City of Peterborough

To:	**Members of the Committee of the Whole**
From:	**W.H. Jackson, Director of Utility Services**
Meeting Date:	**March 31, 2014**
Subject:	**Report USEC14-005** **Road Needs Study**

Purpose

A report to present the findings of the Road Needs Study including a recommendation to increase the funding for pavement maintenance/rehabilitation.

Recommendations

That Council approve the recommendations outlined in Report USEC14-005 dated March 31, 2014, of the Director of Utility Services, as follows:

a) That the presentation of the Road Needs Study by a representative of D. M. Wills be received for information; and

b) That future road pavement capital and operating budgets be prepared to reflect an increase in funding over the three-year period 2015 to 2017 to approximately double the 2014 road pavement capital and operating budgets as shown in the Budget and Financial Implications section of Report USEC14-005.

Budget and Financial Implications

Table 1 shows the proposed funding increases recommended in this report.

Table 1: Proposed Funding Increases

Year	Yearly Increase (M)	Cumulative Increase Since 2014 (M)
2015	$0.65	$0.65
2016	$0.65	$1.30
2017	$0.65	$1.95

Future year funding will be dependant on approval from Council as part of the annual budget submissions. The Operating budget has been assumed to increase by 2% per year with the majority of the increase shown in Table 1 coming from the Capital budget.

BACKGROUND

D.M. Wills Associates Limited was retained by the City (Report USEC13-002) to conduct a Citywide Road Needs Study to evaluate the current condition of the City road network and provide work plans to optimize capital spending. A copy of the Executive Summary of their study is provided in Appendix A.

1. Basics of a Road Needs Study

The Road Needs Study included detailed pavement condition inspections and reporting for each municipal road. All road sections (the portion of roadway between intersections) are inspected in the field with up to 20 different pavement stresses being identified, rated and quantified. This is a method of pavement condition analysis used widely across North America that standardizes data collection and analysis and is highly reproducible.

A Pavement Condition Index (PCI) is created for each individual road section based on the field data collected. PCI is a best practices and commonly used method to assign a score to road networks. The value ranges from zero (Failed) to 100 (Perfect) (see Figure 1) and relies on three key data types; distress type, distress severity and distress quantity.

Figure 1 – Standard PCI Rating Scale and Strategies

	Description	PCI	Pavement Management Strategy	
	Failed	0-10	Full Reconstruction	
	Serious	10-25		
	Very Poor	25-40	Do Nothing	
	Poor	40-55		Critical PCI
	Fair	55-70	Preventive Maintenance	
	Satisfactory	70-85		
	Good	85-100		

Pavement generally provides a constant, acceptable condition for the first part of its service life and then begins to deteriorate very rapidly. The key to managing a pavement network is timing of maintenance and rehabilitation activities. The impact of various maintenance activities on pavement are measured by Pavement Deterioration Models. Standard pavement deterioration models are available and these are adjusted, as possible, for specific City conditions. The pavement deterioration models are used in the evaluation of various pavement management scenarios.

There are four standard categories for pavement management related to maintenance and rehabilitation:

- Stopgap;
- Global;
- Localized; and
- Major Rehabilitation.

Stopgap maintenance includes the minimum level of maintenance that is required to keep the pavement functional and generally includes patching. Stopgap maintenance is considered as a holding strategy and does not improve a pavement's PCI.

"Global" and "Localized" preventive maintenance measures maintain and preserve the pavement before serious deficiencies develop. Examples of these types of actions would be crack filling, slurry sealing and larger patching using hot mix asphalt.

"Major Rehabilitation" is the most serious type of rehabilitation and occurs when a pavement has reached its full service life and it becomes impractical to perform preventive maintenance. This type of activity is usually a complete removal and replacement of the pavement structure.

2. Results of the Road Needs Study

2.1 Pavement Condition

Table 1 summarizes the average condition of all City road sections by road type. Based on the 2013 pavement inspections, the City's pavement network is in fair

overall condition. Included in the table is the average PCI excluding roads less than 15 years old. This score provides some insight in the health of the older pavements in the City by removing the skew in the average PCI due to new roads and their inherently better conditions.

Table 1 – Average Overall Network Conditions in 2013

Road Type	Average PCI	Average PCI (excluding roads less than 15 years old)
Local	66.18	60.49
Collector	72.35	66.84
Arterial	66.88	64.68
OVERALL	**67.57**	**62.37**

An overall PCI of almost 68 is a good result although there are examples of all levels of pavement condition across the City. A map and table showing the entire City road network (by section) with corresponding PCI values is available at:

http://www.peterborough.ca/Assets/City+Assets/Engineering/Documents/Road+Needs+Study+-+Condition+Summary+Map.pdf

http://www.peterborough.ca/Assets/City+Assets/Engineering/Documents/Road+Needs+Study+-+Condition+Summary+Table.pdf

2.2 Maintenance and Rehabilitation Planning

With pavement condition information available for each City road section and with the knowledge of how the various pavement sections will respond to each of the possible maintenance/rehabilitation actions, it is possible to develop long term (20 year) pavement management funding requirements.

In this regard, the following four scenarios were examined:

- Maintain Current Budget and Practices;
- Unconstrained Budget;
- Maintain the Current Overall Pavement Condition; and
- Double the Current Capital Budget.

Appendix B depicts each of the above scenarios graphically over the period 2014 to 2033 while Table 2 provides an overview.

Table 2: Cost and PCI for Various Management Scenarios

Scenario	Total Cost (2014 – 2033)	Average Annual Cost	Pavement Condition Index	
			2014	2033
Maintain Current Budget*	$58M	$2.9M	66	31
Double Current Budget	$93M	$4.7M	67	48
Maintain Current PCI	$215M	$10.8M	71	65
Unrestrained Budget	$152M	$7.6M	94	71

* Current Budget (capital and operating) plus $100,000 per year

3. Discussion

Section 2 provides evidence that without an increase in the annual capital and operating budgets for pavement rehabilitation, the City's road network is in danger of falling into a condition that is typically unacceptable to the majority of users.

With the current Capital funding program of $1.5M (plus an assumed $100,000 additional annually) and Operating of approximately $440,000 (plus an assumed 2% additional annually), the condition of our roads will steadily decline to a "very poor" condition. On the other hand, to maintain our existing pavement condition rating is prohibitively expensive costing almost four times as much as our existing budget.

A compromise is to allow the overall network pavement condition to decline but with a lower limit that still maintains a reasonable condition. The scenario that best achieves this objective sees the overall pavement management budget doubled. Again, as a compromise in funding allocation, it is suggested that this budget increase can be implemented over a period of three years without seriously impacting the outcome of analysis.

Regardless of future funding, a continual update of the data used in the modelling exercise is important and should be considered as a part of the overall pavement management system and budget.

Summary

The importance of a road network condition related to vehicles, transportation of goods, and active modes of transportation cannot be understated. The information provided through the Road Needs Study shows the overall pavement condition index of the City's

roads to be 67. This index rating is within the “Fair” zone but closer to the “Satisfactory” zone.

Testing the information gathered and evaluating various funding scenarios, it is evident that attempting to move the PCI to above 70 would be financially prohibitive. On the other hand, maintaining the present level of funding for road rehabilitation and reconstruction will result in an unacceptable PCI of around 30.

A measured and fiscally responsible response is to double the available pavement maintenance/rehabilitation funding over a three year period.

Of equal importance is the need for updated and improved data and, accordingly it is proposed that staff continues to complete detailed roads inspection each year to maintain up-to-date data.

Submitted by,

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Attachments:

Appendix A – Road Needs Study Executive Summary
Appendix B - Evaluation of Various Funding Scenarios

Appendix A – Road Needs Study Executive Summary

Executive Summary

D.M. Wills Associates Ltd. (Wills) was retained by the City of Peterborough (the City) to carry out a citywide road needs study in spring 2013. The study included a visual inspection of each road in the city and the gathering of the road's current condition information in the form of a Pavement Condition Index (PCI). The inspection data was uploaded to the City's previously selected pavement management system, MicroPAVER. A series of pavement management models were developed in an effort to assist the City with the long-term management and planning for maintenance of renewal of their road infrastructure asset. This report summarizes the pavement inspection efforts, documents the City's existing road infrastructure and related condition, and establishes budgetary costs for consideration in maintaining and/or improving the City's pavement network over the long-term (20 year horizon).

The City's road network totals approximately 422km of roads distributed amongst local, collector and arterial classes. A summary of road classification and relative overall weighted-average PCI is noted in the table below:

Road Type	Rank	Average PCI	Average PCI (excluding roads less than 15 years old)
Local	E	66.18	60.49
Collector	C	72.35	66.84
Arterial	B	66.88	64.68
OVERALL		**67.57**	**62.37**

The City's overall pavement infrastructure is considered to be in fair condition, (PCI 56-70).

The MicroPAVER software was used to develop prediction models for the future state of the City's road infrastructure based on a series of funding scenarios, including the current budget allocations.

Based on standard pavement deterioration rates, the current state of the City's infrastructure, and the currently planned/forecast level of investment in pavement management, the City's current overall PCI of 68 will decrease to approximately 31 over the next 20 years. This reflects the current approach of assigned funding to minor patching (stopgap) and resurfacing activities. There is currently no dedicated funding to global pavement preservation management activities and reconstruction activities related strictly to road condition.

An increase in preservation management funding of $1.5M (approximately double the current budget assignment) dedicated to preservation management activities would stabilize the average PCI at approximately 50 within ten years.

The MicroPAVER model forecasted a budget requirement of approximately $11.0M per year to address the current backlog of pavement rehabilitation requirements, while maintaining the overall PCI in a fair to satisfactory condition.

A preservation management approach to managing the road network is shown to yield a lower life cycle cost while maintaining higher overall PCIs across the network. The preservation management approach is fully supported under the MicroPAVER framework. A 5-Year work plan has been developed for the City based on the current budget allocations and applying a preservation management approach whereby preventative maintenance is undertaken on roads with condition greater than the "Critical PCI" value. Once the pavement passes the Critical PCI condition, it is permitted to deteriorate, with normal maintenance as required, until it reaches its full useful service life and deterioration triggers a full renewal, provided sufficient budget is available.

Optimization of budget allocation in conjunction with optimization of Critical PCI and minimum PCI values is recommended once the final 2014 budget allocation is confirmed.

Work activity tracking in MicroPAVER is recommended so that pavement deterioration rates may be developed specifically for the City's pavement model.

Optimization of acceptable maintenance and renewal strategies is recommended within the MicroPAVER framework.
A program of regular pavement inspection is required to maintain a reliable pavement management model within the MicroPAVER system. A pavement inspection program is recommended as follows:

Table 10.9 Recommended Frequency of Inspection.

Road Type	Rank	Frequency
Local	E	4 Years
Collector	C	3 Years
Arterial	B	2 Years

Appendix B Evaluation of Various Funding Scenarios

Figure 4 – Current Budget Implications

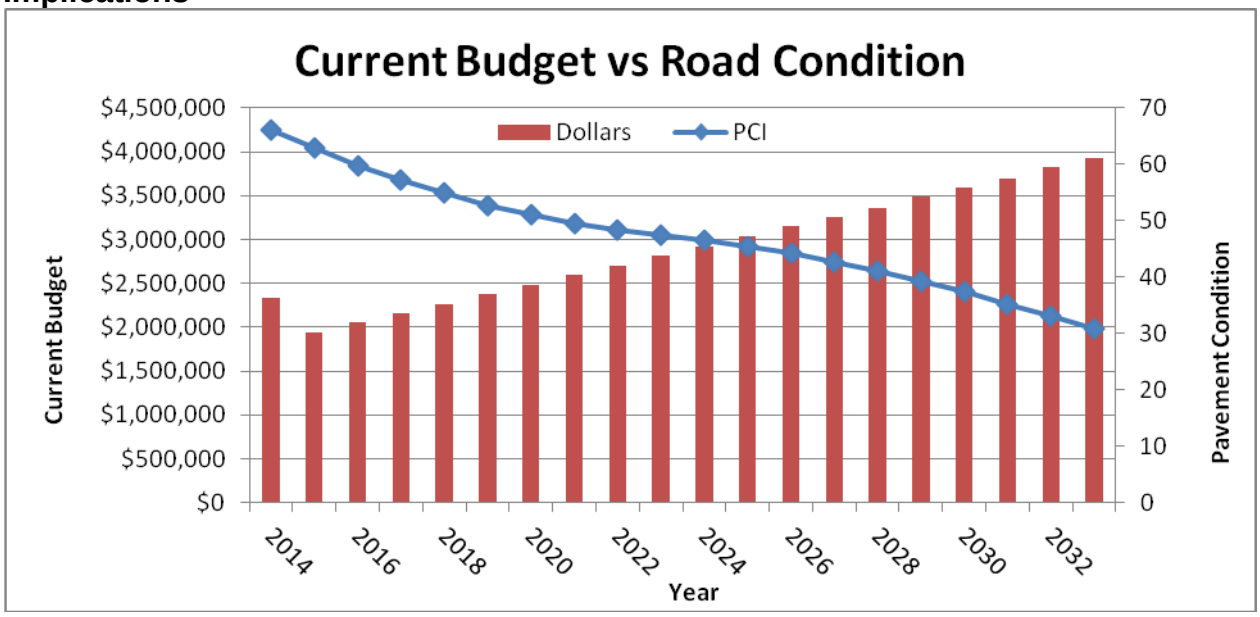

Figure 5 – Unconstrained Budget for Benchmark Purposes

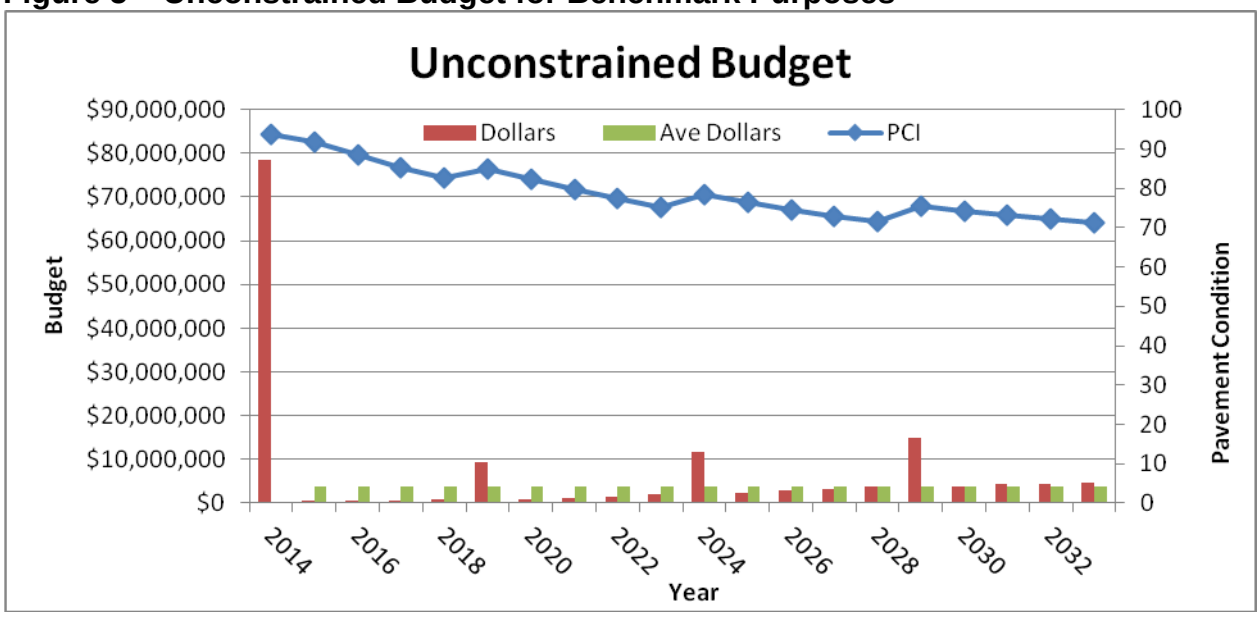

Figure 6 – Maintain Current Pavement Condition

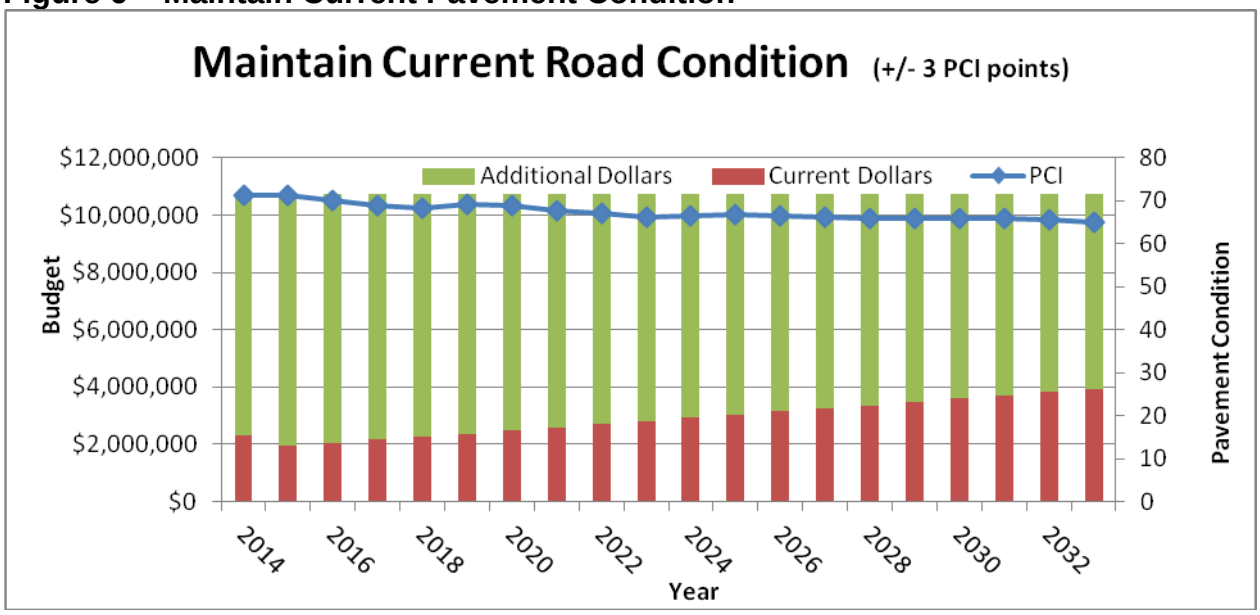

Figure 7 – Approximately Double Current Capital Budget with Annual Increase Thereafter