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Performance Audit of Road  
Infrastructure Maintenance Processes

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March 29, 2019

FINAL REPORT

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## **SUMMARY**

### **OBJECTIVES**

To assess the extent of regard for value for money within the non-winter maintenance program for road infrastructure.

### **BACKGROUND**

The Linear Infrastructure Services Division of the Growth and Infrastructure Department is responsible for maintenance of road infrastructure which includes arterial, collector and local roads, bridges, culverts, sidewalks, traffic and street lights. The Infrastructure Capital Planning Division manages capital expenditures for road infrastructure, water and waste water, drainage and other infrastructure within the Department.

In 2018, the Linear Infrastructure Division employed 135 full time positions and 11,830 part time hours to deliver non-winter maintenance programs. The approved operating budget for these programs was \$ 15.7 million and approved capital budget was \$76.5 million in 2018.

### **SCOPE**

Non-winter maintenance processes on road infrastructure between 2016 and 2018.

### **REPORT HIGHLIGHTS**

Management has taken a number of important steps in recent years to identify, assess and mitigate significant risks while maintaining the City's road infrastructure. Notwithstanding, this audit indicated that capital spending on the existing road infrastructure must be bolstered to stem the continual deterioration of this infrastructure; to ensure compliance with legislation and regulations, to achieve sustainable service level targets and to manage risks more effectively. Opportunities were also identified to improve value-for-money within municipal operations.

### **AUDIT STANDARDS**

We conducted our audit in accordance with Generally Accepted Government Auditing Standards which require that we adequately plan audits; properly supervise staff; obtain sufficient, appropriate evidence to provide a reasonable basis for audit findings and conclusions; and document audits.

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**OBSERVATIONS AND ACTION PLANS:**

**A. ROADS**

**1. Capital and Operating Budgets:**

Since 2002, the amount of spending on the renewal of the City’s roads has been increasing gradually; however, as shown in Figure 1 on the next page, the increases have been insufficient to prevent the ongoing deterioration of some of the City’s roads. This trend has caused increased levels of complaints about the City’s roads and declining levels of citizen satisfaction.

**Table 1– Budget Analysis (Millions)**

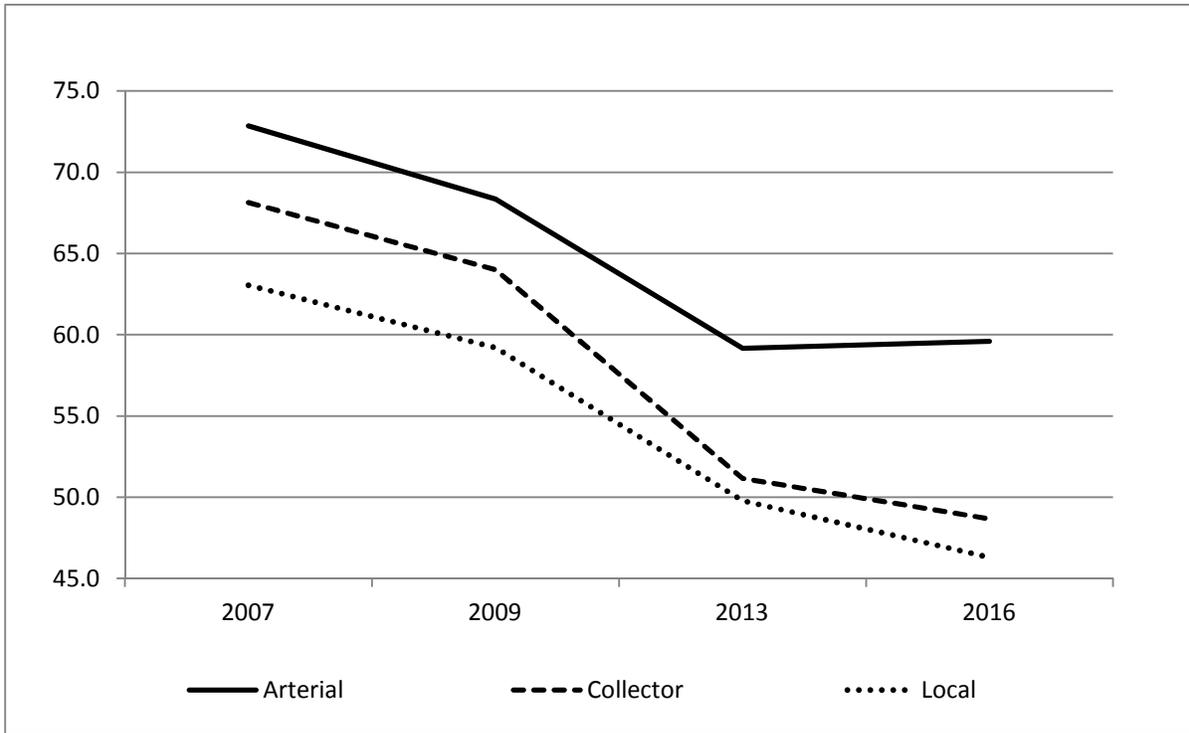
Year	CAPITAL BUDGET			OPERATING <sup>1</sup>			TOTAL BUDGET
	Expansion & Renewal	Renewals <sup>2</sup>	TOTAL	Non-Winter	Winter	TOTAL	
2002	8.7	3.1	11.8	6.8	11.1	17.9	29.7
2003	2.7	5.4	8.1	6.5	9.9	16.4	24.5
2004	2.1	9.3	11.4	7.4	10.4	17.8	29.2
2005	4.1	2.0	6.1	8.3	8.8	17.1	23.2
2006	14.0	3.9	17.9	8.1	10.1	18.2	36.1
2007	14.7	8.0	22.7	11.4	13.9	25.3	48.0
2008	11.2	7.1	18.3	13.0	14.4	27.4	45.7
2009	7.4	11.4	18.8	13.8	14.7	28.5	47.3
2010	9.2	49.8	59.0	14.0	15.1	29.1	88.1
2011	4.6	14.6	19.2	13.6	15.2	28.8	48.0
2012	11.9	12.0	23.9	13.8	15.2	29.0	52.9
2013	10.6	15.2	25.8	14.7	15.0	29.7	55.5
2014	10.4	18.2	28.6	14.9	15.9	30.8	59.4
2015	8.9	17.8	26.7	15.1	16.4	31.5	58.2
2016	8.6	18.3	26.9	15.2	16.6	31.8	58.7
2017	84.5	21.6	106.1	15.5	17.0	32.5	138.6
2018	38.4	38.1	76.5	15.7	17.6	33.3	109.8
2019	9.2	20.4 <sup>3</sup>	29.6	16.2	18.7	34.9	64.5
<b>Total</b>	<b>261.2</b>	<b>276.2</b>	<b>537.4</b>	<b>224.0</b>	<b>256.0</b>	<b>480.0</b>	<b>1017.4</b>
<b>Avg.</b>	<b>14.5</b>	<b>15.3</b>	<b>29.8</b>	<b>12.5</b>	<b>14.2</b>	<b>26.7</b>	<b>56.5</b>
<b>Percent</b>	<b>26%</b>	<b>27%</b>	<b>53%</b>	<b>22%</b>	<b>25%</b>	<b>47%</b>	<b>100%</b>

<sup>1</sup> Excludes operating budget of Infrastructure Capital Planning Division

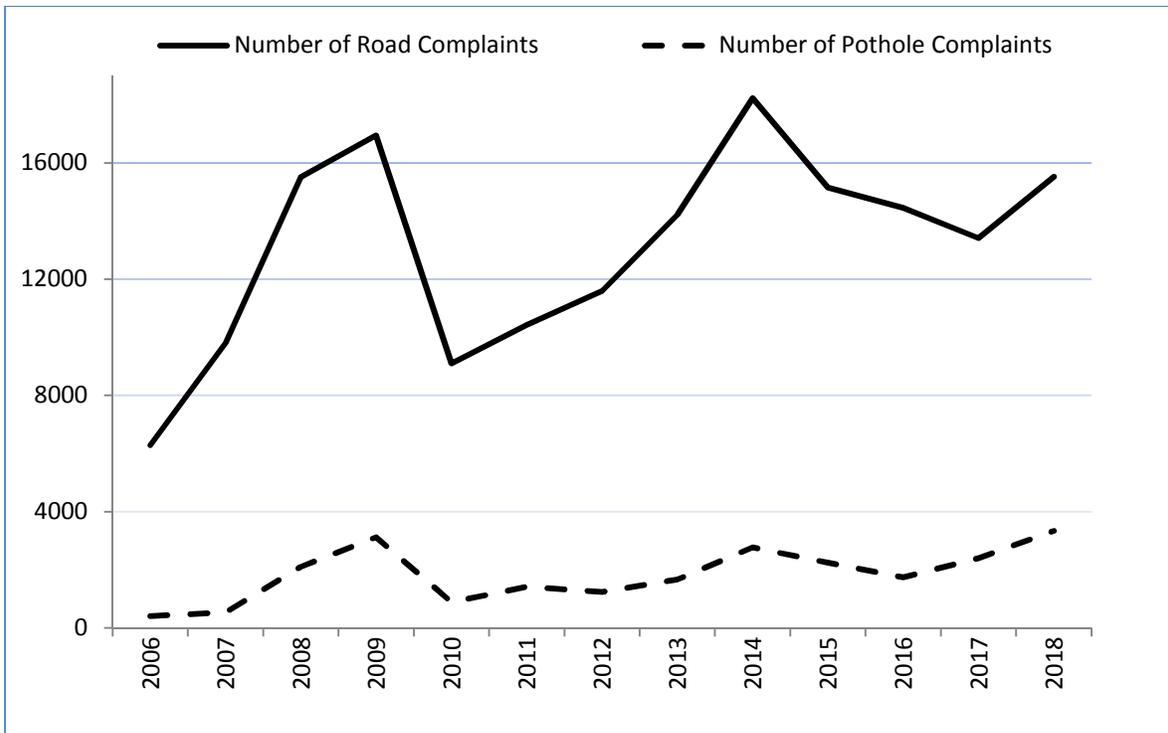
<sup>2</sup> Includes reconstruction, resurfacing, surface treatment, large asphalt patches

<sup>3</sup> In addition to the \$20.4 million, Finance Committee approved \$9.8 Million of additional spending for road maintenance at its March 26, 2019 meeting.

**Figure 1: Pavement Condition Index**



**Figure 2 – Road and Pothole Complaints**



**Figure 3: Figure 3: Citizen Perceptions about Roads**

Rank/Importance of Services	Importance of Services <sup>4</sup>		Top issues affecting CGS <sup>5</sup>	
	2004	2009	2016	2018
Top ranked	94%	92%	-	-
	-	-	70%	78%

**Recommendations:**

Work with asset management and finance staff to identify sustainable levels of service for each category of road and identify funding requirements to manage relevant risks and ensure compliance with relevant legislation.

**Management Response and Action Plan**

*Two financial plans have previously been presented to council. These include the KPMG report “Financial Planning for Roads, Structures and Related Infrastructure” dated July 10, 2012 and the KPMG report “Municipal Asset Management Plan” dated November 28, 2016. Infrastructure Capital Planning and Linear Infrastructure Services staff will work with Asset Management and Finance staff to update the Roads Financial Plan (and other asset categories as required) to identify levels of sustainable funding and manage risk.*

**2. PAVEMENT CONDITION INDEX (PCI) AND OVERALL CONDITION INDEX (OCI):**

Pavement Condition Index (PCI) is used within the industry to measure the physical attributes of roads for roughness, rutting, structural and non-structural conditions. The PCI ranges from a best road condition of ‘100’ to 0 for a worst-case road. In response to input from former Councils, staff has been prioritizing road renewal projects using an Overall Condition Index (OCI) which directs funding toward roads before they experience significant and rapid deterioration.

The OCI is determined by the pavement condition index, safety considerations, timing of water and waste water infrastructure projects, economic development initiatives and extent of road congestion. This approach attempts to maximize the City’s return on investment on road renewal projects by extending the useful lives of roads which are in average condition. The City also employs crack sealing programs to extend the useful lives of roads.

<sup>4</sup> How citizens value the services that they receive – based on citizen rating (Percentage based on not at all important to very important)

<sup>5</sup> Issues/Perception of sample of 1200 resident’s top three issues affecting Greater Sudbury in 2018 – Citizen Satisfaction Survey

One of the unintended consequences of relying solely on the OCI to prioritize capital projects for roads is that insufficient emphasis has been placed on roads with significant deterioration. Table 2 indicates that all three categories of the City’s roads have deteriorated significantly since 2007.

Guidance from the Ontario Good Road Association (OGRA) sets out various ‘triggers’ for road projects based on their Pavement Condition Index. Table 2 below, which incorporates these “triggers”, indicates that a significant percentage of the City’s roads require rehabilitation or reconstruction according to the maintenance methodology recommended by the OGRA.

**Table 2 - Roads Requiring Rehabilitation and Reconstruction using OGRA Methodology**

Category	2007 AVG PCI	2009 AVG PCI	2013 AVG PCI	2016 AVG PCI	% Change from 2007	Rehabilitation		Reconstruction		Total km of Roads in City <sup>6</sup>
						Lane km	% of Total	Lane km	% of Total	
Arterial	72.8	68.4	59.2	59.6	18%	40	14%	58	20%	282
Collector	68.1	64.0	51.1	48.7	28%	71	28%	86	34%	254
Local	63.0	59.2	49.8	46.3	27%	155	13%	268	23%	1,168
<b>Other road sections (Ramp, Prov. Hwy &amp; Private)</b>										200
<b>TOTAL :</b>										<b>1,904</b>

**Recommendation:**

To address the continual deterioration of roads, use a revised OCI measure that consists of PCI, safety factors and the timing of water/waste water initiatives to prioritize rehabilitation and reconstruction projects. Prepare separate business cases to justify additional spending on roads projects that have economic benefits or other merits.

**Management Response and Action Plan**

*Staff can review and update the OCI components. Staff notes the OCI factor which included the economic benefits factor was created before the City’s Cost Sharing Policy was in place. As other City processes currently consider development and economic benefits, a review of the OCI measure and its components is warranted.*

<sup>6</sup> Represents the total kilometers of roads that are assessed for PCI and excludes gravel roads.

## B. BRIDGES AND CULVERTS

The Bridge Condition Index (BCI) provides an objective measure of the condition of the city's bridges and culverts and sets the priority for their repair and renewal. All municipalities are required to undertake detailed visual inspections every second year classifying the structures as excellent, good, fair and poor in accordance with Ontario Structure Inspection Manual (OSIM). In 2016, KPMG recommended the City adopt the more conservative approach for bridge maintenance that is shown below in Table 3.

In 2018, management engaged a consultant to complete detailed inspections of bridges with ratings of 55 or less to prioritize their renewal. Thresholds for maintenance of bridges with ratings lower than 55 were also revised from 5 to 3 years to mitigate the risks of potential failure. We encourage management to continue these practices as they mitigate relevant risks.

**Table 3 – Bridge Maintenance**

CGS Current Categorization (Per CGS Roads Dept.)			KPMG Categorization (Asset Mgt. Plan – 2016)		
BCI Range	Condition	Maintenance	BCI Range	Condition	Maintenance
< 50	Poor <sup>7</sup>	Within one year	NA	NA	NA
50 – 55	Poor to Fair	Within next 1-3 years	< 60	Poor	Within one year
56 – 59	Fair	Within next 2-4 years	< 60	Poor	Within one year
60 – 69	Good	None in 3-5 years	60 - 69	Fair	Within 5 years
70 – 100	Excellent	None	70 - 100	Good	None in 5 years

### ***Management Response and Action Plan***

*All City bridge structures are inspected every 2 years as required by O.Reg 104/97: Standards for Bridges. Staff uses the reports and recommendations prepared by the biennial bridge inspector to develop the bridge repair and maintenance program. Staff will continue to review bridges with Bridge Condition Indices lower than 55 with additional detailed inspections as warranted. Currently there are 2 bridges of the City's 182 bridge structure inventory with a BCI less than 55.*

## C. LABOUR AND CONTRACT COSTS

In 2018, the city used a contingent of 135 FTEs which included full-time, part-time, and casual staff which were augmented by contractors. A mix of staff is used for work crews which are deployed across the city. When work is contracted, the cost of contract labor forms part of contract costs. Labour costs for maintenance activities vary based on wage rates, benefit costs, overtime and deployment schedules. Management is exploring opportunities to optimize costs. As this matter is subject to discussions within the Collective Bargaining Process, we have no recommendation.

<sup>7</sup> Forms a basis for capital budgetary plans

#### **D. MINIMUM MAINTENANCE STANDARDS**

The Minimum Maintenance Standards (MMS) for municipal highways prescribed by Ontario Regulations 239/02 stipulate varying times for the completion of maintenance activities including pothole repairs, crack sealing and road inspection. The MMS stipulate timelines that vary between 4 to 60 days for the remediation of potholes based on the class of highway, surface area and depth.

Road inspections are presently documented on paper-based forms without reference to their frequency, completeness or coverage. Manual processes increase the risk of non-compliance with the regulations prescribed by the province.

#### **Recommendations:**

- A. Assess the feasibility of using hand held units to record inspections and repairs of potholes; and
- B. Take a lead in the study to identify best practices to repair potholes. Ensure the scope of the study includes plant and equipment and well as processes, materials and labour.

#### ***Management Response and Action Plan***

- A. *We agree to assess using hand held units.*
- B. *We agree and we intend to pursue the review of pothole repair best practices.*

#### **E. RISK MANAGEMENT PROCESSES**

As shown in Appendix 1 and 2, management has taken steps to identify, assess and mitigate significant risks associated with maintenance of road infrastructure. Where appropriate, this audit has provided recommendations for further risk mitigation.

#### **Recommendation:**

Continue to integrate risk management processes with other management processes in the Division.

#### ***Management Response and Action Plan***

*Staff will continue to review risks in Linear Infrastructure Services and Infrastructure Capital Planning processes and look for opportunities to mitigate risks.*

## Appendix 1 – Summary of Significant Risks

Risk	Total No. of Risks	Risks Before Controls			Risks After Controls		
		High	Med	Low	High	Med	Low
Reputation	0	0	0	0	0	0	0
Operational	8	4	4	0	0	8	0
Financial	3	2	1	0	0	3	0
Legal	1	1	0	0	0	1	0
<b>TOTAL</b>	<b>12</b>	<b>7</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>12</b>	<b>0</b>

## Appendix 2 – Significant Risks

Risk	Risk Description	Before Controls	After Controls
F2	Deferral of important capital roads projects due to lack of funding	20	15
F1	Failure to proactively manage lifecycle costs of infrastructure	20	14
O3	Inappropriate prioritization of capital projects for roads projects	16	14
L1	Ineffective claims management processes	16	14
O8	Failure to manage service levels	16	14
F3	Failure to forecast infrastructure renewal costs	16	14
O1	Failure to prioritize renewals of vulnerable bridges and culverts	20	12
O2	Failure to effectively inspect bridge and culvert condition	20	12
O4	Failure to manage labour productivity	15	12
O5	Ineffective performance monitoring	14	12
O6	Failure to optimize labour costs	14	12
O7	Failure to optimize contract costs	14	12