



The City of Calgary Zero Based Review (ZBR)

Roads Business Unit 2015 Update Report



Table of Contents

Executive Summary	3
Background on the Roads Zero Based Review (ZBR)	4
Street Light Maintenance.....	7
Pavement Marking.....	15
Sign Manufacturing Shop.....	19
Gravel Crushing Plant.....	27
Pavement Rehabilitation.....	32
Traffic Management Centre	38
Excavation Permission Service	42
Spring Clean-up Program.....	44

Executive Summary

The Zero Based Review (ZBR) presented in 2014 identified recommendations to improve eight service areas of the Roads business unit. A productivity target of \$1.4 to \$1.9 million in annual savings within three years (2017) was accepted by Administration. The savings attributed to the ZBR are expected to contribute to the overall \$10.6 million in efficiency gains that were identified in Action Plan for Roads and removed from the 2015-2018 four year operating budget. Achieving the ZBR financial target will help Roads absorb the growth of annual operating costs that were not funded within the four-year budget.

While the 2015 operations data will not be complete until year end, Roads is forecasting favourable productivity gains or cost savings of approximately \$3.4 million, compared to the 2012 baseline numbers used for the ZBR.

Service area highlights:

Street light maintenance. Performance has steadily improved since 2012. While the number of service requests (SR's) have increased year over year, the contract providers achieved the 30 day SLA average response targets for 2014 and 2015. The purchasing strategy put into place for asset replacement resulted in a substantial cost savings estimate of approximately \$1.0 million compared to previous years.

Gravel Crushing Plant. The implementation of performance monitoring and forecasting strategies, as well as the lifecycle replacement of equipment, resulted in efficiency gains at the gravel plant. There has been an 11% reduction in the costs per tonne for 2014 and 2015 compared to the 2012 baseline. This would equate to comparative savings of approximately \$409,000 based on estimated 2015 production numbers.

Pavement Rehabilitation (Paving). The average daily production increased by 15%, or 200 tonnes per day compared to 2012. This has contributed to the overall efficiency gains that allowed the program to maintain a similar cost per tonne ratio to 2012, despite increases in the costs of asphalt and labour over the past three years. These associated gains, based on the tonnage laid down in 2015, equals a savings of approximately \$1.5 million. The strategic replacement of older paving equipment, as per industry standards, has also resulted in a reduction of \$556,000 in fleet maintenance costs for 2015 compared to 2012.

Sign Manufacturing. The Sign Shop has adopted administrative changes to better support customer service, and acquired more efficient equipment through lifecycle replacement that has reduced the production time on their core products. As a result, they have improved their manufacturing estimates even as the total production numbers have increased year over year from 2012. The sign shop operations underwent further review in 2015 to examine the possibility of expanding the sale of products to other municipal districts and public sector customers. The recommendation is while there is a market for the Sign Shop to develop a larger customer base, there are cost management concerns and financial tracking standards that must be addressed first.

Pavement Marking. By the end of the 2015 season, 540,000 more metres of lane lines will be completed compared to 2012. The electronic mapping project that has begun will improve the ability to monitor and track the performance of the paving program on a weekly basis. The program also reduced their total consumption of glass beads (in the paint) by 25% compared to the previous year, saving approximately \$45,000 (39,000 kg).

Traffic Management Centre (TMC). Emergency back-up centres for the TMC have been established at the Roads' Spring Gardens depot and at The City's Emergency Operations Centre, to ensure operations can continue should the primary site at Manchester lose connectivity to the system. The computer servers have been replaced and upgraded to support these initiatives. Traveller information technology continues to evolve, and new systems are being added, such as the thirteen Dynamic Message Signs that have been installed along Deerfoot Trail and Crowchild Trail. Two more of these signs will be installed along Macleod Trail in early 2016.

Excavation Permits. Throughout 2014, Roads engaged the excavation industry customers regarding the electronic permitting program (ePermit), and new infrastructure protection and maintenance strategies. In 2015, Roads has supported customers with workshops and reminders about the planned transition to have all excavation permit requests go through the on-line ePermits system by the end of the year.

Spring Clean-up (Sweeping). The 2015 Spring Clean-up program was completed two weeks ahead of schedule, due to the mild weather, and included a pre-sweeping program that helped to remove 50% more material from the road before it could reach the storm water system. Collaboration between Roads and Water Services has resulted in tests scheduled for 2016 to develop more environmentally friendly and cost effective street sweeping methods, and develop success measures in order to evaluate the operational and environmental results.

The ZBR process has also led to sustainable changes in how Roads will measure future performance across these service areas, as new metrics were developed as a result of the in-depth review. This will enable Roads to more easily communicate how much they accomplish, how well it was done, and how their customers are benefiting.

Background

Zero-Based Reviews are a part of the Corporate Strategy on Efficiency and Effectiveness, and they support Council's direction to transform government, and specifically to become a more effective and disciplined organization, and to raise the care and attention that Council and the organization pays to restraining expenditures and increasing efficiencies. Each review starts at a 'zero' base by looking at all services that are provided by a business unit through a high level analysis followed by an in-depth investigation and analysis of specific service areas that has the greatest potential for efficiency and effectiveness improvements.

In 2013, Western Management Consultants and ISL Engineering were contracted to undertake a Zero-Based Review (ZBR) of the City of Calgary's Roads Business Unit municipal programs and services. The ZBR program evaluated services on the basis of effectiveness and efficiency, and identified opportunities for change in five service areas: Street Light Maintenance, Pavement Marking, Sign Manufacturing, Gravel Crushing, and Pavement Rehabilitation.

These were the business case descriptions developed by the consultants:

Street Light Maintenance	Pavement Marking	Sign Manufacturing
<i>To explore alternative approaches to improve service efficiency and effectiveness of street light maintenance.</i>	<i>To investigate the feasibility and benefits of contracting out pavement marking to the private sector.</i>	<i>To examine the commercial viability of expanding Sign Shop services to other customers and clients or concentrating on core sign manufacturing processes.</i>
Gravel Crushing	Pavement Rehabilitation	
<i>To investigate the feasibility and benefits of contracting gravel mining and crushing operation to a private sector operator.</i>	<i>To compare the merits of self-performing versus contracting out pavement rehabilitation services.</i>	

Administration reviewed the findings of the consultants, and engaged four peer reviewers from Vancouver, Edmonton, Winnipeg and Toronto, to help provide feedback on the business cases and draft recommendations. The agreed upon results of the ZBR suggested that the total amount of productivity gains that could be achieved is approximately \$1.4 million to \$1.9 million annually, and was estimated to be realized within three years, by 2017.

Although not included as part of the official ZBR business cases, Administration also identified three additional service areas that would be examined for improvement opportunities: the Traffic Management Centre, Permission Service for Road Excavations, and the Roads Spring Clean-up Program. Administration committed to reporting back on the progress of the process improvements for these service areas by the end of 2015.

Traffic Management Centre	Permission Service for Road Excavations	Spring Clean-up Program
<i>To review the processes and procedures that support business continuity and operational efficiency. Strengthen relationships with partners. Examine new technologies that allow remote work, and to enhance traveller information.</i>	<i>To improve the overall permit process for customers, and ensure costs are properly recovered, through the implementation of the Roads e-Permit system.</i>	<i>To investigate the feasibility and benefits of adjusting the Spring Clean-up processes to reduce costs associated with the removal of sediment deposited into the municipal storm system.</i>

The report and recommendations for all eight of these service areas were presented to The City of Calgary's Priorities and Finance Committee in 2014 October (PFC20014-0802). City Council directed Administration to report back on the efforts to achieve the recommendations by Q2 of 2015. Administration requested a deferral of this Q2 report in 2015 June, as a consultant had been recently hired to conduct a feasibility study on the expansion of services at the Sign Shop, and the results would not be completed at that time. Council agreed to defer the update report to Q4 2015.

This 2015 ZBR update report will compare current performance measures to the 2012 baseline data that was utilized by the consultants through the zero-based review.

Street Light Maintenance

SERVICE DESCRIPTION

The Street Light Maintenance group is responsible for the regular maintenance and repair of streetlights that are out, damaged, flickering, or on during the day. They also plan for the lifecycle replacement of the 92,000 streetlights on city right-of-way.

Customers use The City's 3-1-1 system to report problems with the street lights. Roads has maintenance contracts with companies to investigate and handle most of these concerns. The service level agreement requires that reported problems are to be investigated within seven days, and most repairs to be completed within 30 days. More complex issues such as short circuits or underground wire faults may take more than 30 days to address.



ZBR RECOMENDATIONS

1. Out-source street light maintenance to multiple maintenance service providers and that The City's performance expectations related to maintenance should be clearly outlined in any future public tender for this service. Introducing a more competitive environment into the service delivery should foster better service responsiveness and effectiveness.
2. Examine the 30 day service level agreement (SLA) tool and data.

3. Analyze inventory costs related to the on-site storage of light equipment and supplies, and determine what options are available to reduce/eliminate these inventory costs.
4. Examine how to introduce more automation into the process of dispatch and work completion, in conjunction with the outsourcing of street light maintenance.

IMPLEMENTATION

1. Outsourcing Strategy

The ZBR recommendation to move away from a sole contract provider and outsource by quadrant was modified to a more practical service-based approach. This approach recognizes the varying equipment and training requirements to maintain the street light infrastructure, like high mast repairs versus regular bulb replacements, which allows companies to then bid on the work they are able to provide. Five different companies are now contracted to support the street light maintenance program in 2015.

Outsourcing was started in 2012 and further expanded to include more capital projects. Previously these were included under the service level agreement (SLA) with the Enmax Power Services Corporation (EPSC). This resulted in inefficiencies over time as the EPSC's crews working on the SLA had little spare capacity to continue the work on Capital projects. Since 2012 more lifecycle plans and replacement programs have been initiated by Roads, which resulted in many new capital programs being tendered to the open market by the street light design team. This has freed up EPSC to resolve service requests more quickly and focus on their core business. All new contracts, that would have included services under the original SLA, have since been tendered to the open market. The service-based approach has resulted in five different companies being contracted to support the street light maintenance program in 2015 (Table 1). The scope of the service work is now more defined, which enables Roads to better gauge the performance of each service provider.

Table 1 - Streetlight Maintenance Delivery by Contractor 2012-2015

Service Type	2012	2013	2014	2015
Critical Pole	EPSC (SLA)	EPCOR	EPCOR	CANA Utilities
Wire replacement	EPSC (SLA)	EPSC (SLA)	EPSC (open tender bid)	Black & Macdonald
LED retrofit	EPSC (SLA)	EPSC (SLA)	EPSC (open tender bid)	Pillar Contracting & CANA
Decorative pole painting	EPSC (SLA)	EPSC (SLA)	Pillar Contracting	Pillar Contracting
High mast repair	EPSC (SLA)	EPSC (SLA)	Pillar Contracting	Dobbyn Electrical

Manhole relays	EPSC (SLA)	EPSC (SLA)	EPSC (SLA)	EPSC (flood mitigation fund)
Cabinet replacements	EPSC (SLA)	EPSC (SLA)	EPSC (SLA)	EPSC (SLA)
Specialty lighting contractor	EPSC (SLA)	EPSC (SLA)	EPSC (SLA)	Roads - Traffic

2. Recommendations on the Service Level Agreement (SLA)

The City is required to use EPSC to manage lighting infrastructure inside the manholes within the EPC network area. There are numerous other areas in Calgary where lighting controls (relays) are located inside EPC owned transformer boxes outside the core. The City needs to continue to work with EPSC to separate lighting infrastructure from EPC owned assets. EPSC has also been helpful on City projects like fibre connected traffic signals in the core and relay relocation out of manholes (separation from EPC assets). The street lighting performance metrics have been steadily improving since 2012, and as a result the street light design team is recommending to renegotiate directly with EPSC for a period of 5 years and not go back to market for a new SLA provider. This will enable more time to refine metrics, improve response times and continue to decouple infrastructure.

There are currently two service request types (SR's) that EPSC receives directly from 3-1-1: Street Light Damage and Street Light Maintenance. The SLA timeline for both complaint types is 30 days to completion. Citizens can call 3-1-1 back and escalate the complaint within the 30 day limit, but this does not constitute a failure to meet the 30 day SLA. These targets can be accurately measured by existing 311 reporting tools.

Targets will be reviewed annually to align with performance and citizen expectations, and within budgets. The following SLA targets would be a starting point for the next contract:

- 10 days – Many Out Major Road
- 15 days – Many Out Residential Road; One Out Near Crosswalk (residential)
- 15 days – One Out Residential (if sole light in a cul-de-sac)
- 30 days – One Out; Lights burning Daytime

3. Costs related to Equipment Storage

During the LED street light replacement program in 2014, Roads decided to order material from the LED manufacturers and ship the product directly to the contractors (EPSC and Pillar Contracting). Normally, materials would be ordered by the warehouse and entered into inventory; the new process eliminated the use of the city warehouse. Roads reviewed the impact of this change, as recommended in the ZBR.

Roads determined there was a loss in the quality control steps that occurs when items were received directly by the warehouse. As an item arrives from suppliers, the warehouse checks that the material matches the invoice and follows up with the supplier directly in cases of missing or damaged parts. This process was included as a step for the contractors to follow,

but in practice it was missed on more than one occasion which caused project delays. There was also a loss in productivity by having contractors accept deliveries directly due to their hours of operation. The City warehouse has normal business hours for scheduled deliveries. Not all prequalified street light contractors have warehouse core receiving capability and in order to deliver material to them, coordinated approaches were required between contractor and supplier of LED's. In some cases this approach worked, but on occasion deliveries were missed and redelivery attempts were necessary.

With the small volume of LED's (2500 in 2014), it was determined that the added administration time on street light staff was onerous and it was more cost effective to use City stores for receiving. 2500 LED luminaires represents a capital spend of roughly \$800,000. Supply charges capital projects 3% overhead which for the LED supply is roughly \$25,000. The estimated additional administrative time for street light staff was 1 day/week/6 months or approximately \$10,000. The extra labour cost from the contractor is approximately \$7 per location or \$17,000 for the whole project. The additional expenses were higher than the overhead costs for City stores, and come with the loss of their expertise.

The recommended approach is to continue to use the City Stores and supply for their warehousing and receiving expertise as has been done in the past. The warehouse allows The City of Calgary to control and enforce their standards and specifications; ensuring contractors and consultants have approved materials and designs.

Inventory Costs

Following the ZBR recommendations to examine inventory storage costs, Roads also reviewed the purchasing contracts for pre-cast street light bases and poles that are required for the street light maintenance program. The contract for bases was re-tendered, and the bid for street light poles was combined with traffic signal poles with the intention to achieve better unit pricing with a larger contract. This strategy was successful, and has resulted in a significant cost savings estimate for 2015 compared previous years.

Table 2 shows that the same volume of material used year over year is less expensive in 2015 than 2012, 2013 and 2014. The quantity used for the calculation is an historical average of the annual purchases over the last 3 years. The unit prices for 2013 and 2014 were the same, and so only the 2014 price and costs are shown in the table. The yearly pricing is based on what City Street lighting pays which is an overhead of 3% adjusted from stores. Developers and other businesses pay a 15% overhead charge to city stores.

The actual cost savings on materials in 2015 is expected be approximately \$1.0 million, and would be reinvested into the maintenance program.

Table 2 - Approximate Inventory Price per year and Total Costs using fixed Quantities

Item	Quantity Per Year	2012 Price	Total Cost 2012	2014 Price	Total Cost 2014	2015 Price	Total Cost 2015
9m pole single davit	860	\$804	\$691,440	\$703	\$604,580	\$441	\$379,260
9m pole double davit	100	\$1334	\$133,400	\$1382	\$138,200	\$901	\$90,100
15m pole single davit	600	\$1457	\$874,200	\$1457	\$874,200	\$858	\$514,800
15m pole double davit	60	\$2488	\$149,280	\$2488	\$149,280	\$1497	\$89,820
20m pole single davit	30	\$2522	\$75,660	\$2522	\$75,660	\$1617	\$48,510
20m pole double davit	1	\$2987	\$2987	\$2987	\$2987	\$2152	\$2152
Type B base	1050	\$422	\$443,100	\$683	\$717,150	\$520	\$546,000
Type C base	350	\$566	\$198,100	\$720	\$252,000	\$613	\$214,550
Totals			\$2,568,167		\$2,814,057		\$1,885,192
Compare to 2015			+\$682,975		+\$928,865		

4. Automation

The ZBR recommendation to introduce more automation into the dispatch and work completion processes will be negotiated into the new SLA arrangement for street light contractors. It is not currently written into the document authored in 2006. Automation is expected to involve the use of laptops installed directly into EPSC trucks, with access to service request software and the use of field view software so they have access to electrical schematics on site as required.

ADDITIONAL EFFICIENCY

Specialty lighting

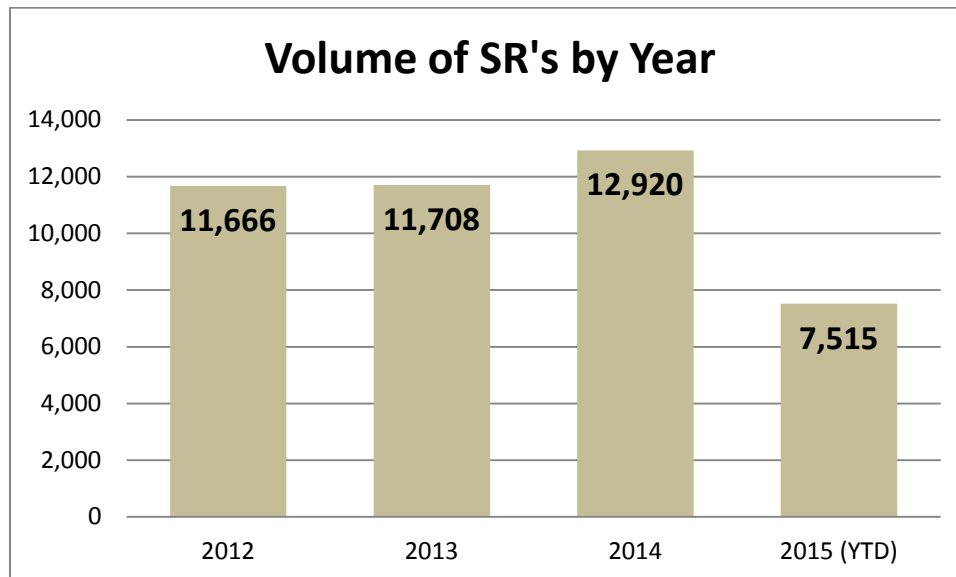
Specialty lighting has been made into a new Service Request (SR) category to improve efficiency. Specialty lighting includes the Peace Bridge, Centre Street Bridge, and the Travelling light. In the future, it will also include the Galleria Trees, Riverwalk, Langevin Bridge, 4th St SE underpass when these locations are passed to Roads for ongoing maintenance. These areas were previously dispatched to EPSC under the service level agreement, but most of the above locations include highly specialized lighting and special tools to complete repairs.

Street lights in the East Village, that are actually under control of the Calgary Municipal Land Corporation (CMLC), were also called in by citizens through 3-1-1, resulting in the work being assigned to EPSC where they had no responsibility to respond. The new Specialty Lighting SR is assigned to street light design staff who can either redirect the SR's to the responsible company, such as CMLC, or design staff can do further evaluation of the problem prior to having a contractor respond to the issue.

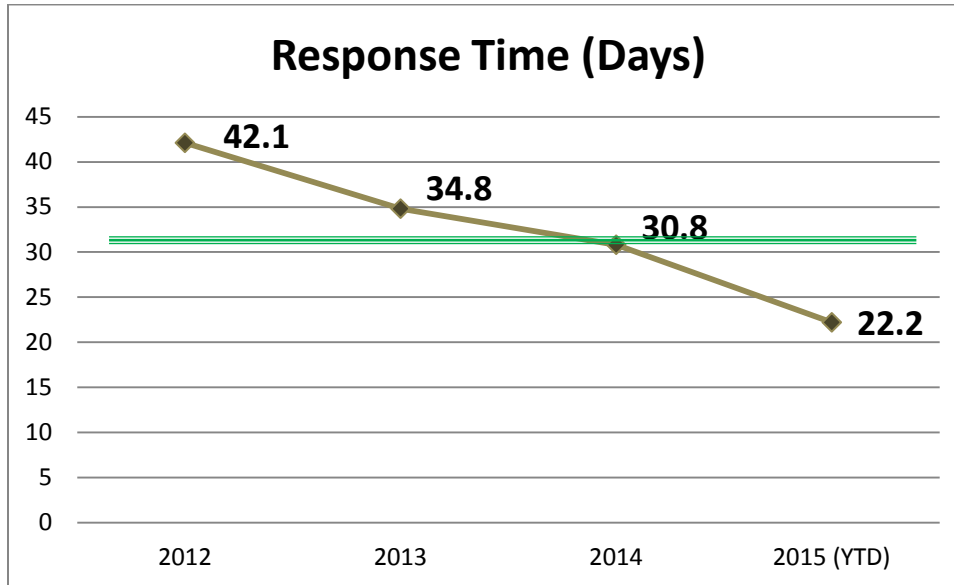
PERFORMANCE MEASURES

While the total call volume of service requests for street light maintenance has increased annually since 2012 (Figure 1), the SR response times have been improving (decreasing) yearly due to the changes in response management initiated by Roads and EPSC in since the ZBR was conducted. Figure 2 shows the response time improvements, and identifies the 30 day SLA target line.

Figure 1 – Volume of Service Requests for Street light Concerns by Year

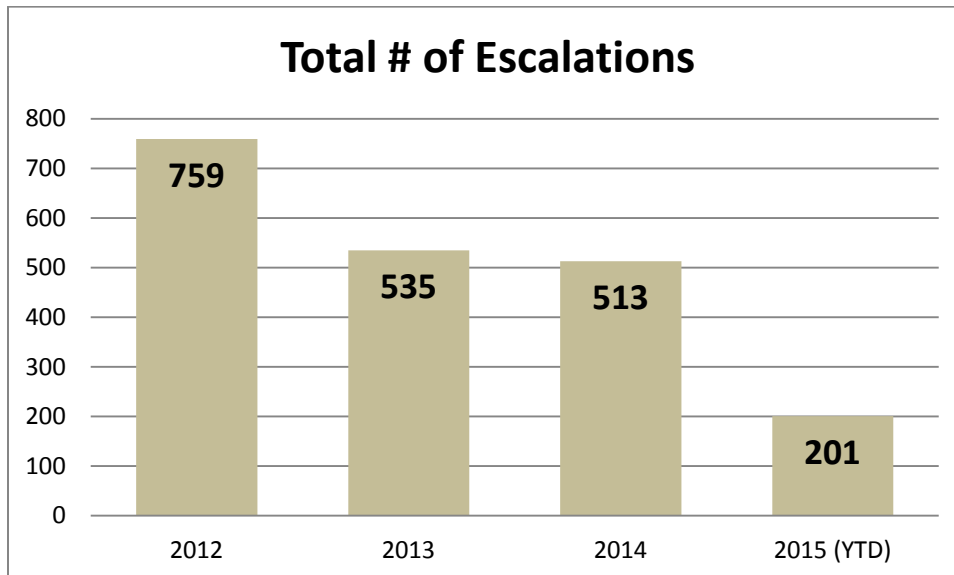


Note. 2015 value is year-to-date, August 31, 2015

Figure 2 - Average SR Response Time for EPSC

Note. 2015 value is year-to-date, August 31, 2015. The highlighted horizontal line marks the 30 day response target for the Service Level Agreement (SLA).

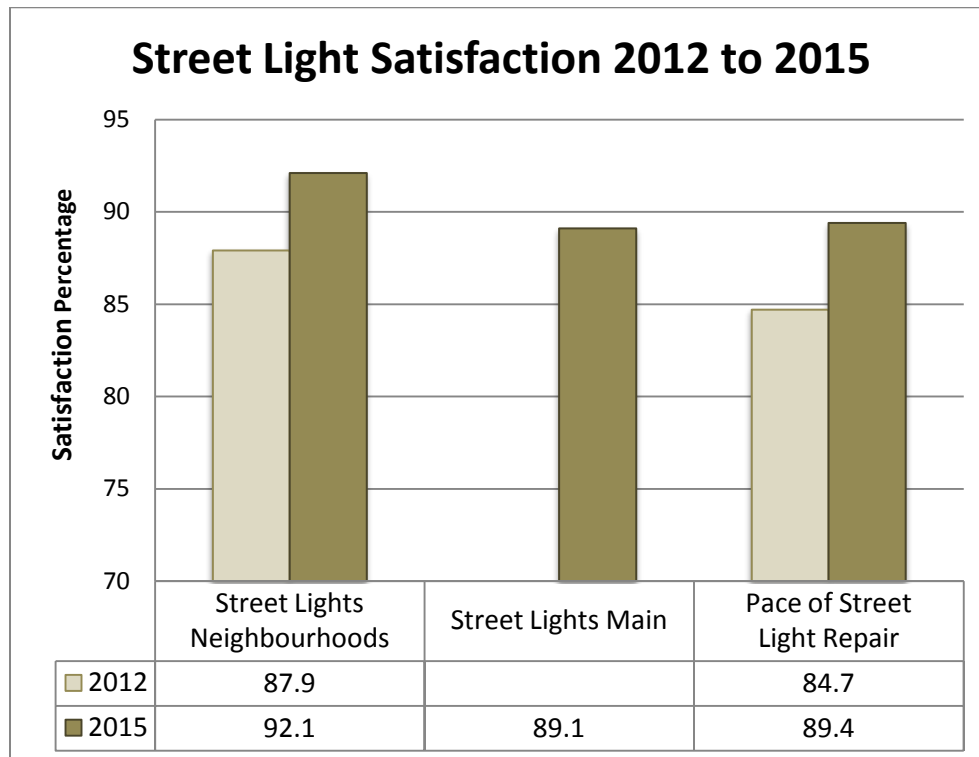
The improvement in the average response times to the SR's resulted in a corresponding decrease in the number of SR Escalations that citizens have created since 2012 (Figure 3). An escalation occurs when a citizen contacts 3-1-1 to inquire about an unresolved service request.

Figure 3 – Annual Service Request Escalations for Street Light Maintenance (2012-2015)

Note. 2015 value is year-to-date, August 31, 2015

The Roads Annual Survey, prepared by HarGroup Management Consultants Inc., asks citizens about their satisfaction with Street lighting on Neighbourhood Roads, Street lighting on Main Roads, and the Pace of Street lighting Repair. The citizen satisfaction results for street lighting improved from 2012 to 2015 (Figure 4).

Figure 4 – Citizen Satisfaction with Street lighting 2012 and 2015



Note. There was no measure in 2012 for Street lighting on Main Roads.

SUMMARY

Street light maintenance performance has steadily improved since 2012, as have the citizen satisfaction numbers. While the number of service requests (SR's) have increased year over year, the contract providers achieved the 30 day SLA average response targets for 2014 and 2015. The purchasing strategy put into place for asset replacement resulted in a substantial cost savings estimate of approximately \$1.0 million, which will contribute to the budgeted productivity gains in Action Plan 2015-2018.

Pavement Marking

SERVICE DESCRIPTION

The Pavement Marking group is responsible for the application and maintenance of all lane-line, centerline, stencils and crosswalk marking on city roadways.



ZBR RECOMENDATIONS

1. Maintain the present state relative to pavement marking service using Roads Business Unit staff and equipment.

IMPLEMENTATION

Although the ZBR did not recommend immediate improvements to the program, the consultants did encourage the division to look for ways to further enhance service delivery, including the use of automated or semi-automated tools to monitor performance. The past practice was a highly manual, paper-based process used to track the completion status of maintenance marking. Currently, Roads is testing a mapping and tracking application (ARC GIS) that would enable the creation of a weekly report that provides accurate updates on the progress of the annual

pavement marking program. These progress reports could be also made available to all interested stakeholders.

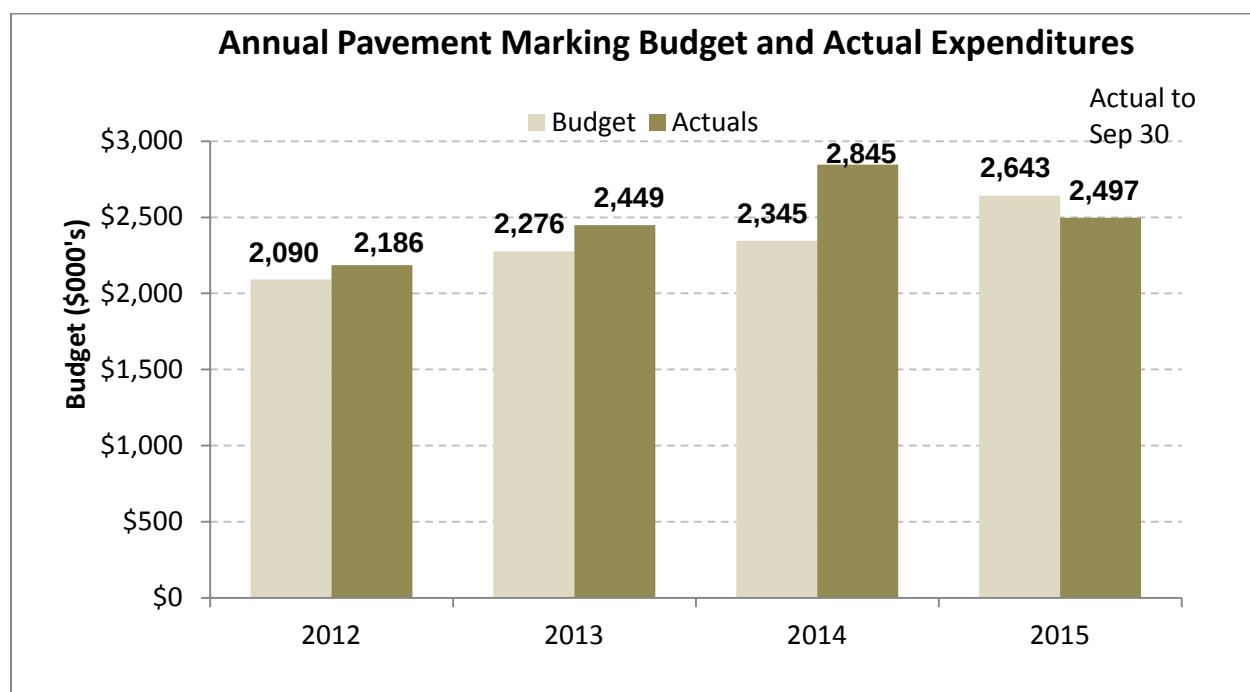
ADDITIONAL EFFICIENCIES

Highlighted below are some of the additional service improvements that were implemented in 2014 and 2015:

- Glass beads are used in pavement marking to increase durability and provide improved visibility at night, as a vehicle's headlight beam reflects and is returned to the driver's eye. In 2014, the program used 118,000 kilograms of regular glass beads and 40,000 kg of high index glass beads. After review, it was determined that there was an excessive amount of overspray resulting in a waste of beads that did not stick to the marking. Therefore, in 2015 the bead dispensers on the pavement marking equipment were adjusted to improve efficiencies resulting in a 25% reduction of total bead consumption, while maintaining the appropriate visibility of the lane lines. This reduction of 28,000 kg of regular beads and 11,000 kg of high index beads equals a cost savings of approximately \$45,000.
- In 2015 a new pavement marking condition survey was implemented to track all durable pavement marking. This program complements the existing pavement marking inventory. This has resulted in an increase in the efficiency of the annual paint replacement program by helping the program identify and prioritize the roads that may or may not need re-striping.
- They went from two spotting crews to three spotting crews. This has resulted in a further reduction in overtime from previous years, resulting in a reduction of down time for the paint crews.
- Expanded staff training into various new specialized markings and materials applications. This is in respond to customer demands from such agencies as The Calgary Police Services and the City's Cycle track projects.

PERFORMANCE MEASURES

The pavement marking program has overspent on their budget every year since 2012 due to the growth of the pavement marking inventory and the added material costs to keep the lines painted (Figure 6). The program has been completed with only minor increases in staff and equipment since 2013, even though the lane line inventory increased by approximately 300,000 linear metres by 2014 compared to 2012 (Table 3). Maintaining service delivery levels in 2015 with existing staff levels is proving to be a challenge, as the inventory grew in all categories from 2014, including an additional 245,000 linear meters of lane lines.

Figure 6 – Pavement Marking Expenditures 2012-2015**Table 3 – Pavement Marking Inventory 2010-2015**

PAVEMENT MARKING INVENTORY							
	2010**	2011**	2012**	2013**	2014	2015*	
LANELINES	2,194,882	2,310,402	2,432,002	2,560,002	2,729,876	2,975,564	Linear Metre INVENTORY
REGULAR CROSSWALKS	6,771	7,127	7,502	7,897	6,306	6,620	Unit
RIGHT TURN CROSSWALKS					1,267	1,274	Unit
LADDERS	676	712	749	789	949	1,000	Unit
STENCILS	2,989	3,147	3,312	3,487	5,995	6,295	Unit
STOP LINES	3,762	3,960	4,169	4,388	4,871	4,895	Unit
STOP "X" (keep clear)	291	306	322	339	385	395	Unit

Note:

* 2015 number are projection

** Right turn crosswalks included in total

SUMMARY

The ARC GIS mapping project will improve the ability to monitor and track the performance of the paving program on a weekly basis. Maintaining service delivery levels in 2015 and beyond with existing staff levels will be a challenge, as the inventory grew in all categories from 2014, including another 245,000 linear meters of lane lines.

While the crosswalk program and the lane line program will definitely be completed for 2015, Paving is forecasting difficulties in completing the road marking for both the Surface Overlay Program and the new construction projects in timely and optimal manner. Paving late into the fall season increases the likelihood of encountering unfavourable weather conditions that put excess stresses on the pavement marking equipment and materials. This results in substandard markings, reducing visibility.

The amount of road stencils increased in 2015 by 50% over the 2013 inventory numbers. In order to address the increased demand for stencils, due in part to new bike lanes and other traffic control measures, an additional two-person crew was allocated to both day shift and night shift. However, it is anticipated that the total numbers of stencils will still exceed the capacity of the crews to install them this year. In 2014, Roads contracted out the application of some bike stencils because they did not have the staff or equipment to do them at that time. Following the 2014 program, it was determined that it was more expensive to contract out than to do the work in house, therefore they did not contract out stencil applications in 2015.

Sign Manufacturing

SERVICE DESCRIPTION

The Roads Sign Shop designs and manufactures regulatory, informational, detour and street name signs for installation on the public right-of-way as part of their core business. They also create custom products, such as vinyl wraps for garbage bins and street furniture, lettering for buildings, and vehicle graphics for many of The City's fleet. The majority of the work orders support other business unit needs, although the Sign Shop has produced signs for other municipalities and government agencies on a request basis.



ZBR RECOMENDATIONS

1. Focus on the production of core signs and graphics related to traffic and roadway signs.
2. Develop a full cost recovery model for the production of all sign shop work and apply this for external customers.
3. Explore the feasibility of expanding services to external organizations including other municipalities.
4. Review equipment utilization
5. Establish a new work order type to track production of all core and non-core work.

IMPLEMENTATION**1. Production****Equipment**

Equipment that was near or at the end of its lifecycle was identified and prioritized according to the gain in production or improvement in quality.

- A new Graphtec vinyl cutter was added that will be able to cut a wider variety of vinyl, and by eliminating duplicate trimming work, will reduce the production time of diamond grade products by 50%. This machine is mainly used for core work.
- A new thermal resin printer was added, which is anticipated to increase printing speeds up to 30%, and decrease production times for decals and decal die cutting. This printer is used on products that generally split between core (60%) and non-core (40%) usage.

People and Process

An administrative position was added to the sign shop team during the time of the zero based review. The clerk has improved customer service by being a consistent point of contact, as well as completing clerical duties, that were previously being done by sign production staff. The work order system was also analysed, and a more effective process was implemented to track when work orders arrive, and when they are due to be completed. As a result, product delivery estimates been reduced compared to 2013 when the typical production estimates were 15 days (Table 4). Reliable data keeping on actual manufacturing times was started in 2015, as it was not available prior to the ZBR, and will be a valuable way to measure future performance. The 2015 manufacturing times (up to August 31) were well within the estimated times of completion.

Table 4 - Estimated Time to Manufacture Signs (Days)

	2013	2014	2015
Average Estimated Manufacture Time	13.4	11.8	11.7
Median Estimated Manufacture Time	15.0	11.0	7.0
Average Time to Manufacture (Days)	N/A	N/A	6.5
Median Time to Manufacture	N/A	N/A	4.0

Note. 'Time to Manufacture' data was not accurately tracked in 2013 & 2014.
2015 numbers are YTD (August 31)

The Shop staff received additional professional training from 3M in 2015 in the application of wrap vinyl. This has improved the skill knowledge across the staffing levels for the most commonly requested custom signage by City departments, including garbage bin wraps, vehicle identification striping, and wall graphics.

A more efficient option for temporary signage was established, using plastic sandwich board-type stands

that use removable inserts. The Sign Shop set up a discounted volume buying system with the manufacturer and the distributor of these boards. These signs have been very popular and are currently being used by multiple business unit partners. These reusable signs have filled a void for signage that can be produced economically and very quickly, allowing the Sign Shop to be responsive to last-minute requests. A recent example of this would be the twenty signs produced for the 2015 September pedestrian crossing safety campaign (Figure 5).

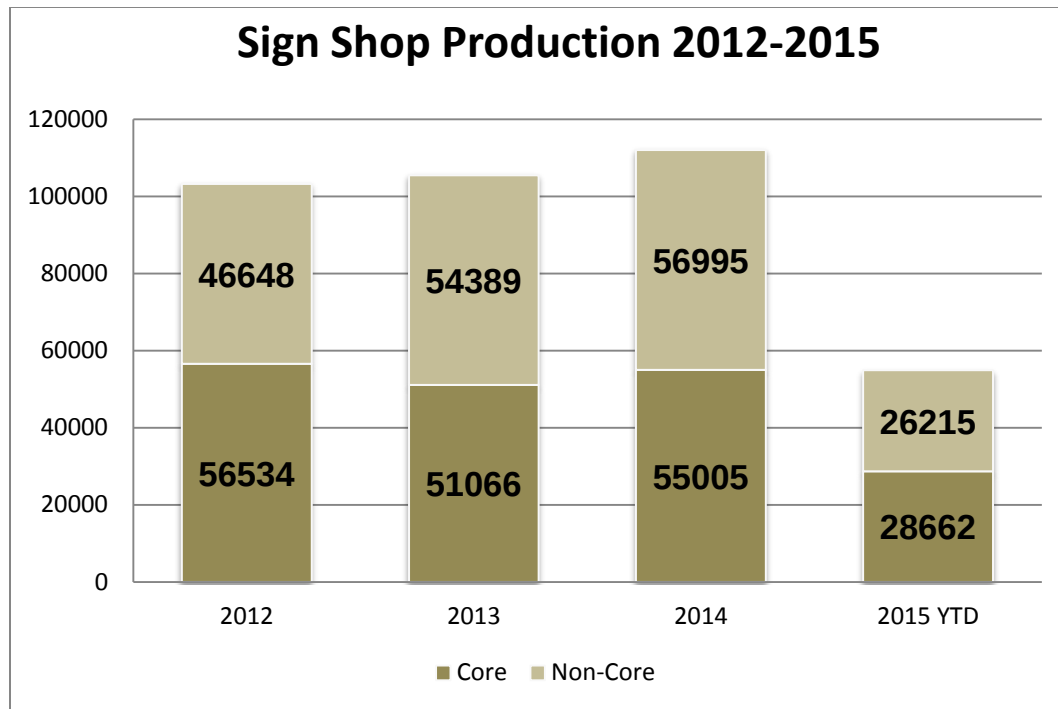
Sign Shop production has increased year over year since 2012 (Figure 7). Even so, the capacity to adjust production to meet rush or priority jobs for Roads operations has been successfully maintained. For example, following Council's decision in June 2014 to adjust the start and finish times for playgrounds and school zones within Calgary, 8500 new decals were manufactured within two days to allow the field crews to start work immediately. The field crews had only the summer to complete the work, so the changes would be in place prior to the start of the next school year. The Sign Shop also trained the field crews on how to do a proper installation, and with the timeliness of the decal production, this contributed to the success of the field crews completing the re-decaling of the signs two weeks ahead of schedule.

The current 2015 production numbers (through August 31) are trending towards a similar total as 2014.

Figure 5 – Pedestrian Safety Campaign sign



Figure 7 – Sign Shop Production of Core and Non-Core Signs from 2012-2015



Note. 2015 value is year-to-date, August 31, 2015

2. Cost Recovery

A review of the financial and record keeping processes for the Sign Shop is underway, and some analysis is also included within the review conducted by MNP LLP Consulting (See next section, *Expansion of Services*). Currently, there are three categories of customer that are then charged out different rates: Roads Operations, Internal Business Units, and External customers. However, these fees have been calculated using the raw material costs plus the actual labour and benefits costs (hourly), and then a small mark up was added for other business units and external clients. The current administrative costs for clerical and supervisory support, facility operations, and other supply costs (ink, maintenance supplies) have not been added to any of the base fees. The true costs of production are being reviewed by the Sign Shop, and will be part of any discussion about updating the pricing structure for the services of the shop.

3. Expansion of Services

MNP LLP Consulting (MNP) was tasked with preparing a market opportunity assessment for the Sign Shop to determine the feasibility of expanding operations to include external customers, including other municipalities. This review also provided analysis and recommendations based on best practices, industry standards, financial viability, and readiness of the Sign Shop to adopt these changes. The key findings are summarized below.

Market Demand

MNP conducted an industry scan for the Alberta market, and reviewed Industry Canada information for the political, economic, social and technology trends regarding this manufacturing sector. Sign manufacturing is a mature industry that has plateaued, increasing pressure on the sector to remain competitive through innovation and cost control. There are approximately three dozen competitors operating in the Alberta region, two thirds of which would be considered direct competitors to the services the Sign Shop provides. Most of the direct competitors offer services that would be classified as non-core at Roads. It was estimated that the Alberta market size is approximately \$17 million annually.

Municipalities were determined to be the most attractive future customer for the Sign Shop to pursue, for both core and non-core work. Population growth in the region, and predicted increases in capital spending at the Provincial level may generate additional demand for sign production at the municipal level. The Alberta Government's 5 year capital plan currently identifies \$29.5 billion in spending on existing projects and future infrastructure demands.

Internally, the Sign Shop's primary business unit customers - Roads, Transit, Parks and Fleet - already utilize the shop for the majority of their core and non-core sign production. Maintaining this customer group is very important to the operations of the shop. Creative Services has commented that there could be further business within The City, however timelines for custom work have not been met in the past, due to work for Roads operations taking priority.

Sign Shop Strengths & Weaknesses

Experience, reputation and leadership were considered to be strengths in the development of expansion plans for the Sign Shop, as well as stable demand within The City. Existing manufacturing processes and positive relationships with vendors and other municipalities and districts were also cited as strengths to build upon.

The fixed labour cost, due to The City's negotiated salary and benefits structure with the unionized work force, is the primary challenge to competing in the marketplace. Wages accounted for approximately 45% of the Sign Shop's total expenses in 2014. In comparison, the private sign manufacturing companies in Alberta would be described as small business operations, and the industry's labour cost as a percentage of total expenses is less than 15% (2013 data). The offer of personal incentives to reward employees above their base salary for reaching production or cost savings targets are common in the private sector, but is not available within the collective bargaining agreements with the unions.

The systems and processes in place to record and recover costs are being used inconsistently. There were 258 and 164 work orders completed with zero revenues in 2013 and 2014 respectively. This represents over \$100,000 of unrecovered cost each year, which would have resulted in a favourable budget balance for the Sign Shop in both years. While this unrecovered cost is a net benefit to the internal business units who placed the order, addressing uncollected revenues through diligent recording of work and costs will be an essential step to improving the readiness of the Sign Shop.

Improvement in technology support for the specific administrative and sales processes that are required to produce accurate quotes, track work orders from start to finish, and invoicing is needed. A more detailed accounting and tracking system is necessary to provide the Sign Shop with the production trends and performance indicators that will enable them to assess their competitiveness.

Cost Competitiveness

MNP provided a pricing comparison on 12 core products (Table 5), produced with the highest quality materials ('diamond grade'). These products were selected based on annual volume produced as well as information available on comparable market prices.

Table 5 – Comparable Pricing of Top 12 Core Products and Net Savings

Product Description	Sign Shop Vendor Price	Comparable Market Price	Orders (3 years)	Customer Savings (3 years) (Sign Shop Price – Market Price)
50km/h	\$32.13	\$98.52	306	\$20,315.34
No Parking Anytime	\$10.91	\$28.42	4448	\$77,884.48
Pedestrian Crossing	\$38.88	\$103.37	1277	\$82,366.50
Keep Right	\$32.33	\$103.37	1468	\$104,286.72
Stop	\$41.39	\$89.95	1893	\$91,924.08
2 Hour Parking	\$17.25	\$39.91	1108	\$27,456.24
Sign Speed Max	\$37.00	\$98.52	242	\$15,079.02
No Parking Permit	\$14.30	\$44.91	590	\$18,059.90
Handicapped	\$13.67	\$32.16	572	\$10,576.28
Checker Board	\$67.39	\$128.63	108	\$6,613.92
Do Not Enter	\$28.26	\$90.44	256	\$15,918.08
No Left	\$32.80	\$90.44	201	\$11,585.64
Total	\$30.28	\$79.05	12,469	\$482,066.20

Note: MNP determined market price through external sources, including 310 Sign.

Based on the number of orders for each of these core products, the Sign Shop passed on savings of up to \$482,000 to its customers over the past three years. The main customer for

these products is Roads - Traffic. The sign shop vendor price only includes the base material and labour costs.

MNP advises that if the Sign Shop is able to accurately record costs and define the full product cost – including all related administrative, facility and supply costs – the next step to determining competitiveness would be to compare market prices to assess the ability to include a margin while being price competitive. Using the Sign Shop Vendor Price as a base-line product cost, the average mark-up percentage (market price to product cost ratio) for these core products is 117%. This illustrates that there may be room to appropriately increase the sign shop pricing to reflect true costs, and still offer competitive pricing on particular products.

Recommendations

MNP do believe there is a market for expansion. There are no formal restrictions or guidelines that would suggest that acting as a profit business would be inappropriate, as work is typically won via a transparent, competitive proposal process. Public sector customers would be the most likely target for external expansion of both core and non-core services, including other municipalities, districts, and First Nations.

However, expansion at this time is not recommended. Operational and cost management issues must be sufficiently addressed first.

Critical Success Factors

Cost Management and Control

- Adjust accounting and reporting system to clearly distinguish between core and non-core production, administrative expenses, and net savings to business units. System improvements will also help eliminate unrecorded work orders that lead to unrecovered costs.
- Conduct in-depth cost and pricing review for key products to determine which services should be produced, once the full cost recovery (including administrative costs) is determined.
- Measure performance, monitor change and employ information in business decisions.

Labour Relations

- Adopt new technologies or improved processes to support employee accountability by accurately recording production time and maintenance/support time.
- Develop a skills matrix that is mapped to the key products identified, to highlight potential staffing allocations or solutions that balance effective production.

Revenue Generation

- Develop a targeted market strategy for other municipalities or public sector institutions that clearly identifies the types of services available through inventory sales or custom production.

- Adopt industry best practices for client expectations, including quotations and billing procedures.

4 & 5. Equipment Utilization and New Work Order Types

These components are currently under review, as part of the feasibility study into what key products should be produced and marketed, outside of core signage support for The City. Equipment usage is anticipated to be broken down into core and non-core work hours of operation to validate the production choices, and to inform future maintenance and lifecycle replacement decisions. New work orders may be a recommended solution to meet some of the critical success factors listed above, including improved workflow management and time tracking.

SUMMARY

The Sign Shop has adopted administrative changes to better support customer service, and acquired more efficient equipment through lifecycle replacement that has reduced the production time on their core products. As a result, they have improved their manufacturing estimates even as the total production numbers have increased year over year from 2012.

The feasibility study by MNP into the expansion of sign manufacturing for other municipal districts and public sector customers was completed in 2015. The recommendation is while there is a market and capacity for the Sign Shop to develop a larger customer base with other municipalities, there are cost management concerns and financial tracking standards that must be addressed first. Recommendations will be prioritized, and implementation plans will be developed in 2016, within existing available budgets.

Gravel Crushing

SERVICE DESCRIPTION

The Spyhill Crushing Plant is part of the Manchester Asphalt Plant Operation. The crushing plant mines and crushes rock to produce gravel to supply the Manchester Asphalt Plant. Gravel products are also sold to internal and external clients. It operates six days a week with two crews during crushing season, from April to December.

In partnership with the Waste and Recycling Services business unit (WRS), the mining operation creates space for the expansion of the adjacent Spyhill landfill. Costs for common site work are shared with WRS under a Relationship Agreement.



ZBR RECOMENDATIONS

1. Implement industry standard measures for cost control of the mining, crushing and stockpiling of gravel at Spyhill.

Forecast and monitor costs and unit costs as they are incurred on a weekly basis and take corrective action if and when needed. Use the unit costs as a basis for internal cost recovery, especially for “specialty” products

TARGET: Roads should see a twenty to thirty percent improvement in efficiency or savings of \$600,000 to \$900,000 per annum via cost control within three years (by 2017).

IMPLEMENTATION

1. **Forecasting and Monitoring**

Accurate tracking and forecasting of production numbers helps the gravel crushing operations determine when to change over to producing another product in a more efficient way. Roads implemented daily record keeping, weekly tracking and monthly reporting to achieve industry standards for operations and cost control. This improved level of tracking has enabled the plant to more accurately monitor production numbers and cost trends, and to anticipate when production targets will be met so the “change over” of production can be scheduled with other maintenance activities, so to minimize down time.

One example of using this data to drive business decisions is when Waste & Recycling Services (WRS) asked the plant to produce approximately 3,000 tonnes of 20-50mm clear rock for their cell development. It was determined the quantity was too small to be cost effective, as it would have required a shutdown of operations to switch over and produce this for them. Instead another product was sourced for their use. The plant will refrain from producing low volume products in the future, such as the 20-50mm clear rock or sanding chips, and instead will look to source it from external vendors.

The wages of the supervisor were previously allocated to another operating budget. To ensure appropriate monitoring of all costs attributed to the gravel plant, the supervisor wages were transferred to the plant budget in 2015.

2. Additional Efficiencies

Process

Following the ZBR, the crushing plant looked for further efficiencies in the operations. It was decided to start labour crews earlier in the season in 2015, April instead of June, to capitalize on the available staff who worked over the winter season to complete the physical relocation of the crusher plant. In the past, these staff would have transferred to snow/ice control or street sweeping activities. This enabled the plant to schedule two shifts, increasing the weekly production hours by working six days a week, compared to four previously.

Increased annual production is not the overall goal however, due to limited space for material storage, and trucking restraints. The plant aims to produce only what is forecast for sales and asphalt production. The earlier start to operations means the plant will reach their production targets sooner, but then shift the maintenance and repair cycle earlier into the fall as well.

People

More focus was also placed on the responsibilities of the plant supervisor. They elevated the level of decision making to ensure it would be based on targets and overall operations, including the planning of all production change-overs and maintenance decisions, where that had been left to the crew foreman before. The supervisor is working more closely with the crews to keep them updated on the operational goals and targets, and to improve their investment in the work they do.

Equipment

Equipment upgrades have been completed, following the ZBR. A new screendeck, feeder, stacker and control tower have since been purchased as part of Roads asset lifecycle management. This will result in longer-term productivity gains by producing a higher quality product more efficiently, and reducing the frequency of downtime due to repairs. Roads also developed an initiative to recycle concrete from curb and gutters and sidewalk demolition. A private contractor was first brought in to do this recycling work; however the resulting material was then retained by the contractor. Roads saw the opportunity to purchase a crusher/impactor to recycle their own concrete, which is then used as granular base course in the concrete rehabilitation of our curbs and gutters and sidewalks.

PERFORMANCE MEASURES

Cost per tonne of material (aggregate) was the primary measure used by the ZBR consultants. The recommended cost control strategies were brought into practice for 2014, and the plant saw an 11% reduction in costs per tonne by the end of the year, compared to 2012. In 2015, the efficiency gains are expected to be similar to the final 2014 numbers (Table 6).

Table 6 – Aggregate Production comparisons for 2012-2015

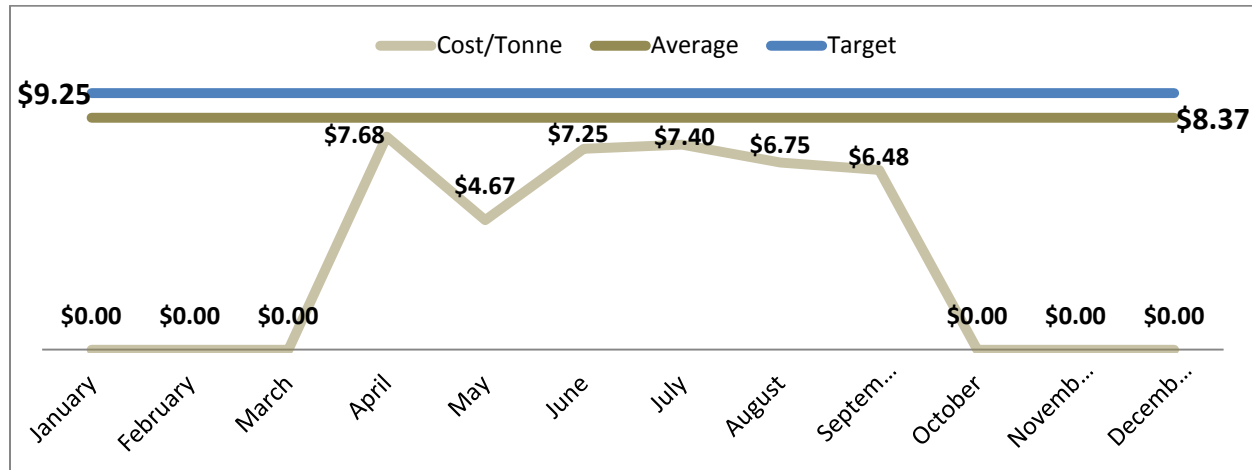
Year	RD-Aggregate Production (22940)	RS-Site Expenses (224930)	Total Expenses	Production (tonnes)	Cost/tonne
2012	\$2,851,213	\$578,881	\$3,430,095	327,000	\$10.49
2013	\$3,025,436	\$680,322	\$3,705,759	308,515	\$12.01
2014	\$2,790,627	\$192,870	\$2,983,497	320,599	\$9.31
2015 YTD (Sept 30)	\$2,416,302	\$88,375	\$2,504,677	299,189	\$8.37
2015 Target			\$3,200,000	344,000	\$9.30

The 2013 costs per tonne were much higher than in past years, as regular production was stopped in order to produce specific materials in response to the infrastructure damage due to the 2013 flood. Therefore, this data was not used as a comparison against the 2014-2015 costs, as they are considered extraordinary.

The cost per tonne reductions in 2014 would equate to a savings of \$378,306 compared to the 2012 costs of \$10.49/tonne. A similar cost comparison using the 2015 predicted year end values of would register a savings of \$409,360 if total production at year end were to equal the 2015 target estimate.

The monthly cost tracking for 2015 (Figure 8) highlights the continued improvement of the gravel plant operations against the forecast cost per tonne values for 2015.

Figure 8 – Monthly Cost Tracking for Gravel Production 2015



Note: Cost tracking numbers through end of September 2015

In 2015, the Plant has forecast an increase in total production, over the annual average of 325,000 tonnes. This is partly due to an unexpected increase in the sale of aggregates in 2014. This resulted in having a lower starting inventory in 2015, and production needed to catch up on the forecasted volumes for operations, and to have a sustainable inventory over the winter.

Production targets were purposely lower over the last couple of years to reduce inventory at Spyhill to make re-location easier of the crusher operation easier. All of the stockpiled material needed to be relocated elsewhere before May 2015 for WRS to start cell development.

The Relationship with Waste & Recycling Services (WRS)

The joint operation between the Spyhill Crushing Plant and WRS is a win-win partnership for The City. Roads creates the air space by mining gravel in accordance with WRS landfill design grades, and then uses the material for asphalt production and for road sanding operations during the winter season. WRS uses the expanded space for their landfill operations, which will eventually be reclaimed for future parks and open space. This joint operation meets or exceeds regulatory compliance requirements, including the ISO 14001 standards, and upholds The City's environmental policy. The shared space at Spyhill also produces energy, infrastructure and maintenance savings for both WRS and Roads, compared to operating separate sites.

The aim of mining gravel to create a landfill does not usually align with the financial goals of private gravel operations who typically want to maximize extraction of gravels (as deep as possible), in as small of a surface area to minimize development and reclamation costs. Roads invited private gravel operators to discuss the type and scope of work required for the Spyhill joint development and only one contractor expressed interest in undertaking this work however the timelines did not match and it was not pursued further.

The Crushing Plant also partners with WRS on ways to incorporate recycled glass into gravel and asphalt products. The crushed glass comes from bottles collected through the Blue Box program. As much as 7,700 tonnes of recycled glass was blended into road base gravel and used for the new scale house projects at both the East Calgary and Spyhill landfills. Glass has also been added to asphalt mix, and used to pave an access road to one of The City's material distribution centres. The use of this recycled glass helped to reduce the overall material costs of these projects.

Future Risks to Productivity Gain Targets in Action Plan 2015-2018

WRS Cell Development near the landfill is limiting the space to stockpile aggregates and operate in an efficient way. This will result in the relocation of some existing stockpiles, adding an extra cost for double handling and production downtime. The plant will try to mitigate this by working closely with WRS and schedule activities that work for both parties.

Roads will also need to move the crusher location again in a few years to the west to stay ahead of the WRS operations. Expansion of the landfill is tentatively scheduled for 2017-2018. The last relocation occurred in 2005. The work would be scheduled during the winter so production would not be affected, but it will add extra costs from the operating budget for labour, equipment, and new power line connections.

SUMMARY

The implementation of performance monitoring and forecasting strategies, as well as the lifecycle replacement of equipment, has resulted in efficiency gains at the gravel crushing plant. As a result, there has been an 11% reduction in the estimated 2015 cost per tonnage compared to 2012, which equates to a comparative savings of approximately \$409,000. While these numbers are approaching the ZBR targets for 2017, there are additional costs associated with the future expansion of land at the WRS landfill that will need to be managed within existing operating budgets.

Pavement Rehabilitation

SERVICE DESCRIPTION

The Paving division ensures that the public is provided with safe and comfortable driving conditions through the timely and cost effective construction and rehabilitation of the roadway network. Paving operations is one of the most expensive and complex operations to run in a limited time frame due to Canadian weather patterns. The peak season for road paving is July to mid-October.

Planning paving locations is undertaken well before the paving season commences. Locations are looked at for estimated size, tonnages, schools, valves, manhole counts, transit, EMS and Fire, trucking routes, distances from the plant and road base issues. Work then commences to ensure the proper mix designs are provided per location based on traffic volumes, truck routes, and bus routes. Tier 2 (road base repairs) locations are completed by Contract Services prior to the commencement of paving.



ZBR RECOMMENDATION

1. Implement industry standard measures for cost control

Productivity Target: Implement industry standards to reduce cost of maintaining standard of city roads by \$800,000 to \$1.0 million within three years (2017).

IMPLEMENTATION

Planning and Scheduling

The paving division has coordinated with the asphalt plant to streamline trucking and start times. Start times for hired trucks are separated based on the output of the plant. When loading out of the asphalt silo, 10 -12 trucks are now loading at 6:00 AM in order to get the first 144 tonnes of material on the road. A second set of trucks will load at 6:30 AM. Based on the travel times to

the location of the paving equipment, the trucks will have time enough to return before 8:00 AM when the plant needs to shutdown and switch over to another product type (J Mix) for the Roads maintenance division. This shutdown takes about an hour to complete before the plant can start loading the paving trucks again. This scheduling change allows for 1.5 to 2 rounds of loading, where before only one loading cycle could be completed.

The scheduling of relief breaks for the paving crews was examined, and changes were made to stagger the break times to ensure the production at the asphalt plant does not shutdown due to periods of inactivity. This prevents the restarting of the plant which can result in a loss of an hour out of productivity. The plant can also prepare to refill the silo's to get back to full production.

Shift times for the paving crews were also adjusted this year in the late September in order to maximize the amount of work completed during day light hours. As the days get shorter, staff start times were adjusted by 30 minutes beginning Sept 21, from 6:00 AM to 6:30 AM. The start times will be further adjusted the following week to 7:00 AM to compensate for the average 3 min loss of light per day. These changes may improve quality of the paving work, and still allows for adequate time for staff to check out and warm up equipment prior to the first asphalt truck arriving.

Once work commences for the paving season, crews confirm mix designs and projected tonnages per location. Trucking is also adjusted based on distance from the plant and traffic conditions to optimize a fleet usage to haul to the paving locations. Additional hired trucks may be brought in based on distance, plant output and job complexities. These adjustments are done on a daily to weekly basis.

Equipment

Fleet and equipment lifecycle needs for the Paving division were reviewed following the ZBR recommendations. Inquiries were made to private industry partners about their common practice regarding fleet replacement. Generally, they replace their purchased or leased vehicles once the warranty approaches the expiration date to minimize the costs of ongoing maintenance and loss of productivity. Following the lifecycle review, plans to replace the aging fleet were begun, and by the start of 2015, the majority of the old fleet had been replaced. As expected, this change reduced downtime and the maintenance costs of the fleet. The total cost savings from the reduction in required vehicle maintenance compared to 2012 was approximately \$556,000.

Staff Training

In 2012 paving crews were placed together to support training due to erosion of skilled paving staff due to retirement, promotion, and departure. The lack of skills had made it difficult to staff two paving crews that could produce quality pavement. This situation had become critical for the completion of major roadways which has been mainly staffed with inexperienced employees.

In 2012, a change was made to deal with this situation by assigning all employees to work in one larger crew to ensure availability of a full contingency of experienced operators and provision for cross training opportunities. It takes 12 weeks to train up a paving crew to produce pavement to average quality. Higher skill sets are needed for paving on major roadways to produce the smoothness needed for higher driving speeds.

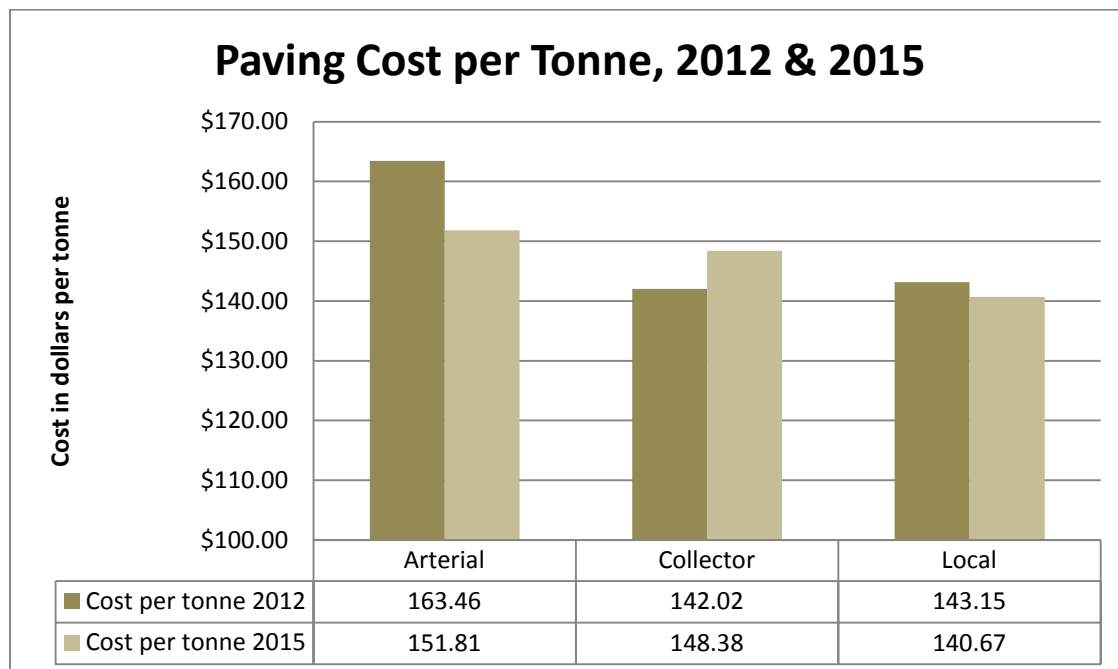
The changes to staff training and development that begun in 2012 has resulted in higher productivity, better quality, improved smoothness and projects completed with little disruption to residents and businesses in 2015.

These combination of the improvements to planning and scheduling, equipment and training has contributed to an increase in the daily production averages (laying of asphalt) of the crews (Figure 9). In 2012, from July to September, the average production was 1,150 tonnes per day. In 2015, that number improved to 1,350 tonnes per day (July to August 10), and the program has a goal of reaching 1500 tonnes per day in the future.

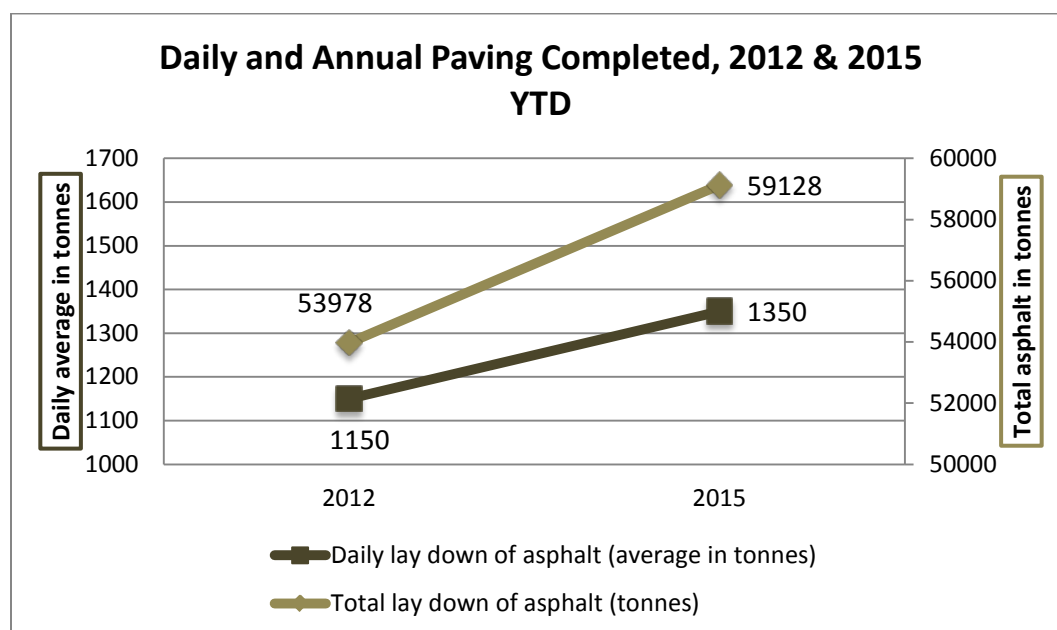
PERFORMANCE MEASURES

Compared to the 2012 baselines number in the ZBR, the Pavement Rehabilitation program has managed to maintain a similar annual cost per tonne of paving by implementing changes that increased the productivity of the paving crews, which has helped to offset the increases in asphalt, equipment and labour costs over the same time period. Data is presented in Figure 9 and 10, and Table 7.

Figure 9 – Comparison of Cost per Tonne of Paving for 2012 & 2015



Note. 2015 values are based on year to date numbers (to end of August 2015).

Figure 10 – Daily and Annual Paving Completion (in tonnes) for 2012 & 2015

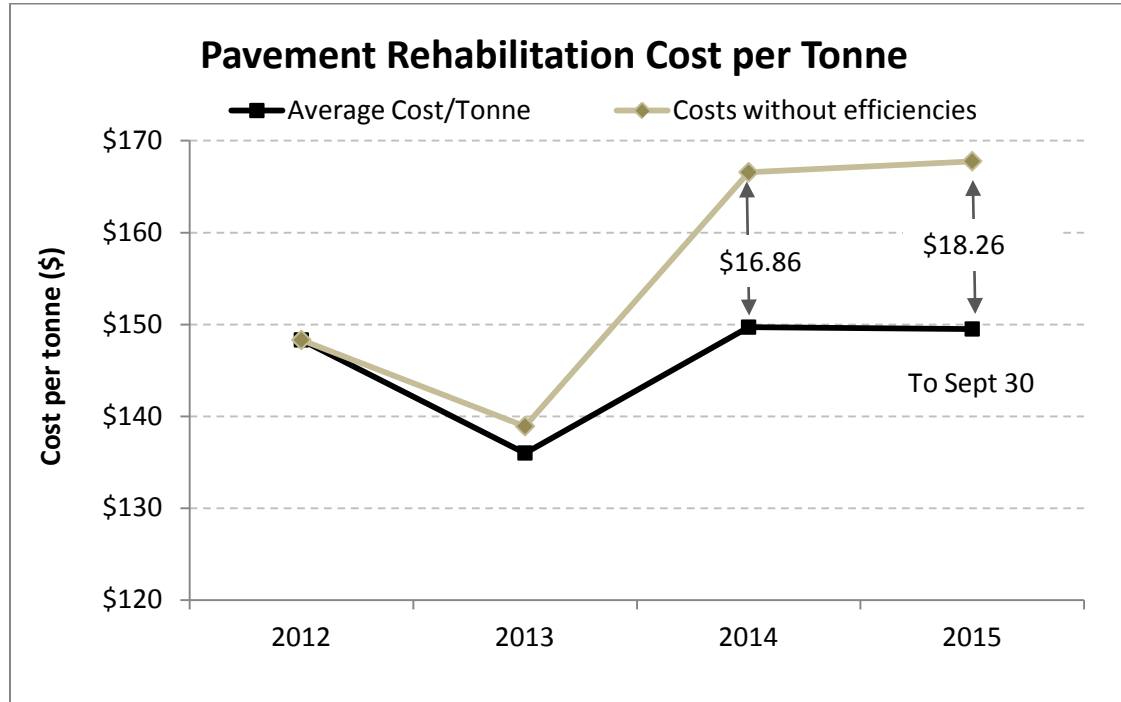
Note. Compares tonnage laid down between July 1–September 15 for both 2012 & 2015.

The cost per tonne for asphalt has increased significantly since 2012, and makes up approximately 75% of the total operating costs of the program (Table 7). Labour costs also increased by 8.5% since 2012, due to negotiated union agreements.

Table 7 – Cost of Asphalt per Tonne, 2012-2015

Cost of Asphalt per Tonne by Year			
2012	2013	2014	2015
\$96.33	\$99.25	\$113.19	\$114.59

The efficiencies gained through increased production, scheduling and equipment have offset the rising input costs of asphalt and labour. Based on the tonnes of asphalt to be laid down in 2015, this equates to a savings of approximately \$1.5 million when compared to the estimated cost per tonne if paving operations had remained the same as they were in 2012 (Figure 11).

Figure 11 – Difference in Paving Costs per Tonne, With and Without Efficiencies**Table 8 – Summary of Cost Analysis of Paving, 2012-2015**

Summary of Cost Analysis of Paving - 2012					
	ART	COL	LOC	Avg -2012	Total in Season 2012
Cost/ton	\$163.46	\$142.02	\$143.15	\$148.31	
Cost/SQ M	\$24.32	\$18.28	\$21.86	\$21.20	
Total Cost	\$3,179,497	\$3,324,288	\$4,087,307		\$10,591,092
Total Tonnes	19,451	23,408	28,552		71,411
Total Area	130,744	181,831	186,986		499,561

Summary of Cost Analysis of Paving - 2013					
	ART	COL	LOC	Avg -2013	Total in Season 2013
Cost/ton	\$131.5	\$141.3	\$135.0	\$136.0	
Cost/SQ M	\$24.9	\$21.2	\$19.8	\$22.2	
Total Cost	\$4,862,875	\$4,810,107	\$2,442,204		\$12,115,186
Total Tonnes	36,971	34,042	18,084		89,096
Total Area	195,592	226,369	123,501		545,462

Summary of Cost Analysis of Paving - 2014					
	ART	COL	LOC	Avg -2014	Total in Season 2014
Cost/ton	\$153.1	\$146.3	\$148.9	\$149.7	
Cost/SQ M	\$24.8	\$22.2	\$22.1	\$23.2	
Total Cost	\$3,769,942	\$2,950,935	\$2,456,453		\$9,177,329
Total Tonnes	24,632	20,167	16,497		61,295
Total Area	151,778	132,762	111,094		395,634

Summary of Cost Analysis of Paving – 2015 YTD (August)					
	ART	COL	LOC	Avg -2015	Total in Season 2015 YTD
Cost/ton				\$146.00	
Cost/SQ M				\$21.64	
Total Cost	\$1,726,221	\$2,794,143	\$1,467,578		\$5,987,942
Total Tonnes	10,522	19,238	10,737		40,738
Total Area	79,340	125,623	72,953		277,916

SUMMARY

The Paving program has increased the average daily production by 200 tonnes per day compared to 2012. This productivity gain has contributed to the overall efficiency gains that allowed the program to maintain a similar cost per tonne ratio to 2012, despite increases in the costs of asphalt and labour over the past three years. These associated gains, based on the tonnage of asphalt to be laid down in 2015, equals a savings of approximately \$1.5 million.

The strategic replacement of older paving equipment, as per industry standards, has also resulted in a reduction of \$556,000 in fleet maintenance costs for 2015 compared to 2012.

Traffic Management Centre

SERVICE DESCRIPTION

The Traffic Management Centre (TMC) is a 24/7 operations center and is responsible for keeping Calgarians on the move. The TMC achieves this by providing the following services:

1. Dispatch: This station handles service requests that need immediate attention. This includes dispatching city staff to attend to signals going on flash, clearing hazards on roads, securing roadway incidents, netc.
2. Traveller Information. This station collects incident and roadway closure information from different sources and posts it on Calgary.ca, 106.5 FM and City's Twitter page.
3. Traffic Monitoring and Management: This station monitors the city's roadway network including the Airport Trail Tunnel. Technologies such as lane reversals, remotely changing traffic signals, and dynamic message boards are used to manage congestion caused by incidents or events.



ZBR RECOMENDATIONS

Administration identified three areas for ongoing improvement in the TMC.

1. Business continuity and operational efficiency by the streamlining and documenting of sustainable processes and procedures.
2. Continued focus on strengthening relationships and looking for synergies with partners.
3. The use of new technology within the Traffic Management Centre to improve the quality of information, carry out tasks remotely, enhance our ability to respond pro-actively and provide reliable traveller information.

IMPLEMENTATION

1. Business Continuity

Emergency back-up centres have been established at the Roads' Spring Gardens depot and at The City's Emergency Operations Centre, which is managed by the Calgary Emergency Management Agency (CEMA). The computer servers have been replaced and upgraded to support these initiatives.

Supervisory coverage at the TMC has been expanded to 24 hours/7 days a week to make decisions, provide guidance to the staff during incidents, and to address business and operational continuity needs. The supporting documentation has also been completed, including the CEMA impact assessment score card for Roads, the emergency response plan for the TMC, and the business continuity processes report.

Work is currently underway in upgrading the current TMC into a 'next generation' traffic centre. The current TMC is reaching capacity due to older technology and limited space. The Next Generation TMC would upgrade monitoring and detection systems, expand the ability to remotely communicate with traffic signals and variable message boards, and support the delivery of customer-focused services through more responsive operations. This initiative was approved through the Action Plan 2015-2018 budget discussions.

2. Strengthening Relationships

The TMC partners with many agencies such as the Alberta Motor Association, Alberta Transportation, The University of Calgary, and internal partners including the Calgary Police Service, Calgary Transit and the Calgary Emergency Management Agency. Some of the projects that the TMC has collaborated on since the ZBR report include:

- CEMA: Trained in using the Common Operating Picture mapping software. This software will help us transfer information in real-time during EOC activation.
- Added Transit to the TMC's Minor and Major Event Notification distribution list.
- Developed and implemented an emergency response process to handle ENMAX emergencies like rolling backouts.

- Assisted CPA with the installation of the Travel Time project in parkades.
- Support incident and emergency management services along Deerfoot Trail and Stoney Trail. Implement, operate and maintain cameras and variable message boards as part of a contract with Alberta Transportation.
- Alberta 511 portal was integrated into TMC.
- Integrated camera images along Deerfoot Trail and Stoney Trail into 511 systems.
- Continue to streamline communication with Water Services during emergency water main breaks.
- Partnering with University of Calgary Transportation Lab to provide them with live camera feeds and other TMC systems to assist research students.

3. Enhancements to Technology

Technology is the lifeblood of the Traffic Management Centre. Remote access to cameras, signals and message boards provides timely solutions to manage congestion and notify travellers to use alternate routes.

Completed

- Implemented an Automatic Traffic Incident Detection system for the Airport Trail Tunnel.
- Using Twitter to report incidents in addition to The City's website and the Traffic Radio station 106.5FM.
- Posted real-time Traveller information from Crowchild Trail, Glenmore Trail and Deerfoot Trail on Calgary.ca.
- Acquired 40 more portable Dynamic Message Sign (DMS) boards equipped with GPS and remotely upload messages to the public when needed.
- Developed pan-tilt-zoom camera (PTZ) master plan which shows location of future cameras that will provide 90% coverage of Calgary major roads. This increases the TMC's ability to detect, verify and monitor incidents.
- Installation of a new DMS on Macleod Trail, just north of 25 Avenue SE.

In Progress

- Operating the new 5th Avenue SW lane reversal during the evening rush hour
- Collaborating with Public Safety Communications (PSC) to improve transfer of incident information.
- Add 10 new PTZ cameras.
- Advance Travel & Emergency Management System project: Display real-time parking information, lane closure and incident notification at key locations on overhead DMS boards within the downtown.
- As part of a contract with Alberta Transportation, replacing DMS board across Deerfoot Trail north of Peigan Trail for SB traffic and south of Calf Robe Bridge for NB traffic.
- As part of a contract with Alberta Transportation, installing three PTZ cameras along Stoney Trail at Crowchild Trail, McKnight Boulevard and Sarcee Trail.
- As part of a pilot program, installing 30 cell phone modems at key intersection to provide the TMC the ability to remotely upload signal timings and monitor signal performance.
- Incorporate incident notification and travel time information provided by a 3rd party

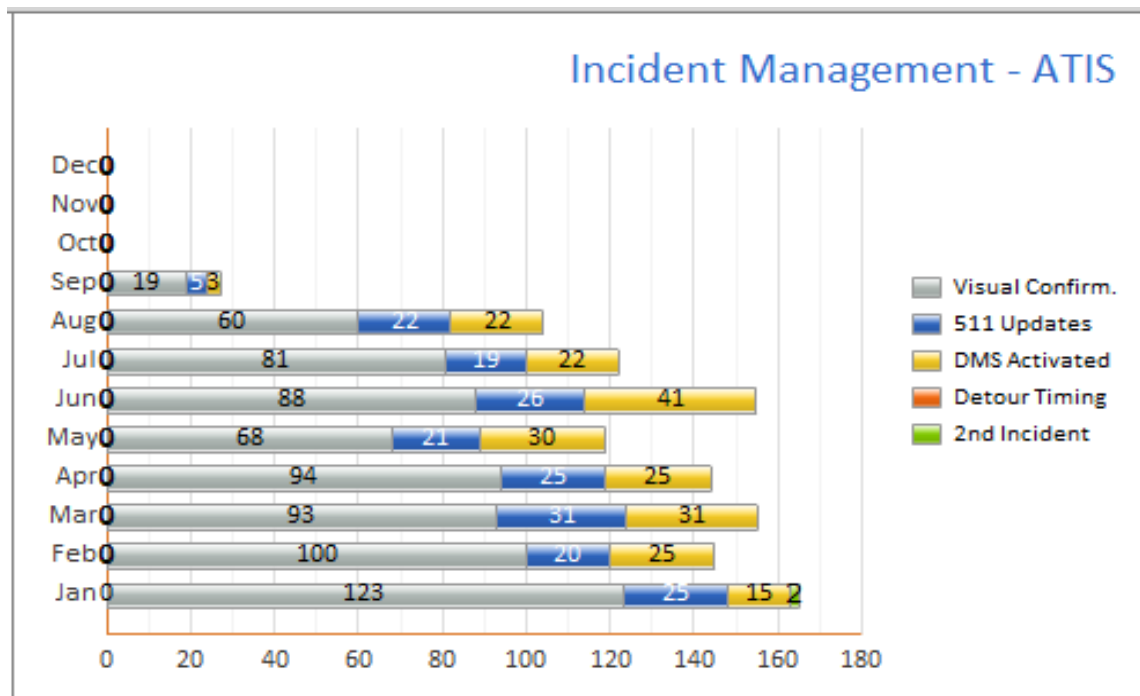
Future Planning

- Incorporate technology into the TMC that is compatible with connected & autonomous vehicle technology.
- Investigate the use of drones to monitor incidents.

PERFORMANCE MEASURES

As the initiatives are implemented, the TMC will operate more efficiently and effectively with clear protocols on working with other partners, and more technology to depend on. The figure below (Figure 12) shows how the TMC works to improve customer service through improving communication about traffic incidents. The TMC will visually confirm traffic incidents with the camera network, and based on the scale of the incident, determine additional actions to notify the travellers in the area about possible delays or to use alternative routes.

Figure 12 – Incident Management (YTD, January – September, 2015)



Note. 511 Updates refers to the Alberta Transportation road reports and notifications

The Roads Annual Survey, prepared by HarGroup Management Consultants Inc., asks citizens about their satisfaction with Roads Communications. The performance of the TMC is linked to these measures, and the citizen satisfaction results in 2015 remain high – **89%** satisfaction.

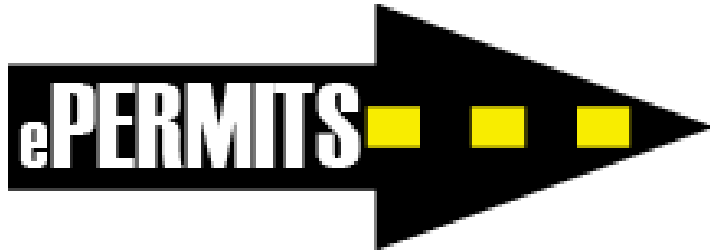
SUMMARY

The TMC has implemented operational improvements as suggested by Administration as part of the ZBR, and will continue to explore new technology and partnership opportunities as the work progresses on the next generation TMC.

Permission Services for Road Excavations

SERVICE DESCRIPTION

The Roads Excavation Permit Office is responsible for issuing and invoicing permits to City-indemnified contractors for all excavation work in the city's road right-of-way.



ZBR RECOMENDATIONS

Administration set a goal to have all permit requests done through electronic permits by the end of 2015. The excavation permit office will continue to evolve with e-Permits to improve the overall permit process and ensure Roads recovers its cost to administering permits.

IMPLEMENTATION

The excavation permit process has traditionally relied on paper permits being distributed to customers, returned to Roads, and circulated amongst Roads staff for review and update. This reliance on paper permits required that most customers visit the Excavation Permit Office in person in order to pick up any approved permits, or drop off completed permits. Requests for new permits have traditionally been taken either in person, by phone, or by email. Roads determined that gains in efficiency and productivity would occur by phasing out the paper permits and having customers use a single application system for the permission needs.

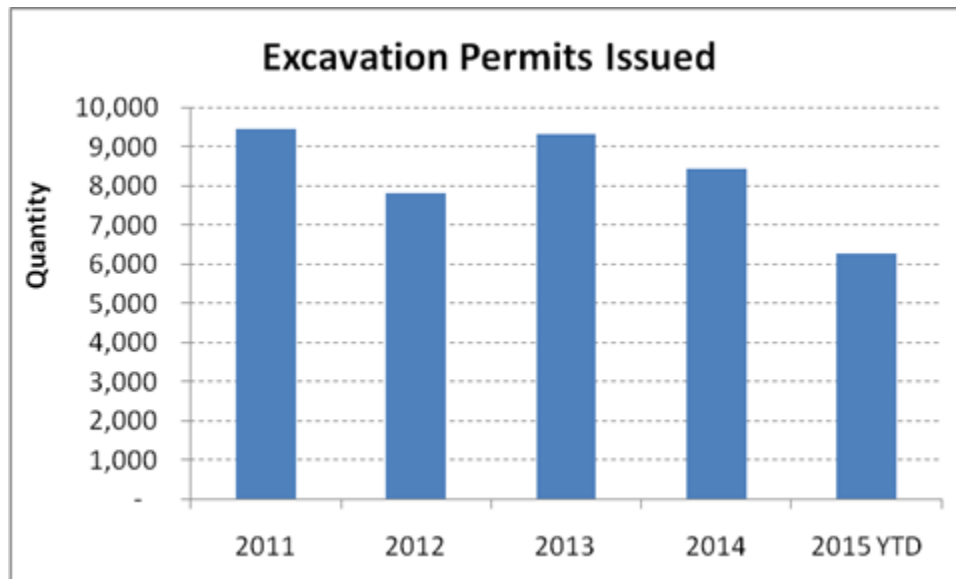
In 2012, Roads started development of an electronic, web-based permitting system called ePermits. This system facilitates requests for new excavation permits, as well as permit returns, removing the need for customers to spend time at the Roads Excavation Permit Office. In 2013, Roads introduced e-permits online with reduced rates as an incentive to use ePermits. To the end of August 2015, approximately 33% of excavation permits are being requested through ePermits, while two thirds are still requested by another method.

The Roads ZBR target is to have all excavation permits, for both internal and external customers being handled through ePermits by the end of 2015. This requirement has been communicated to all excavation permit customers. A number of workshops were held for excavation permit customers to demonstrate the system, and a training video for using ePermits has been available online since October of 2014. Reminder notices will be sent out in October 2015 to all excavation permit customers about the requirement to use ePermits by the start of 2016. Further information sessions would be made available if requests are made.

Roads have also been working on system enhancements to improve system integrations, and expand the functionality of ePermits to improve the external and internal customer experience. These include support for multiple logins from a single customer, and billing to different customer divisions. For internal customers this would include internal account coding structure for transfer of funds between departments and invoice creation. Water Services initiates 30% to 40% of all excavation permit requests annually, so a simpler solution would be beneficial to this customer. The timeframe for an invoice solution to be created is the end of Q3 2016.

NUMBERS

Figure 13 – Excavation Permits Issued 2012 - 2015



Note: 2015 YTD is to end of September.

SUMMARY

Permission services are on track to meet the goal of having all excavation permit requests by customers done through the Roads ePermits system by year end. This decision will improve the efficiency of the permit process by removing multiple points of contact that can affect the accuracy and timing of the response to customers.

Spring Clean-up Program

SERVICE DESCRIPTION

Roads Spring Clean-up is an annual street cleaning program that removes sanding materials and debris that has accumulated on roads and along major sidewalks and boulevards during the winter months. This road maintenance helps make our roads safer, reduces the run-off of silt and debris into the storm water system, and improves the appearance of city roads.



ZBR RECOMENDATIONS

Administration determined that Roads, Fleet and Water Services will examine potential improvements to the Roads Spring Clean-up processes that could reduce the environmental impact and operational costs of cleaning up sand and gravel from the storm water system.

IMPLEMENTATION

In the 2015 Spring Clean-Up Plan, Roads identified locations to sweep first in order to reduce the amount of deleterious materials that would enter the storm sewer system. With the mild weather experienced in the Spring of 2015, Roads Maintenance was able to undertake an extensive pre-sweep operation that allow a significant amount of the winter snow and ice control materials to be removed from all the roadway surfaces. Roads picked up 61,449 tonnes of debris in 2015, compared to 40,927 tonnes in 2014, which is an increase of approximately 50%. The Spring Clean-up Program (SCU) was completed two weeks ahead of schedule. The cost of the 2015 clean-up was 33% less than the previous year, equalling \$130.60 per tonne of debris in 2015 compared to \$174.28 per tonne in 2014.

Collaboration between Roads and Water Services has resulted in tests scheduled for 2016 to develop more environmentally friendly street sweeping methods. The project will include research into new equipment to improve debris removal; an investigation of the recycling of sweepings, and the development of success measures to evaluate the operational and environmental results of the sweeping program.

Water Resources will provide a list of highest priority locations for street sweeping which will be added to the pre-sweeping program. Should weather impact the progress of pre-sweeping (i.e. sweeping in advance of the SCU program), then these locations will be a high priority as Roads enters the community/area as part of the SCU program plan. The list of high priority locations will be provided to Roads no later than December 1 annually for inclusion in the following years pre-sweep and SCU program.

Should Water Resources wish to pursue enhanced fine debris removal from roadways and/or multiple street sweepings/year in high priority areas, this would require the purchase/lease of additional equipment, staff training and/or an increase in head count. Additional funding sources would be required.

One equipment type under consideration is a regenerative air sweeper, which picks up smaller debris by means of a vacuum and pressurized air to blow the material off the surface. An industry check completed by Roads resulted in no regenerative air sweepers being available for immediate purchase, lease or on a contracted service basis in the Calgary area. Mechanical sweepers are the industry standard. The purchase or lease lead time for a new street sweeper is 1 year from order date since street sweepers are a specialised piece of equipment which are not an "on the lot" item. The 2017 RFP for street sweepers will include the option to purchase or lease regenerative air sweepers.

Other areas which may be considered to reduce fine material include, but are not limited to, the purchase of a more robust (larger) aggregate which does not break down as quickly, screen out all fine material in the aggregate before blending the salt pickle mix. They will also investigate alternate SNIC products such as brines that could further reduce aggregate usage on certain key SNIC routes. All options would likely involve an increase to the Maintenance operating budget, however some may be cost effective should these operational and/or engineering controls increase the life expectancy of the storm water retention ponds throughout the city.

SUMMARY

The 2015 Spring Clean-up Program, with the addition of pre-sweeping operations, resulted in the removal of 50% more material from the road before it could reach the storm water system, reducing effort and costs on behalf of Water Services. Collaboration between Roads and Water Services has resulted in tests scheduled for 2016 to develop more environmentally friendly and cost effective street sweeping methods.