

Aggregate and Weigh Scale Management Process Review

City of Kitchener

Prepared by Leading Edge Group

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1. Executive Summary

The City of Kitchener (“the City”) engaged the Leading Edge Group (LEG) to conduct a Lean review of their Aggregate Management process. This engagement focused on how current and past practices including the use of the weigh scale have impacted the materials being written off at the end of each year, with an eye to reducing waste in all its form and enhancing staff efficiency.

The review followed the lean roadmap of Plan-Do-Check-Act with a stepwise approach to understanding and mapping the current state, analyzing the process, identifying waste and determining the underlying root causes. Potential solutions were then identified and prioritized. These then formed the basis for developing a comprehensive future state design.

Some of the significant findings included inconsistent compliance with stated policies and procedures among various user groups. Misaligned roles and responsibilities as well as a reliance on a cumbersome manual paper-based process were also noted. Physical as well as perceived barriers to using the existing weigh scale as well as the inherent risk of errors in multiple handoffs and handwritten sources of data exacerbated the problem. There was also very little by way of an audit trail to determine sources of errors and hence no way to effectively correct them.

Key recommendations include establishing a set of standard weights to be used by staff in obtaining estimates of aggregate weights that would be within acceptable tolerance limits. This would reduce or eliminate the staff travel time to and from the scale with each trip for materials. In addition, staff training would be deployed to ensure user accountability for compliance as well as audit and oversight by supervisors.

The inventory management process would also be simplified by taking low volume and/or single user aggregates out of inventory and charging them to an appropriate cost centre upon purchase. In addition, migrating away from a paper-based system to a digital data entry that captures materials usage along with staff time and equipment will serve to enhance the process. Not only will it improve staff efficiency, but also improve data capture, compliance and accuracy. Improved fiscal management will also be achieved by reducing the annual write-off of variances.

2. Client Requirements

Each year, the City of Kitchener generates over 50,000 metric tons of surplus material in the course of service delivery including but not limited to those involving watermain breaks, infrastructure repair and maintenance. The material is then reused, recycled or dispatched to an approved facility for treatment. Recent regulation demands that this excess soil be traced. However, the current use of the weigh scale only encapsulates parts of the process and is not incorporated with the work management processes.

In addition, aggregates are not being ascribed precisely to work activities nor is inventory being relieved. This results in considerable write-offs and substantial discrepancies during the annual physical inventory. This invariably leads to an inability to properly track costs for user pay activities. Over the years, Internal Audit has recommended improvements in this area but with no project manager in place coupled with a lack of resources, this project has not gained traction.

The City of Kitchener retained Leading Edge Group to embark on a third-party service delivery and modernization review of the City's aggregate management processes. On November 17, 2020, the Province of Ontario announced a second intake for its Audit and Accountability Fund. This fund is earmarked to "offer large municipalities an opportunity to benefit from provincial funding to conduct service delivery and administrative expenditure reviews". The City is seeking to avail itself of this provincial funding opportunity. This review will enable the City of Kitchener to streamline and deliver service in a more efficient manner while preserving front line jobs.

3. Sources of Information

In order to create a comprehensive view of the Aggregate Management process it was necessary to obtain input from a wide cross-section of individuals. These stakeholders included directors, managers, supervisors as well as key individual contributors.

Process information was received from staff representing various project accountabilities as well as functional areas. These included: Excess Soils Management Site Plan, Stores, Finance, Asset Management, Technology Innovation Services, Fleet, Gas & Water Utilities, Operations-Roads & Traffic and Sanitary & Stormwater Utilities.

Historical data was provided by subject matter experts with access to the SAP system and other repositories of information.

4. Introducing Lean and Process Improvement Methodology

Lean is a systematic approach to identifying and eliminating wasteful activities in a process through continuous improvement. The key focus of Lean Thinking is identifying the value of any given process by distinguishing value-added steps from non-value-added steps and eliminating waste so that, eventually, every step adds value to that process. This is achieved by enabling the flow of a product or service at the pull of the customer, so that the service can be responsive to the customer's needs.

The term 'Lean' is applied to a process because a Lean process utilizes:

- Less operational space
- Fewer financial resources
- Fewer materials and services
- Less time to deliver a service to its customers

Lean Thinking is not a manufacturing strategy or a cost-reduction program, but a philosophy that can be applied to a variety of organizations. This is because it is focused on processes. All organizations are made up of a series of processes, sets of activities or steps intended to create value for people who are dependent on them, namely customers and colleagues.

Lean Thinking is based around the application of a number of tools and strategies aimed at streamlining all aspects of a process. These tools are intended to reduce unnecessary labour, space, capital, materials, equipment and time involved in the delivery of appropriate services to customers.

Using the principles and tools associated with Lean Thinking to reduce and eliminate waste enables organizations to increase their quality of service and become more competitive. It enables them to:

- Operate more quickly and efficiently at lower costs
- Become more responsive to the needs of customers
- Focus on quality
- Increase service levels

This helps organizations to ensure their employees experience increased job satisfaction and their customers receive the best possible service.

During a Lean review, all processes can be examined with a view to finding waste across eight common sources.

Waste	Definition
Defects	These are process outputs that need to be corrected through rework.
Over-production	Producing more information than the customer needs in order to manage the next step in the process or producing something before it is actually required.
Waiting	Wasted time waiting for the next step in the process to occur.
Non-utilized skills	Staff performing functions that are better suited to other grades of staff.
Transportation	Unnecessary movement of inventory, materials, equipment, supplies and products.
Inventory	Keeping excessive inventory and products that are not being processed which ties up money and reduces available space.
Movement	Unnecessary movement of staff members in order to complete their daily work activities.
Excessive processing	Excessive processing work that is not required by the customer and adds no value but consumes resources.

Table 1: The eight wastes

5. Background and Context

The Aggregate Management process has been addressed on a number of occasions over the past few years. However, this activity has yet to yield a lasting solution for this ongoing challenge. A number of factors have contributed to this. There has been no single point of responsibility for all the interrelated activities. In particular, there has not been a designated manager for the yard where the aggregate is stored. Due to the multiple reporting lines, it has been difficult to get to all the stakeholders to the table for discussion. With a renewed focus on this spearheaded by Procurement and Finance functions, the impacted stakeholders have now been aligned to provide resolution. This has been further supported by access to the Audit and Accountability Fund which has allowed the City to obtain the funding to retain the necessary project management expertise above and beyond their internal capacity.

The organization has recently experienced a heightened level of change readiness. This has been due in part to activities being undertaken in the face of the ongoing pandemic. Notably, a task force has been assembled comprising directors within Infrastructure Services, heads of department as well as the Stores function which reports into Procurement. The ongoing meetings of this task force, as well as an overall awareness of the yard operations has set the stage for this improvement initiative. The Excess Soil Management project currently underway, has also paved the way for a holistic review of all activities within the yard, which in turn has paved the way for a successful initiative. In addition, oversight for this project was provided by the Procurement Manager, and the Director of Financial Operations was a key enabler for gaining the buy-in and sustaining the momentum for this initiative.

Based on the precedents at aggregate facilities, there has been a focus on the weigh scale as an integral part of the Aggregate Management process. Because of its age and limited technical capability, one challenge presented to the team was how to cost effectively integrate it with existing systems to allow for digital connectivity including seamless data transfer. Other technical solutions to be explored included leveraging GPS technology to determine the location of vehicles as a means of tracking aggregate use. In addition to technical limitations, there is also the issue of staffing coverage as the yard loader is onsite only during a single shift. This presents the additional challenge of how best to track aggregate use when materials are retrieved in off-shift hours, in particular for emergency repairs.

6. Approach Taken

In order to understand the current state of Aggregate Management, it was necessary to gain insights from the various user groups of this material. It was important to integrate all aspects of the process from acquisition to consumption, recording and data entry, year end reconciliation, as well as management and financial reporting. This broad-based assessment necessitated gathering input from a wide spectrum of stakeholders spanning multiple functional areas.

Initially, telephone interviews were conducted with the managers and/or supervisors of each functional area. Key aspects of the activities related to Aggregate Management were discussed through a series of structured questions and process concerns were noted. These insights served as a starting point for a comprehensive analysis of the process.

Division	Current State Review Date
Procurement	May 10, 2021
Stores	May 21, 2021
Asset Management	May 27, 2021
Excess Soils Management	May 28, 2021
Finance	June 3, 2021
Infrastructure Services	June 14, 2021

Table 2: Initial interview schedule

Based on the insights gleaned from the interviews, it became apparent that while all stakeholders had the best interest of the citizens at heart, the various functional perspectives created goals and expectations that were at times at odds with each other.

Stores

From a purchasing perspective, aggregates are acquired by means of setting of contracts with various suppliers. Once contracts have been set up with the selected suppliers, all users are then directed to use them for their aggregate needs. There are usually 12 to 15 different aggregates that are in use at any given time. Orders to replenish the materials are placed by Operation staff approximately 70% of the time with the remaining 30% being handled by the Stores staff. Materials may be delivered by the suppliers or picked up by the Kitchener staff. Delays in receiving the proof of purchase has been an ongoing challenge. Quite often the notification that materials have been consumed from inventory arrives before the notification that inventory has been purchased. This results in delays for the processing staff who are not allowed to

enter a negative inventory into SAP, their system of record. In addition, Stores is involved at year end when they conduct a physical inventory verification of the aggregate on hand.

The Stores staff are at the hub of recording for an essentially paper-based process. Inventory is added when packing slips or proof of delivery are received. On the other hand, inventory is relieved when a work order with materials amounts written on them are received. These are typically scanned and emailed by administrative staff who support the various operational groups. Not only is the process for maintaining the inventory cumbersome, but the Stores team does not see or handle the aggregate. In essence, they act as the record keepers for materials over which they have no control, accountability or oversight. An ongoing concern for this team is that they add no perceived value to the process and that this set of tasks is actually an inappropriate use of their time and resources.

Asset Management

For the Asset Management team, accurate allocation and reporting of the aggregate used, is an integral part of ensuring that the City's asset values are accurately documented. When accurate records are not maintained on an ongoing basis, there is the need for an annual reconciliation process at year end. They rely on the City Works application for tracking of labour hours and equipment used when staff document their work. However, inventory is tracked in SAP and when relieved from SAP, it is recorded in the City Works work order. The admin staff inputting items in City Works do not have visibility to the SAP inventory system, and Stores does not have access to City Works. The frontline staff who do the work have access to neither system. Hence, data capture is managed by means of a fragmented approach requiring multiple hand-offs of data handwritten on paper work orders.

Asset Management is currently investigating a digital solution for data entry. This will have the ability to capture time and attendance, vehicle use as well as materials. This opens the possibility of front-line users doing data entry. This would also eliminate the multiple handoffs and the inherent issues of paperwork being delayed, misplaced or lost. The aforementioned gaps in the current process have led to inaccuracies, which in turn fuels a lack of trust in the data. This has broader implications as it impacts decision making, where there is a reliance on instinct rather than data. This also limits their ability to perform real time analysis.

Excess Soils Management

The overall management of materials in the KOF yard includes salt as well as excess soils. Although these items are out of scope for aggregate management, they must be taken into account to ensure that all aspects of the yard operate seamlessly. There is also the opportunity to share best practices where applicable. There are two high usage materials Aggregate A and Aggregate B which are produced onsite and not purchased from external vendors. This is recycled material that is created by crushing asphalt and concrete that has been retrieved from work sites and stored in the yard. This crushing process is typically done annually in the fall, after a significant amount of material has accumulated, in order to justify the cost.

The use of the weigh scale has not been fully integrated into the excess spoil management process. It is encouraged rather than enforced. Reluctance to use the scale by front line staff is a common theme across all materials taken to and from the yard and excess soil is no exception. The scale tends to be used for contaminated soil entering the yard but not for soil leaving it. It has been an expectation that the new aggregate process might serve to inform the soil process. One limitation to moving forward with scale enhancements to facilitate the materials management in the yard has been cost. Previously obtained cost estimates for a new scale or retrofitting the existing one had been priced at \$100,000 and \$50,000 respectively.

Finance

The Finance team has very limited involvement with the aggregate process. Their activity typically occurs at year end after the annual physical inventory has been done. Typically, there is a variance between what the inventory value as shown in SAP and the amount that is physically present in the yard. In order to finalize the financial statements an adjusting entry needs to be made. However, because of the gaps in data that is captured it is extremely difficult to determine which user groups actually consumed the missing quantities.

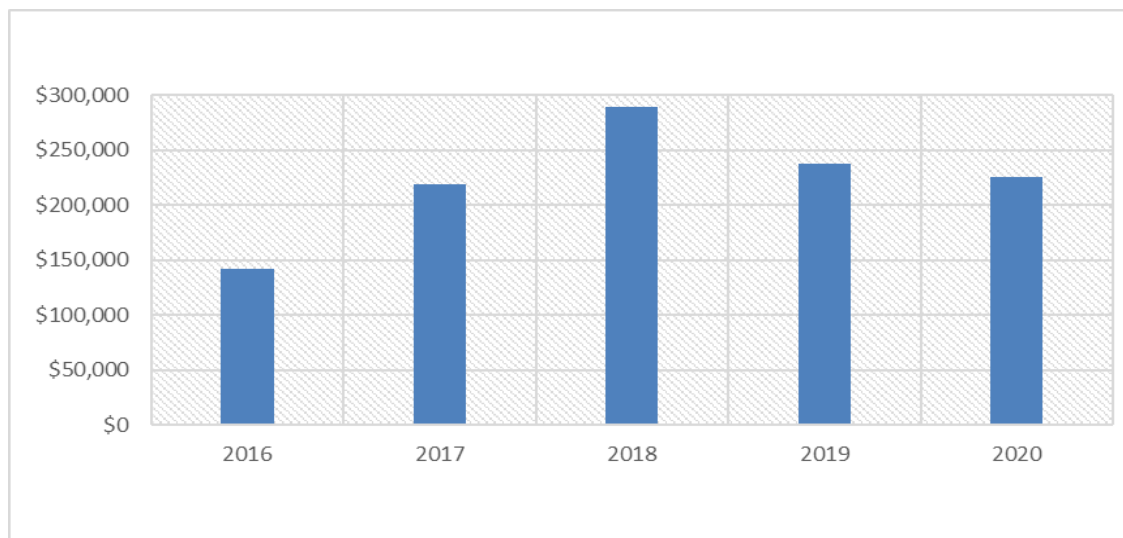
Between unreported usage, underreported usage, lost or missing papers and data entry errors due to illegible handwritten notes an accurate assessment is all but impossible. Therefore, an allocation formula based on prior recorded usage is used to divide the amounts to be charged back to the various user groups. The accuracy of this methodology has come into question. Some groups that have been quite diligent in recording materials, feel that they are being unfairly penalized in the allocation of charges. In addition, users who have not been reporting their true usage are underrepresented or even missed when variances are being allocated.

Infrastructure Services

The frontline staff who come to the yard to retrieve aggregate, do so to apply this material to a wide variety of repair and maintenance activities. There is a heightened sense of urgency in particular when the work involves critical repair such as a watermain break. There has been a prevailing sense that time is of the essence in delivering value to customers and that it would be detrimental to service levels to take the time to drive over the scale twice to weigh in and weigh out. Congestion into and out of the yard during peak times serve as another disincentive to using the scale, which is not optimally positioned with respect to traffic flows. Poor lighting at night coupled with inadequate winter maintenance have also been cited as reasons for not using the scale. Also, there has also been a longstanding distrust for the accuracy of the scale.

From an overall process perspective, the reliance on transferring information by passing along pieces of paper also limits the level of accuracy and efficiency. When material is consumed, the weight has to be recorded on the work order which gets passed to the supervisor and on to the administrative team who in turn scan and email it to the Stores staff for data entry. A number of factors translate into inaccuracy and ultimately variances at year end which must be written off. Information may be written illegibly resulting in data entry errors. In some instances, the material never gets written onto the work order. This gap in compliance is estimated to be as high as 50%. Some user groups use materials and without documenting its consumption. Another perception that hinders compliance with established policy, is that the value of the material being used for a job is so small compared to the other components such as equipment and labour, that it is not worth the effort to accurately record it.

Annual Aggregate Purchases¹



¹ This represents aggregate orders only. Other material costs through City Works total \$7.3million. Aggregate purchases are approximately 4% of material costs.

Table 3: Annual aggregate purchase 2016 – 2020

Value Stream Mapping (VSM)

Due to the current pandemic restrictions, value stream mapping was conducted virtually by interviewing the subject matter experts. The output was shared electronically and validated by the various stakeholder groups.

A value stream is a list of activities in a process that outlines the flow from the beginning to the end, from the initiation of the service delivery to the final delivery to the customer (internal or external). A value stream map follows a service or item from beginning to end, identifies and quantifies value-adding and non-value-adding activities within the value stream and links all associated material and information flows.

The VSM process is based on the following:

1. Developing a current state ('as is') value stream map of a pre-identified/pre-selected processes/services to fully understand how things currently operate.
2. Conducting a Lean analysis of the current state to identify opportunities for improvement.

3. Establishing a desired future state ('to be') value stream map through stakeholder consensus for a more streamlined process or service where value-adding activities are increased and non-value-adding or wasteful activities are minimized, while process steps and procedures are standardized as is practical.
4. Developing priorities that will allow for a transition from current to future state and realize and sustain improvement opportunities.

A VSM workshop should involve the people who understand the process best (those who work with it every day). The team provides input to map out the process, develop the current and future state maps and agree on a plan to realize improvement opportunities.

As well as providing the platform for identifying improvement opportunities, VSM activities enable a common language and standard for process improvement, while participants gain new perspectives and a deeper appreciation of flow issues across functions and functional areas.

The teams together identified numerous challenges and bottlenecks within the existing processes as well as opportunities for improvement. Below is a list of identified issues and solutions proposed by the team that could serve as inspiration for continuous improvement activities.

VSM Output: Cross Functional Working Group

#	<u>Issue/Pain Point</u>	<u>Solution Ideas</u>
1	Tickets for purchased materials get lost or misplaced	✓ "Bin" for tickets in the yard
2	Waiting for tickets - staff in every 1 -2 weeks	✓ Vendor provides signed/stamped ticket along with invoice ✓ Train staff who pick up aggregate themselves to use Bin
3	Individual supplier POs cannot be created until Stores gets notified	✓ Create Contract PO for top up items
4	Stores is involved at multiple points to enter data although they are quite removed from the day-to-day activity	✓ Reinstitute vendors managing top ups ✓ Leverage software to remove Stores from the process

5	Aggregate stored without covering can retain ice and/or water (a) making the weights inaccurate, (b) create a cave-in risk when retrieving and (c) repairs deteriorating quickly	✓ Coverall for aggregate as is done now for clear stone
6	Scale used very rarely so estimated values are entered	✓ Tie the materials usage reporting to the timesheet (mobile)
7	Multiple routes into the yard make it difficult to streamline the flow	✓ Utilize estimates to eliminate/minimize travel to and from scale
8	Weight display is visible from one direction only	
9	Not convenient for inbound and outbound trucks to use the scale	
10	Inadequate lighting poses a risk for nighttime use	
11	Quick turnaround times for jobs is a disincentive to use the scale	
12	Staff needs to write down weights and do Math	✓ Utilize estimates and standard measures
13	Yard Loader unavailable after hours	
14	Sometimes for emergency repairs work order numbers are unknown	✓ Deploy mobile data entry worksheets
15	Errors occur when workorder numbers get recorded from memory with aggregate being assigned to the wrong job/department	
16	Illegible handwriting results in data entry errors	

17	Write-offs based on prorated aggregate use are not accurate	✓	Conduct assessment of historical use and adjust year-end allocation model
18	Teams that do not record their usage get overlooked for charges and variances	✓	Deploy training to staff and supervisors

Table 4: Issue and solutions developed in by the Cross Functional Working Group.

7. Challenges Encountered

A cross functional multi-stakeholder process improvement initiative is never without its fair share of challenges and this engagement was no exception. Some of the specific challenges encountered included the following:

- Due to the health and safety measures related to the pandemic, it was not possible to host in-person workshops and value stream mapping sessions.
- Ideally Lean process mapping would engage the staff who actually perform the day-to-day tasks. However, in light of the ongoing restrictions supervisors were engaged via video conferencing and had to act as a conduit between front-line staff and the broader project team. We were also able to get on site once with frontline staff to observe the process in the yard.
- Data has been historically captured in multiple systems making it quite challenging to consolidate it for the purpose of analysis.
- Gaps in the data being provided by users made it difficult to quantify the impact of various root causes responsible for the variances being written off at year end.

8. Analysis and Recommendations

The staff responsible for the repair and maintenance of the City's infrastructure take a great deal of pride in their work and are very conscientious about meeting the needs of the citizens. This translates into a sharp focus on turnaround times, especially for critical repairs. This has created a shift away from the use of the weigh scale in order to minimize the time required for their work. The challenge for the team was therefore how to increase compliance with accurate measurement of the aggregates while maintaining timeliness in execution.

A focus on improved data accuracy resulted in looking at various options for fully integrating the existing weigh scale into the process. Options investigated included moving the scale to align with the flow of traffic in and out of the yard, adding improved visibility for the weight read outs, general maintenance to improve aesthetics and therefore compliance. Additional considerations included retrofitting the scale with technology as well purchasing a new scale with the greater inbuilt capability for data capture and transmission. The working group ultimately decided against these options as they were either prohibitive in cost or seen as being counter productive for front line staff and not providing adequate return on investment.

Key considerations for improving the process centred on (a) ease of use for the staff, (b) greater efficiency, (c) appropriate accountability and responsibility, (d) enhanced compliance and (e) improved data accuracy. From an ease-of-use perspective the use of standard estimates for loads of material was adopted. These would be based on a table of weights generated from actual materials in the yard. This was deemed to be acceptable when compared to the inherent variability in the scale itself. Also, the improved compliance would outweigh any inaccuracies in the estimates themselves.

Embracing mobile data entry meets the need for improved efficiency, by eliminating multiple hand-offs and reliance on pieces of paper that could get lost. This also placed the accountability with the actual users of the material as well as their immediate supervisors. Coupled with the reduced travel time to the scale, this real time data entry would serve to enhance compliance and accuracy. More timely and accurate data would result from not having to decipher handwriting or waiting until the handoffs formerly needed to get the data to the staff who would do the entry.

Additional considerations included simplifying the acquisition cycle from the vendors as well as the management of aggregate in inventory. In keeping with aligning accountability, the strategy was to remove materials from inventory that could be charged in other ways. This removed the responsibility from Stores and placed it back with the user groups.

In addition to the broader themes for improvement identified, a number of specific areas of process wastes are outlined below:

Waste Type	Process
Defects	✓ Aggregate used not entered on work order. ✓ Incorrect aggregate used to perform repair. ✓ Incorrect item number recorded on work order. ✓ Illegible handwriting leading to data entry errors.
Over-production	✓ Multiple pieces of paper being handed off throughout the process.
Waiting	✓ Waiting for vendor tickets to arrive so that acquired material can be recorded. ✓ Waiting for work orders to be emailed so that consumed materials can be relieved from inventory.
Non-utilized skills	✓ Stores staff are engaged in data entry for materials that they do not use nor add any value to the processing cycle. ✓ Staff having to manually calculate the weight of aggregate based on the before and after scale readings.
Transportation	✓ Driving from aggregate bins to and from the scale.
Inventory	✓ Items ordered into stock or recycled material not used.
Movement	✓ Administrative staff scanning and emailing work orders to the Stores staff for data entry into SAP.
Excessive processing	✓ Multiple handoffs of paperwork between staff when data is to be recorded. ✓ Keying in handwritten data.

Table 5: Aggregate Management process waste examples

Summary of Recommendations

Short-term Recommendations

Develop & Deploy Estimates

- ✓ Conduct a 1-day exercise with the yard loader to develop the table of estimates.
- ✓ Create laminated cards summarizing the estimates, customized and colour coded for the user groups as needed.
- ✓ Design, create and post signage at the aggregate bins.
- ✓ Roll out cards and revised process to all impacted staff.
- ✓ Determine most efficient manner to record materials onto current work orders.
- ✓ Deploy staff education at supervisor level for all user groups to ensure that material is consistently written on work orders.
- ✓ Establish oversight to ensure compliance with recording aggregate used.

Develop Tiered Approach

- ✓ Roll out communication to continue tracking at their current level of detail for exempted group who will continue to use the scale e.g., Traffic Operations.
- ✓ Identify decision makers for single user items
- ✓ Determine which items need to be charged back e.g., to customers or the Region of Waterloo.
- ✓ Develop process for recording expense directly to cost centre or other internal order for small quantity aggregate at time of purchase.
- ✓ Establish a cut-off for switching from inventory items to expense items.
- ✓ Conduct year end analysis of variances and analysis of per load estimates to work, and write-offs.

Aggregate Ordering & Receiving

- ✓ Create a bin for tickets to support receipt of materials supplied by vendors.
- ✓ Deploy vendor managed top-ups.
- ✓ Have vendors provide signed proof of delivery
- ✓ Align with City Works team to execute aggregate management as a part of the digital worksheet pilot roll out.

Medium-term Recommendations

- ✓ Engage the administrative team to capture data from work orders in a spreadsheet for upload to SAP until digital worksheets are available.
- ✓ Implement more rigorous tacking and monitoring for crushed aggregate that is made from recycled materials onsite.
- ✓ Transition a second tier of multi-user aggregates out of inventory into alternate recording cost centres.

Long-term Recommendations

In the future, aggregate management should be transitioned to a fully automated digital worksheet data entry. This will allow the actual users of the material to be the single point of data entry that feeds the necessary reporting systems. By doing so, duplicate data entry will be eliminated along with the multiple handoffs and the need for tracking pieces of paper. By tying in material use with tracking time and equipment, this will provide a robust and holistic reporting mechanism with improved visibility to all aspects of work being done. This would need to be supported by consistent data feeds and maintenance of the cost centres and reporting areas associated with the inputted data.

Additionally, aggregate could be taken completely out of inventory. This would alleviate the need for the Stores team to be doing data entry for materials that are essentially outside of their control and posting transactions to which they add no value. The revised process could also include the Aggregate A and B which are created onsite and drawn down but supported by data entry that does not reside with Stores. The oversight of the material usage would then be transitioned to the supervisors of

the frontline staff who actually consume the material while executing work orders. This creates a better alignment of accountability and supervision for the aggregate being used.

This all hinges on education of the staff at various levels and with that a change of perspective. This is a shift from a historical practice where use of materials, reporting the usage and oversight and accountability for reporting were all separated functions. While change management will be needed for all involved to embrace a new way of working, the results of improved material utilization, reporting and asset management will yield benefits that will more than compensate for the efforts involved in the making the transition.

BENEFIT CALCULATIONS

I. Cost Avoidance vs Option 1 (Mandatory use of Weigh Scale)

<u>Category</u>	<u>Amount</u>
Time spent per trip going over the scale	5 min
Total number of annual trips of aggregate	1,860
Percentage reduction in number trips	90%
Annual productivity savings	140 hrs
Fully burdened cost of an operator ²	\$136.00
Annual Cost Savings	\$19,040

(² Actual pay rates may be higher or lower than this estimated rate based on different pay rates in various operating areas as well as overhead cost recovery practices.)

II. Improving Cost Allocation / Reducing Annual Inventory Write-Offs

<u>Category</u>	<u>Amount</u>
Average value of annual write-offs	\$51,000
Percentage reduction in write-offs	70%
Improved allocation to correct cost centres	\$35,700

III. Manual Data Entry and Paperwork Tracking Reduction

<u>Category</u>	<u>Amount</u>
Total number of annual aggregate transactions	1,860
Time for multiple handoffs, scanning emailing and data entry per transaction	10 min
Annual productivity savings	310 hrs **
Hourly labour rate	\$50.00
Annual Cost Savings	\$15,500

*** Time freed up to be reinvested in value added activities.*

9. Future Challenges and Opportunities

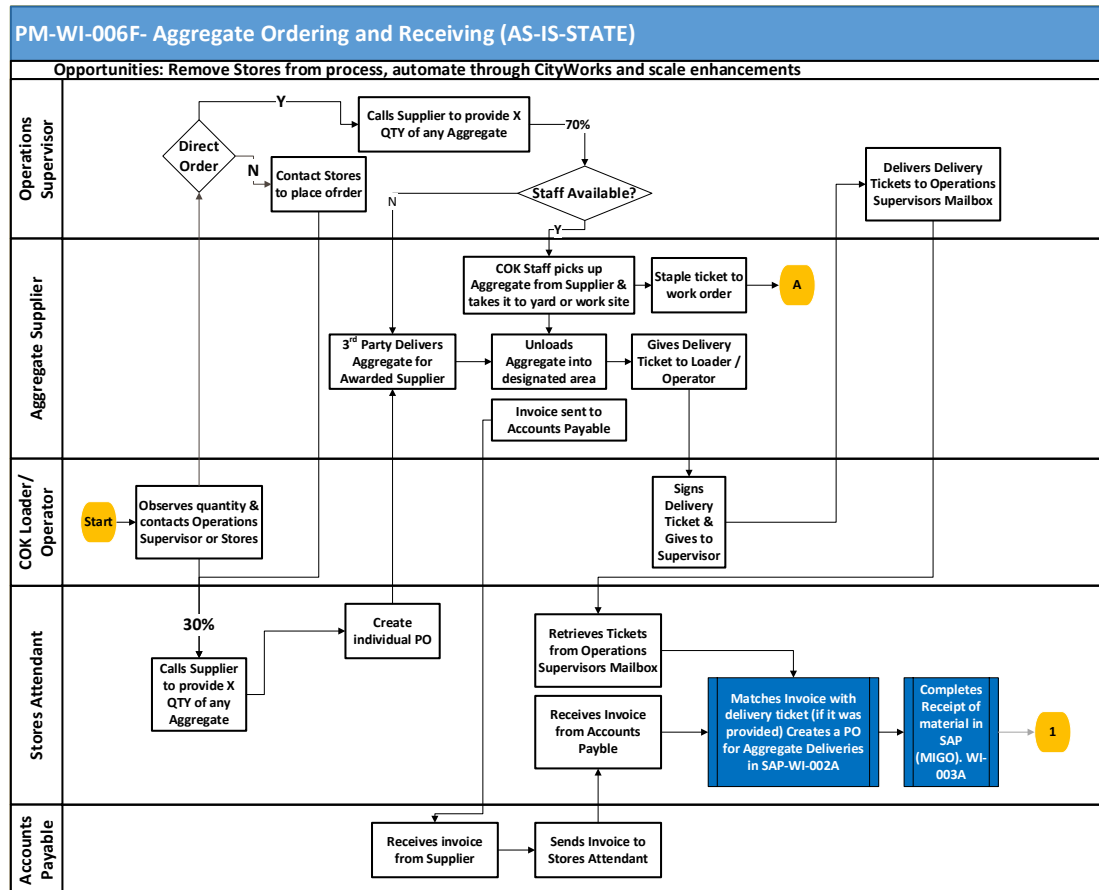
The operations staff who carry out the maintenance and repair activities have felt that the time and effort required to weigh and record the aggregate used was disproportionate to the cost of the material being used. A reduction in the amount of paperwork involved as well as the time for recording and reporting usage will create more capacity for value-added activities that drive customer satisfaction for the residents of the City.

Aggregate Management is currently not conducted as an integrated whole but as a series of interrelated activities with varying lines of responsibility and accountability. Adopting a more holistic approach to the oversight of the materials usage as well as leveraging appropriate technology will serve to alleviate the administrative burden. The benefits from these enhancements will impact staff across multiple levels of the organizational as well as at various levels. Notably, these include the front-line staff, their respective administrative support teams, the staff responsible for recording and reporting as well as those who rely on the data for strategic decision making.

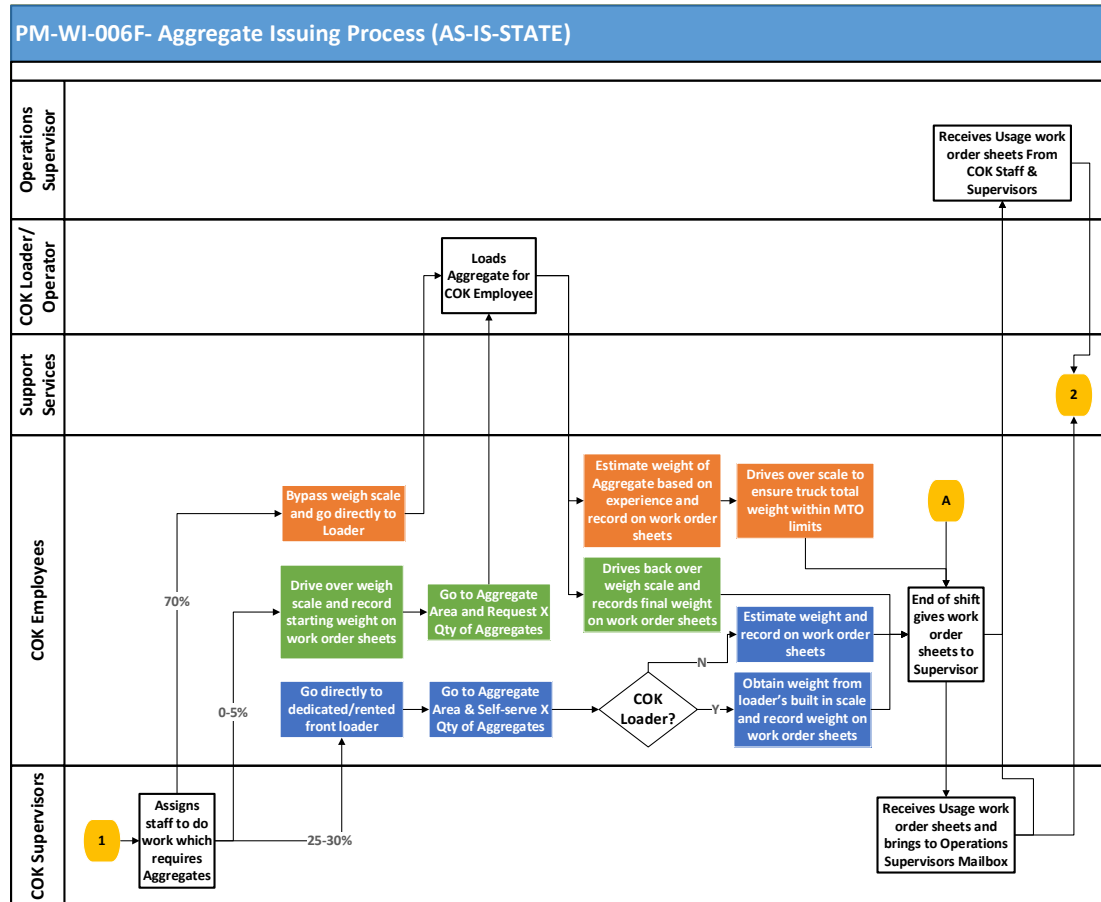
By continuing to leverage collaboration forged in the context of the Lean review, the organization will undoubtedly have a more efficient process spanning the full cycle of material acquisition, consumption, recording, reporting and replenishment. By enhancing communication by means of ongoing dialogue between all impacted stakeholders and with an eye to embracing and integrating new technology, the team will be well positioned to enhance both internal and external stakeholder satisfaction.

10. Appendices

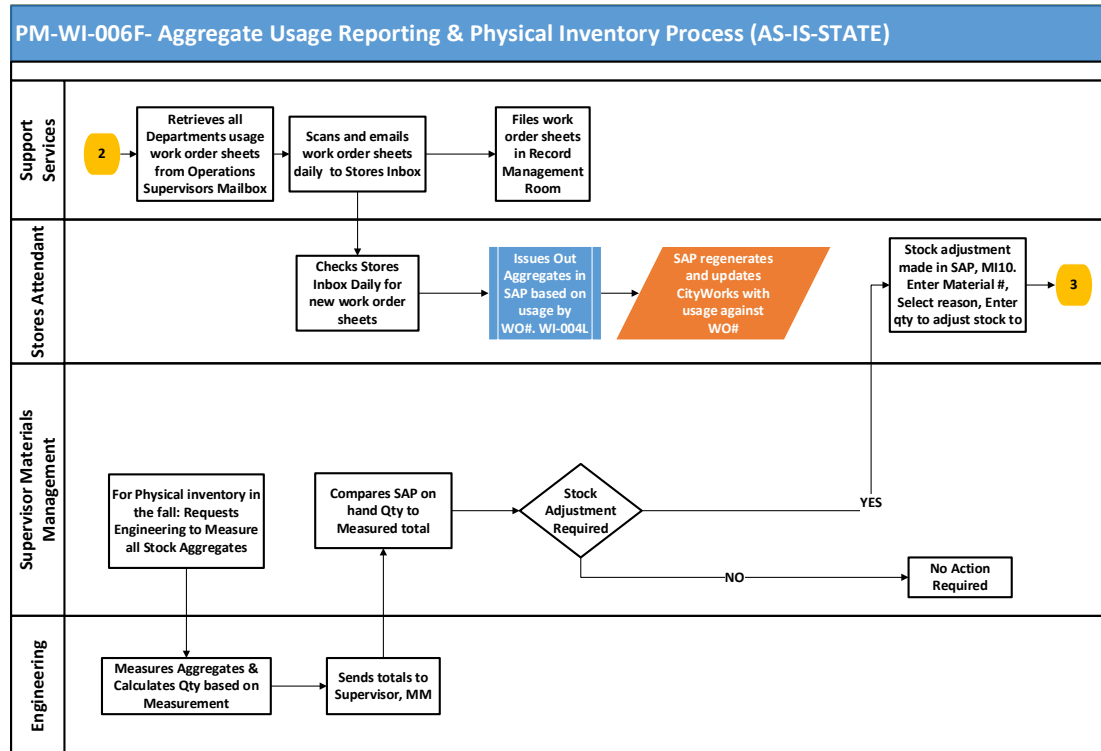
Appendix 1: Aggregate Ordering & Receiving Current State Map



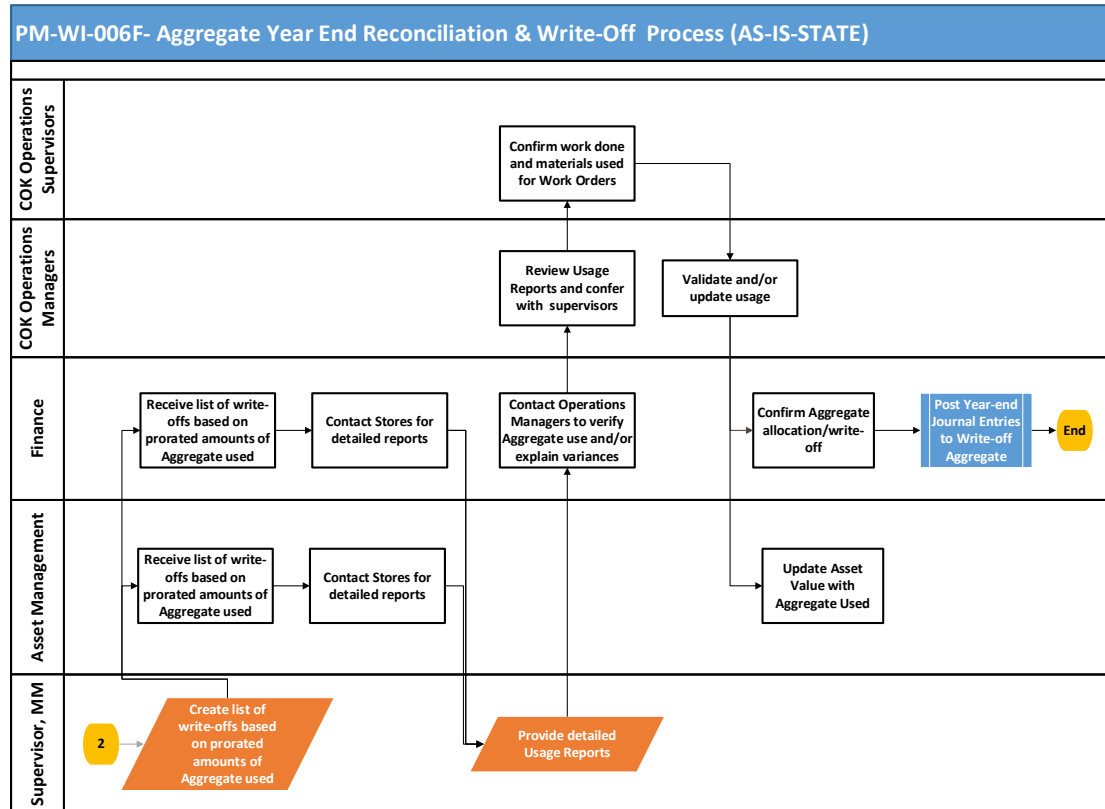
Appendix 2: Aggregate Issuing Current State Map



Appendix 3: Aggregate Usage, Reporting & Physical Inventory Current State Map



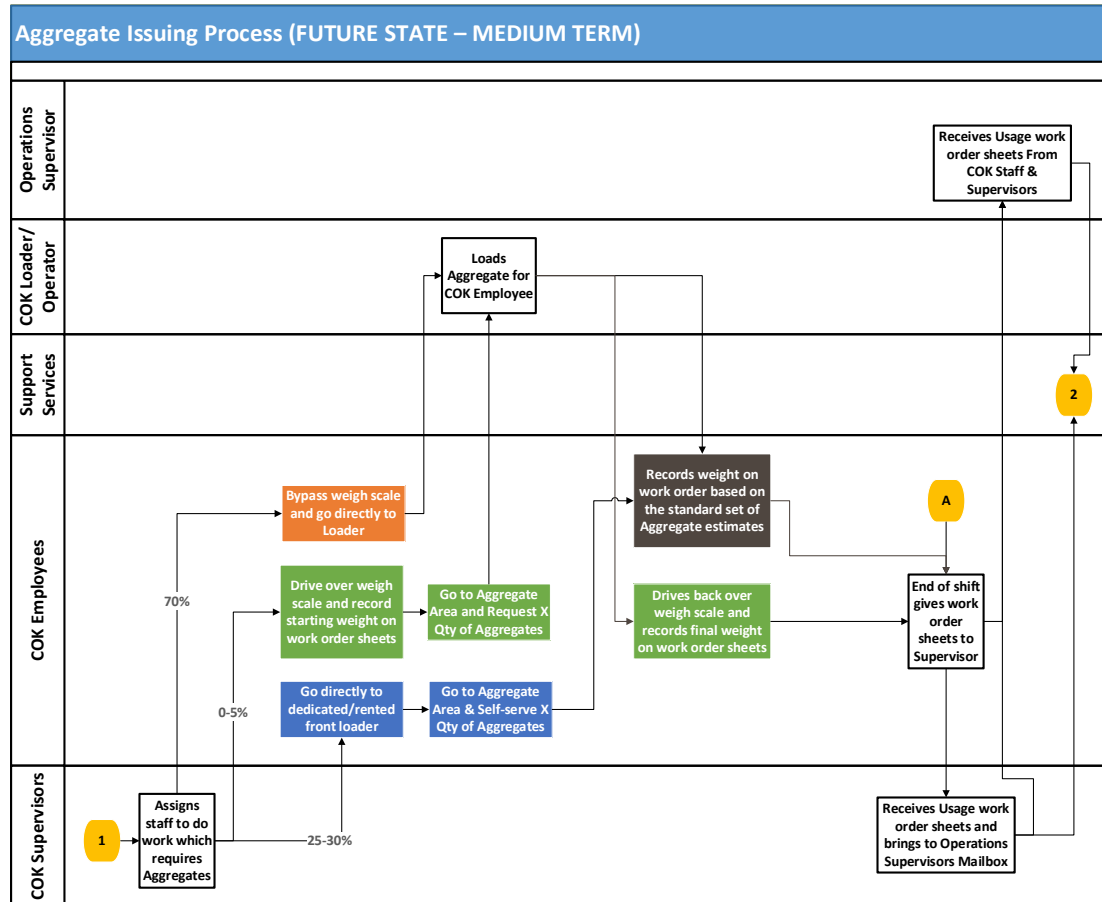
Appendix 4: Aggregate Year End Reconciliation & Write-Off Current State Map



Appendix 5: Comparison of Options

Option 1. – Reinforce the use of the scale and compliance with the existing paper-based process for reporting aggregate usage.	Option 2 - Use alternate method to get accuracy of inventory and process to minimal input from staff and 99% capture rate of materials and estimate. <i>(Identified as important to the City Directors of the impacted areas.)</i>
• Formalize process for mandatory use of scale when material is coming in or out of the yard. • Create signage to scale in/scale out. • Educate staff on why we need to weigh in/weigh out, benefits, plus change management, adoption, compliance. • Add scales to all loaders. • Upgrade scale to put in displays at both ends of scale on a pole for easy-to-read weight. • Paint lines on waiting area/lane to turn left to use scale, and a staging area from the other ramp as a minimum set back with signage.	• Conduct an audit of work orders and create a realistic baseline for usage. • Develop a set of estimates for tracking based on average use per repair. • Charge variances to Gas & SSU. • Expense aggregate at time of purchase. • Short Term: Leverage estimates to eliminate travel time to and from the scale. • Medium Term: Remove low-cost single use aggregates from inventory and charge to alternate cost centres. • Long Term: Use digital data sheets to capture material usage, eliminate paper-based tracking and remove Stores from the process.

Appendix 6: Aggregate Issuing Future State Map – Medium Term



Appendix 7: Aggregate Issuing Future State Map – Long Term

