggregation of weights, and rating to produce an ordering of preference of alternatives. |
| **Factor** | See Global Factors. |
| **Function Form** | See Utility Function |
| **Global Factors** | The main categories of factors, (i.e. Transportation, Economic Environment, Natural Environment, Social and Cultural, Land Use and Property and Cost). All sub-factors are components or a subset of global factors. |
| **Linear Utility Function** | A function that can be defined using a linear equation of the form:<br>y = a + bx, where<br>y is the dependent variable (raw score)<br>x is the independent variable (measurement)<br>b is the slope of the function, and<br>a is the y intercept, normalized in this study to be equal to one or zero |
| **Matrix** | A rectangular array of criteria and values. |
| **MATS** | Multi-Attribute Trade-off System |
| **MECP** | Ministry of the Environment, Conservation and Parks |
| **Mitigation** | Taking actions that either remove or alleviate to some degree the negative impacts associated with the implementation of alternatives. |
| **MTO** | Ministry of Transportation of Ontario |
| **Overall Score** | The final value of an alternative's score derived by summing all of the weighted scores. |
| **Performance Factor** | See Utility Function |
| **Ranking** | The ordering of alternatives from first to last for comparison purposes. |
| **Raw Data** | The measurement of the impact, or measured data, under each criterion. |
| **Risk** | Probability that a given outcome will or will not materialize. Distinct from uncertainty in that the alternative outcomes are known or defined and that the probability of each is measureable. |

| | |
|---|---|
| **Screening** | Process of eliminating alternatives from further consideration, which do not meet minimum conditions or categorical requirements. |
| **Sensitivity Tests** | A series of tests to assess the robustness of the evaluation and alternative scores. |
| **Step Function** | A utility function can be defined by several linear functions within separate ranges that have a slope equal to zero. For this study, two step functions are used:<br>Case A: y = 1, for x = desirable and y = 0, for x = undesirable<br>Case B: y = 1 for x = desirable, y = 0.5 for x = medium performance and y = o for x = undesirable |
| **Sub-factor** | A single criterion used for the evaluation. Each sub-factor is grouped under one of the factors. |
| **TAC** | Technical Advisory Committee |
| **TPA** | Technically Preferred Alternative |
| **Traceability** | Characteristic of an evaluation process which enables its development and implementation to be followed with ease. |
| **Utility Function** | A function (linear, step, dichotomous) that represents the Utility Score versus the criterion measurement or desirableness. |
| **Utility Score** | The “y” value derived from the Utility Function of the measurement of the impact induced by a particular alternative’s criterion. A measurement of the usefulness or attractiveness of an alternative with respect to an individual evaluation criterion based on its measured effect (a number between 0 and 1). The utility score is dimensionless. |
| **Weight** | The importance attributed to a criterion relative to other criterion. The value of the weight is expressed in a percentage and the sum of all criterion weights is equal to 100%. |
| **Weighted Additive Method** | The method used in the quantitative evaluation of alternatives, which reduces the project’s numerous criteria into a dimensionless number for each alternative suitable for comparison. |
| **Weighted Score** | A raw score that has been multiplied by the criterion weights. The weighted scores reflect the social value or importance of the specific group providing weights. |

# Appendix B

Short-Listed Alignment Corridor Alternatives

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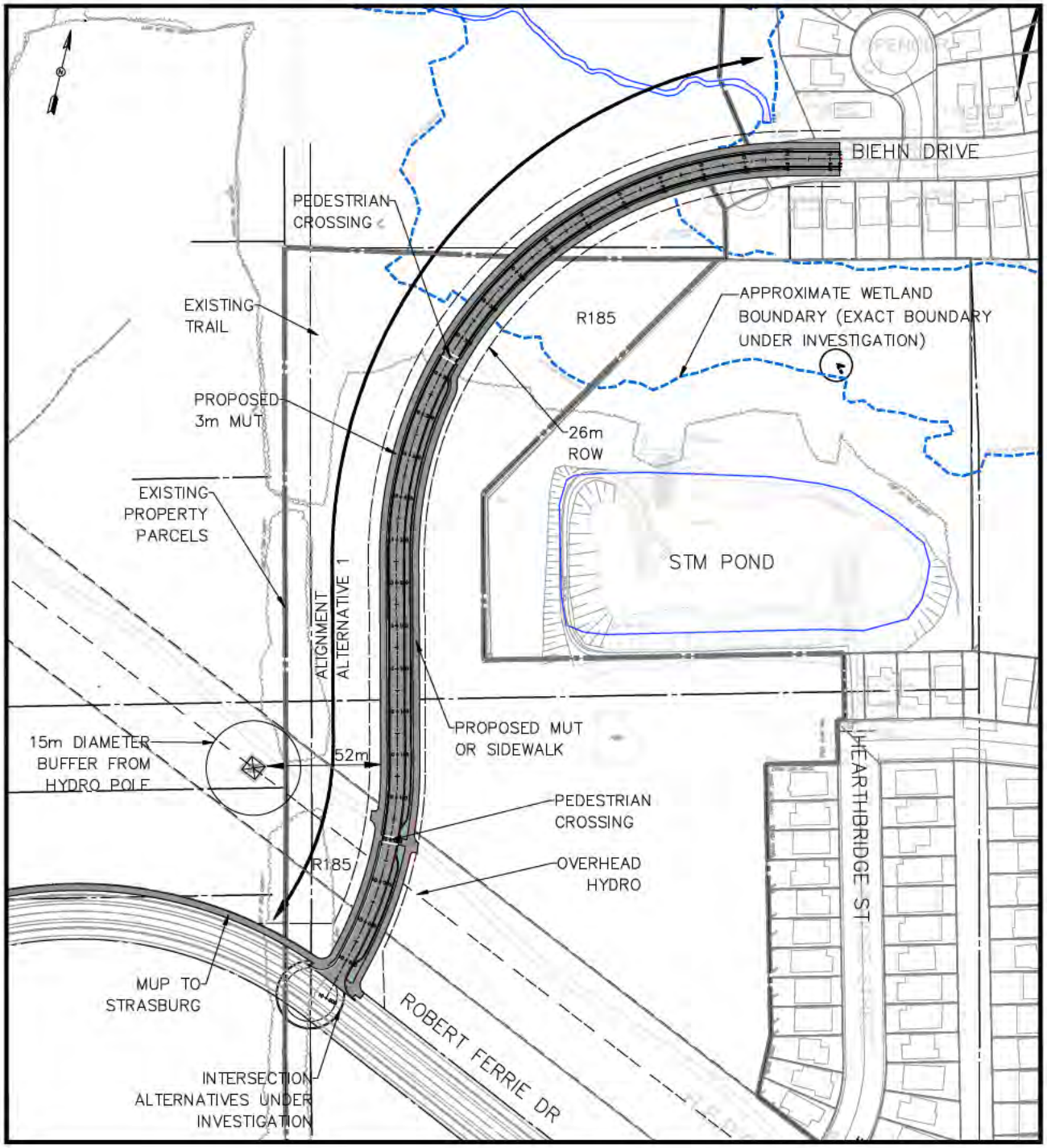
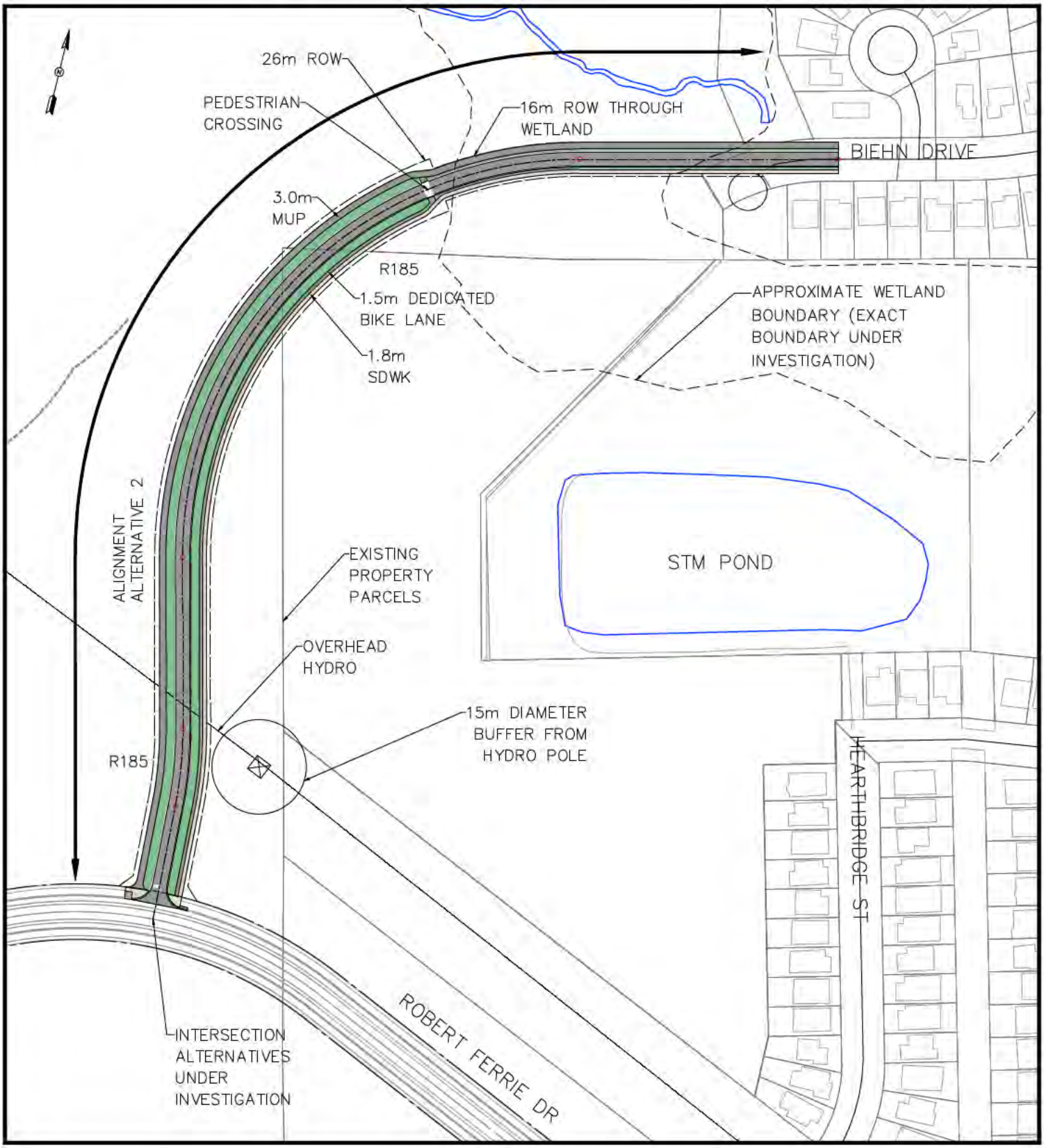
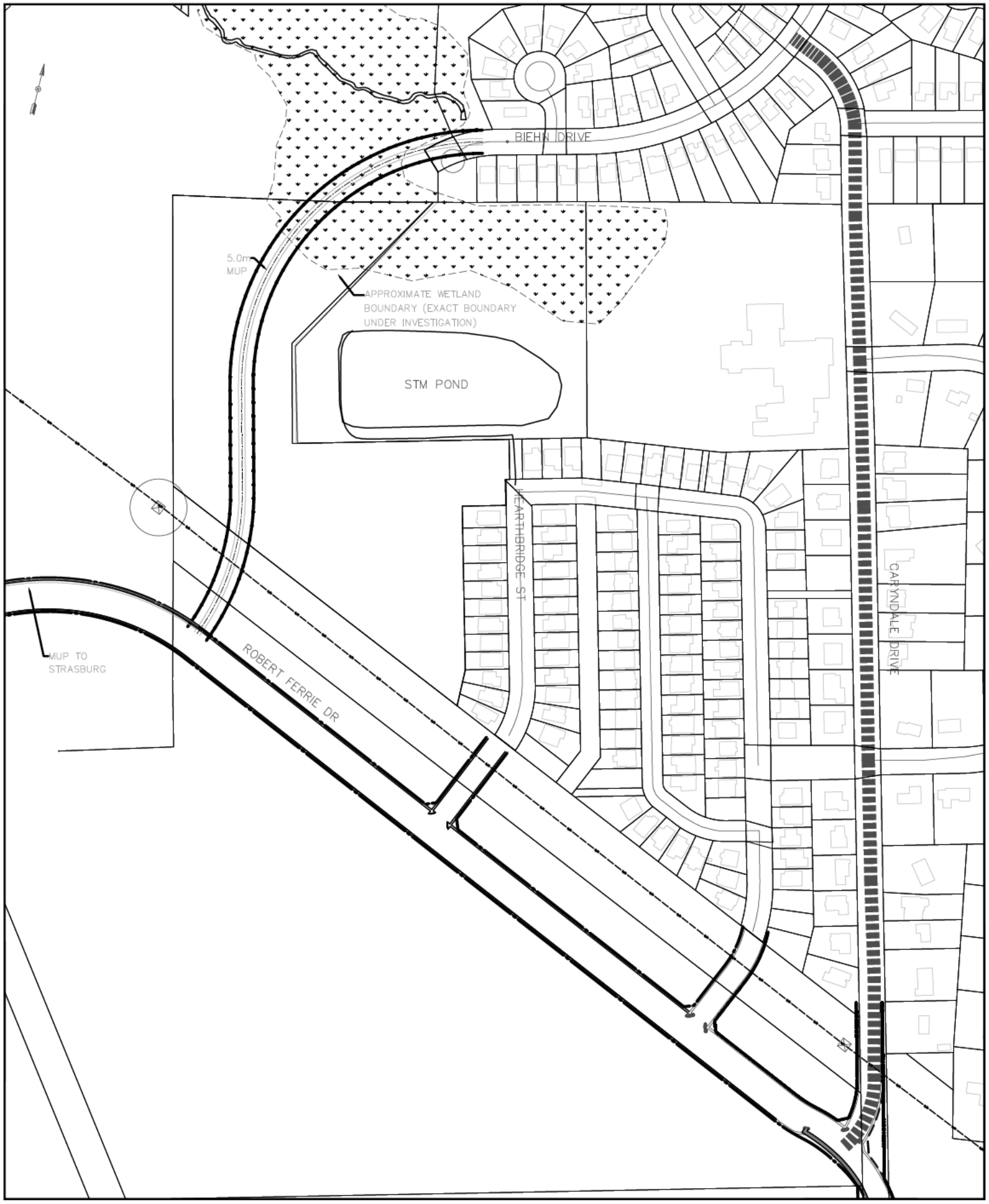
# BIEHN DRIVE – ALTERNATIVE 1 – TPA



# BIEHN DRIVE – ALTERNATIVE 2



BIEHN DRIVE – ALTERNATIVE 4



# Appendix C

Long List of Evaluation Criteria

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**Alignment Alternatives**
**Long List of Evaluation Criteria**

| Factors and Sub-Factors | Unit of Measure | Carried Forward ? | Remarks |
|---|---|---|---|
| **Transportation** | | | |
| Delays (during construction) | veh-h | X | All equal |
| Supports Urban Transit Service | High/Medium / Low | ✓ | |
| Improved Emergency Response | Yes/No | ✓ | |
| Fuel Consumption | l (litres) | X | Measured under travel time |
| Road User Costs | $ | X | Measured under travel time |
| Roadway Safety | Length (m) | ✓ | |
| Roadway Safety - Collision Potential at Intersections | Number | X | |
| Active Transportation Connectivity - Conflicts through Communities | Length (km) | X | All equal.<br>All alternatives provide an active transportation link extension from Biehn Drive westerly. |
| Active Transportation - Proximity to Community Facilities | number | X | Covered above |
| Bicycle - Conflicts with Existing Bicycle Routes | Length (km) | X | See Active Transportation criterion |
| Flexibility for Future Expansion | Yes/No | X | |
| Horizontal Curvature | degrees of deflection | X | |
| Vertical Curves | Number | X | Meets City standards |
| Minimum Radius of Curves | m | X | Meets City standards |
| Skewed Intersections / Angle of Skewed Intersections | Number | X | |
| Level of Service on Local Roads | High/Low | X | Measured under Efficiency of Travel |
| Efficiency of Travel | High/Medium /Low | ✓ | |
| Compatibility with Integrated Transportation Master Plan | Yes/No | ✓ | |
| Safety of School Zone | Yes/No | ✓ | |
| Ability to Maintain Existing Roadway Classification | Yes/No | X | |

| Factors and Sub-Factors | Unit of Measure | Carried Forward ? | Remarks |
|---|---|---|---|
| Bicycle and Pedestrian Safety - Conflicts with Planned Hydro Corridor Multi-Use Trail | No. of Crossings | X | |
| Personal Security of Pedestrians and Cyclists | Yes/No | ✓ | |
| Intersection Spacing | m | ✓ | |
| Robert Ferrie Drive Intersection Location to Accommodate Future Development | Length (m) | X | |
| **Natural Environment** | | | |
| Climate Change - Change in Greenhouse Gas Emissions | Tonnes/year | X | |
| Sustainability - Use of Natural Resources to Construct Project | ha | X | |
| Aquatic Species at Risk Potential Habitat Impacted | Number of Occurrences | X | Confirmed by field inventories and mapping. |
| Potential Species at Risk Potential Habitat Impacted | Number | X | Potential for Butternut, Black Ash and Myotis species. |
| Significant Woodlands Removed | ha | X | |
| Other Woodlands and Woodlots Removed (does not include significant woodlands) | ha | X | |
| Warm / Cool Water Fish Habitat Impacted | $m^2$ | X | Potential for ephemeral or intermittent watercourses in PSW. |
| Cold Water Fish Habitat Impacted | $m^2$ | X | Downstream impacts to Strasburg Creek cold water fish habitat. Confirmed in field that all are equal. |
| Loss of Fish Habitat | $m^2$ | X | Measured above. |
| Water Quality (Stormwater Surface Runoff) | ha | X | All equal. |
| Drainage Courses Crossed | Number | X | Included under Cool/Cold and Warm Water Fish Habitat Impacted and Warm water Fish Habitat Impacted above. |

| Factors and Sub-Factors | Unit of Measure | Carried Forward ? | Remarks |
|---|---|---|---|
| Stormwater Management Measures (Quantity and Quality Control) | Developed/ undeveloped | X | All equal. Mitigation for stormwater (road and land development) will include temporal and LID technology. |
| Type of Soil for Stormwater Management | Type | X | All equal |
| Drainage: Road Grades (Slope) | % | X | All equal. Meets standards. |
| Wildlife Habitat | ha | ✓ | |
| Accommodating Wildlife Movement | Preferred/Not Preferred | ✓ | |
| Migratory Bird Nesting Impact | Yes/No | X | Mitigation measures applied. |
| Area of Natural and Scientific Interest Removed | ha | X | No ANSIs. |
| Provincially Significant Wetland (PSW) Removed | ha | ✓ | Strasburg Creek PSW |
| Potential Black Ash Impacted | ha | ✓ | |
| Groundwater Infiltration | ha | ✓ | Strasburg Creek PSW |
| Conservation of Tree Canopy | ha | X | Measured under Provincially Significant Wetland Removed |
| Adjacent Lands Removed | ha | X | |
| Fragmentation of PSW | ha | X | All equal.<br>Each of the alternatives will cross the PSW in the approximate same location.<br>As such, the resultant fragmentation will be nearly identical.<br>Alternative 3 was not carried forward, in part, because it had a larger fragmentation and multiple wetland crossings. |
| Wetlands Removed | ha | X | See above. |
| Unevaluated Wetlands Removed | ha | X | |
| Aggregate Resource Area Removed | ha | X | |
| Groundwater – Wellhead Protection Sensitivity Areas (WHPA) Vulnerability (GRCA) Area 4 | ha | X | All equal. Sanitary sewer trench to include mitigation (clay seals) to avoid groundwater flow. |

| Factors and Sub-Factors | Unit of Measure | Carried Forward ? | Remarks |
|---|---|---|---|
| Loss of Flood Plain Storage - Regulated Areas | ha | X | Outside the floodplain. |
| Kitchener Core Natural Heritage Features/Region Core Environmental Features Impacted, Map 6 Natural Heritage System City of Kitchener Official Plan | ha | X | Included in the PSW criteria. |
| Specimen Trees | Number | X | All equal |
| **Cultural Environment** | | | |
| Designated Heritage Property Impacted | ha | X | Not Applicable |
| Heritage Property Listed in Register Impacted | ha | X | Not Applicable |
| Heritage Property Impacted (not Designated or Listed) | ha | X | Not Applicable |
| Heritage Buildings Impacted | Number | X | Not Applicable |
| Impact to Heritage Landscape Features (fence rows, tree lines, etc.) | High/ Medium/ Low | X | Not Applicable |
| Cemeteries Impacted | Number | X | See Registered Archaeological Sites |
| Pre-contact Sites | Number | X | See Registered Archaeological Sites |
| Post-contact Sites | Number | X | See Registered Archaeological Sites |
| Mapped 19th Century Structures (no longer standing) | Number | X | Double counted with Post contact sites |
| Cultural Landscape Features Impacted (not Designated or Registered Historical Properties) | Number of Settlement Areas | X | Not Applicable |
| Area of Archaeological Potential | ha | X | All equal. |
| **Socio-Economic Environment** | | | |
| Air Quality (Sensitive Receptors) | Number of Sensitive Receptors | X | All equal. |
| Sound Level Increases (greater than 55 dBA) | Number | X | No increase. |
| Sound Level Increases (less than 55 dBA) | Number | X | No increase. |

| Factors and Sub-Factors | Unit of Measure | Carried Forward ? | Remarks |
|---|---|---|---|
| Vibration Impacts | Number | X | Measured under Sound Level Increases |
| Proximity to Hearthwood Park | Number | X | All equal, avoided. |
| Emergency Response | Yes/No | X | Refer to Transportation |
| Community Festivals Impacted | Yes/No | X | Avoided |
| Potential School Pick-up/Drop-off Locations | Number of schools | X | See Community Disruption. |
| Community Disruption - Biehn Drive North | Distance (km) through Neighbour-hoods | ✓ | |
| Community Disruption - Biehn Drive South | Distance (km) through Neighbour-hoods | ✓ | |
| Community Disruption - Caryndale Drive | Distance (km) through Neighbour-hoods | ✓ | |
| Institutions Impacted | Number | X | Brigadoon Public School<br>Considered under Transportation subfactors. |
| Visual Intrusion to Adjacent Residents | Number | X | Considered under community disruption. |
| Pits and Quarries Impacted | Number | X | |
| Farming Activity Impacted | hectares | X | Interim use only. To be redeveloped |
| Businesses Impacted | Number | X | |
| **Land Use and Property** | | | |
| Supports City of Kitchener's Official Plan | Yes/No | ✓ | |
| Residences Partially Impacted | Number | X | |
| Residential Buyouts | Number | X | |
| Low Rise Residential Property Required | ha | X | All equal. City of Kitchener Official Plan, supported by landowner. |
| Institutional Property Required | ha | X | City of Kitchener Official Plan |

| Factors and Sub-Factors | Unit of Measure | Carried Forward ? | Remarks |
|---|---|---|---|
| Natural Heritage Conservation Property Required | ha | X | City of Kitchener Official Plan, Measured under Natural Environment |
| Park Property (Hearthwood Park) Required | ha | X | City of Kitchener Official Plan |
| Mineral Aggregate Resource Areas | ha | X | City of Kitchener Official Plan |
| Commercial Property Required | ha | X | Employment Areas are avoided. City of Kitchener Official Plan |
| Rural Property Required | ha | X | City of Kitchener Official Plan |
| New Utility Corridor Crossing Required | Number | X | Considered under Cost |
| Communication Towers Impacted | Number | X | Communication towers are avoided. |
| Natural Heritage System/Major Open Space Required | ha | X | Measured under Natural Environment |
| Hydrology/Hydraulics: Land Uses Upstream of Road | ha | X | To be determined at a later date |
| Former Landfill Sites/Potential Site of Environmental Concern Impacted | Number | X | To be determined at a later date. |
| Planned Primary Multi-Use Pathway/Connection (Type 1) Impacted, Map 11 Integrated Transportation System City of Kitchener OP | Number | X | All equal. Trail system is accommodated. |
| Planned Secondary Multi-Use Pathway/Connection (Type 2) Impacted, Map 11 Integrated Transportation System City of Kitchener OP | Number | X | All equal. Trail system is accommodated. |
| Efficient Utilization of Future Development Land | High/ Medium / Low | ✓ | Measures the efficiency for development. |
| Crossing of the Hydro Corridor | No. of Crossings | ✓ | |
| Property Required | ha | ✓ | |
| **Cost** | | | |
| Capital Cost | $ | ✓ | |
| Operating Costs | $ | X | |
| Life Cycle Cost | $ | X | |

| Factors and Sub-Factors | Unit of Measure | Carried Forward ? | Remarks |
|---|---|---|---|
| **Engineering** | | | |
| Stormwater Runoff | High / Medium / Low | X | |
| Accessibility for maintenance of sanitary sewer | High/low | X | |
| Biehn Drive Stormwater Enhancement | High/High-Medium /Low | X | |
| Sanitary Sewer Alignment | Yes/No | X | |
| Overland Stormwater Management Route | Order of Magnitude | X | |

# Appendix D

Sub-Factor Definitions

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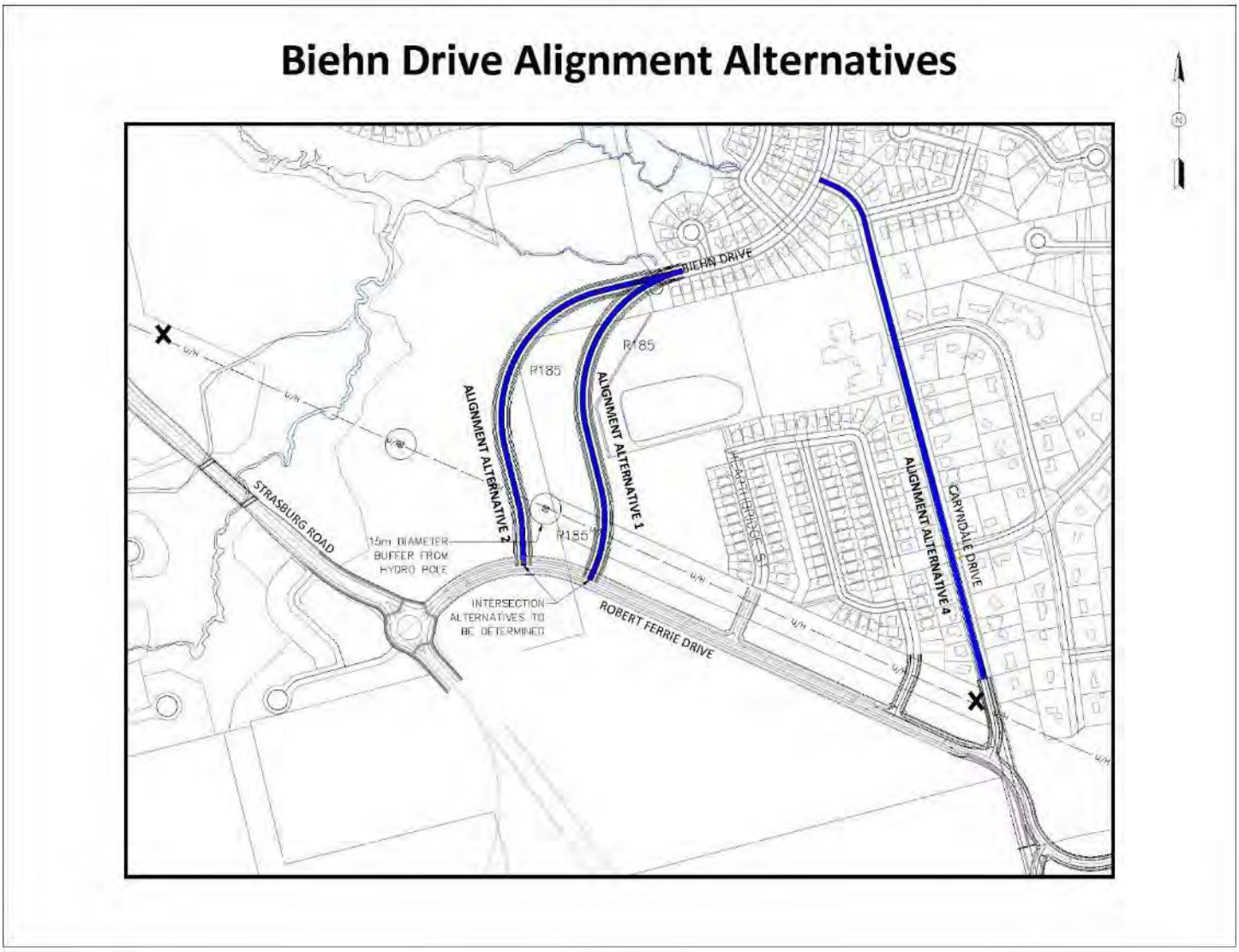
**Biehn Drive Alignment Alternatives**

| Alternative | Description |
|---|---|
| Do Nothing | Existing - Caryndale Drive |
| Alternative 1 | Connect Biehn Drive to Robert Ferrie Drive – East Alignment |
| Alternative 2 | Connect Biehn Drive to Robert Ferrie Drive – Central Alignment |
| Alternative 4 | Existing - Caryndale Drive<br>Provide an Active Transportation Link<br>Municipal Trunk Sewer to follow Alternative 1 |



Scoring Legend based on the Likert system:

| | Score |
|---|---|
| Extreme Negative impact / Highly Unsatisfactory | 0.00 |
| Negative impact (Intermediate) | 0.25 |
| Neutral / No change / No impact | 0.50 |
| Positive Impact (Intermediate) | 0.75 |
| Extreme Positive Impact / Highly Satisfactory | 1.00 |

## Transportation

### Supports Urban Transit Service

**Definition:** This sub-factor measures the ability to accommodate future transit service, supporting City and Regional Transportation Master Plan objectives to promote alternative travel modes and to support planned area development.

**Mitigation:** None.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 1 |
| Alternative 2 | 0.75 |
| Alternative 4 | 0.25 |

## Transportation

### Improved Emergency Response

**Definition:** This sub-factor considers the benefit to emergency response. To improve the emergency response to the neighbourhood, the provision of alternative routes with an additional access to the community is preferred.

**Mitigation:** None.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 1 |
| Alternative 2 | 1 |
| Alternative 4 | 0 |

## Transportation

### Roadway Safety

**Definition:** This sub-factor measures the length of area collector roads where traffic volumes would be reduced, supporting existing and planned neighbourhood traffic calming measures to improve traffic safety. Alternatives which benefit the greatest length of existing collector roads are preferred.

**Mitigation**: Implementation of additional traffic calming measures including the potential use of roundabout control can be considered where traffic volumes would not be reduced.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 1 |
| Alternative 2 | 1 |
| Alternative 4 | 0.25 |

## Transportation

### Compatibility with Integrated Transportation Master Plan

**Definition:** This sub-factor measures the compatibility with the Integrated Transportation Master Plan which was the basis for the approval of all existing area development. Those alternatives which will result in a more even distribution of traffic consistent with the current roadway classifications are preferred.

This sub-factor considers the existing roadway classifications and the potential requirement to reclassify Caryndale Drive from a minor collector to a major collector. Those alternatives which would allow the existing classifications to be maintained and would not require Caryndale Drive to be reclassified to a major collector are preferred.

**Mitigation**: None.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 1 |
| Alternative 2 | 1 |
| Alternative 4 | 0 |

## Transportation

### Safety of School Zone

**Definition:** This sub-factor considers traffic safety within area School Safety zones. Those alternatives which avoid passing the Brigadoon Public School located on Caryndale Drive are preferred.

**Mitigation**: Additional traffic calming to further control traffic speeds and increased enforcement.

Use of school crossing guards.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 1 |
| Alternative 2 | 1 |
| Alternative 4 | 0.25 |

## Transportation

### Personal Security of Pedestrians and Cyclists

**Definition:** This sub-factor considers the personal security of pedestrians and cyclist where there is a multi-use path adjacent to a roadway. Those alternatives with a multi-use path adjacent to the roadway are preferred.

**Mitigation**: None.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 0.75 |
| Alternative 2 | 0.75 |
| Alternative 4 | 0.25 |

## Transportation

### Intersection Spacing/Safety

**Definition**: This subfactor considers the standard spacing of intersections (250 m) along Robert Ferrie Drive and the effects that closely spaced intersections can have upon traffic operations and vehicle conflicts due to traffic queuing on future development north of Robert Ferrie Drive. The measurement for this sub-factor is in metres. Alternatives that satisfy intersection spacing standards and avoid directing traffic through closely spaced intersections are preferred.

Minimum TAC intersection spacing 250 m.

**Mitigation:** None.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0.25 |
| Alternative 1 | 0.75 |
| Alternative 2 | 0 |
| Alternative 4 | 0.25 |

## Natural Environment

### Wildlife Habitat

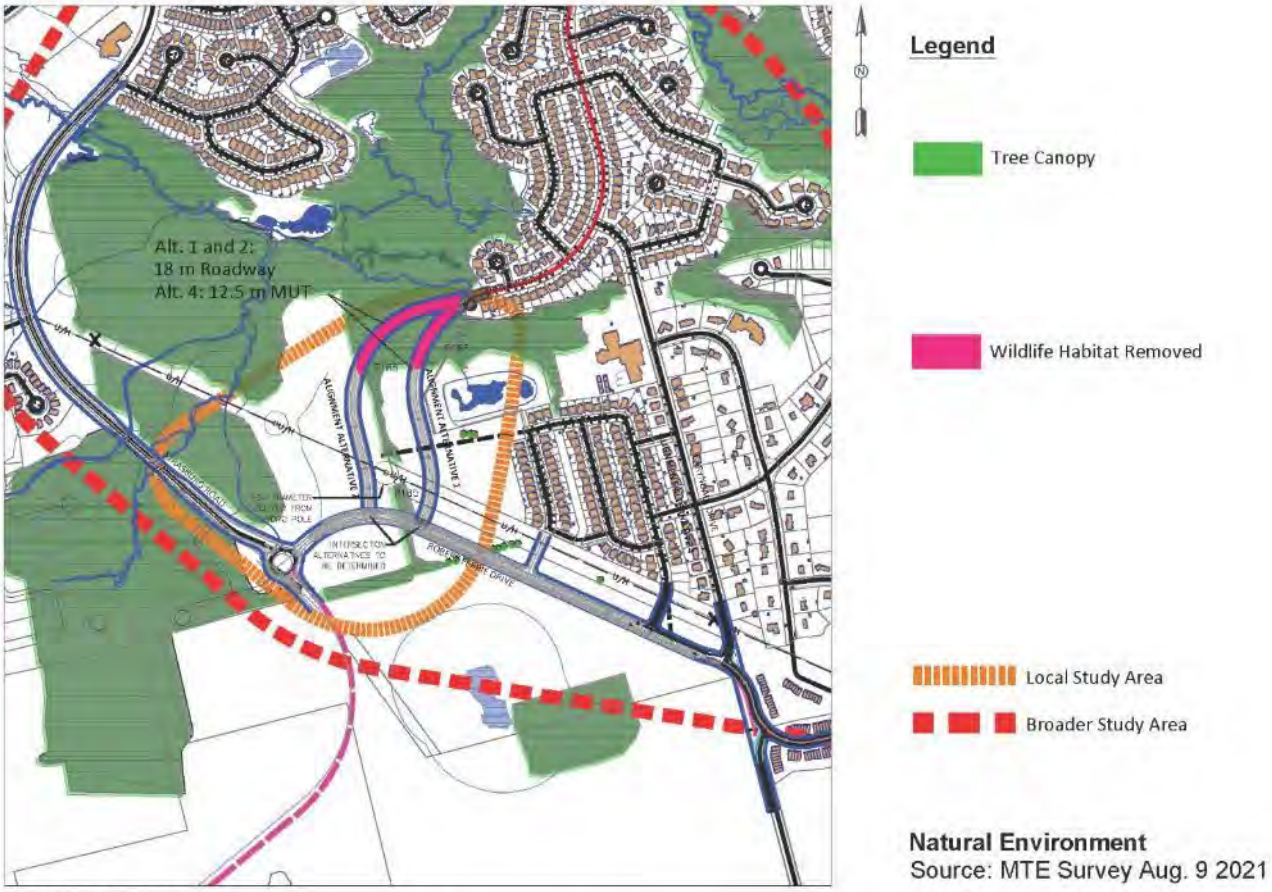
**Definition:** This sub-factor measures the removal of Wildlife Habitat within the right-of-way, along any of the proposed alternative Alignments.

Those alternatives that remove the least amount of wildlife habitat are preferred.

**Mitigation:** To be considered for the Technically Preferred Alternative using Best Management Practises and identify enhancement opportunities.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 1 |
| Alternative 1 | 0 |
| Alternative 2 | 0 |
| Alternative 4 | 0.5 |




City of Kitchener
**Biehn Drive Extension Environmental Assessment Study**
Municipal Class Environmental Assessment
NTS

## Natural Environment

### Accommodating Wildlife Movement

**Definition:** This sub-factor measures the impact on wildlife habitats crossings. The measurement for this sub-factor is the width of the right-of-way and level of traffic for each alternative. The alternative with a narrow right-of-way width and least amount of traffic is preferred.

Do Nothing: No traffic

Alternative 1: Traffic and 26 m ROW 6.6 m paved street and provides a wildlife culvert.

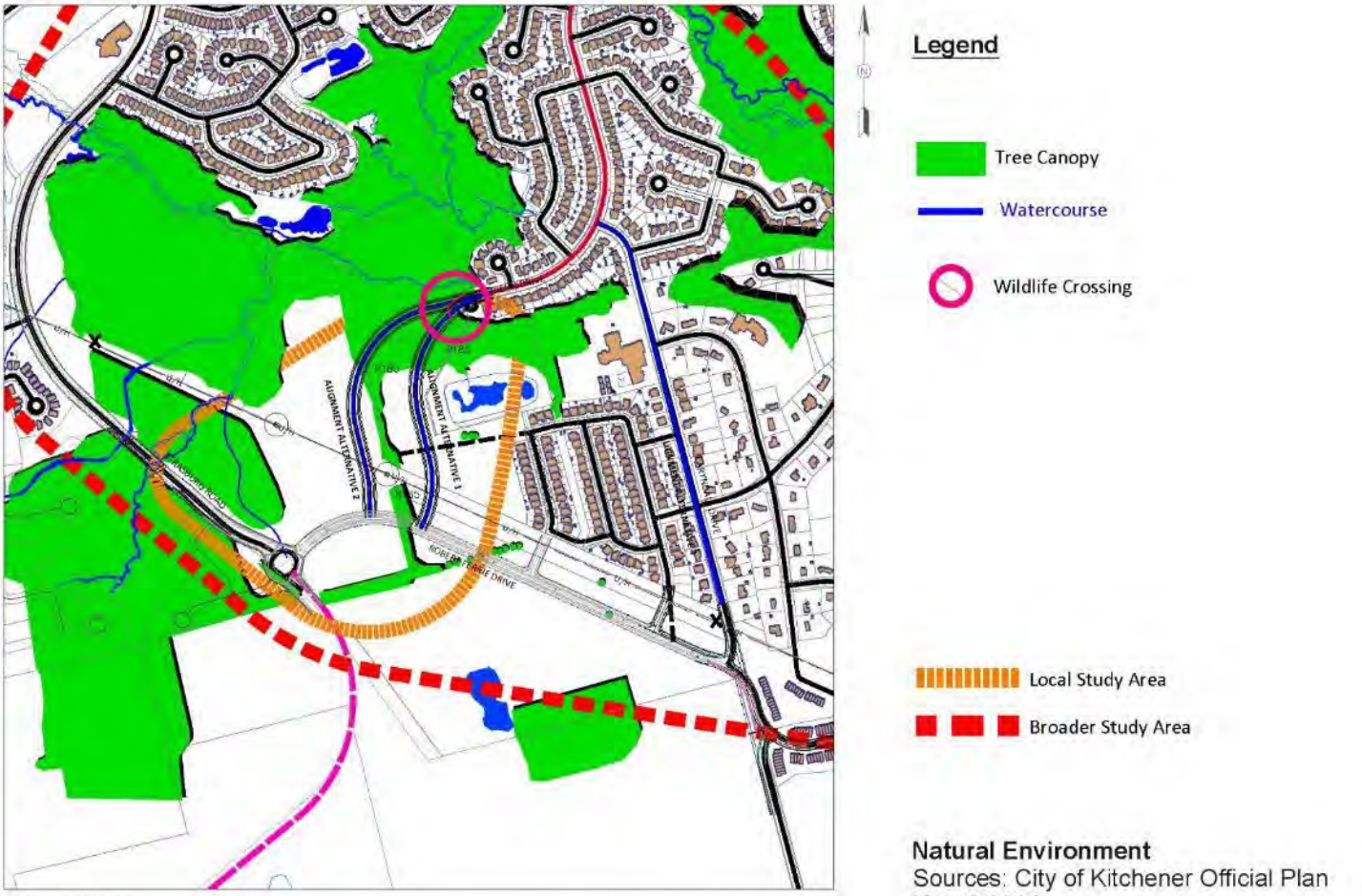
Alternative 2: Traffic and 26 m ROW 6.6 m paved street.

Alternative 4: No traffic.

**Mitigation:** Provide or enhance alternative wildlife crossings along the alignment.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 1 |
| Alternative 1 | 0.25 |
| Alternative 2 | 0 |
| Alternative 4 | 0.5 |




City of Kitchener
**Biehn Drive Extension Environmental Assessment Study**
Municipal Class Environmental Assessment
NTS

**Natural Environment**
Sources: City of Kitchener Official Plan Map 6 2014.
GRCA Open Data License V2 Regulatory Floodplain

## Natural Environment

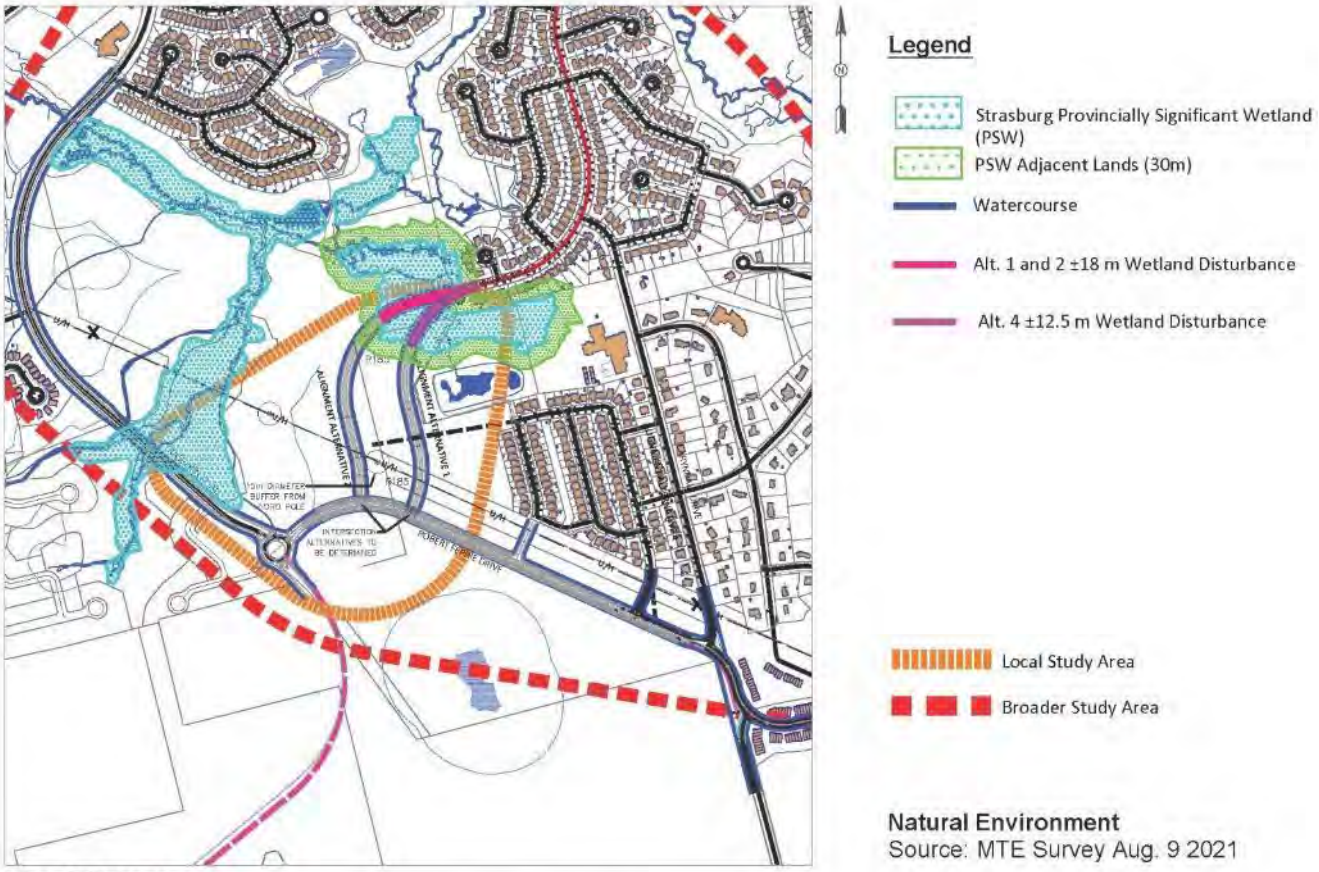
### Provincially Significant Wetlands Removed

**Definition:** This sub-factor measures the removal of Provincially Significant wetlands, including the removal of the tree canopy. The removal of wetland and tree canopy can result in direct habitat loss, may contaminate adjacent habitat, and may also alter existing stream flow and hydrologic patterns. The measurement for this sub-factor is in hectares. Those alternatives that affect the least area of wetlands and tree canopy are preferred.

**Mitigation:** Develop a wetland mitigation plan prior to construction. The plan will detail pre- and post-construction methodology and practices to prevent contamination or alteration to existing wetland conditions and enhancements or creation opportunities.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 1 |
| Alternative 1 | 0 |
| Alternative 2 | 0 |
| Alternative 4 | 0.5 |




City of Kitchener
**Biehn Drive Extension Environmental Assessment Study**
Municipal Class Environmental Assessment
NTS

## Natural Environment

### Potential Black Ash Impacted

**Definition:** This sub-factor measures the potential impact to Black Ash, recently added to the Species at Risk. The City has committed to provide compensation for any loss of Black Ash trees. Those alternatives that affect the least area of Black Ash are preferred.

**Mitigation:** Compensation.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 1 |
| Alternative 1 | 0 |
| Alternative 2 | 0 |
| Alternative 4 | 0.5 |

## Natural Environment

### Groundwater Infiltration of Rainfall

**Definition:** This sub-factor measures the loss of water permeable area within the Provincially Significant wetlands. The removal of permeable wetland area can result in direct reduction in groundwater and may also alter existing stream flow and hydrologic patterns. The measurement for this sub-factor is in hectares. Those alternatives that affect the least area are preferred.

**Mitigation:** Introduce LID treatment to allow water infiltration.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 1 |
| Alternative 1 | 0.25 |
| Alternative 2 | 0.25 |
| Alternative 4 | 0.5 |

## Socio-Economic Environment

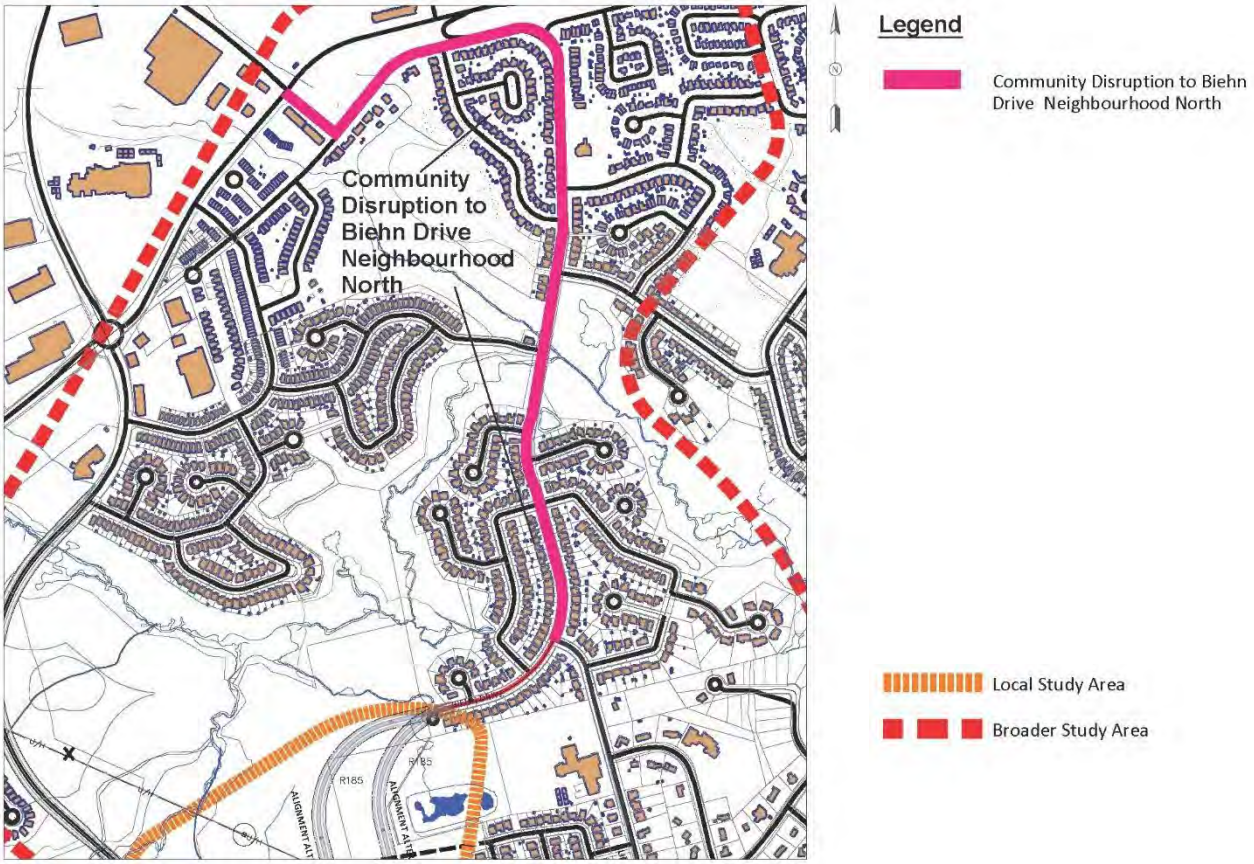
### Community Disruption to Biehn Drive North

**Definition:** This sub-factor measures the impact to neighbourhoods. The measurement for this sub-factor is the length of corridor within the Biehn Drive north neighbourhood. Those alternatives that impact the least number of kilometres within the Biehn Drive north neighbourhood are preferred.

**Mitigation:** None. (Traffic calming measures are already being developed for implementation.)

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0.5 |
| Alternative 1 | 1 |
| Alternative 2 | 1 |
| Alternative 4 | 0.5 |




City of Kitchener
**Biehn Drive Extension Environmental Assessment Study**
Municipal Class Environmental Assessment
NTS

**Socio-Economic Environment**

## Socio-Economic Environment

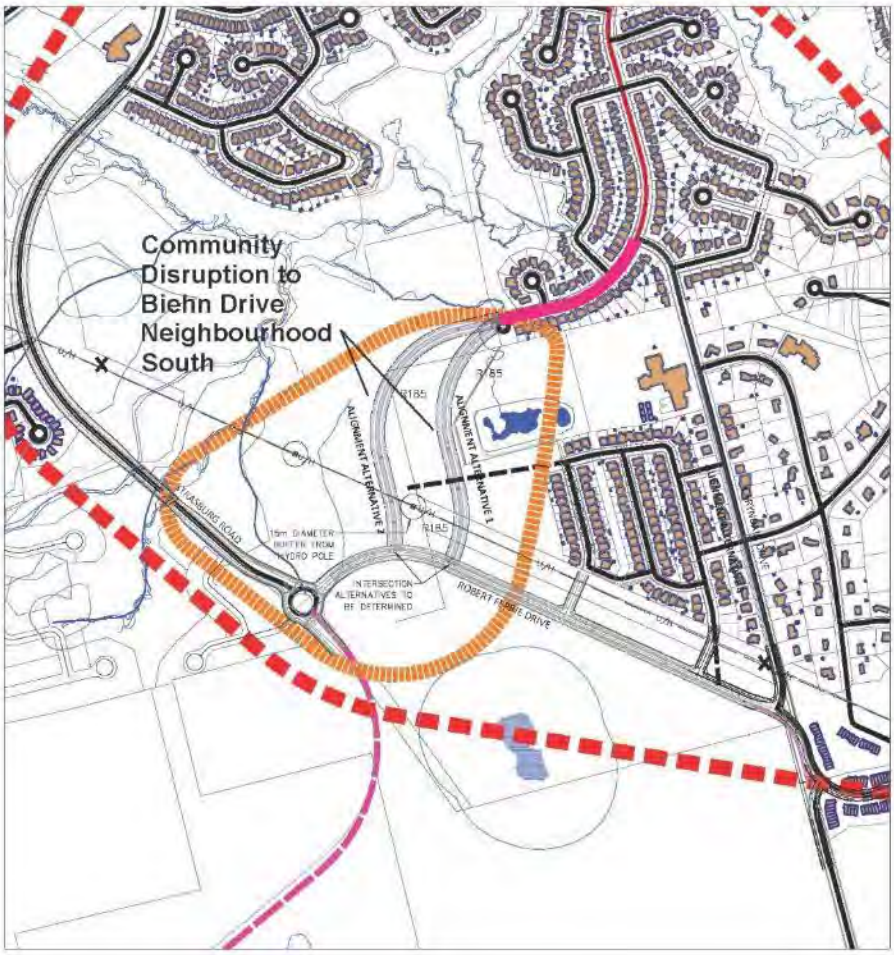
### Community Disruption to Biehn Drive South

**Definition:** This sub-factor measures the impact to neighbourhoods. The measurement for this sub-factor is the length of corridor within the Biehn Drive south neighbourhood. Those alternatives that impact the shortest section within the Biehn Drive south neighbourhood are preferred.

**Mitigation:** Traffic calming measures.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0.5 |
| Alternative 1 | 0.25 |
| Alternative 2 | 0.25 |
| Alternative 4 | 0.5 |




City of Kitchener
**Biehn Drive Extension Environmental Assessment Study**
Municipal Class Environmental Assessment
NTS

**Socio-Economic Environment**

## Socio-Economic Environment

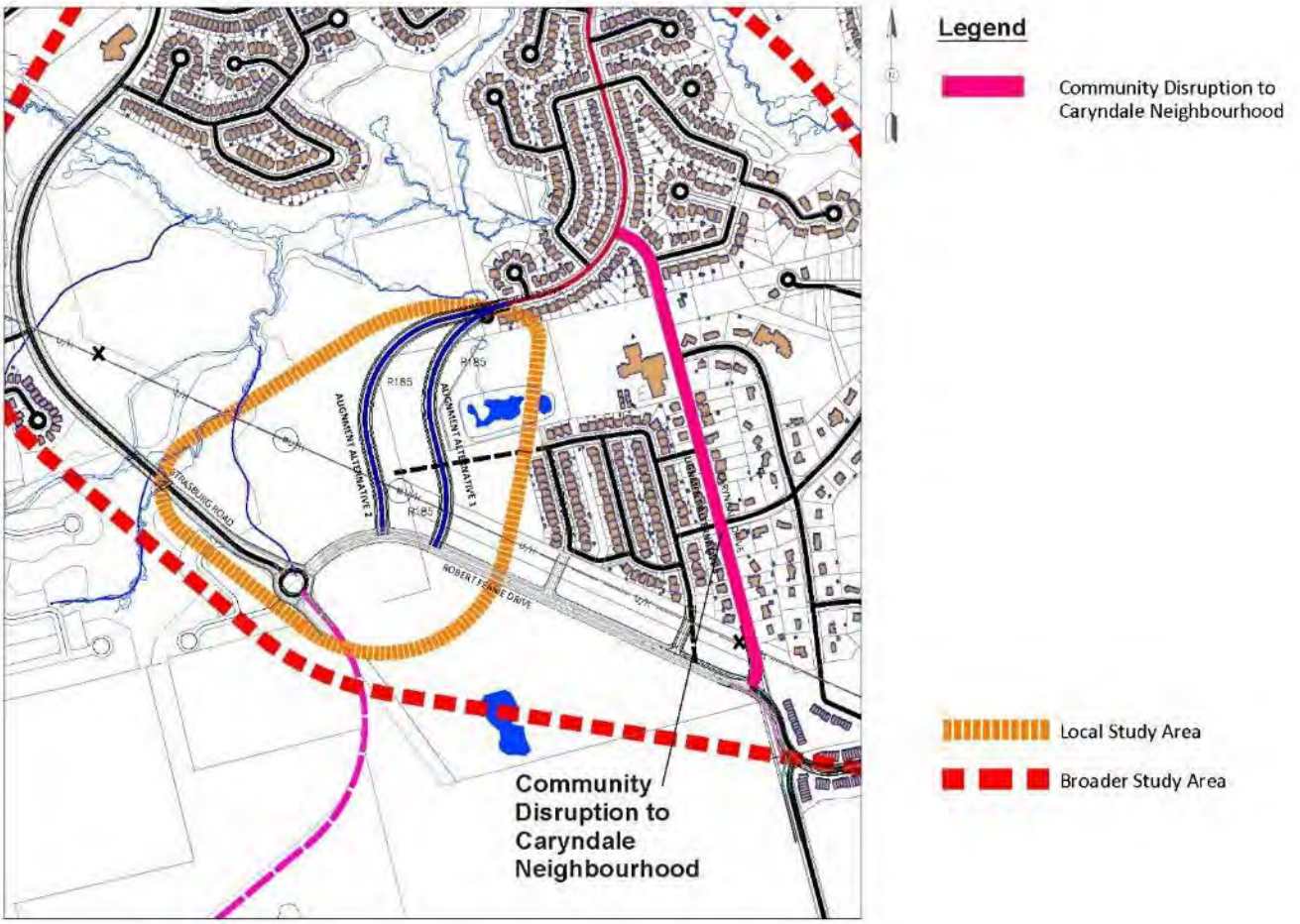
### Community Disruption to Caryndale

**Definition:** This sub-factor measures the impact to neighbourhoods. The measurement for this sub-factor is the length of corridor within the Caryndale neighbourhood. Those alternatives that impact the least number of kilometres within the Caryndale neighbourhood are preferred.

**Mitigation:** None. (Traffic calming measures have already been implemented.)

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0.25 |
| Alternative 1 | 0.75 |
| Alternative 2 | 0.75 |
| Alternative 4 | 0.5 |




City of Kitchener
**Biehn Drive Extension Environmental Assessment Study**
Municipal Class Environmental Assessment
NTS

**Socio-Economic Environment**

## Land Use and Property

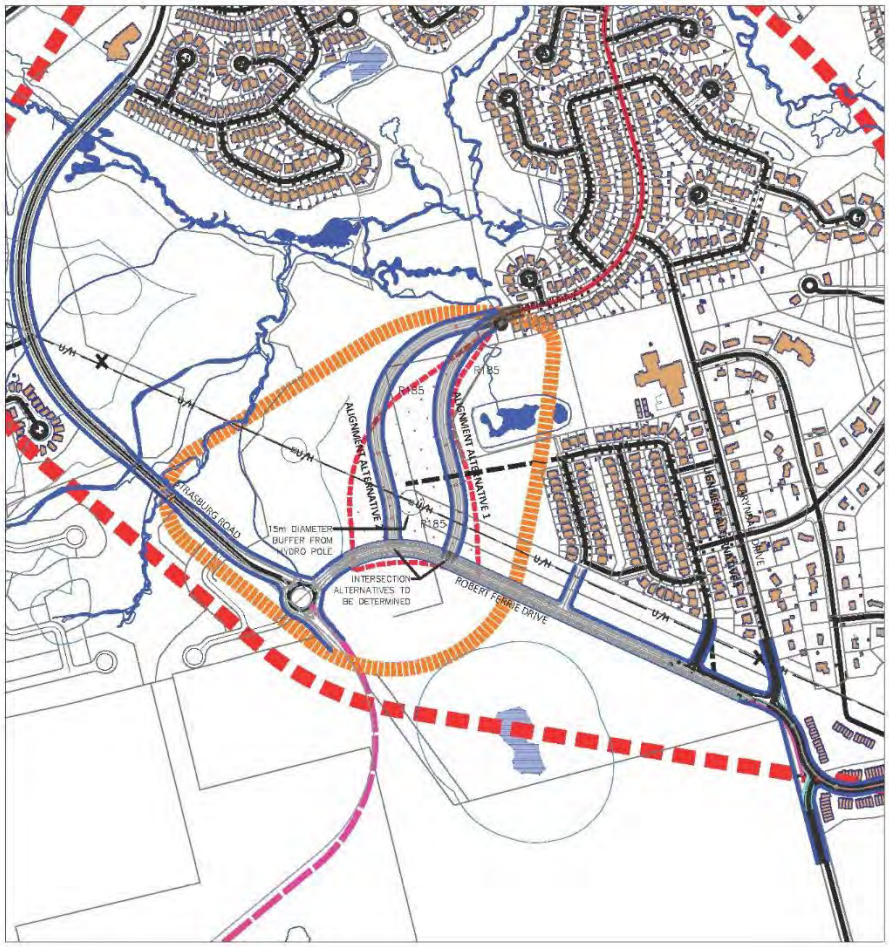
### Supports the City of Kitchener's Official Plan

**Definition:** This sub-factor measures whether the alignment alternative supports the City of Kitchener Official Plan. The measurement for this sub-factor is Yes/ No. Those alternatives that support the Official Plan, which was the basis for all existing development, are preferred.

**Mitigation:** None.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 1 |
| Alternative 2 | 1 |
| Alternative 4 | 0.25 |




**Legend**

Biehn Drive Extension Area
Source: City of Kitchener Official Plan Schedule B 2014.

Local Study Area

Broader Study Area

City of Kitchener
**Biehn Drive Extension Environmental Assessment Study**
Municipal Class Environmental Assessment
NTS

**Land Use**

## Land Use and Property

### Efficient Utilization of Land

**Definition:** This sub-factor measures whether the alignment alternative supports the efficient use of lands. Those alternatives that best support access and maximize the land available for development are preferred.

**Mitigation:** None.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0 |
| Alternative 1 | 1 |
| Alternative 2 | 0.5 |
| Alternative 4 | 0.25 |

## Land Use and Property

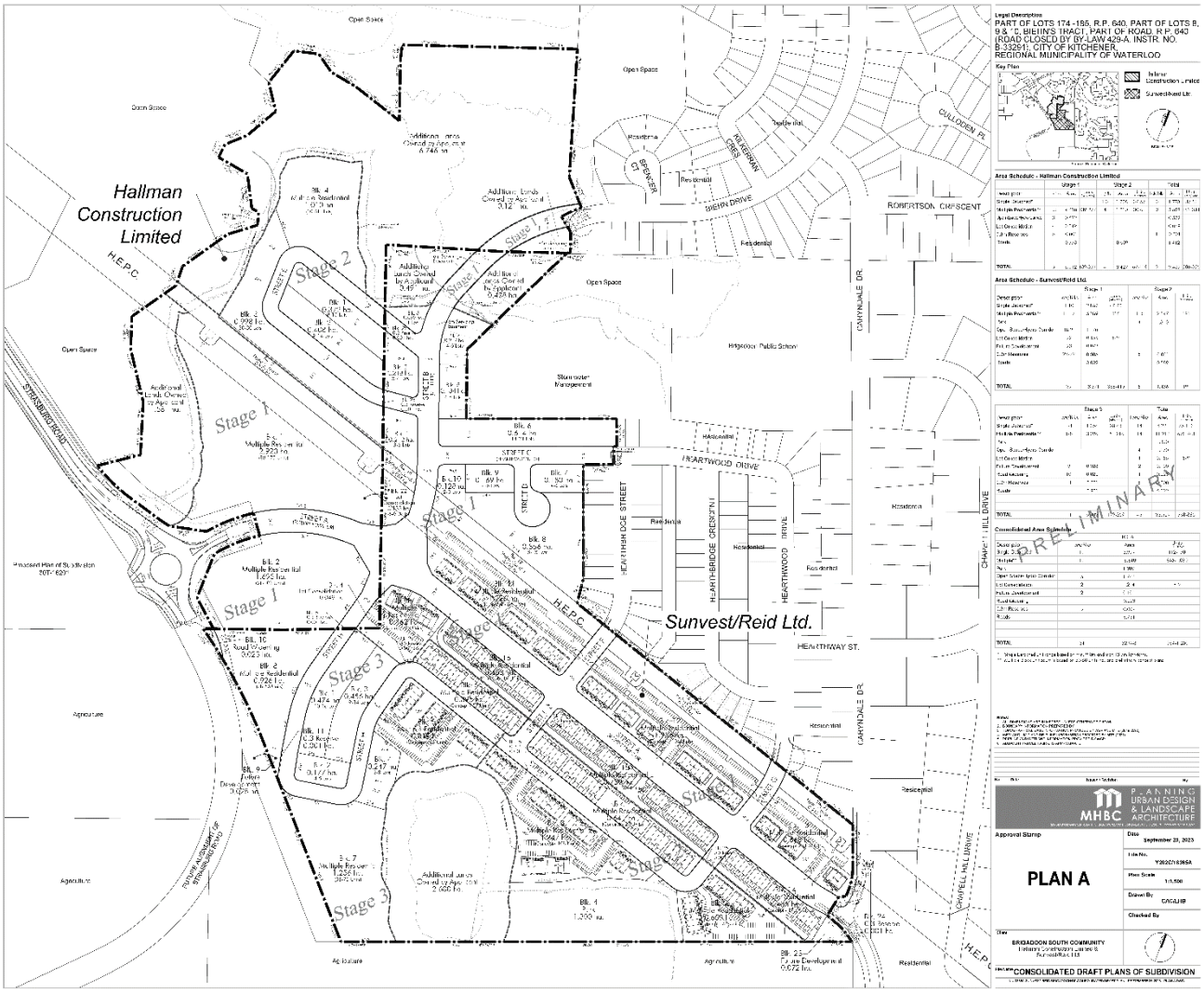
### Crossing of the Hydro Corridor

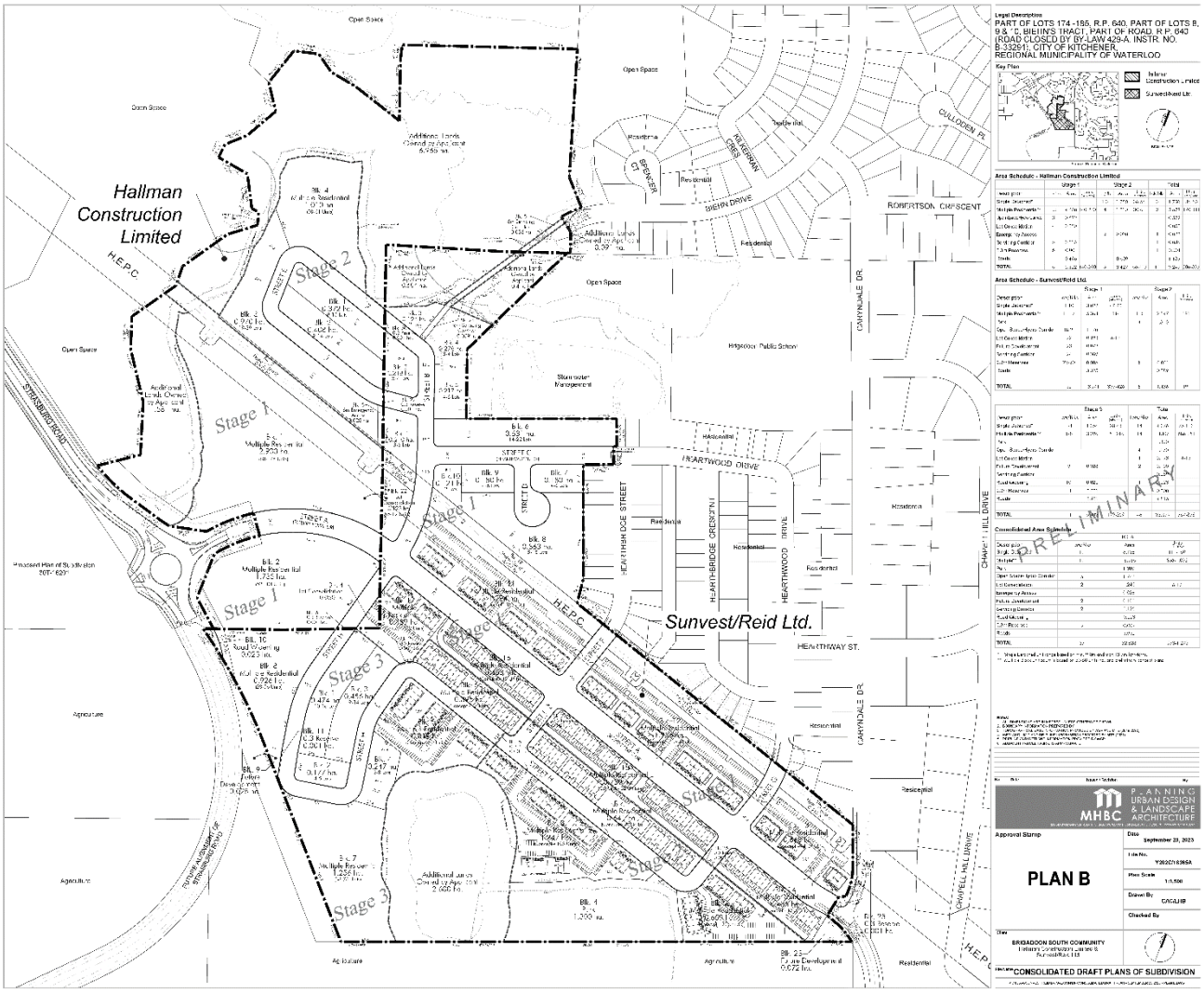
**Definition:** This sub-factor measures the number of crossings of the hydro corridor. The hydro corridor is a high voltage transmission line. Each crossing/conflict with the hydro corridor will require additional approval from Hydro One. The proposed extension of Biehn Drive would result in one crossing of the hydro corridor. Alternatives with the least number of hydro corridor crossings are preferred. A revised subdivision plan has only one crossing resulting in all the alternatives are equal.

**Mitigation**: Limit parking under the transmission lines.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 0.5 |
| Alternative 1 | 0.5 |
| Alternative 2 | 0.5 |
| Alternative 4 | 0.5 |


Hallman Construction Limited
Sunvest/Reid Ltd.
Open Space
Residential
Agriculture
Stage 1
Stage 2
Stage 3
HEARTWOOD DRIVE
HEARTHWAY ST.
CAMPBELL HILL DRIVE
ROBERTSON CRESCENT
BIEHN DRIVE
PRELIMINARY
PLAN A
CONSOLIDATED DRAFT PLANS OF SUBDIVISION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BIEHN DRIVE
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HEARTHSTONE STREET
HEARTHBRIDGE CRESCENT
HEARTHWOOD DRIVE
HEARTHWAY ST.
CAMPBELL HILL DRIVE
CAMPDALE DR.
ROBERTSON CRESCENT
CULLODEN PL.
BROWER CT.
ALDERMAN CRES.
STRASBURG ROAD
H.E.P.C.
Open Space
Residential
Agriculture
Brigadoon Public School
Stormwater Management
PLAN B
BRIGADOON SOUTH COMMUNITY
CONSOLIDATED DRAFT PLANS OF SUBDIVISION
PRELIMINARY

## Cost

### Capital Cost

**Definition:** This sub-factor measures the total capital cost of the alternative (including land purchasing, permitting, etc.). Cost estimates are for the alternative alignments in 2023. Those alternatives with the lowest capital cost are preferred.

**Mitigation:** Not applicable.

**Alternatives:**

| Alternative | Score |
|---|---|
| Do Nothing | 1 |
| Alternative 1 | 0 |
| Alternative 2 | 0 |
| Alternative 4 | 0.25 |

# Appendix M

Council Resolution

BT ENGINEERING

# Internal memo

Corporate Services Department

KITCHENER

www.kitchener.ca

**Date:** March 9, 2023

**To:** E. Riek, Project Manager

**From:** M. Mills, Committee Administrator

**cc:** C. Reyes

**Subject:** Biehn Drive and Sanitary Trunk Sewer Extension Class Environmental Assessment (EA) - Environmental Study Report

This is to advise that City Council at its regular meeting held on Monday, February 27, 2023 passed the following resolution:

> “That the following motion be **deferred to the March 20, 2023 Council Meeting** to allow an opportunity to further review the scoring for alternative 4 outlined in the Environmental Assessment; the traffic demand needs for the community; alternative servicing and construction options; additional environmental impacts such as flooding and salt contamination; impacts on future development and housing supply; and, future construction of Robert Ferrie Drive:
>
> > "That the Biehn Drive and Trunk Sanitary Sewer Extension Class Environmental Assessment (EA) - Environmental Study Report (ESR), prepared by BT Engineering, dated January 18, 2023, be received; and, That the Biehn Drive and Trunk Sanitary Sewer Extension Environmental Study Report (ESR), be filed with the Ministry of the Environment Conservation and Parks (MECP) for the mandatory thirty (30) day review period as required by the Environmental Assessment (EA) Act, as outlined in Development Services Department report DSD-2022-188."

M. Mills

**Summary/Conclusion of New Information Presented for March 20, 2023**

**by Bonnie Bender-Vargas**

**Re: Biehn Dr. Extension**

Good Evening Mayor and Council Members.

Before I begin our conclusion, I would like to thank Councillors Chapman, Deneault, and Owodunni for joining us on the walking tour of our wetland and trails around the end of Biehn Dr., as well as Regional Councillor James and David Weber from the Green Party.

In summary, there is a solution that enables us to satisfy the needs of development with those of the environment and preserving our green space. The answer is simple: a combination of Alternatives 1 and 4 from the Environmental Study Report, where traffic is routed along Caryndale Drive and municipal services are installed using directional drilling – without the need for extending Biehn Drive through PSW-30.

This solution would:

- Safeguard the wetland, including its vegetation, streams and pond
- Protect wildlife such as the brook trout and other species, endangered or otherwise
- Prevent groundwater and drinking water contamination caused by salt runoff
- Maintain critical flood-prevention infrastructure and minimize insurance costs
- Respect the warnings and forecasts from the environmental experts … yes, we have a climate emergency. A lot has happened since the 30 years that this has been "on the books," and I would hope that elected officials execute plans based on the best, current data

The results of the "risk" solution, by extending Biehn Dr, seem to "split hairs" in that we really don't know what will happen to the wetland until it happens … then it's too late. But we do know for sure that:

- The wetland would absolutely and unavoidably, suffer damage from the construction of a trenched sewer and road extension
- Construction would be disruptive to wildlife during the process, and despite the proposed culvert, would almost certainly result in injuries and roadkill once traffic begins to flow.
- The brook trout would be affected, due to their well-known and data-backed sensitivity to salt runoff
- There is a huge concern of the impact of salt runoff on groundwater, which is a stated concern of the Region of Waterloo
- There is a real possibility of impact on the availability and cost of flood insurance in an already flood-prone area, should construction impact the wetland's ability to absorb storm water

Bulldoze and build, bulldoze and build. This is what some call progress.

I would define progress as working together with the City, its development interests, and local residents, to protect wetlands, in order to achieve the common goal: smart, and still profitable, development that maximizes preservation of green space for the benefit of all.

Trees filter air pollution and purify water. The more trees we remove, and wetlands we damage, the less filter we have. A CTV article from February 17, 2023, which was cross-posted to the front page of the Waterloo Region Record on February 27th, noted that Kitchener was ranked fourth out of the most polluted 16 Canadian cities, based on measurements of airborne fine particulate matter. This equates to each Kitchener resident inhaling 115 cigarettes per year, whether they want to or not. Paving wetlands results in irreversible damage for innumerable species of trees and wildlife, and, yes, including our own species.

Our presenters provided you with research from renowned experts to save the Wetland, including:

Dr. Nandita Basu, Professor Gail Krantzberg, and from the Government of Canada's heavily promoted video we watched earlier this evening. The Government's core thesis is that wetlands are a major line of defence in nature-based climate change solutions.

The City of Kitchener has been a leader and put itself on the map in so many ways, including the work with directional drilling on Dodge Drive. Let's continue that progress and not follow in the footsteps of Oakville, which is facing a class-action lawsuit from residents over water damage due to overzealous development. We can respect and be stewards of the Wetland, and yet continue to satisfy those who build and develop the infrastructure, roads, and buildings we need… just by looking at alternatives. There are always alternatives if we just work together and keep an open mind. Let's look at the using Caryndale Dr. as the traffic route to Robert Ferrie. Let's look at Directional Drilling.

As our mayor has stated in the past: "Build a better Kitchener together", "Work together with our citizens." With the many attendees joining us this evening, both in person and virtually, we, citizens of this City, ask that you be a leader when voting on this matter.

Thank You.

# Thank you Mayor and council.

I am here to address the Biehn Dr. Extension project and speak to what us residents encounter having our houses in this wetland. It is my hope that with this information, you can make an informed decision that will not negatively impact the houses in the area.
We have lived in our house for 6 years and we learned quickly that our house and many others had water and flooding issues that dated back to the building of these houses. The first spring we were in the house, the basement flooded. We demo'ed the basement and left it for 2 years. In that time we had 3 additional floods. The constant presence of the water table against the concrete foundations causes regular cracks. Some homeowners have not been able to get insurance or have such high deductibles that it renders the insurance useless to protect them, such is my neighbours situation in which their deductible soared to $5000.
Every house in this area has sump pumps, usually 2 as back ups are needed. They regularly run even in the winter.

So what does this mean to you? And how can we as a city address these concerns?

Recently, a study from the University of Waterloo was published regarding the effects of climate change on the Canadian housing market. Its purpose was to inform home owners, mortgage lenders and municipalities. It examined whether catastrophic flooding affects house sold prices, days on market and number of listings. The 2 primary factors of climate change they noted was increased overall precipitation and loss of natural infrastructure (eg forests, grasslands and wetlands) which act as sponges. Among other detrimental effects to the market, the biggest and most notable finding was a 44.3% reduction in listings. As low level of listings is a significant factor in housing affordability, we should be mindful of that.

It gave 6 recommendations, one of which was directed specifically to governments. It was recommended to enforce guidelines and standards to retain and restore natural infrastructure to limit current and future flood risk. Many delegations have spoken on the harm that road construction will do to this area and was admitted by the consultants that this construction would likely raise the water table in the area. That's a concern not only for current residents but for the potential new ones. We don't want the city council to continue with the project after these many warnings from biologists, engineers, and residents alike. The implications of continuing this project in the suggested form with the full knowledge of how we and future homeowners will be negatively affected is arguably a big liability for council. There is currently a $1B class action suit by Oakville residents against the city and province claiming certain development made some homes into a flood plain that were previously not in one.
Should the water table rise and flood our homes are we prepared for the possibility of a class action law suit?
I urge you to consider the detrimental effects this project will have on us. There are many experts that agree with protecting wetlands: let's listen to them.

# Biehn Drive Extension Presentation – Council Meeting March 20, 2023

Mayor and Council Members

My name is Kelli Kuzyk and I am a long-time resident of Brigadoon living on Caryndale Drive very close to Brigadoon School. A few weeks ago, I presented information regarding the changes and improvements I have personally seen in the local traffic flow in the Biehn and Caryndale Drive area.

Further to our presentations, concerns were raised by City Staff regarding better public transit and accessibility to the neighbourhood by emergency services — it is these two issues I will address tonight.

Brigadoon is a fully developed subdivision yet has always lacked good transit options since it was completed in 1989. Today, the closest bus stop for Brigadoon residents is on the corner of Biehn and Black Walnut Drives, about a 12 minute walk for many people in this area. We are aligned with the City that transit access should be expanded. Opportunities already exist to incorporate bus stops within Hearthwood Hills, a subdivision off of Caryndale Drive and to return the bus stop back onto Biehn Drive that was close to the intersection of Caryndale. Future opportunities also exist to put in new transit stops within the new development that is being planned with the goal of aligning all routes in the area, including those already present in the Doon South Community. We do believe with these improvements, we can link the various communities together and create a far better transit solution going forward.

(1st slide)

We also heard at the last Committee meeting concerns raised by the City about the inability of emergency services to fully access Biehn Drive south of Marl Meadow in the event of a road closure. I would like to refer you to the map on your screen with the streets outlined in pink. You will note that both Kilkerran and Robertson Crescents allow for ample access to Biehn Drive. Kilkerran connects with Biehn at two points, while Robertson Crescent enables a bypass of part of Biehn Drive using Caryndale. We believe that both these routes adequately meet the needs of emergency services to fully access Biehn Drive

appropriately without the need for the extension going through a wetland. Further, in the 35 years residents have lived in this area on Biehn Drive, we are not aware of any issue being reported where access was ever impeded.

(2nd slide)

In light of my remarks, we respectfully urge you to fully consider this new information presented tonight. Alternative 4 as shown on the map in purple will work well for the current and anticipated traffic flow connecting the various communities; the Alternative 1 route in yellow will address the need to put in the municipal services in conjunction with directional drilling but with no planned extension of Biehn Drive. We also shouldn't lose sight of the potential of enhancing the trail system in the new development to link to Brigadoon Woods without invasive measures. We know that the existence of lots of green space and trails is very attractive for potential homeowners.

Truly, this is a win-win solution for all parties, including the Developers and the wildlife in PSW-30, as well as Ward's Pond. It is the best solution for preserving our wetland and its habitat which is so precious to this area. It eliminates a great deal of liability and risk to the City should groundwater become contaminated, and should flooding and property damage ensue — damage that would no doubt result in lawsuits —AND it still allows for good traffic flow, new transit options, and adequate emergency services access.

Thank you for allowing our presence and voices to be seen and heard again. Thank you for keeping our environment at the forefront as you discuss and vote on this. Together we can implement a solution that is responsible, viable, but most importantly protects the wetlands that need protecting.

# Tributaries and Confluences in the **Provincially Significant Wetlands** (PSW-30)

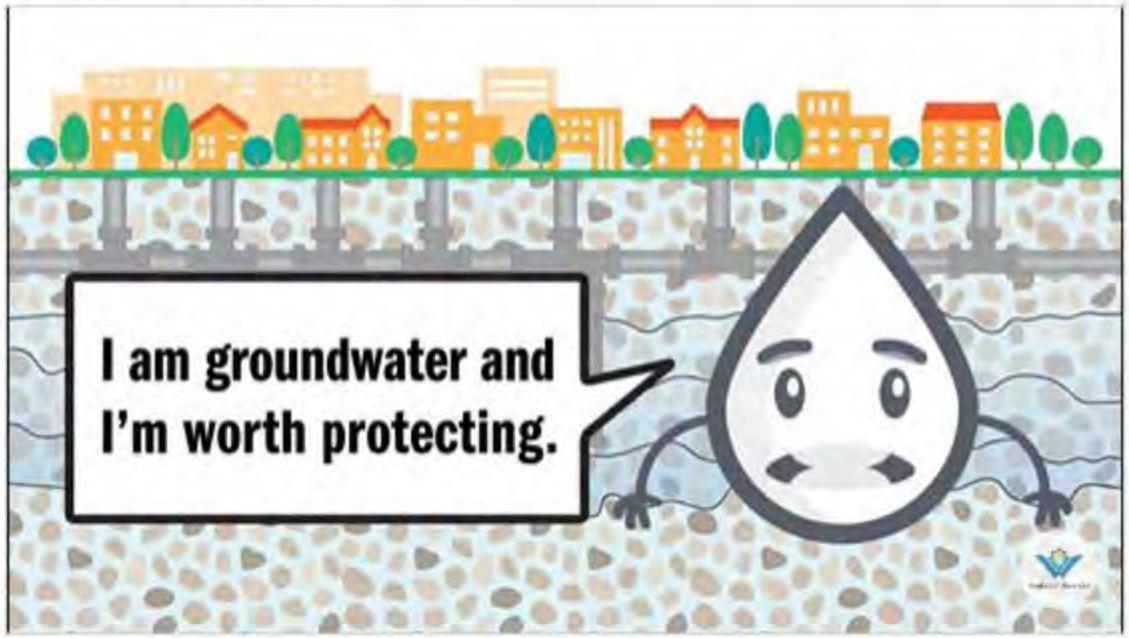
# Protecting Natural Biodiversity in the PSW-30

In 2010, the City of Kitchener invested $2 million in the rehabilitation of Strasburg Creek and Wards Pond.

## Project Success

Since its rehabilitation in the summer of 2010, Strasburg Creek has demonstrated significant improvements in aquatic environments within Strasburg Creek and Wards Pond.

# Region of Waterloo Committed to Protecting Groundwater




Region of Waterloo website design

Region of Waterloo poster design

# Wetland Discharge, Confluence, Tributary

**Wetlands discharge** water to the watershed.

**Confluence**: where two or more bodies of water meet, usually refers to the joining of tributaries.

**Tributary**: stream flowing into a larger river, pond, or lake

Dr. Nandita Basu, University of Waterloo
Professor & Canada Research Chair in Global Water Sustainability and Ecohydrology
Director, Collaborative Water Program
Civil and Environmental Engineering

**Feb 6 2023, Podcast CBC Morning Edition KW**

**Small and Isolated Wetlands should be protected rather than paved over**

> “They are so important because they catch the pollutant run-off from our farm fields, from our paved roads, and retain them, they hold onto them and that pollutant doesn't show up in our lakes, our rivers, our downstream water bodies. They are a big filter.”

> “We found that if you have a small wetland that is in your neighbourhood or in your backyard, that actually can be twice as effective at retaining pollutants than the wetlands you can see near the lake.”

> Once a wetland is gone, can it ever be brought back? ... "it takes hundreds of years"

> “Wetlands store carbon, and these functions take hundreds of years to develop.”

> “When you see population increase, pollution increases. If you take away one in my neighbourhood and take away one your neighbourhood, over time the filtering ability of the landscape goes away so you get more pollutants in our beaches, in our lakes,... there's toxins in our drinking water from harmful algal blooms, and problem keeps increasing with the changing climate.”

Dr. Nandita Basu, University of Waterloo
Professor & Canada Research Chair in Global Water Sustainability and Ecohydrology
Director, Collaborative Water Program
Civil and Environmental Engineering

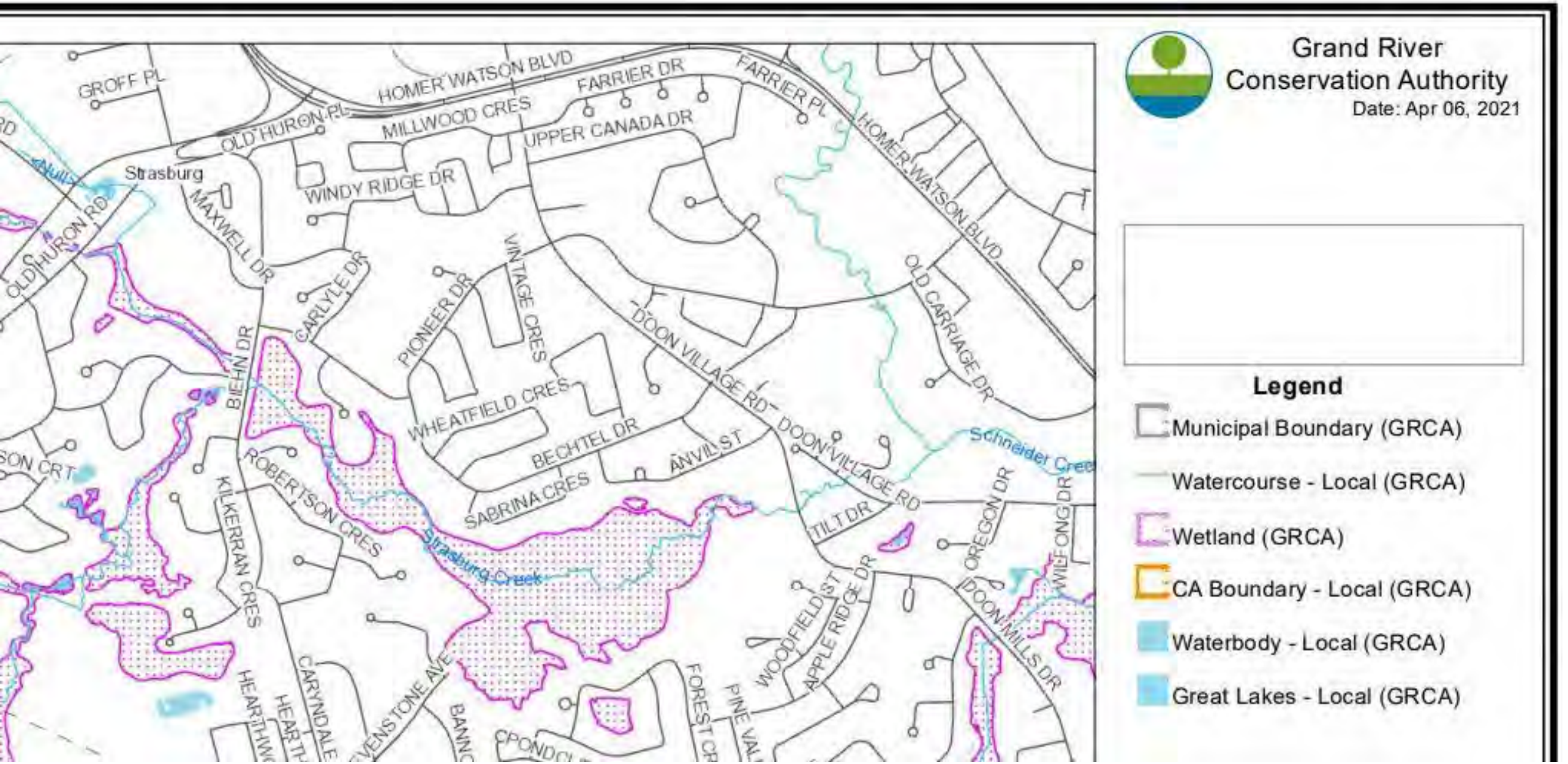
**Feb 6 2023, Podcast CBC Morning Edition KW**

> “Sometimes they don't look the prettiest because they are cleaning your pollutants.”

Eric Hodgins, Manager Hydrogeology and Water Programs
Region of Waterloo

- "Our experience and observations is limited to the impacts to the Region's drinking water supply wells. With that being said, the additional road would require winter maintenance, and the application of salt both flows overland into stormwater basins and related wetlands as well as infiltrates into the groundwater. The degree to which it infiltrates or runs off at any location would be determined by the type of soils, grading, and construction profile of the road and could vary at different locations along a road length. The Region is not aware of these details for this road in part because there was no assessment of impact to source water conducted as part of the Environmental Assessment by the city."

Green=storm, blue=water


Grand River
Conservation Authority
Date: Apr 06, 2021
Legend
Municipal Boundary (GRCA)
Watercourse - Local (GRCA)
Wetland (GRCA)
CA Boundary - Local (GRCA)
Waterbody - Local (GRCA)
Great Lakes - Local (GRCA)
GROFF PL
HOMER WATSON BLVD
OLD HURON PL
MILLWOOD CRES
FARRIER DR
FARRIER PL
UPPER CANADA DR
HOMER WATSON BLVD
Strasburg
WINDY RIDGE DR
MAXWELL DR
OLD HURON RD
CARLYLE DR
PIONEER DR
VINTAGE CRES
DOON VILLAGE RD
OLD CARRIAGE DR
WHEATFIELD CRES
BECHTEL DR
ANVIL ST
SABRINA CRES
DOON VILLAGE RD
Schneider Creek
TILT DR
OREGON DR
WILFONG DR
ROBERTSON CRES
KILKERRAN CRES
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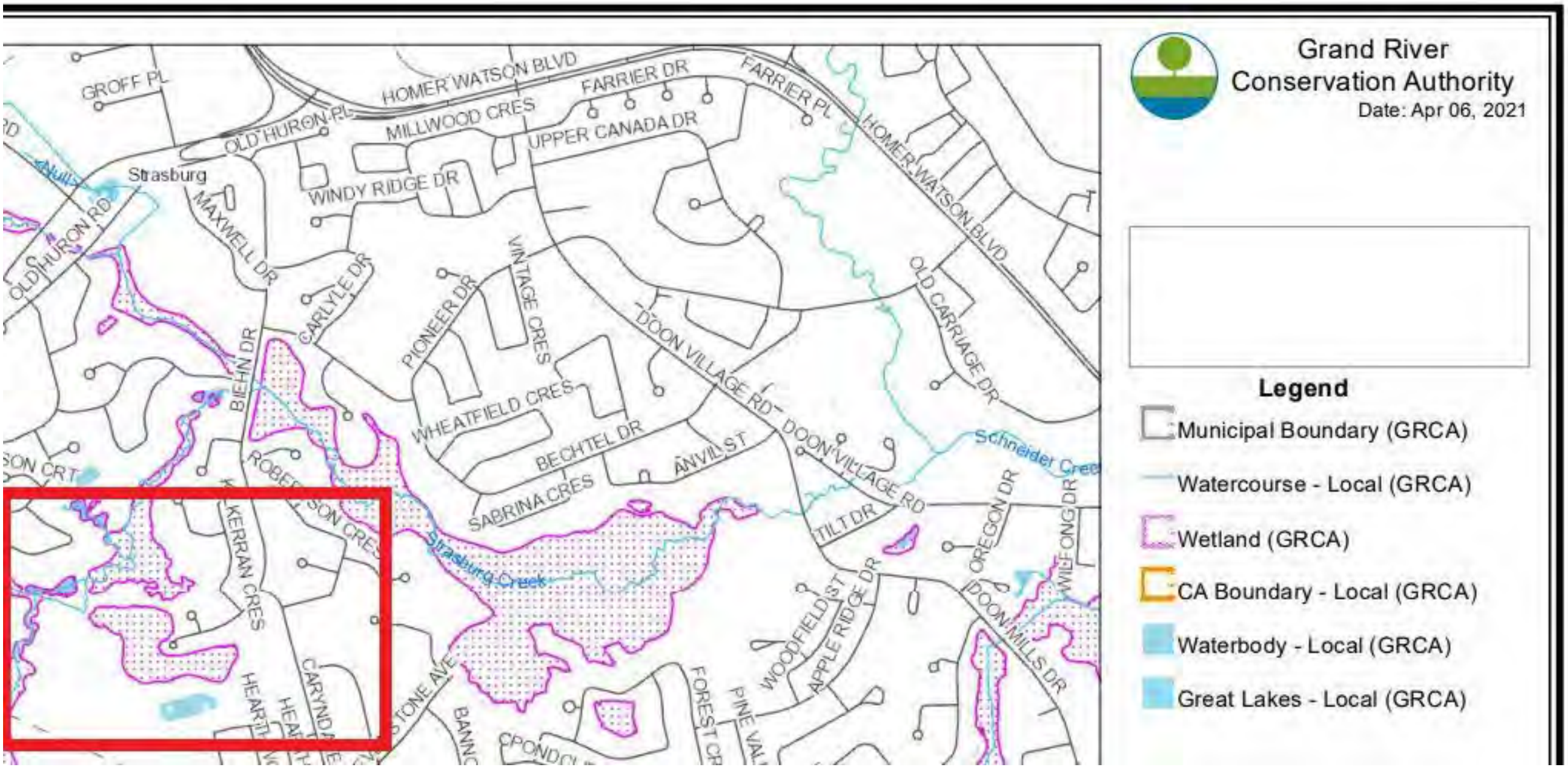
CARYNDALE
HEARTHSTONE AVE
FOREST CR
PINE VAL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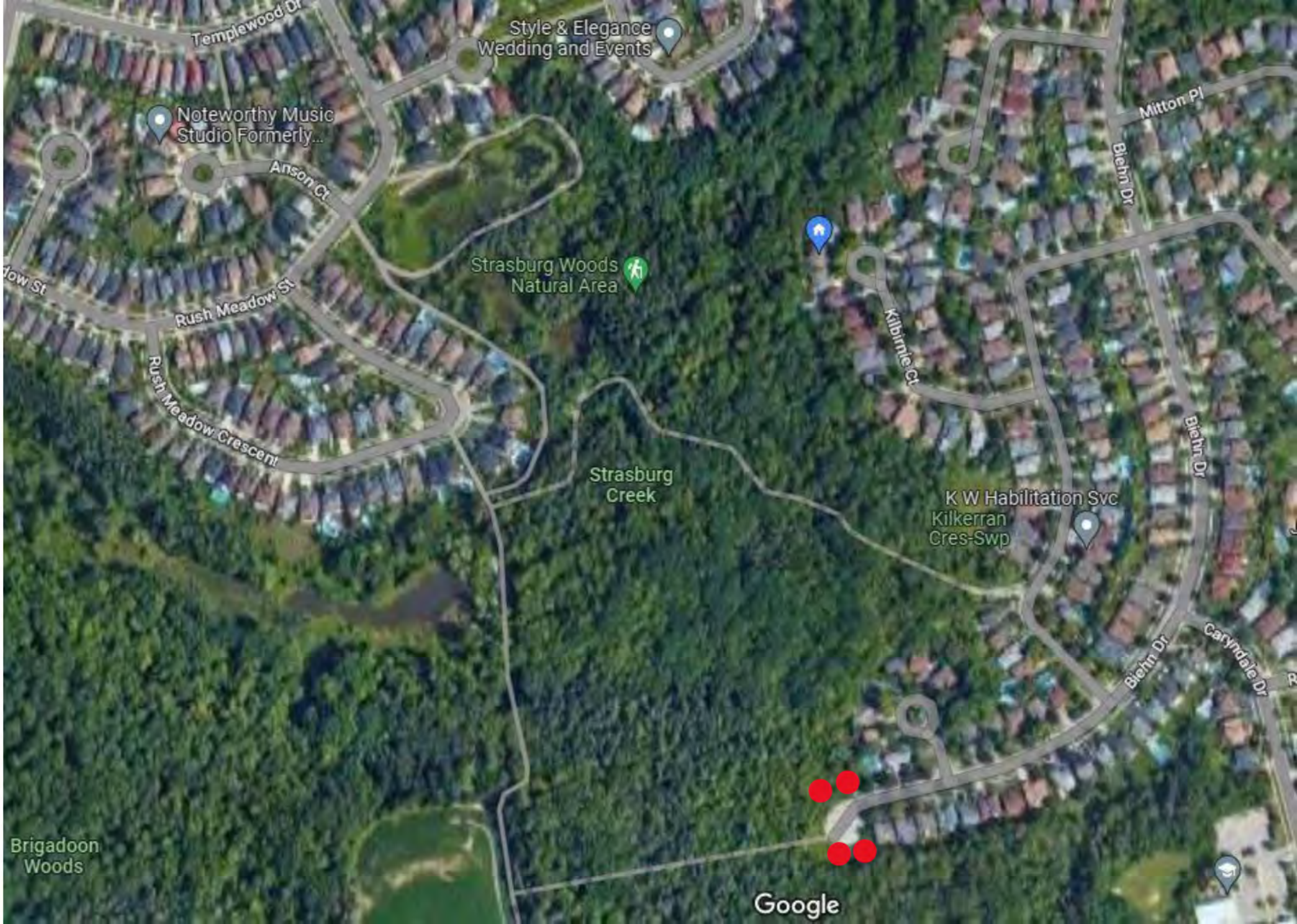
WILFONG DR
DOON MILLS DR
WOODFIELD ST
APPLE RIDGE DR
KERRAN CRES
CARYNDALE
FOREST CR
PINE VAL
BANNOCK
GROFF PL

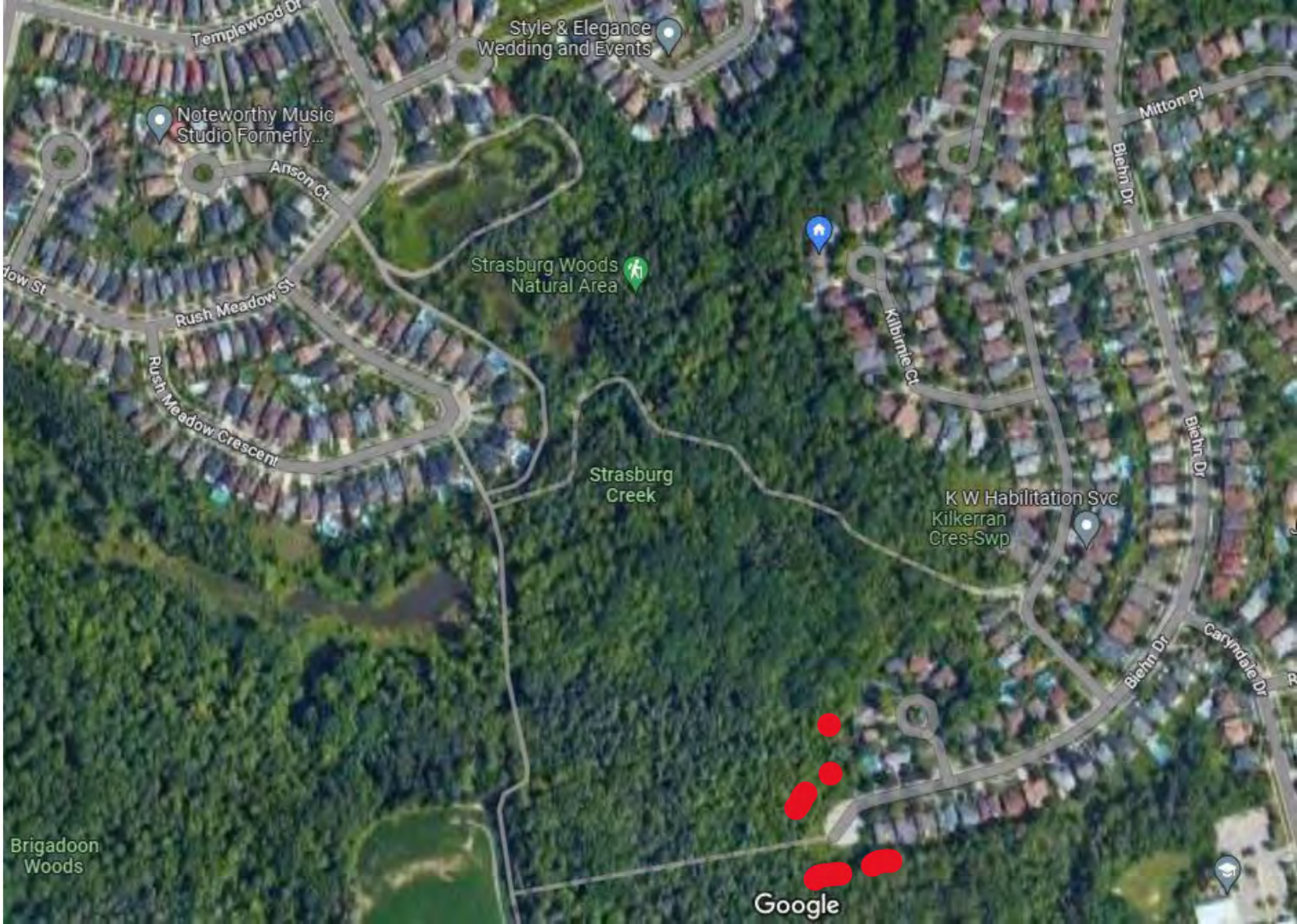
**Aerial view of PSW-30 surrounding the end of Biehn Drive discharges into Strasburg Creek**

# Stormwater enters the Strasburg Creek

- Salt contamination
- 6PPD-quinone (tires)
- Increased road temperatures

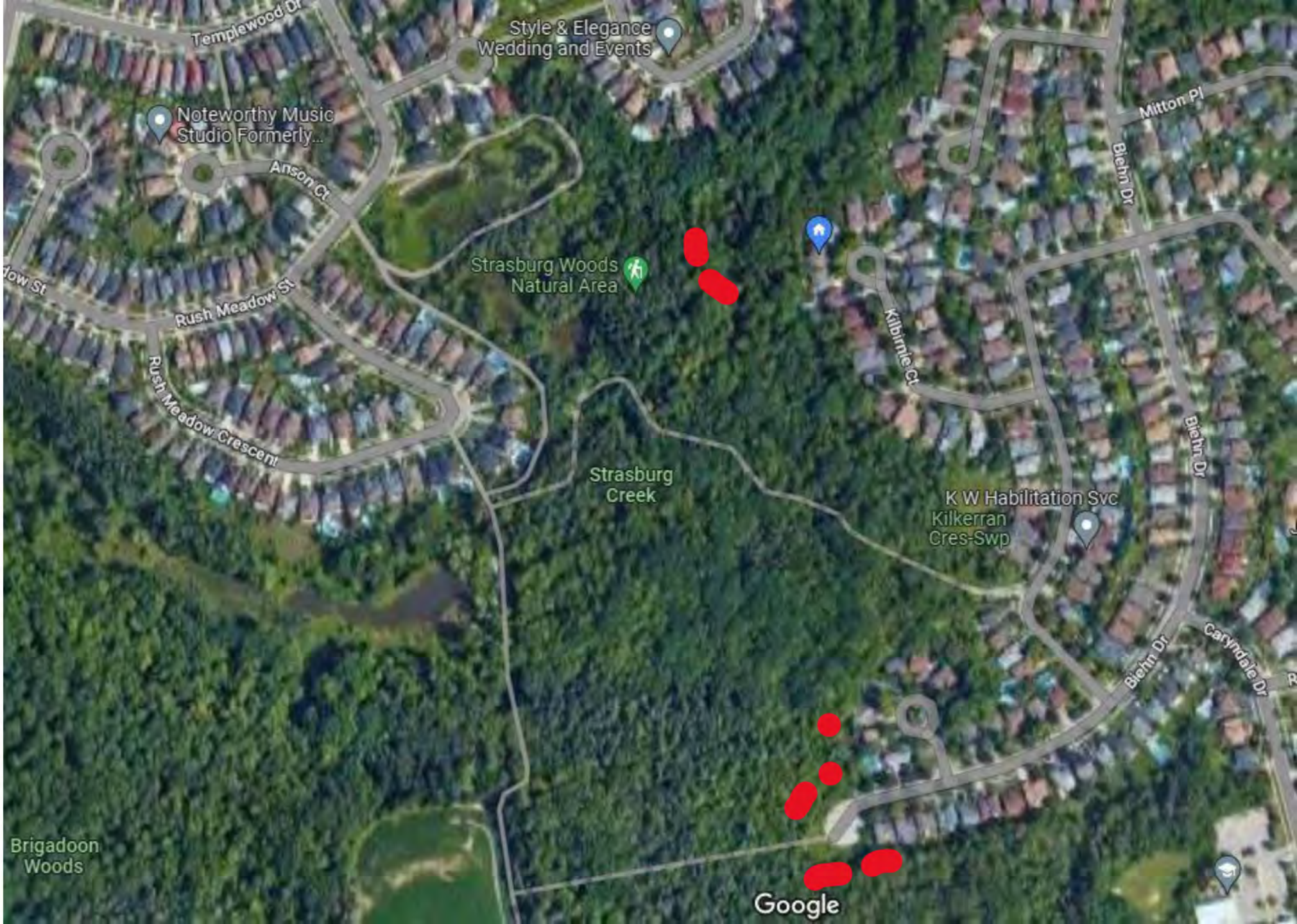


**Multiple wetland discharge points enter the stream.**



**Discharge points add to stormwater run-off.**

**Multiple confluence points connecting together to feed into Strasburg creek.**



Templewood Dr
Style & Elegance
Wedding and Events
Noteworthy Music
Studio Formerly...
Mitton Pl
Biehn Dr
Kilbirnie Ct
Biehn Dr
K W Habilitation Svc
Kilkerran
Cres-Swp
Biehn Dr
Carryndale Dr
Brigadoon
Woods
Google

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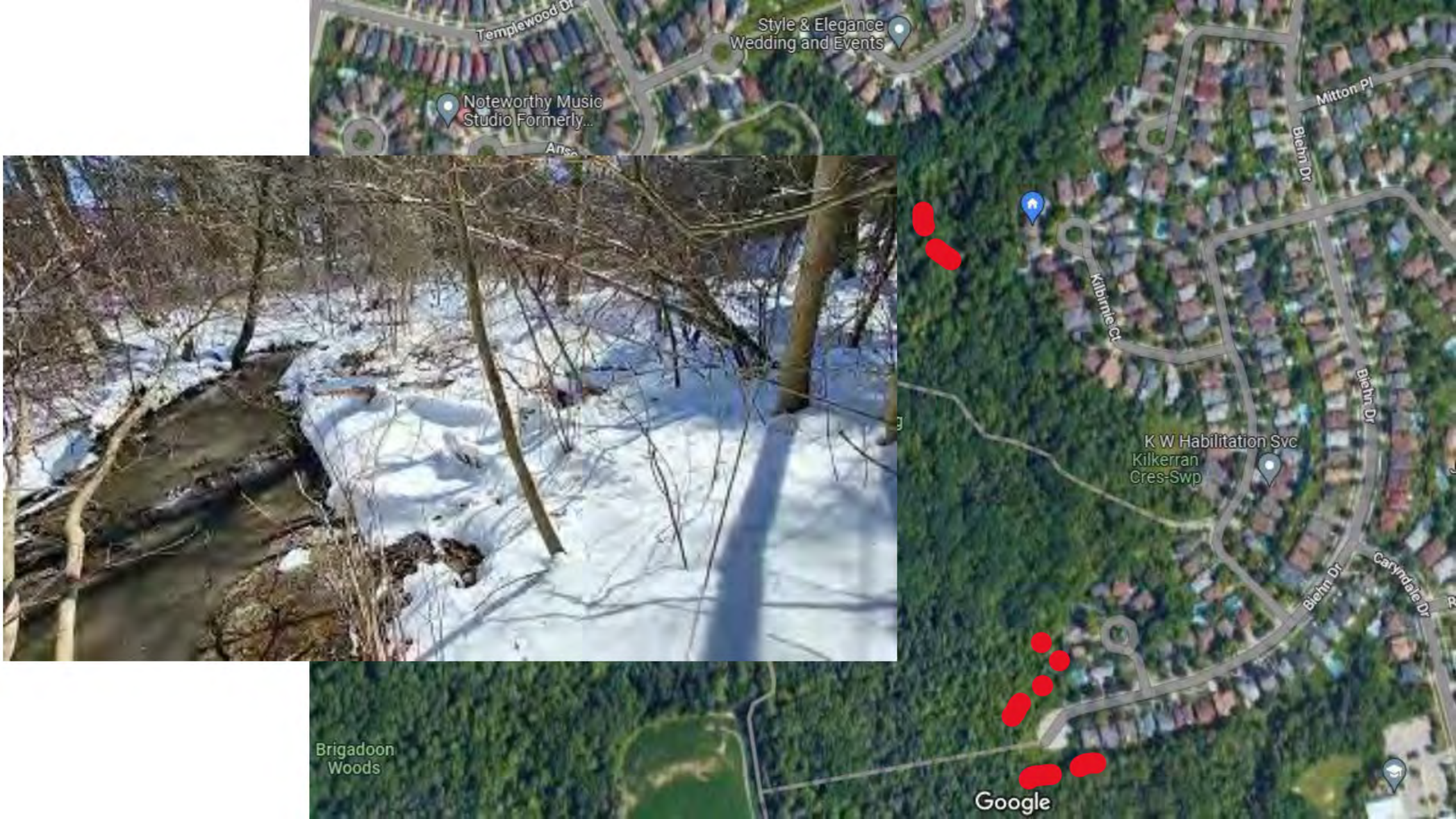
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Google

**Well at Kilkerren and Box Culvert Confluence**

# Strasburg Creek- Impacts of Development

Impact through:

- Salt run-off
- 6PPD-quinone (tires)
- Elevated street temperatures effect water temperature entering the stream confluence

Under scouring of tree roots results in loss of tree canopy and shade to maintain stream temperatures.

This community needs the Kitchener City Council to reconsider not disrupting the Provincial Significant Wetland 30 to protect the city's drinking water and the surrounding ecological habitats.

# References

- Nandita Basu, PhD. : Podcast: *Small and Isolated Wetlands should be protected rather than paved over*
  > Professor & Canada Research Chair in Global Water Sustainability and Ecohydrology
  > Director, Collaborative Water Program
  > Civil and Environmental Engineering, University of Waterloo
  > Earth and Environmental Sciences, University of Waterloo
  > Canada Research Chair
- Eric Hodgins

  >Manager for Hydrogeology and Source Water at Region of Waterloo

City of Kitchener
Resolution Page
Council Meeting

**Title:** Biehn Drive and Sanitary Trunk Sewer Environmental Assessment, DSD-2024-374, listed as item 7.1.c (Cont'd)

**Date:** Monday, December 16, 2024

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**Moved by** Councillor M. Johnston

**Seconded by** Councillor D. Schnider

"That the Biehn Drive and Trunk Sanitary Sewer Extension Class Environmental Assessment (EA) - Environmental Study Report (ESR), prepared by BT Engineering, dated November 2024, attached to Development Services Department report DSD-2024-374, be received; and further,

That the Biehn Drive and Trunk Sanitary Sewer Extension Environmental Study Report (ESR), be filed with the Ministry of the Environment Conservation and Parks (MECP) for the mandatory thirty (30) day review period as required by the Environmental Assessment (EA) Act."

**Carried, on a recorded vote**