Peterborough County

# 2022

# Asset Management Plan

WSCS Consulting
Think Beyond

WILLS

4 ROADS MANAGEMENT SERVICES

# Acknowledgements

This Asset Management Plan was developed as a joint project with many contributors.

On behalf of **WSCS Consulting Incorporated,** we would like to acknowledge the following companies and individuals in preparations of this updated Asset Management Plan for the County of Peterborough;

**David Anderson CET and President of 4 Roads Management Services Incorporated,** for the preparation of the State of the Infrastructure and assistance throughout the project.

**David Bonsall, P. Eng. Senior Project Manager with D.M. Wills Associates Limited** with respect to County structures data, condition and financial information (OSIM).

Peterborough County representatives including but not limited to:

- **County Council**
- **Sheridan Graham, Chief Administrative Officer (CAO), Deputy Clerk, Deputy Treasurer**
- **Trena DeBruijn, Director of Finance/Treasurer**
- **Dan Sutherland, Asset Management Analyst**
- **Bryan Weir, Director of Planning and Public Works**
- **Doug Saccoccia, Manager of Engineering**
- **Peter Nielson, Manager of Capital Projects**

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# Executive Summary


The County of Peterborough (the County) manages a broad cross section of assets providing core services to residents, businesses and visitors. The County is committed to being good stewards of these assets for both current and future generations.

The County is on a continuous journey to address the infrastructure deficit that was originally identified in its 2018 Asset Management Plan (AMP) which was undertaken in anticipation of the additional requirements outlined in O. Reg 588/17 Asset Management Planning Regulation under *the Infrastructure for Jobs and Prosperity Act, 2015.*

While the 2018 AMP addressed many of the requirements outlined in O.Reg 588/17, the AMP must be updated on a regular basis. Figure 1 shows the timelines for each of the new requirements. This 2022 AMP includes a forward looking approach for the County's core assets included suggested levels of service and a recommended financing strategy.

It should be noted that the requirements for 2022 include the County's core assets only (roads and structures) which has consistently represented 82% of its total assets. The data from the 2018 AMP for facilities was included in the financing strategy in the AMP but no further information was gathered or updated. This will need to be done by 2024 and the AMP updated at that time. The current level of service of those assets are based upon condition assessments undertaken in 2021 as well as a survey undertaken of County stakeholders. While not a representative sample, the survey revealed that there is much work to be done in communicating the challenges of asset management in municipalities. Overall, 68% of respondents indicated that they were satisfied with the state of the County's infrastructure. It will be important to undertake further consultation upon release of the this plan. Additions are required for all other assets in 2024 and 2025. As such, this updated plan focuses on the County's core assets

It is also important to note that this plan focuses on existing core assets. The County's Transportation Master Plan (TMP) focusses on growth. It was first developed in 2014 has commenced an update in 2020. At the time of this report, the TMP was completed but yet to be approved by Council (expected in October 2022). The County recently updated its Development Charges Background Study (Hemson, 2022) and its Official Plan. While some growth was covered by DCs, **Bill 23, More Homes Built Faster Act, 2022** has an estimated $1.5 million impact. The capital growth projects for services related to highways were identified with estimated cost of $143 million over 30 years, 13% of which would not be funded by development charges.

It is recommended that the County segregate its reserves between existing infrastructure and the TMP so not to confuse the purposes of the Infrastructure Reserve and funding sources. Further, it is recommended that assessment growth (estimated at 1.3%) be allocated to the TMP reserve to fund the unfunded portion. Any further assessment growth should be allocated to the roads infrastructure reserve.

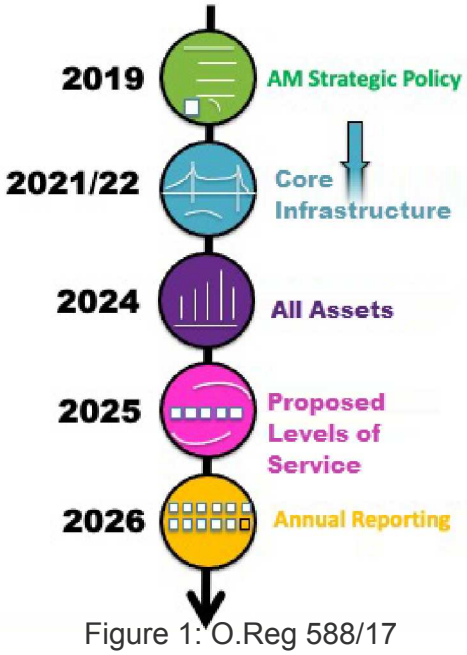


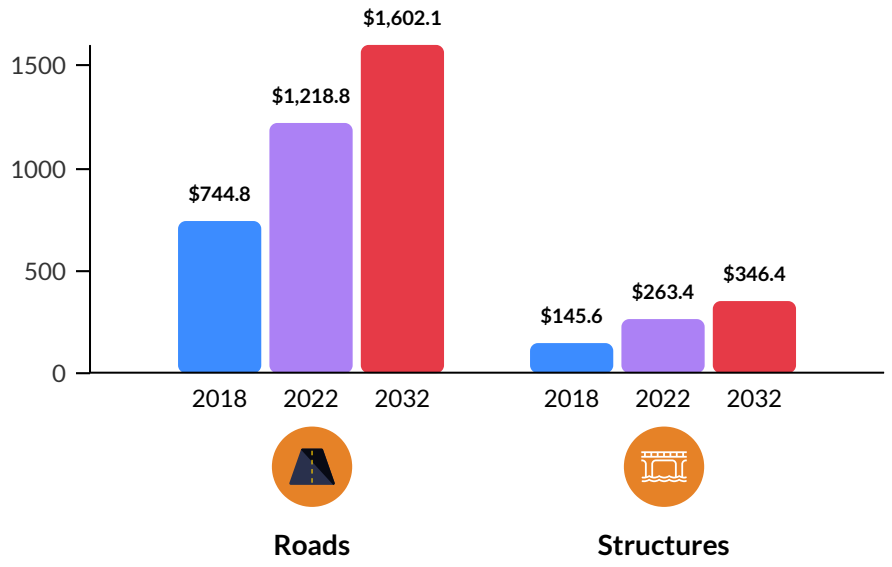

Figure 1: O.Reg 588/17 Asset Management Planning Regulation Timelines

# The Last 4 Years

# Prices Rising 2018 to 2022

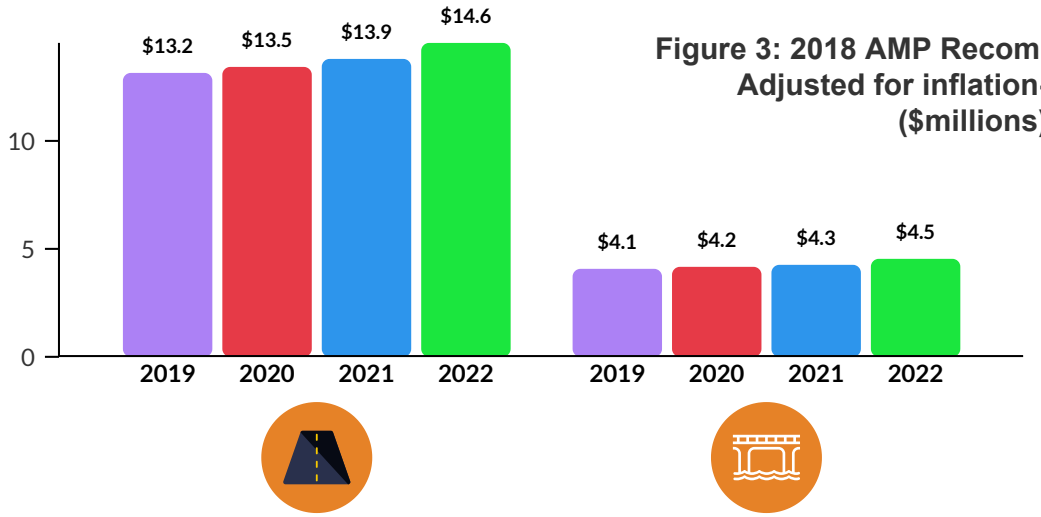
The County and entire sector is experiencing significant challenges in its tenders, not just price but availability. Figure 1 shows that as of 2022, replacement costs of the County's roads and structures is now estimated at $1.48 billion or an increase of $592 million in just four years (66%). This is significantly higher than the Consumer Price Index that others have experienced. Statistics Canada Indices indicate approximately 37% increase since 2018. Current forecasts indicate that construction costs are expected to continue to climb resulting in another increase of approximately $466 million by 2032. It is important to update both replacement and improvement costs in the AMP each year based upon tender prices received.

**Figure 2: Replacement Cost Changes 2018-2022 - 2032 Forecast ($millions)**




The 2018 AMP recommended a 10 year program with an annual average of $13 million and $4 million for roads and structures respectively. Figure 2 shows that the inflated costs from 2018 are in line with the recommendations in this updated 2022 AMP which recommends approximately an average annual budget of $15 million and $4.9 million for roads and bridges respectively. This illustrates the need for updated AMP costs each year as well as the capital program. It also illustrates that the original recommendations continue to be in line with requirements to improve the condition of the infrastructure.

**Figure 3: 2018 AMP Recommended Program Adjusted for inflation-2018 - 2022 ($millions)**



# The Last 4 Years
# 2018 to 2022

**26%**

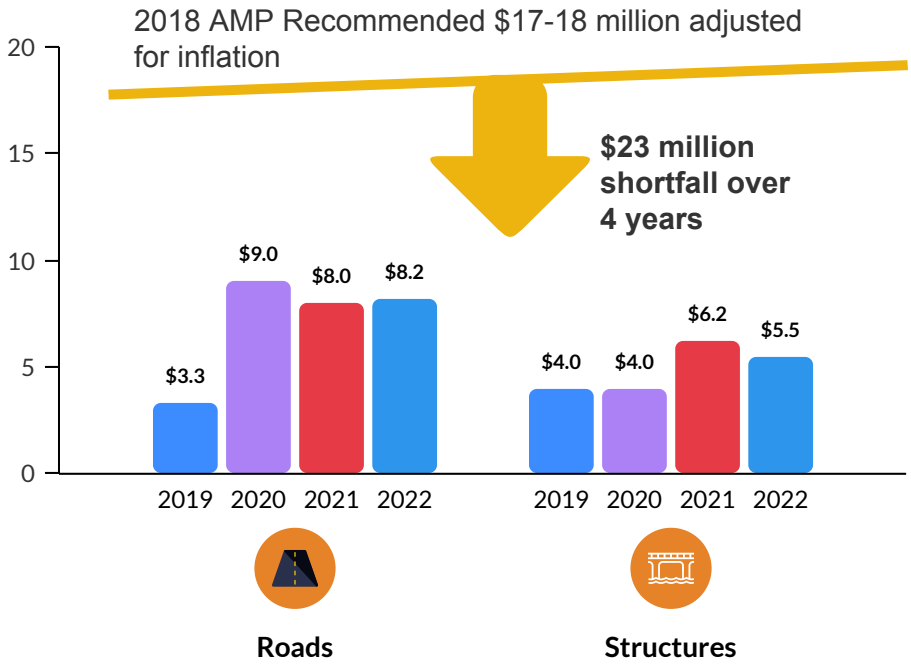
Funding Shortfall

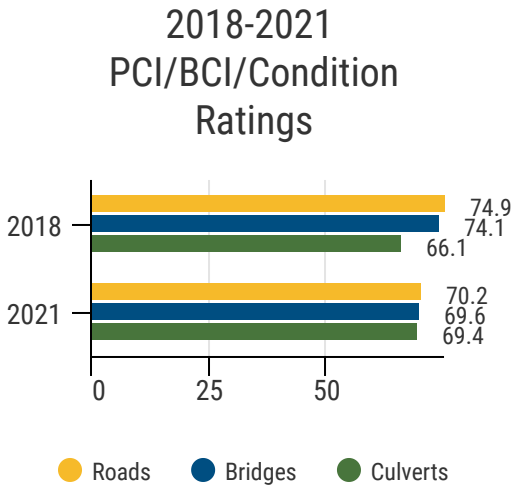
The County's actual preservation budget over the past four years represents a total shortfall of $23 million (26%) While its budget has grown with the assistance of an infrastructure levy, not all of the funding went towards preservation.

Overall, the condition of roads and bridges have declined by 6% since 2018 However, culverts have seen an increase in condition by 5%.

Consequently, it is important that the County act now to ensure that it maintains its core assets now with a focus on maintaining levels of service, both from a community and technical perspective. This means making the right investments at the right time on the right assets. It is not clear that has been the case in all instances. In some years, it may be best to wait to do certain projects in favour of others. Better ongoing analysis and data collection is key to good return on investment.

**Figure 4: 2019-2022 Infrastructure Spending vs. 2018 AMP Recommendation ($millions)**




**53%**

**Weighted Average Condition**

**40%**

**Good to Very Good Roads**

**6%**

**Roads and Bridges [PCI/BCI)Condition Decline**

**5%**

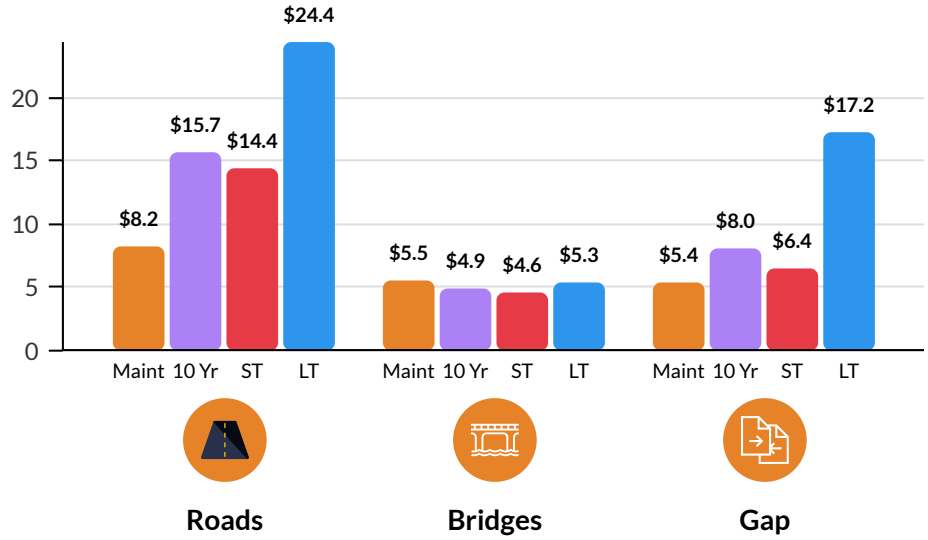
**Culverts Condition Increase**

# The Next 10 Years
# 2023 to 2032

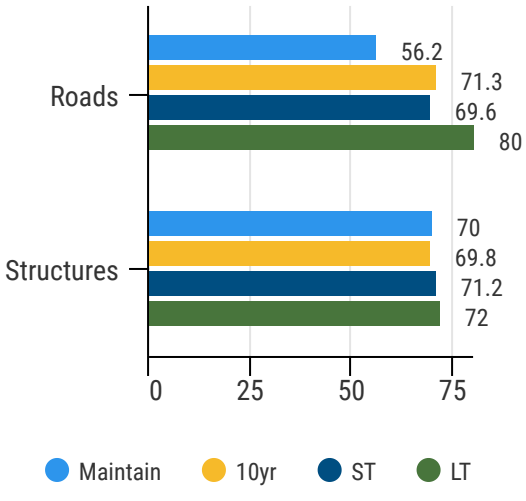
The 2022 AMP outlines the 10 year program, the amounts which are not significantly different from the 2018 AMP. It also provides recommendations for short term and long term sustainability based upon targeted conditions. These condition ratings can be interpreted to be proposed levels of funding as required by O.Reg. 588/17 by 2025. The challenge is funding the gap between the current budget and maintaining the current levels of service as well as proposed levels of service. It requires an increase in taxes and/or debt which of course, results in increased taxes in the long run. Debt has its risks as well, particularly since the interest rates are rising. The time to have borrowed would have been while the rates were low. At the time of this report, the prime rate was 4.7% as opposed to almost nil two years ago. Debt is only a short term solution but could get the County to the desired levels of service in a shorter period of time and then allow for the maintenance.

Currently, the County's infrastructure is declining and will continue to do so without additional funding. While the County receives some funding from other levels of government through grants, it cannot rely on those funds. They are not stable nor sustainable. It is important that the County act now to ensure that it maintains its core assets now with a focus on maintaining levels of service, both from a community and technical perspective. This means making the right investments at the right time on the right assets. It is not clear that has been the case in all instances. In some years, it may be best to wait to do certain projects in favour of others. Better ongoing analysis and data collection is key to good return on investment.

**Recommended Programs Average Annual Budget 2023- 2032**




**Estimated Average Condition Ratings by Program in 2032**




Maintain = 2022 Budget levels (Current Levels of Service)
**10 Year = Recommended 10 Year Program**
**ST = Short Term Sustainability (Target of 70)**
**LT = Long Term Sustainability (Improve/Proposed Levels of Service)**

# Key Financials

## $ 1.5 billion

Replacement Costs of road and structure assets in 2022 dollars.

## $8 million

Estimated annual average funding gap in 2022 dollars. Increasing to $2 million by 2032 with inflation.

## $466 million

Forecasted increase in replacement costs due to inflation by 2032 (10 years).

## $172+ million

Current "NOW" needs for roads and structures aka backlog of improvement costs.

## $40,000

Replacement costs per household ($2022) rising to $52,600 in 2032.

## 89 cents a day

Average additional cost per day per household to close the funding gap including inflation.

# State of the Infrastructure
## Roads

### 689 kms

**92.6% Rural, 7.4% Urban or Semi-Urban - adjusted for boundary roads**

### 71.9%

**Average structural adequacy rating - all roads**

### 40.3%

**Roads in good to very good condition**

### $160 million

**"NOW" needs = backlog ($2022)**

### $157 million

**Improvement costs over 10 years ($2022)**

### $14.4 million

**Annual recommended budget for short term sustainability ($2022) $24.4 million recommended for long term sustainability.**

### $1.2 billion

**Replacement costs ($2022) - Up from$744.7 million ($2018) - Forecasted to Grow to $1.6 billion in $2032**

# State of the Infrastructure

## Structures

**153**

**127 Bridges, 26 Culverts >3 metres**

**~70**

**Average bridge condition index (71.2) culverts condition (69.4)**

**59.4%**

**Structures in good to very good condition**
**(Bridges = 60%, Culverts = 52% of group)**

**$12 million**

**NOW needs = backlog ($2022)**

**$48.9 million**

**Improvement costs over 10 years ($2022)**

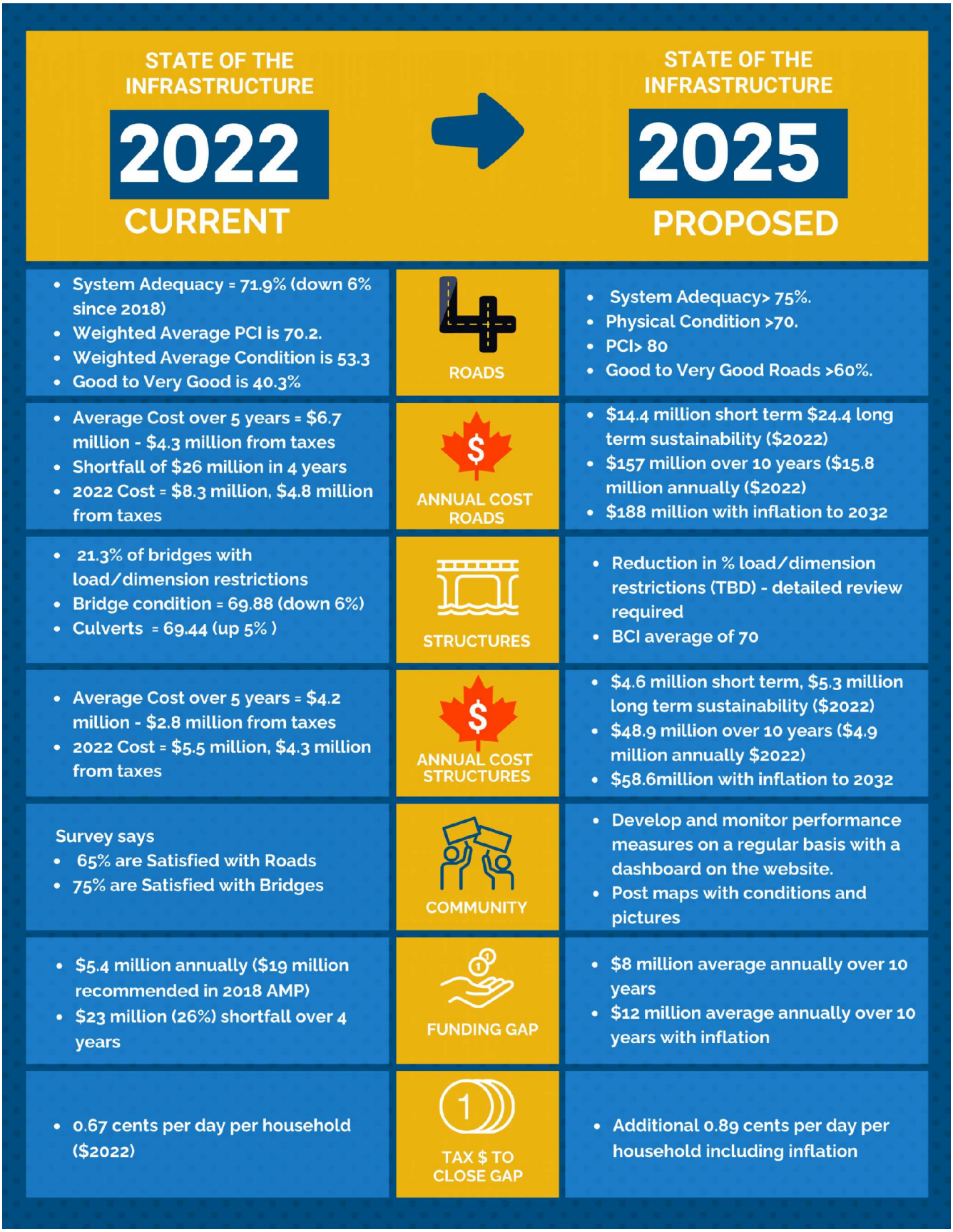
**$5.3 million**

**Annual recommended budget based upon 50 useful life ($2022)**

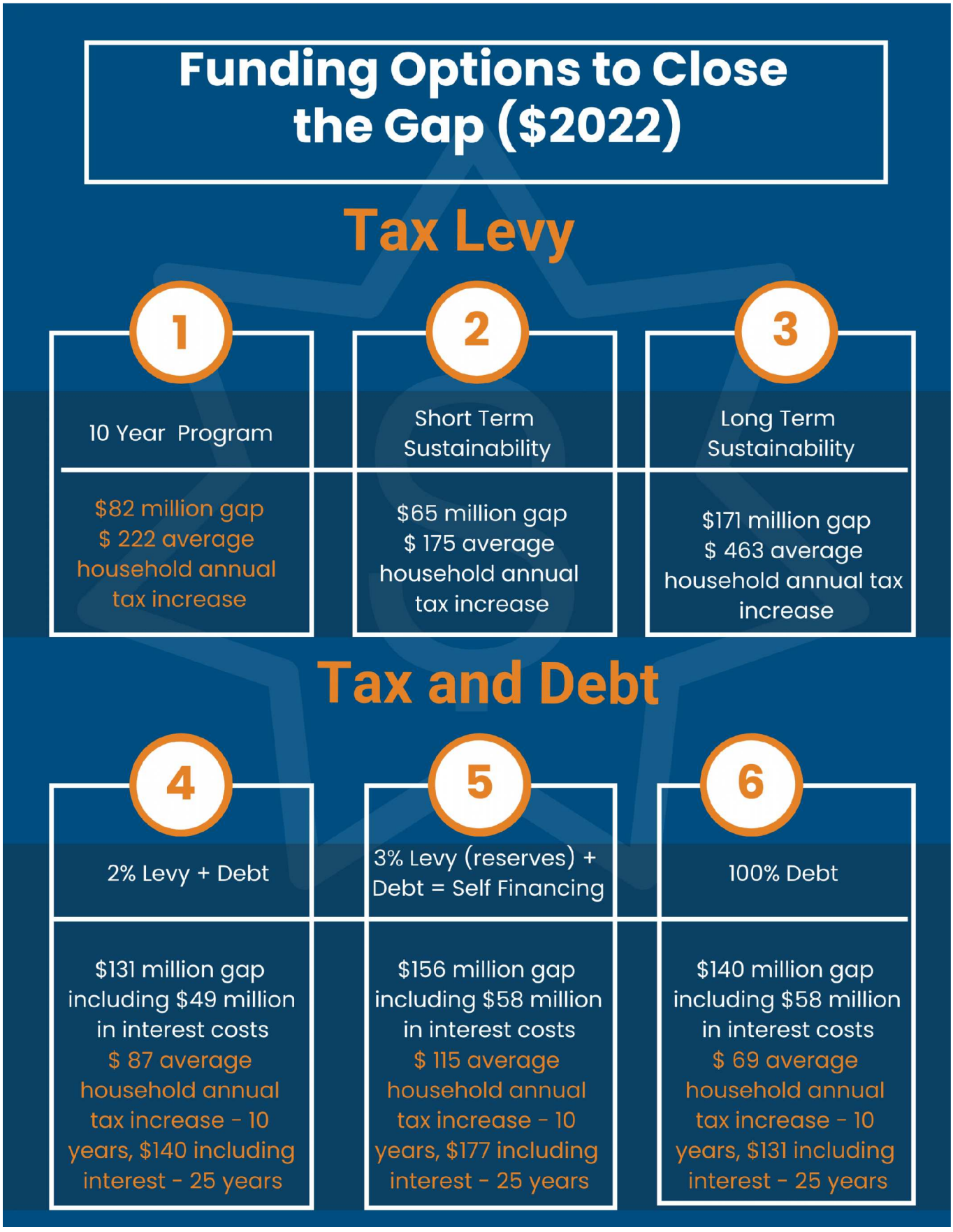
**$263.5 million**

**Replacement costs ($2022) - Up from $145.6 ($2018) -**
**Forecasted to Grow to $346 million in $2032**

# Levels of Service (LOS)



# Financing Strategy



# Chapter 1

## Introduction

# Introduction

Peterborough County provides a variety of services to its residents, businesses, and other stakeholders, including the maintenance of roads and structures (core assets). Other less asset intensive services include land use and development planning, paramedics and waste management.

The County provides many of these services by maintaining various infrastructure and other assets. Assets have physical substance that are utlized by the County to deliver services. They are defined as having a useful life of more than one year but are not restricted to certain values. This is often a misunderstood concept as many municipalities identify a financial 'threshold' to be included in their financial statements under the Public Sector Accounting Board (PSAB) standards. PSAB and asset management are not necessarily the same. In 2009, all municipalities across Canada were required to incorporate Tangible Capital Asset reporting on their financial statements. This gave municipalities a better understanding of what assets they owned, and their financial value.

## The County's Asset Portfolio:

**32**
Facilities (from 2018 AMP)

**153**
Structures

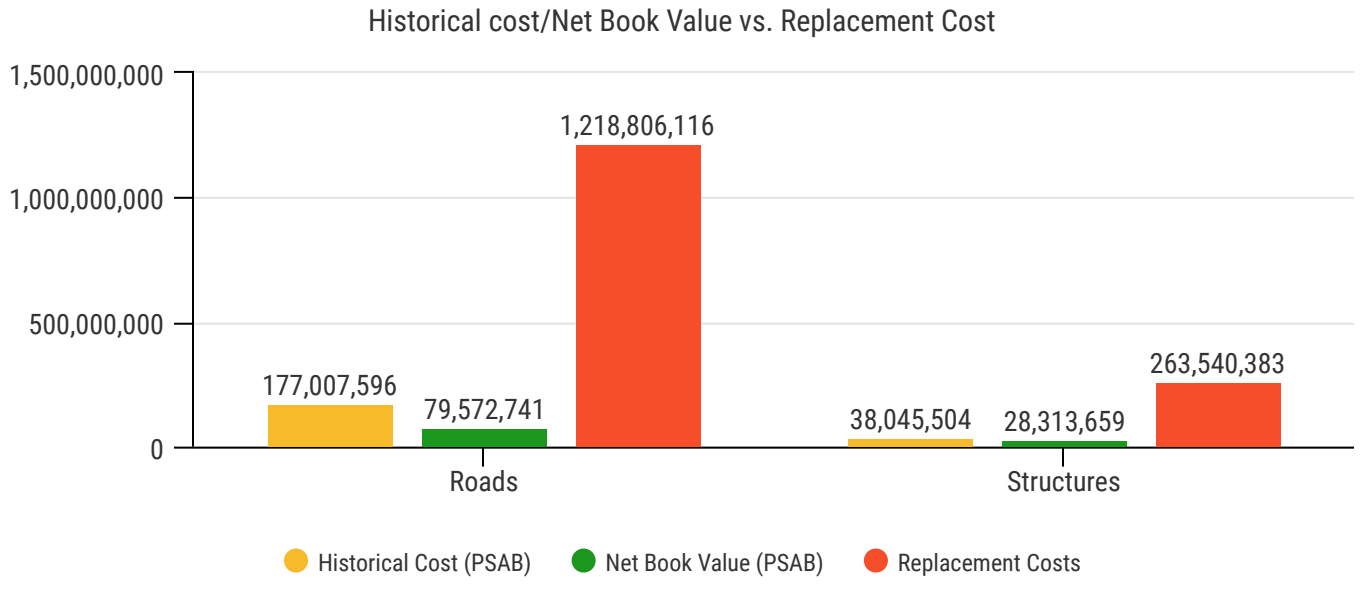
**689.8**
Kilometres of roads (adjusted for boundary roads)

**100 +**
Various pieces of fleet and equipment (from 2018 AMP)

Accounting for tangible capital assets in annual financial reports assists municipalities in understanding the rate of asset deterioration, or “consumption”, from a financial perspective. However, all costs are historical. It only provides marginal information regarding future infrastructure investment needs. Asset management planning takes this to the next level by determining future lifecycle needs of each asset.

Departments should manage and plan for these physical assets regardless of the cost. Asset management planning analyzes how to best provide services in a cost-efficient and sustainable manner.

Fundamentally, assets exist to provide services to the community. Hence, what the community expects is extremely important. The challenge for municipalities is that it is not only their taxpayers that utilize the services. Clearly, people from all over use County roads and bridges to get from one place to another. Developers look at municipality's ability to move people and goods as a key economic indicator.



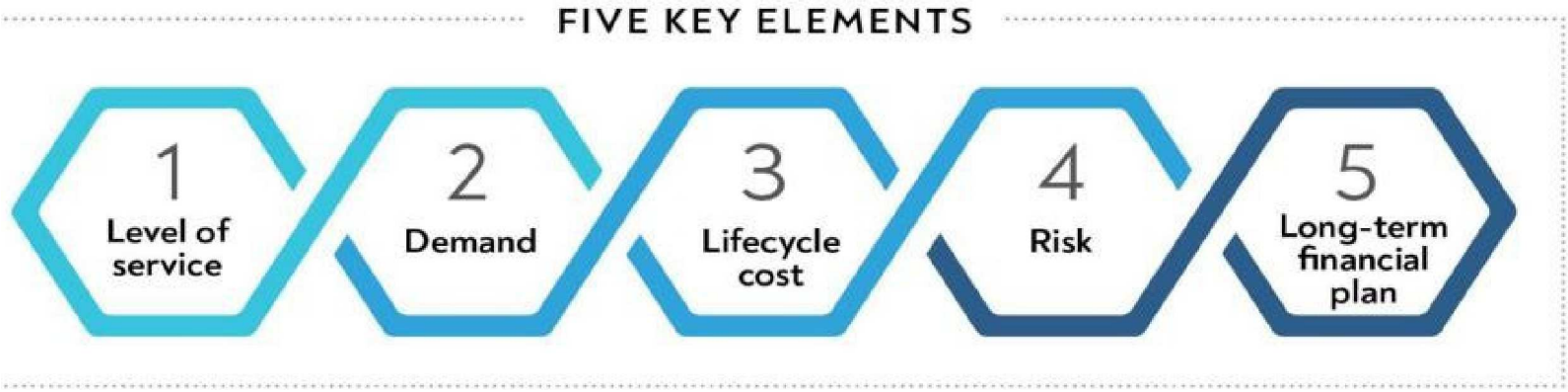
# What is Asset Management Planning?

**What is asset management?**

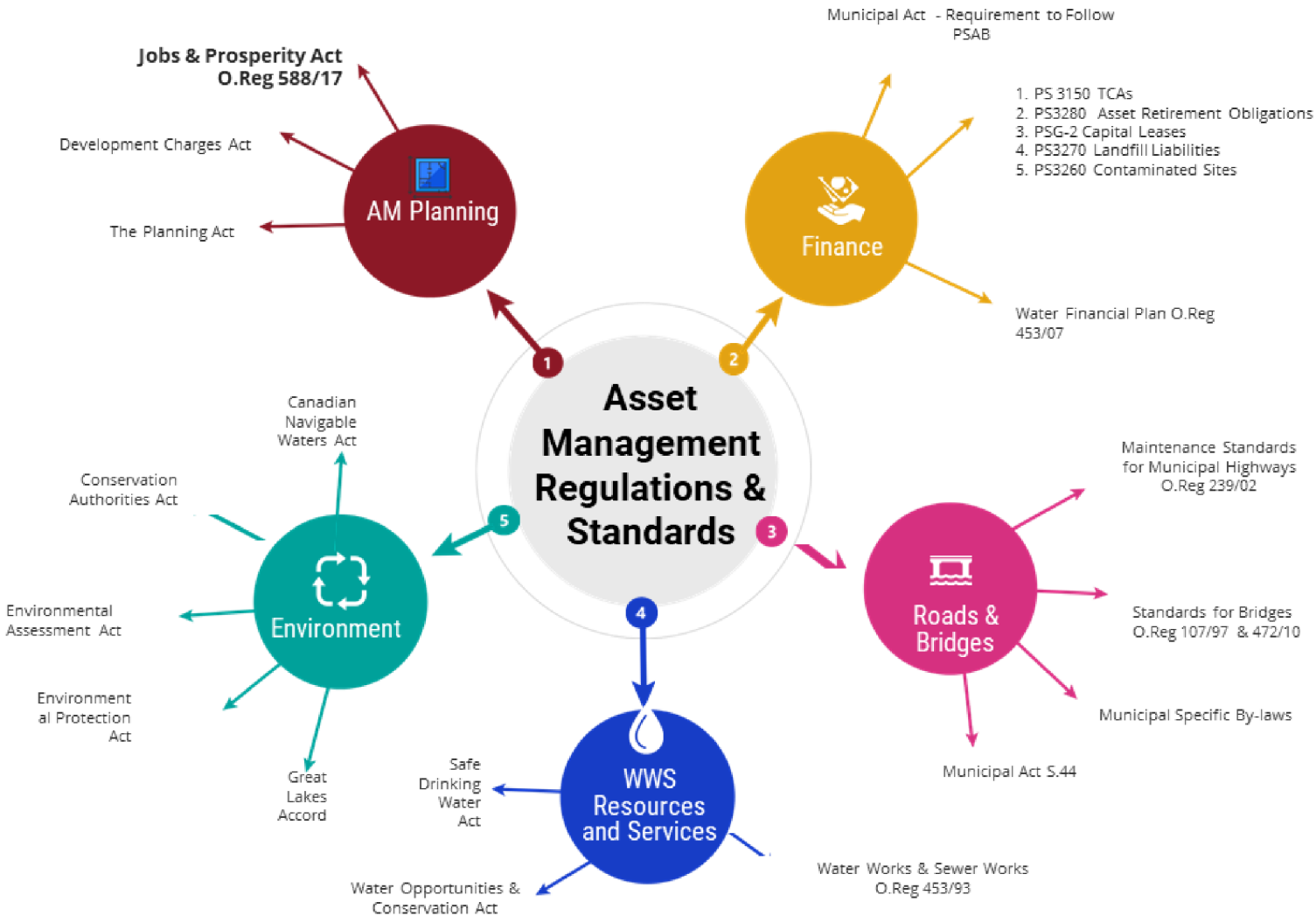
## Many Definitions…

ISO 55000 defines AM as "the ***coordinated*** activity of an organization to realize value from assets"


*"Asset Management is a framework for making cost effective resource allocation, programming and management decisions. It combines engineering principles with sound business practices and economic theory, and provides tools to facilitate a more organized, logical and comprehensive approach to decision making." ….. (TAC adopted from USDOT)*



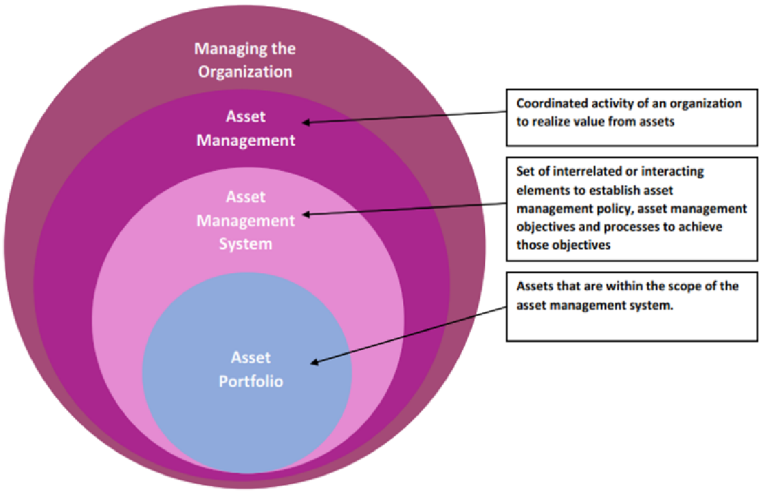
# Asset Management
# Regulatory Framework



# O.Reg 588/17 Asset Management Planning Regulatory Timelines


City of Brampton's AM Roadmap

# Asset Management Processes

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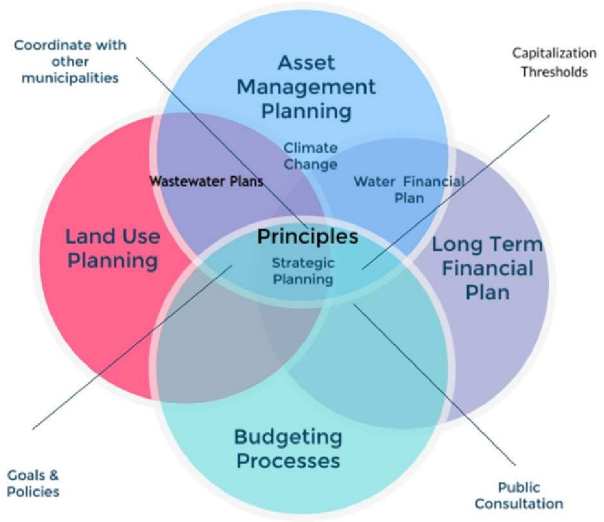
Asset management consists of more than just the development of an asset management plan. Asset management is a process that results in clear and effective decision making regarding the provision of services within the County. An asset management plan is an output from that process. The asset management process is integrated with other corporate processes, so that decisions are made based on the strategic direction of the County All master plans should be aligned and inform the asset management plan..




- What assets do you have?
- Where are they located?
- What condition is it in?
- What is it worth?
- What will it cost to replace it?
- What is the remaining useful life?
- What service level is required?

# Strategic Asset Management Policy

The Strategic Asset Management Policy is intended to ensure the County of Peterborough is dedicated to the development and maintenance of its asset management program in order to provide residents with sustainable, reliable services that are appropriate for the County, are regulatory compliant, and optimize life cycles for all assets.


## Our Goals

Our 2019-2022 Strategic and Operational plan has 6 key priorities all of which rely on solid asset management practices.


### GOAL 1: REGULATORY COMPLIANCE

Regulatory Compliance with O.Reg. 588/17 and all applicable legislation.

### GOAL 2: CONDITION SUSTATAINABILITY

Ensure overall asset condition will not decrease over time, or the asset type will achieve and sustain its Level of Service (LOS) goal.

### GOAL 3: RETURN ON INVESTMENT

Selection of appropriate treatments, at the appropriate asset condition level to yield thee best ROI are critical to AMP optimization.

### GOAL 4: MASTER PLAN INTEGRATION

AMP will be integrated with ALL master plans including long-term financial plans and budgets for all infrastructure assets.

### GOAL 5: CLIMATE CHANGE

Develop estimated costs and adaptation opportunities to manage vulnerabilities, mitigation approaches, disaster planning, and contingency funding.

### GOAL 6: PROGRAMMING

Detailed project lists will be developed for infrastructure assets for a 10 year period as a minimum, and updated on an annual basis.

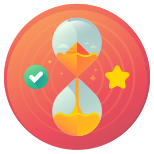
# Chapter 2

# State of the Infrastructure for Roads

# SOTI for Roads

## 689 kms

**92.6% Rural, 7.4% Urban or Semi-Urban - adjusted for boundary roads**



## 71.9%

**Average structural adequacy rating - all roads**

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**Roads in good to very good condition**

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**Replacement costs ($2022) - Up from$744.7 million ($2018) - Forecasted to Grow to $1.6 billion in $2032**

## SOTI For Roads: Contents

## List of Tables

## List of Figures



## List of Appendices – Appendix 1: Roads

## ***Asset Management Planning – Historical and Current Context for Roads***

Road Needs Studies (SOTI) were implemented by the Ministry of Transportation Ontario (MTO) in the 1960's, and evolved into the current methodology by the late 1970's. The most current version of the Inventory Manual for Municipal Roads is dated 1991, and is the methodology used for this report.

The process was originally created by the MTO as a means to distribute conditional funding, on an equitable basis, between municipalities. The practice was discontinued by a number of municipalities, when conditional funding for roads was eliminated in the mid 1990's. The SOTI process is a sound, consistent asset management practice that still works well today, and in view of the increasing demands on efficiency and asset management, represents a sound business practice that is beneficial to continue.

To put the Road Needs Study in a more current context, the State of the Infrastructure (SOTI) is essentially a Road Needs Study. This project enhances the basic requirements of a condition report by providing detailed analysis and development of a work plan based on the data, and the current budget, incorporating modern asset management principles.

In August 2012, the Province of Ontario, introduced a requirement for an Asset Management Plan (AMP) as a prerequisite for municipalities seeking funding assistance for capital projects from the province; effectively creating a conditional grant. To qualify for future infrastructure grants, an AMP had to be developed and approved by a municipal council by December 2013. On April 26, 2013 the province announced that it had created a $100 million Infrastructure Fund for small, rural and northern municipalities.

Subsequently, the province has introduced further initiatives for infrastructure funding: Ontario Community Infrastructure Fund (OCIF) and the Small Communities Fund (SCF). An Asset Management Plan (AMP) approved by Council is required as part of the submission for OCIF Applications. Asset Management Plans were to be reviewed for comprehensiveness.

On December 27, 2017, the Province filed Regulation 588/17, Asset Management Planning for Municipal Infrastructure. The regulation identifies provincial requirements and timelines for development and implementation of asset management plans. Initially, AMP's will have to include the 'core' assets; water and waste water linear and treatment, roads, bridge and culvert structures, and storm water linear and treatment. Regulation 588/17 Classification and Level of Service Measures are reported on separately through the County's Asset Management Plan update.

Regulation 588/17 requires and Asset Management Plan (AMP) for core assets by July 1, 2022 (originally July 1, 2021) that is based on condition data that is no more than two years old. This project positions the County well for compliance with the Regulation.

As an asset management practice, the County of Peterborough updates the condition information for the road system bi-annually. This ensures that pavement management decision making is based upon current data from field survey information.

## ***State of the Infrastructure (SOTI) Approach and Scope for Roads***

The scope of this report is to prepare a State of the Infrastructure Report that includes:

- Provide an analysis of the County of Peterborough (the County) road system based on data provided by the County.
- Add or change road sections attribute data to better reflect the constitution of the road system.
- Develop current replacement costs for each road asset.
- Develop recommendations for annual budgets based on current costs for amortization/capital depreciation and major program areas based on updated unit costs provided by the County.
- Develop analysis on the effect of current and recommended budgets on overall system performance.
- Develop a 10 year work plan
- Provide Asset Management Strategy recommendations
- Provide the answers to the basic asset management questions;
    - What you have
    - Where it's located
    - What condition is it in?
    - What is it worth?
    - What will it cost to replace it?
    - Useful remaining life?
    - What service level will be required over the service life?

The 2021 State of the Infrastructure Report summarizes the road system survey conducted by the County during the late summer / fall of 2021, combined with other road related data and ratings. The data provided identified the condition of each road asset by a pavement Condition Index and recommended maintenance, rehabilitation, or reconstruction treatment.

The report also provides an overview of the physical and financial needs of the road system in its entirety as well as by road section. Both information sources are used to develop programming and budgets. Once a road section reaches the project design stage, further detailed review, investigation, and design will be required to address the specific requirements of the specific project.

Accurate and current traffic counts are critical in managing a road system and their importance cannot be over emphasized. Accurate traffic and truck counts are critical to decision making in many areas such as establishing road maintenance classifications for Minimum Maintenance Standards purposes, as per Ontario Regulation 239/02 (*Minimum Maintenance Standards for Municipal Roads*), as well as determining appropriate geometry, structure, and cross-section when the road is rehabilitated or reconstructed. The County provided traffic information for the 2021 report. County of Peterborough.

## ***SOTI for Roads Methodology Overview***

Regulation 588/17 Asset Management Planning for Municipal Infrastructure requires;

'*v. a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.'*

The County collected their data in accordance with Ministry of Transportation of Ontario SP021 and SP024 Manuals

This report utilized that data, converting some of the information to an equivalent rating per the Ministry of Transportation Ontario (MTO) *Inventory Manual for Municipal Roads* from 1991. (*Inventory Manual or IM*) and added additional attribute data to provide a more holistic database. In the Inventory Manual Methodology, ratings are either a standalone value or incorporated into calculations performed, that then then classify the road section as a 'NOW', '1 to 5', or '6 to 10' year need for maintenance, rehabilitation or reconstruction in six critical areas.

The *Inventory Manual* offers a holistic review of each road section, developing a Time of Need (TON) or an Adequate rating in six areas that are critical to municipal decision making:

- Geometrics
- Surface Type
- Surface Width
- Capacity
- Structural Adequacy
- Drainage

The Time of Need is a prediction of the time until the road requires reconstruction, ***not the time frame until action is required***. Generally, the closer the timeline to reconstruction, the greater the deterioration of the road. For example, a road may be categorized as a '6 to 10' year need with a resurfacing recommendation. This road should be resurfaced as soon as possible to further defer the need to reconstruct.

Reporting and analysis is on an individual road asset (or road section) basis. Road sections should be reasonably consistent throughout their length, according to roadside environment, surface type, condition, cross section, speed limit, traffic count or a combination of these factors. For example, new sections should be created as surface type, surface condition, cross-section, or speed limit changes.

4 Roads understands that the County's recommendations are made based on the defects observed and PCI rating Once a road asset reaches the project level, the municipality may have selected another alternative based on additional information and investigation, asset management strategy, development considerations or available funding.

***'NOW'*** needs represent road sections that require reconstruction or major rehabilitation. 'NOW' needs are the backlog of work required on the road system; however, 'NOW' needs may not necessarily be the priority, depending on funding levels. Preservation and resurfacing treatments typically offer a better Return on Investment (ROI) than major rehabilitation or reconstruction, and are a higher priority from an asset management perspective. Construction improvements identified within this time period are representative of roads that have little or no service life left and are in poor condition, or have a significant structural, drainage or capacity need. Resurfacing treatments are never 'NOW' needs by definition in the Inventory Manual.

***'1 to 5'*** identifies road sections where reconstruction is anticipated within the next five years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other

deficiencies), deferring the need to reconstruct. These roads would be considered to be in fair condition.

***'6 to 10'*** identifies road sections where reconstruction improvements are anticipated within six to ten years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other deficiencies), thus deferring the need to reconstruct. These roads would be considered to be in good condition.

***'ADEQ'*** identifies road sections that do not have reconstruction or resurfacing needs, although minor maintenance such as crack sealing, other preservation treatments or spot drainage may be required. These roads would be considered to be in good to excellent condition.

This report summarizes the needs identified through a number of tabular appendices.

When the *Inventory Manual* was originally developed, the Province provided funding for municipal road systems; the road systems were measured by their system adequacy. *The system adequacy is the percentage of the road system that is not a "NOW" need*.

## ***Observations from Data Analysis***

During the data review and analysis, there were several unique aspects of the network that came to light:

- Current Level of Service measures are as follows;
    - System Adequacy measure for the County road system is 71.9% by centreline kilometres. System Adequacy includes all six critical measures; it is not solely pavement condition.
        - System Adequacy by Structural Adequacy alone is 73.1%. Some of the Structural Adequacy Needs are also identified as Capacity needs. As such there is not a simple mathematical correlation to the overall System Adequacy.
        - This LOS measure can be misleading. For example, if the condition of all segments was 36, the system would be 100% adequate. If the condition of all segments was 35, the system would be 0% adequate.
    - Weighted Average PCI is 70.2. 4 Roads recommends a minimum of 80, based on the County's deterioration curves. (Further discussion in section 8.3 of the report.)
    - Weighted Average Condition is 53.3 The cost to raise the current system condition to 70 is estimated to be $100,551,800 based on the most recent unit costs provided August 2022. The estimate does not include costs for other assets.
    - Good to Very Good roads for the entire system is 40.3% by centreline kilometres (All metrics considered in the six critical areas, by ln-km.) to 41% (Structural Adequacy Only.)
    - Potential Capacity Needs exist on 0.58% of the County road system.
- The anecdotal information with respect to the data does not appear to correlate. Anecdotally, the road system is described as being in worse condition that the data would appear to indicate.
- With respect to asset management programming;

  - The current work plan development may not be compliant with the requirements of Regulation 588/17. O.Reg 588/17 requires that the asset group condition be maintained over time. Current funding is very marginal.
  - From information the County has provide, the road system condition has decreased over time. The decrease is potentially caused by underfunding or program selection, or both.
  - The Strategic Asset Management Policy appears to be lacking in a number of areas. There does not appear to be specific Levels of Service (LOS) for existing conditions or target conditions.
  - From the County's records the overall condition of the road system has decreased approximately 10% over the previous 8 years (from 77.7 to 70.2).

- With respect to the proposed current funding level;
  - It appears that the proposed current funding will hold and improve the system condition.
    - The caveats are that asset deterioration will be as anticipated, the condition ratings are accurate, the selected treatments are appropriate and adhered to in the program, and the treatments will perform as anticipated.
- With respect to the improvement types
  - It was recognized during the development of the performance model that some of the improvement types, particularly those associated with LCB surfaces, did not appear to introduce sufficient structural enhancement to road sections at a lower condition level. The result was the appearance that the system could be sustained at a lower dollar value as a low cost improvement with a significant increase in condition would produce a higher Return on Investment, and this became a preferred selection.
  - In consultation with County staff the improvements in the software were revised to correct this circumstance and be more consistent with the treatments that were actually undertaken in the field.
- A Resurfacing or surface rehabilitation treatment is required on 382.120 Cl km. Of that amount, 170.19 CL km are NOW needs.
- It is anticipated that there will be Resurfacing needs, additional to the report, on approximately 47.24 Cl km in the next 1 to 2 year period (6.8% of the network).
- With respect to the database content;
  - The database was not populated to the extent that would have been required for subsidy purposes prior to 1995
    - i.e., drainage, and maintenance demand ratings were not populated,
  - Some fields were not populated in accordance with the Inventory Manual
    - i.e., Average Operating Speed
  - There were errors in surface type and Boundary Road designations.
  - Potentially substandard vertical and horizontal alignment has not been identified in the database.

- The PCI rating methodology that was in use prior to 2021, was not appropriate for evaluation of surface treated roads as some of the principal defects were not included in the ratings.

Based on the current review of the road system, the current system adequacy measure is **71.9**% by Centre Line Kilometres meaning that, 28.1% is deficient in the 'NOW' time period, in poor condition, or requires widening, based on the data provided.

## ***Needs and Funding Recommendations***

Based on the current unit costs being experienced, the estimated total cost of recommended improvements is **$252,960,939.** The improvement costs include **$160,369,939** for those roads identified as NOW needs and **$92,591** is for road work required in the '1 to 10' year time period or for maintenance. Included in those amounts is **$1,738,068** is for work on road sections that are adequate (Maintenance or Preservation). The unit costs and treatments were provided by the County.

The asset management plan is a function of the strategy and available financing. The development process for all elements is iterative, concurrent and holistic on a number of levels. It is complex.

From Regulation 588/17;

> *"4. For each asset category, the lifecycle activities that would need to be undertaken to maintain the current levels of service as described in paragraph 1 for each of the 10 years following the year for which the current levels of service under paragraph 1 are determined and the costs of providing those activities based on an assessment of the following:*
>
> *i. The full lifecycle of the assets.*
>
> *ii. The options for which lifecycle activities could potentially be undertaken to maintain the current levels of service.*
>
> *iii. The risks associated with the options referred to in subparagraph ii.*
>
> *iv. The lifecycle activities referred to in subparagraph ii that can be undertaken for the lowest cost to maintain the current levels of service."*
>
> ***underlined by 4 Roads**

Also, from Regulation 588/17;

> ***Endorsement and approval required***
>
> *"**8.** Every asset management plan prepared under section 5 or 6, or updated under section 7, must be,*
>
> *(a) endorsed by the executive lead of the municipality; and*
>
> *(b) approved by a resolution passed by the municipal council."*
>
> ***underlined by 4 Roads**

To paraphrase the foregoing, the work plan must be funded sufficiently as to sustain the asset group and be approved the Executive Lead and Council.

Based on the composition of the road system, and the most current unit prices provided in August 2022, budget recommendations have been developed for annual capital and maintenance programs as follows:

- **$24,376,100** for the road depreciation, based upon a 50-year life cycle. (This would be similar to the PSAB 3150 amortization value using current replacement cost.). The estimated *replacement cost* of the road system is $1,218,806,100. The *current value* of

the road system is estimated to be $966,765,100.

The design life for a road structure has typically been considered to be 50 years before reconstruction/replacement. However, in an urban setting in particular, with the underground utilities typically having an expected life in the 75 year range, it would seem more pragmatic to match the lifecycles of the road and utility assets. Road assets can be designed to last 75 years with only resurfacing required. Rural cross sections should be treated similarly.
This funding recommendation is for the existing system only and are not intended to include expansion projects.

- **$12,470,100** for average annual hot mix resurfacing, based upon a 16 (16.5) year cycle. This would approximate an average of 32.3 Cl km per year.
- **$1,628,300** on average annually, for single surface treatment of existing surface-treated roads, based on a seven-year cycle (this does not include additional padding or geometric correction).
- **$280,200** on average annually for crack sealing.

For modeling purposes, 4 Roads has created a funding level described as the 'Short Term Sustainability funding level of the road system. The Short Term Sustainability funding level,is the total of the recommended funding levels for hot mix resurfacing, single surface treatment and crack sealing: **$14,350,700**. The premise being that if the preservation and resurfacing programs are adequately funded then the system should be sustained over the short term. To sustain the road system over the entire life cycle, the Long Term Sustainability funding level is required. Performance modeling is discussed in Section 9 of this report.

To clarify, the Short Term Sustainability funding level is the required funding level to sustain or improve the road system over the *short* term; it is not the total of all of the above recommendations. Sustainable funding over the long term or life cycle has to be at the Long Term Sustainability level. The Short Term Sustainability funding level and performance model thereof, are computer derived. Intangible values and decisions and the effects of other external forces cannot be incorporated into the model. As such the Short Term Sustainability model is the minimum required to maintain the system- in theory. **Theoretically, the 'Short Term Sustainability' funding level would work. Practically, that would rely on every assumption and rating to be absolutely correct, and the program adhered to explicitly.** From a more pragmatic perspective and to deal with the real life realities of maintaining a road system, funding should be greater than the Short Term Sustainability value.

Municipal pavement management strategies are critical to managing the performance of the road system, more so, if funding is limited. Funding constraints should push the strategy toward those programs that extend the life cycle of the road by providing the correct treatment at the optimum time. Resurfacing, rehabilitation, and preservation projects should be a higher priority than reconstruction projects. The objective is to "keep the good roads good".

As the municipality advances the development of their Asset Management Plan (AMP), a paradigm shift will be required in the way that we approach management of assets. Traditionally, municipalities have spent a fixed amount on capital and maintenance each year. As evidenced by Table ES 17, programs are not at a consistent funding level on an annual basis. The annual budget overall is met, however, the distribution of costs between traditional capital and maintenance activities varies. That variance is being driven by the demands of the road system based on condition and project selection is based on condition and best Return on Investment.

This concept should be applied to all assets.

**The prime goal of any pavement management strategy should be to maintain overall system adequacy. The funding level for road-related programming should be set at a sufficient level so as to ensure that overall system adequacy does not decrease over time.**

In addition to the budgetary recommendations, the following recommendations are provided for the management of the road inventory.

1. The information and budget recommendations included in this report be used to further develop corporate Asset Management Planning.
2. Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those sections that are not going to be affected by upgrade due to development demands.
3. The funding level should be increased to the Long Term Sustainability limit over a ten year period.
4. Funding levels to be adjusted annually to accommodate growth / system expansion.
5. Funding should be adjusted annually to accommodate inflation.
6. The work plan should
    - Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those sections that are not going to be affected by upgrade due to development demands.
    - The work plan should cross integrate assets.
    - The work plan should be followed to optimize investments and performance of the road system.
7. The road system inspection interval should continue at the current 2 year interval.
8. Traffic counts should continue to be updated and repeated on a regular basis. The counting should include the percentage of truck traffic.
9. The data with respect to the number of potentially substandard vertical and horizontal curves should be entered into the database. A Roadside Safety Audit should be undertaken to assess the potential safety requirements on rural road sections with potentially substandard alignment.
10. The status of the Boundary Road Agreements should be reviewed.
11. The Level of Service for System Adequacy should be a Minimum of 75%.
12. The Level of Service for Weighted Average Physical Condition should be a minimum of 70.
13. The Level of Service for Weighted Average Pavement Condition Index should be a minimum of 80
14. The Level of Service for Good to Very Good Roads should be a minimum of 60%.
15. Develop a corporate asset management system throughout the organization with the development of a Standard Operating Procedure (SOP) for asset management.

16. Consideration should be given to development of the storm sewer system as a rate supported utility.
17. Improve the understanding of the evaluation systems being used for various assets.
18. The County should review the road asset identification scheme
19. The roadside drainage should be evaluated and recorded in the database

# Summary Information

***All tabular data adjusted for boundary roads unless otherwise noted***

Table ES 1: Boundary Roads by Roadside Environment and Centreline Kilometres

| Adjacent Agency | Rural | Semi Urban | Urban | Totals |
|---|---|---|---|---|
| County of Haliburton | 3.49 | 0.00 | 0.00 | 3.49 |
| Municipality of Trent Hills | 3.09 | 0.00 | 0.00 | 3.09 |
| City of Kawartha Lakes | 26.45 | 0.00 | 0.00 | 26.45 |
| **Grand Total** | **33.03** | **0.00** | **0.00** | **33.03** |
| **System Adjustment for Boundary Roads** | | | | **16.515** |

Table ES 2: Roadside Environment and Functional Class

| Functional Classification | Lanes | Roadside Environment | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rural | | Semi Urban | | Urban | | | | | |
| | | Cl-Km | Lane-Km | Cl-Km | Lane-Km | Cl-Km | Lane-Km | Cl-Km | Lane-Km | Cl-Km | Lane-Km |
| 200 | 2 | 11.040 | 22.080 | - | | - | - | **11.040** | **22.080** | 1.60% | 1.60% |
| 300 | 2 | 15.600 | 31.200 | - | | - | - | **15.600** | **31.200** | 2.26% | 2.26% |
| 400 | 2 | 115.520 | 231.040 | - | | - | - | **115.520** | **231.040** | 16.75% | 16.70% |
| 500 | 2 | 211.125 | 422.250 | - | | - | - | **211.125** | **422.250** | 30.61% | 30.52% |
| 600 | 2 | 111.140 | 222.280 | - | | - | - | **111.140** | **222.280** | 16.11% | 16.07% |
| 700 | 2 | 63.950 | 127.900 | - | | - | - | **63.950** | **127.900** | 0.0927 | 0.0924 |
| 800 | 2 | 110.550 | 221.100 | - | | - | - | **110.550** | **221.100** | 16.03% | 15.98% |
| ART | 2 | - | - | 1.180 | 2.360 | 0.330 | 0.660 | **1.510** | **3.020** | 0.22% | 0.22% |
| ART | 4 | - | - | 0.840 | 3.360 | 1.120 | 4.480 | **1.960** | **7.840** | 0.28% | 0.57% |
| C/R | 2 | - | - | 7.640 | 15.280 | 21.270 | 42.540 | **28.910** | **57.820** | 4.19% | 4.18% |
| CCI | 2 | - | - | - | | 10.160 | 20.320 | **10.160** | **20.320** | 1.47% | 1.47% |
| L/R | 2 | - | - | 7.020 | 14.040 | 1.320 | 2.640 | **8.340** | **16.680** | 1.21% | 1.21% |
| **TOTAL** | | **638.925** | **1,277.850** | **16.680** | **35.040** | **34.200** | **70.640** | **689.805** | **1,383.530** | | |
| **% OF TOTAL** | | 92.62% | 92.36% | 2.42% | 2.53% | 4.96% | 5.11% | | | | |

***Note: Adjusted for Boundary Roads, Minor Differences in Calculated fields due to rounding and sub calculations***

Table ES 3: Regulation 239/02 Classification- Minimum Maintenance Standards for Municipal Highways

| Lanes | | MMS Class - Regulation 239/02 - Minimum Maintenance Standards for Municipal Highways | | | | | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2 | | 3 | | 4 | | 5 | | 6 | | | | | |
| | Roadside | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km |
| 2 | Rural | 72.530 | 145.060 | 411.685 | 818.970 | 144.780 | 289.560 | 6.720 | 13.440 | 3.210 | 6.420 | **638.925** | **1,273.450** | 92.62% | 92.34% |
| 2 | Semi Urban | | | 6.670 | 13.340 | 1.020 | 2.040 | 5.160 | 10.320 | 2.990 | 5.980 | **15.840** | **31.680** | 2.30% | 2.30% |
| 4 | Semi Urban | 0.840 | 3.360 | | | | | | | | | **0.840** | **3.360** | 0.12% | 0.24% |
| 2 | Urban | 0.330 | 0.660 | 6.860 | 13.720 | 14.890 | 29.780 | 11.000 | 22.000 | | | **33.080** | **66.160** | 4.80% | 4.80% |
| 4 | Urban | 1.120 | 4.480 | | | | | | | | | **1.120** | **4.480** | 0.16% | 0.32% |
| **TOTAL** | | **74.820** | **153.560** | **425.215** | **846.030** | **160.690** | **321.380** | **22.880** | **45.760** | **6.200** | **12.400** | **689.805** | **1,379.130** | | |
| **% OF TOTAL** | | 10.85% | 11.13% | 61.64% | 61.35% | 23.29% | 23.30% | 3.32% | 3.32% | 0.90% | 0.90% | | | | |

***Note:*** ***Adjusted for Boundary Roads***
***Minor Differences in Calculated fields due to rounding and sub calculations;***
****Includes all potential Time of Needs elements including Capacity, Drainage, Surface Width, Surface Type, Geometry and Structural Adequacy***

Table ES 4: O.Reg 588/17 Classification

| Lanes | Roadside | Regulation 588/17 Class - Asset Management for Municipal Infrastructure | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Arterial | | Collector | | Local | | | | | |
| | | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km |
| 2 | Rural | 72.530 | 145.060 | 556.465 | 1,108.530 | 9.930 | 19.860 | **638.925** | **1,273.450** | 92.62% | 92.34% |
| 2 | Semi Urban | | | 7.690 | 15.380 | 8.150 | 16.300 | **15.840** | **31.680** | 2.30% | 2.30% |
| 4 | Semi Urban | 0.840 | 3.360 | 0.000 | 0.000 | 0.000 | 0.000 | **0.840** | **3.360** | 0.12% | 0.24% |
| 2 | Urban | 0.330 | 0.660 | 21.750 | 43.500 | 11.000 | 22.000 | **33.080** | **66.160** | 4.80% | 4.80% |
| 4 | Urban | 1.120 | 4.480 | 0.000 | 0.000 | 0.000 | 0.000 | **1.120** | **4.480** | 0.16% | 0.32% |
| **TOTAL** | | **74.820** | **153.560** | **585.905** | **1,167.410** | **29.080** | **58.160** | **689.805** | **1,379.130** | | |
| **% OF TOTAL** | | 10.85% | 11.13% | 84.94% | 84.65% | 4.22% | 4.22% | | | | |

Table ES 5: Roadside Environment and Surface Type

| Material Description | Local Municipality | | Roadside Environment | | | | | | Total | | % of Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rural | | Semi Urban | | Urban | | | | | |
| | ID # | Name | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms |
| High Class Bit.-asphalt | 66615 | Township of Asphodel-Norwood | 5.280 | 10.560 | 0.000 | 0.000 | 1.480 | 2.960 | **6.760** | **13.520** | 0.98% | 0.98% |
| High Class Bit.-asphalt | 66616 | Township of North Kawartha | 19.570 | 39.140 | 0.000 | 0.000 | 1.190 | 2.380 | **20.760** | **41.520** | 3.01% | 3.00% |
| High Class Bit.-asphalt | 66617 | Township of Cavan Monaghan | 36.635 | 73.270 | 0.000 | 0.000 | 5.190 | 10.380 | **41.825** | **83.650** | 6.06% | 6.05% |
| High Class Bit.-asphalt | 66618 | Township of Douro-Dummer | 47.255 | 94.510 | 1.180 | 2.360 | 1.980 | 3.960 | **50.415** | **100.830** | 7.31% | 7.29% |
| High Class Bit.-asphalt | 66619 | Municipality of Trent Lakes | 59.295 | 118.590 | 0.000 | 0.000 | 0.000 | 0.000 | **59.295** | **118.590** | 8.60% | 8.57% |
| High Class Bit.-asphalt | 66620 | Township of Havelock-Belmont-Methuen | 38.110 | 76.220 | 0.730 | 1.460 | 2.260 | 4.520 | **41.100** | **82.200** | 5.96% | 5.94% |
| High Class Bit.-asphalt | 66621 | Township of Otonabee-South Monaghan | 19.890 | 39.780 | 0.000 | 0.000 | 0.000 | 0.000 | **19.890** | **39.780** | 2.88% | 2.88% |
| High Class Bit.-asphalt | 66623 | Township of Selwyn | 36.360 | 72.720 | 3.010 | 7.500 | 6.420 | 12.840 | **45.790** | **93.060** | 6.64% | 6.73% |
| High Class Bituminous with micro | 66615 | Township of Asphodel-Norwood | 26.380 | 52.760 | 0.000 | 0.000 | 1.070 | 2.140 | **27.450** | **54.900** | 3.98% | 3.97% |
| High Class Bituminous with micro | 66616 | Township of North Kawartha | 13.040 | 26.080 | 0.000 | 0.000 | 0.800 | 1.600 | **13.840** | **27.680** | 2.01% | 2.00% |
| High Class Bituminous with micro | 66617 | Township of Cavan Monaghan | 19.170 | 38.340 | 0.000 | 0.000 | 1.310 | 2.620 | **20.480** | **40.960** | 2.97% | 2.96% |
| High Class Bituminous with micro | 66618 | Township of Douro-Dummer | 41.000 | 82.000 | 0.000 | 0.000 | 0.970 | 1.940 | **41.970** | **83.940** | 6.08% | 6.07% |
| High Class Bituminous with micro | 66619 | Municipality of Trent Lakes | 20.700 | 41.400 | 0.000 | 0.000 | 1.940 | 3.880 | **22.640** | **45.280** | 3.28% | 3.27% |
| High Class Bituminous with micro | 66620 | Township of Havelock-Belmont-Methuen | 0.000 | 0.000 | 0.000 | 0.000 | 2.280 | 4.560 | **2.280** | **4.560** | 0.33% | 0.33% |
| High Class Bituminous with micro | 66621 | Township of Otonabee-South Monaghan | 35.490 | 70.980 | 0.510 | 1.020 | 3.670 | 7.340 | **39.670** | **79.340** | 5.75% | 5.73% |
| High Class Bituminous with micro | 66623 | Township of Selwyn | 59.030 | 118.060 | 1.340 | 2.880 | 3.640 | 9.520 | **64.010** | **130.460** | 9.28% | 9.43% |
| Low Class Bit.-surface treated | 66615 | Township of Asphodel-Norwood | 3.945 | 7.890 | 0.000 | 0.000 | 0.000 | 0.000 | **3.945** | **7.890** | 0.57% | 0.57% |
| Low Class Bit.-surface treated | 66616 | Township of North Kawartha | 36.080 | 72.160 | 0.000 | 0.000 | 0.000 | 0.000 | **36.080** | **72.160** | 5.23% | 5.22% |
| Low Class Bit.-surface treated | 66617 | Township of Cavan Monaghan | 16.710 | 33.420 | 0.000 | 0.000 | 0.000 | 0.000 | **16.710** | **33.420** | 2.42% | 2.42% |
| Low Class Bit.-surface treated | 66618 | Township of Douro-Dummer | 20.865 | 41.730 | 0.000 | 0.000 | 0.000 | 0.000 | **20.865** | **41.730** | 3.02% | 3.02% |
| Low Class Bit.-surface treated | 66619 | Municipality of Trent Lakes | 20.740 | 41.480 | 0.000 | 0.000 | 0.000 | 0.000 | **20.740** | **41.480** | 3.01% | 3.00% |
| Low Class Bit.-surface treated | 66620 | Township of Havelock-Belmont-Methuen | 40.880 | 81.760 | 3.300 | 6.600 | 0.000 | 0.000 | **44.180** | **88.360** | 6.40% | 6.39% |

| Material Description | Local Municipality | | Roadside Environment | | | | | | Total | | % of Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rural | | Semi Urban | | Urban | | | | | |
| | ID # | Name | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms |
| Low Class Bit.-surface treated | 66621 | Township of Otonabee-South Monaghan | 6.240 | 12.480 | 2.000 | 4.000 | 0.000 | 0.000 | **8.240** | **16.480** | 1.19% | 1.19% |
| Low Class Bit.-surface treated | 66623 | Township of Selwyn | 16.260 | 32.520 | 4.610 | 9.220 | 0.000 | 0.000 | **20.870** | **41.740** | 3.03% | 3.02% |
| **TOTAL** | | | **638.925** | **1,277.850** | **16.680** | **35.040** | **34.200** | **70.640** | **689.805** | **1,383.530** | | |
| **% OF TOTAL** | | | 92.62% | 92.36% | 2.42% | 2.53% | 4.96% | 5.11% | | | | |

***Note: Adjusted for Boundary Roads, Minor Differences in Calculated fields due to rounding and sub calculations***

Table ES 6: Roadside Environment and Lanes by Municipality

| Lanes | Municipality | Roadside Environment | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rural | | Semi Urban | | Urban | | | | | |
| | | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms |
| 2 | Township of Asphodel-Norwood | 35.605 | 71.210 | 0.000 | 0.000 | 2.550 | 5.100 | **38.155** | **76.310** | 5.53% | 5.52% |
| 2 | Township of North Kawartha | 68.690 | 137.380 | 0.000 | 0.000 | 1.990 | 3.980 | **70.680** | **141.360** | 10.25% | 10.22% |
| 2 | Township of Cavan Monaghan | 72.515 | 145.030 | 0.000 | 0.000 | 6.500 | 13.000 | **79.015** | **158.030** | 11.45% | 11.42% |
| 2 | Township of Douro-Dummer | 109.120 | 218.240 | 1.180 | 2.360 | 2.950 | 5.900 | **113.250** | **226.500** | 16.42% | 16.37% |
| 2 | Municipality of Trent Lakes | 100.735 | 201.470 | 0.000 | 0.000 | 1.940 | 3.880 | **102.675** | **205.350** | 14.88% | 14.84% |
| 2 | Township of Havelock-Belmont-Methuen | 78.990 | 157.980 | 4.030 | 8.060 | 4.540 | 9.080 | **87.560** | **175.120** | 12.69% | 12.66% |
| 2 | Township of Otonabee-South Monaghan | 61.620 | 123.240 | 2.510 | 5.020 | 3.670 | 7.340 | **67.800** | **135.600** | 9.83% | 9.80% |
| 2 | Township of Selwyn | 111.650 | 223.300 | 8.120 | 16.240 | 8.940 | 17.880 | **128.710** | **257.420** | 18.66% | 18.61% |
| 4 | Township of Selwyn | 0.000 | 0.000 | 0.840 | 3.360 | 1.120 | 4.480 | **1.960** | **7.840** | 0.28% | 0.57% |
| | **Total** | **638.925** | **1277.850** | **16.680** | **35.040** | **34.200** | **70.640** | **689.805** | **1383.530** | | |
| | **% of Total** | 92.62% | 92.36% | 2.42% | 2.53% | 4.96% | 5.11% | | | | |

***Note: Adjusted for Boundary Roads***

***Minor Differences in Calculated fields due to rounding and sub calculations***

Table ES 7: Drainage Type

| Drainage Type | Roadside Environment | | | TOTAL | % OF TOTAL |
|---|---|---|---|---|---|
| | Rural | Semi Urban | Urban | | |
| AC - Adjacent Road, combination sewer | 1.310 | 0.000 | 0.000 | **1.310** | 0.19% |
| CS - Combination Sewer | 0.000 | 0.000 | 2.680 | **2.680** | 0.39% |
| DS - Ditch and Storm Sewer | 0.000 | 0.730 | 3.220 | **3.950** | 0.57% |
| N - None | 24.130 | 0.000 | 0.000 | **24.130** | 3.50% |
| OD - Open Ditch | 613.485 | 15.950 | 4.540 | **633.975** | 91.91% |
| SS - Storm Sewer | 0.000 | 0.000 | 23.760 | **23.760** | 3.44% |
| **TOTAL** | **638.925** | **16.680** | **34.200** | **689.805** | |
| % OF TOTAL | 92.62% | 2.42% | 4.96% | | |

Table ES 8: Drainage Needs

| Roadside Environment | Time of Need 1-5 | 6-10 | ADEQ | TOTAL | % OF TOTAL |
|---|---|---|---|---|---|
| Rural | 5.450 | 0 | 633.475 | **638.925** | 92.62% |
| Semi Urban | 0.000 | 0 | 16.680 | **16.680** | 2.42% |
| Urban | 0.000 | 0 | 34.200 | **34.200** | 4.96% |
| **TOTAL** | **5.450** | **0** | **684.355** | **689.805** | |
| **% OF TOTAL** | 0.79% | 0% | 99.21% | | |

Table ES 9: Potential Capacity Needs

| Roadside Environment | Time of Need 1 to 5 (km) | 6 to 10 (km) | ADEQ (km) | NOW (km) | TOTAL (km) | % OF TOTAL |
|---|---|---|---|---|---|---|
| Rural | 0 | 0 | 654.05 | 1.39 | **655.44** | 92.79% |
| Semi Urban | 0 | 0 | 16.68 | 0 | **16.68** | 2.36% |
| Urban | 0 | 0 | 31.52 | 2.68 | **34.2** | 4.84% |
| **TOTAL** | **0** | **0** | **702.25** | **4.07** | **706.32** | |
| % OF TOTAL | 0.00% | 0.00% | 99.42% | 0.58% | | |

***Not adjusted for Boundary Roads***

Table ES 10: O.Reg 588/17 Level of Service Measures for Roads

| Column 1 Service attribute | Column 2 Community levels of service (qualitative descriptions) | Column 3 Technical levels of service (technical metrics) | Level of Services Measure for Roads |
|---|---|---|---|
| Scope | Description, which may include maps, of the road network in the municipality and its level of connectivity. | Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality. 3,769.29 sq. km | Arterial Roads = 4.07**%**<br>Collector Roads = 30.95**%**<br>Local Roads = 1.54**%** |
| | Description or images that illustrate the different levels of road class pavement condition. | 1. For paved roads in the municipality, the average pavement condition index value.<br>2. For unpaved roads in the municipality, the average surface condition (e.g., excellent, good, fair or poor). | Weighted Average Overall road condition is = 70.2<br>Weighted average paved road condition is =70.2 |

Table ES 11: Time of Need by Length and MMS Class –All Needs*

| Time of Need | Regulation 239/02 Classification | | | | | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | 3 | | 4 | | 5 | | 6 | | | | | |
| | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km |
| 1-5 | 15.91 | 31.82 | 132.785 | 265.57 | 55.89 | 111.78 | 10.57 | 21.14 | 2.99 | 5.98 | **218.145** | **436.290** | 14.24% | 12.97% |
| 6-10 | 41.06 | 86.04 | 77.34 | 154.68 | 39.51 | 79.02 | 2.21 | 4.42 | | | **160.120** | **324.160** | 8.89% | 8.66% |
| ADEQ | 11.56 | 23.12 | 75.08 | 150.16 | 22.87 | 45.74 | 8.01 | 16.02 | | | **117.520** | **235.040** | 35.08% | 44.93% |
| NOW | 6.29 | 12.58 | 140.01 | 275.62 | 42.42 | 84.84 | 2.09 | 4.18 | 3.21 | 6.42 | **194.020** | **383.640** | 41.78% | 33.44% |
| **TOTAL** | **74.82** | **153.56** | **425.215** | **846.03** | **160.69** | **321.38** | **22.88** | **45.76** | **6.2** | **12.4** | **689.805** | **1379.130** | | |
| **% OF TOTAL** | 10.85% | 11.13% | 61.64% | 61.35% | 23.29% | 23.30% | 3.32% | 3.32% | 0.90% | 0.04% | | | | |
| System Adequacy | 91.6% | 91.8% | 67.1% | 67.4% | 73.6% | 73.6% | 90.9% | 90.9% | 48.2% | 48.2% | 71.9% | 72.2% | | |
| Good to Very Good | 70.33% | 71.09% | 35.85% | 36.03% | 38.82% | 38.82% | 44.67% | 44.67% | 0.00% | 0.00% | 40.25% | 40.55% | | |

***Note: Adjusted for Boundary Roads, Minor Differences in Calculated fields due to rounding and sub calculations***

Table ES 12: Road System Needs Summary by Municipality

| Municipality | Time of Need / Length / Improvement Costs | | | | | | | | | | | | TOTAL | | | % OF TOTAL | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1-5 | | | 6-10 | | | ADEQ | | | NOW | | | | | | | | |
| | Imp. Costs | CL-Km | Lane-Km | Imp. Costs | CL-Km | Lane-Km | Imp. Costs | CL-Km | Lane-Km | Imp. Costs | CL-Km | Lane-Km | Imp. Costs | CL-Km | Lane-Km | Imp. Costs | CL-Km | Lane-Km |
| Township of Asphodel-Norwood | 1,760,113 | 5.815 | 11.630 | 1,187,021 | 19.520 | 39.040 | 3,994 | 2.180 | 4.360 | 8,913,899 | 10.640 | 21.280 | 11,865,026 | 38.155 | 76.310 | 4.69% | 5.53% | 5.52% |
| Township of North Kawartha | 11,441,816 | 30.050 | 60.100 | 1,956,494 | 11.590 | 23.180 | 11,617 | 6.300 | 12.600 | 22,843,256 | 22.740 | 45.480 | 36,253,183 | 70.680 | 141.360 | 14.33% | 10.25% | 10.22% |
| Township of Cavan Monaghan | 6,669,166 | 14.995 | 29.990 | 1,734,893 | 23.840 | 47.680 | 149,805 | 16.140 | 32.280 | 21,467,697 | 24.040 | 48.080 | 30,021,561 | 79.015 | 158.030 | 11.87% | 11.45% | 11.42% |
| Township of Douro-Dummer | 10,667,898 | 44.365 | 88.730 | 2,122,576 | 23.880 | 47.760 | 20,257 | 20.850 | 41.700 | 20,894,289 | 24.155 | 48.310 | 33,705,021 | 113.250 | 226.500 | 13.32% | 16.42% | 16.37% |
| Municipality of Trent Lakes | 15,148,564 | 32.880 | 65.760 | 1,367,968 | 9.310 | 18.620 | 216,894 | 13.440 | 26.880 | 34,509,266 | 47.045 | 94.090 | 51,242,692 | 102.675 | 205.350 | 20.26% | 14.88% | 14.84% |
| Township of Havelock-Belmont-Methuen | 7,195,826 | 18.340 | 36.680 | 1,236,599 | 10.450 | 20.900 | 155,591 | 9.660 | 19.320 | 43,571,828 | 49.110 | 98.220 | 52,159,844 | 87.560 | 175.120 | 20.62% | 12.69% | 12.66% |
| Township of Otonabee-South Monaghan | 9,498,036 | 28.090 | 56.180 | 1,178,884 | 19.390 | 38.780 | 1,097,967 | 16.840 | 33.680 | 1,331,592 | 3.480 | 6.960 | 13,106,480 | 67.800 | 135.600 | 5.18% | 9.83% | 9.80% |
| Township of Selwyn | 14,226,901 | 40.890 | 81.780 | 3,460,176 | 42.140 | 88.200 | 81,944 | 34.830 | 69.660 | 6,838,113 | 12.810 | 25.620 | 24,607,133 | 130.670 | 265.260 | 9.73% | 18.94% | 19.17% |
| **Total** | **76,608,320** | **215.425** | **430.850** | **14,244,611** | **160.120** | **324.160** | **1,738,068** | **120.240** | **240.480** | **160,369,940** | **194.020** | **388.040** | **252,960,939** | **689.805** | **1,383.530** | 100.00% | 100.00% | 100.00% |
| % of Total | 30.28% | 31.23% | 31.14% | 5.63% | 23.21% | 23.43% | 0.69% | 17.43% | 17.38% | 63.40% | 28.13% | 28.05% | **100.00%** | **100.00%** | **100.00%** | | | |

***Note: Adjusted for Boundary Roads, Minor Differences in Calculated fields due to rounding and sub calculations***
***The recommendations are based on the observed and calculated deficiencies in the road system and are have not been cross asset integrated with other infrastructure***

Table ES 13: Road System Needs by Improvement Type and Time of Need by Centre Line Kilometre

| Improvement Class | Improvement ID/Desc | | Time of Need *1-5* | | *6-10* | | *ADEQ* | | *NOW* | | TOTAL | | % OF TOTAL | | Cost Per Km ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | |
| County | 1DST2_10% | DST Rehab 10 % base repairs | 3,426,558 | 10.190 | 1,299,723 | 4.610 | 0 | 0.000 | 0 | 0.000 | **4,726,281** | **14.800** | 1.87% | 2.10% | 319,343 |
| County | 1DST2_20% | DST Rehab 20% Base repairs | 8,404,477 | 22.770 | 0 | 0.000 | 0 | 0.000 | 4,563,589 | 9.860 | **12,968,066** | **32.630** | 5.13% | 4.62% | 397,428 |
| County | 1MICRO2D | Microsurfacing - Scratch and Surface Lift | 3,036,160 | 51.340 | 7,340,946 | 117.380 | 251,150 | 4.130 | 246,898 | 3.450 | **10,875,154** | **176.300** | 4.30% | 24.96% | 61,686 |
| County | 1MILLO1a2 | Grind and Overlay - Urban | 1,177,250 | 2.790 | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | **1,177,250** | **2.790** | 0.47% | 0.40% | 421,953 |
| County | 1ROL12 | Rural Overlay - County | 22,519,805 | 61.480 | 0 | 0.000 | 1,061,107 | 2.720 | 0 | 0.000 | **23,580,912** | **64.200** | 9.32% | 9.09% | 367,304 |
| County | 1SST1a | Single Surface Treatment - County | 0 | 0.000 | 0 | 0.000 | 203,789 | 3.020 | 0 | 0.000 | **203,789** | **3.020** | 0.08% | 0.43% | 67,480 |
| County | 1SST1a_10% | SST with 10% Base repairs | 0 | 0.000 | 5,603,943 | 38.130 | 0 | 0.000 | 218,826 | 1.570 | **5,822,769** | **39.700** | 2.30% | 5.62% | 146,669 |
| County | CIR-R2 | Cold in Place Recycling - Rural (100mm) | 4,042,066 | 6.490 | 0 | 0.000 | 0 | 0.000 | 2,486,130 | 4.020 | **6,528,196** | **10.510** | 2.58% | 1.49% | 621,141 |
| County | CIR-U2 | Cold in Place Recycling - Urban | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | 1,066,371 | 1.370 | **1,066,371** | **1.370** | 0.42% | 0.19% | 778,373 |
| County | CRK4rds | Crack Sealing | 0 | 0.000 | 0 | 0.000 | 222,023 | 85.050 | 0 | 0.000 | **222,023** | **85.050** | 0.09% | 12.04% | 2,611 |
| County | FDR-R2 | Full Depth Expanded Rural | 34,002,003 | 64.860 | 0 | 0.000 | 0 | 0.000 | 57,092,940 | 107.840 | **91,094,943** | **172.700** | 36.01% | 24.45% | 527,475 |
| County | LCB-REC2 | LCB Full Reconstruct | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | 88,681,206 | 76.150 | **88,681,206** | **76.150** | 35.06% | 10.78% | 1,164,560 |
| County | NONE | No Action Required | 0 | 0.000 | 0 | 0.000 | 0 | 25.320 | 0 | 0.000 | **0** | **25.320** | 0.00% | 3.58% | - |
| County | RR-HM-CLA2 | Class A Roads - Rural - Hot Mix - Reconstruction | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | 1,044,425 | 0.550 | **1,044,425** | **0.550** | 0.41% | 0.08% | 1,898,955 |
| County | URCONHMBC2 | Class B & C Roads - Urban - Hot Mix Reconstruction | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4,969,554 | 1.23 | **4,969,554** | **1.23** | 0.02 | 0.00 | 4,040,287 |
| **TOTAL** | | | **76,608,320** | **219.920** | **14,244,612** | **160.120** | **1,738,068** | **120.240** | **160,369,939** | **206.040** | **252,960,939** | **706.320** | | | |
| **% OF TOTAL** | | | 30.28% | 31.14% | 5.63% | 22.67% | 0.69% | 17.02% | 63.40% | 29.17% | | | | | |

***Note: Adjusted for Boundary Roads, Minor Differences in Calculated fields due to rounding and sub calculations***
***The recommendations are based on the observed and calculated deficiencies in the road system and are have not been cross asset integrated with other infrastructure***

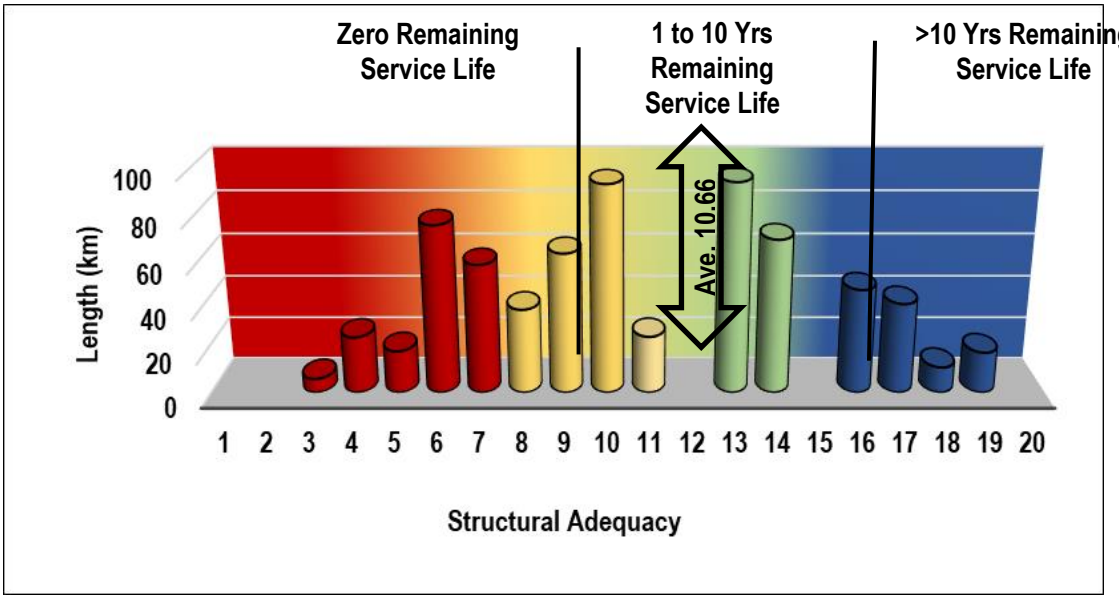
Table ES 14: Replacement Costs by Asset Class

| Asset Class | Roadside Environment Rural | | Semi Urban | | Urban | | TOTAL | | % OF TOTAL | | Cost /km |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Repl. Cost | Cl km | Repl. Cost | Cl km | Repl. Cost | Cl km | Repl. Cost | Cl km | Repl. Cost | Cl km | |
| CLA_R_HCB | 155,200,219 | 73.94 | 5,246,555 | 2.02 | 0.00 | 0.00 | **160,446,774** | **75.96** | 13.16% | 10.75% | 2,112,253 |
| CLA_U_HCB | 0.00 | 0.00 | 0.00 | 0.00 | 31,149,453 | 10.65 | **31,149,453** | **10.65** | 2.56% | 1.51% | 2,924,831 |
| CLB_LCB | 80,273,086 | 68.93 | 4,215,705 | 3.62 | 0.00 | 0.00 | **84,488,791** | **72.55** | 6.93% | 10.27% | 1,164,559 |
| CLB_R_HCB | 657,553,575 | 370.41 | 7,029,603 | 4.02 | 0.00 | 0.00 | **664,583,178** | **374.43** | 54.53% | 53.01% | 1,774,920 |
| CLB_U_HCB | 0.00 | 0.00 | 0.00 | 0.00 | 70,603,107 | 20.87 | **70,603,107** | **20.87** | 5.79% | 2.95% | 3,382,995 |
| CLC_LCB | 108,059,475 | 92.79 | 7,325,079 | 6.29 | 0.00 | 0.00 | **115,384,554** | **99.08** | 9.47% | 14.03% | 1,164,559 |
| CLC_R_HCB | 81,691,350 | 49.37 | 1,199,058 | 0.73 | 0.00 | 0.00 | **82,890,408** | **50.10** | 6.80% | 7.09% | 1,654,499 |
| CLC_U_HCB | 0.00 | 0.00 | 0.00 | 0.00 | 9,259,851 | 2.68 | **9,259,851** | **2.68** | 0.76% | 0.38% | 3,455,168 |
| **TOTAL** | **1,082,777,705** | **655.44** | **25,016,000** | **16.68** | **111,012,411** | **34.20** | **1,218,806,116** | **706.32** | | | |
| % OF TOTAL | 88.84% | 92.80% | 2.05% | 2.36% | 9.11% | 4.84% | | | | | |

Table ES 15: Replacement Cost by Functional Classification

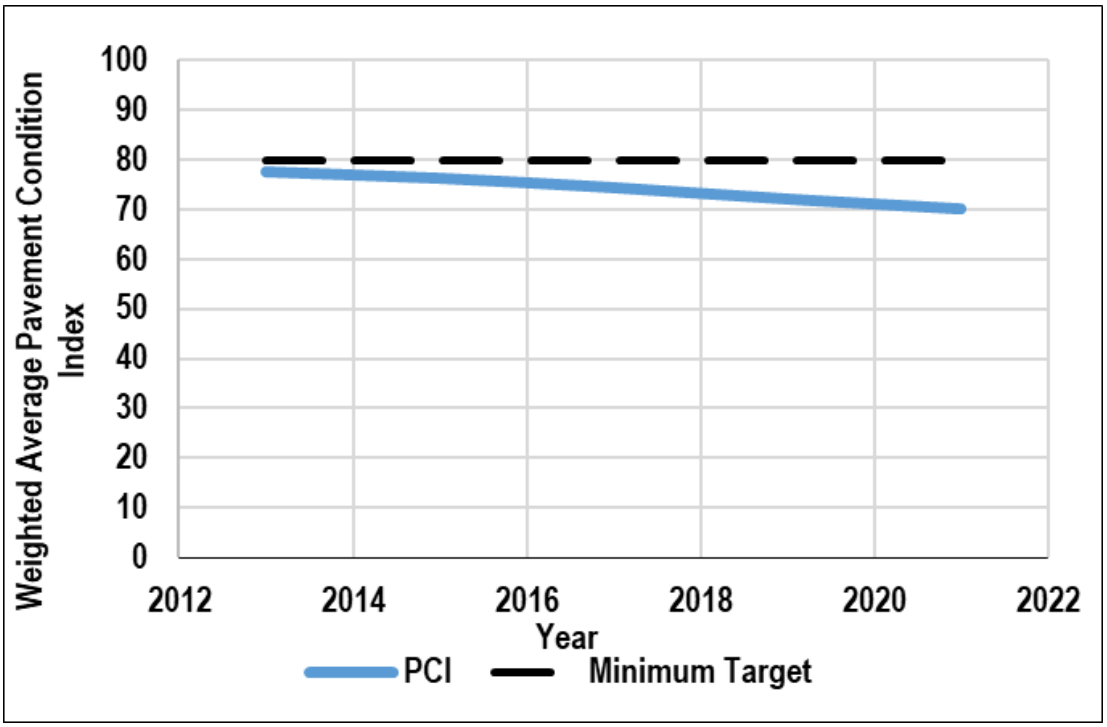
| Functional Classification / Subtype | Lanes | Roadside Environment Rural | | Semi Urban | | Urban | | TOTAL | | % OF TOTAL | | Cost /km |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Repl. Cost | Length (km) | Repl. Cost | Length (km) | Repl. Cost | Length (km) | Repl. Cost | Length (km) | Repl. Cost | Length (km) | |
| 200 | 2 | 12,856,737 | 11.04 | 0.00 | 0.00 | 0.00 | 0.00 | **12,856,737** | **11.04** | 1.05% | 1.56% | 1,164,560 |
| 300 | 2 | 18,167,128 | 15.60 | 0.00 | 0.00 | 0.00 | 0.00 | **18,167,128** | **15.60** | 1.49% | 2.21% | 1,164,559 |
| 400 | 2 | 158,726,960 | 115.52 | 0.00 | 0.00 | 0.00 | 0.00 | **158,726,960** | **115.52** | 13.02% | 16.36% | 1,374,021 |
| 500 | 2 | 345,866,839 | 214.50 | 0.00 | 0.00 | 0 | 0.00 | **345,866,839** | **214.50** | 28.38% | 30.37% | 1,612,433 |
| 600 | 2 | 212,902,244 | 124.28 | 0.00 | 0.00 | 0.00 | 0.00 | **212,902,244** | **124.28** | 17.47% | 17.60% | 1,713,085 |
| 700 | 2 | 114,245,522 | 63.95 | 0.00 | 0.00 | 0.00 | 0.00 | **114,245,522** | **63.95** | 9.37% | 9.05% | 1,786,482 |
| 800 | 2 | 220,012,275 | 110.55 | 0.00 | 0.00 | 0.00 | 0.00 | **220,012,275** | **110.55** | 18.05% | 15.65% | 1,990,161 |
| ART | 2 | 0.00 | 0.00 | 2,559,672 | 1.18 | 951,379 | 0.33 | **3,511,051** | **1.51** | 0.29% | 0.21% | 2,325,199 |
| ART | 4 | 0.00 | 0.00 | 2,686,883 | 0.84 | 4,088,175 | 1.12 | **6,775,058** | **1.96** | 0.56% | 0.28% | 3,456,662 |
| C/R | 2 | 0.00 | 0.00 | 11,245,308 | 7.64 | 70,023,521 | 21.27 | **81,268,829** | **28.91** | 6.67% | 4.09% | 2,811,098 |
| CCI | 2 | 0.00 | 0.00 | 0.00 | 0.00 | 31,435,753 | 10.16 | **31,435,753** | **10.16** | 2.58% | 1.44% | 3,094,070 |
| L/R | 2 | 0.00 | 0.00 | 8,524,137 | 7.02 | 4,513,583 | 1.32 | **13,037,720** | **8.34** | 1.07% | 1.18% | 1,563,276 |
| **TOTAL** | | **1,082,777,705** | **655.44** | **25,016,000** | **16.68** | **111,012,411** | **34.20** | **1,218,806,116** | **706.32** | | | |
| % OF TOTAL | | 88.84% | 92.80% | 2.05% | 2.36% | 9.11% | 4.84% | | | | | |

Graph ES 1: Condition Rating vs. Length (km)

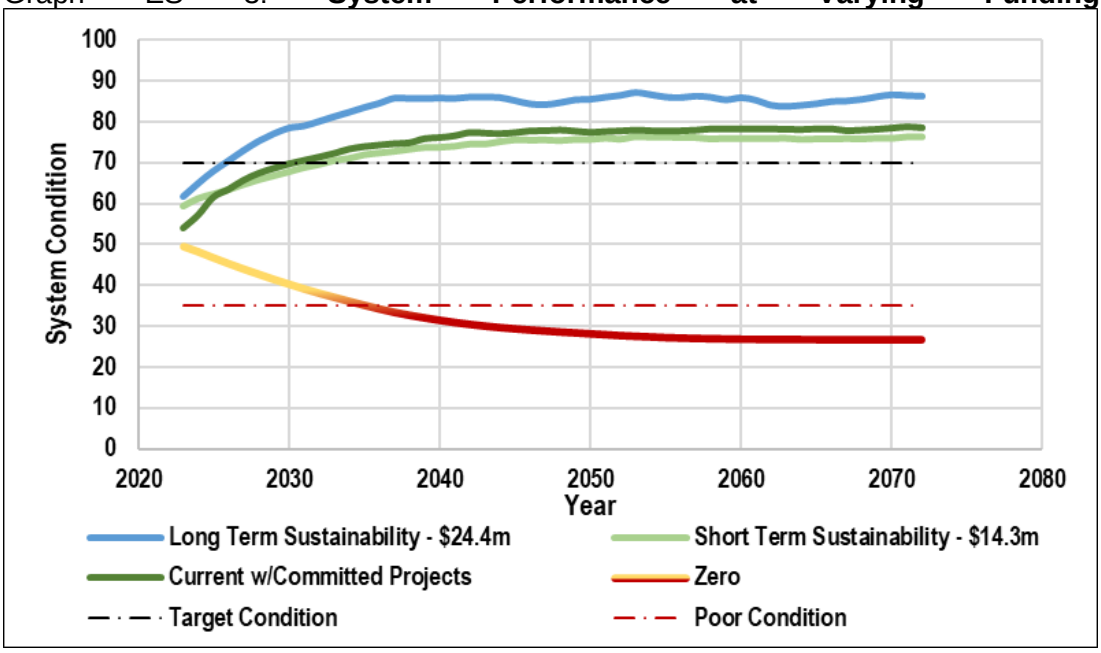



***Note: Physical Condition is Structural Adequacy multiplied by 5***

Graph ES 2: Weighted Average Pavement Condition Index vs. Time

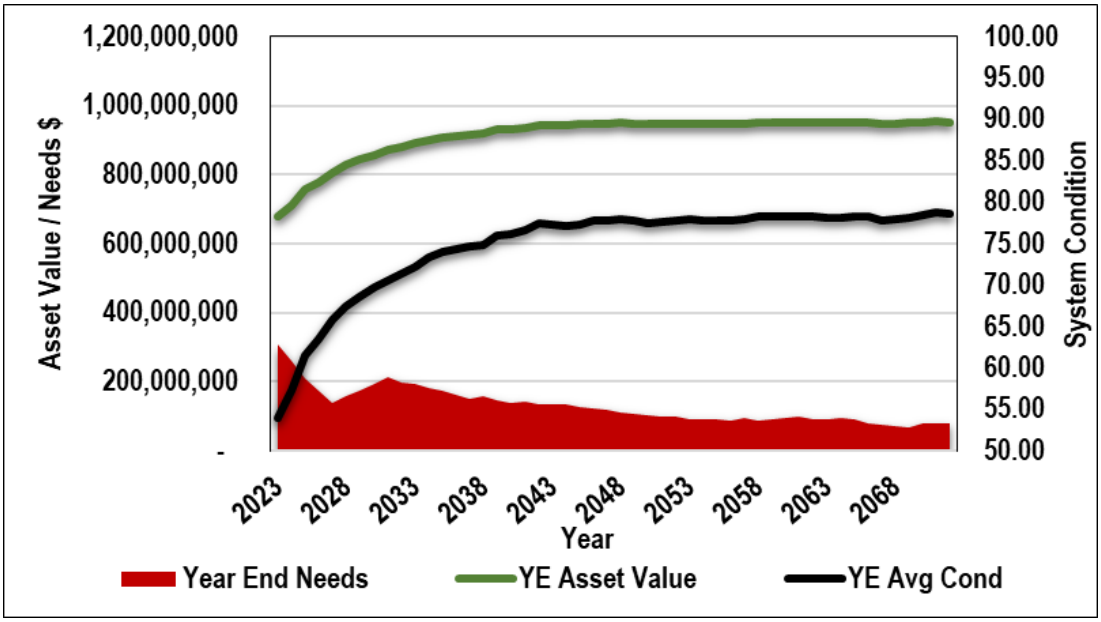


Graph ES 3: **System Performance at Varying Funding Levels**




***Assumes pavement will perform as a perpetual pavement after improvement***
***The current budget is only proposed at this time and has not been approved by Council*.**

Graph ES 4: Anticipated System Performance at Proposed Funding Level, with Committed Projects



Graph ES 5: The Funding Window

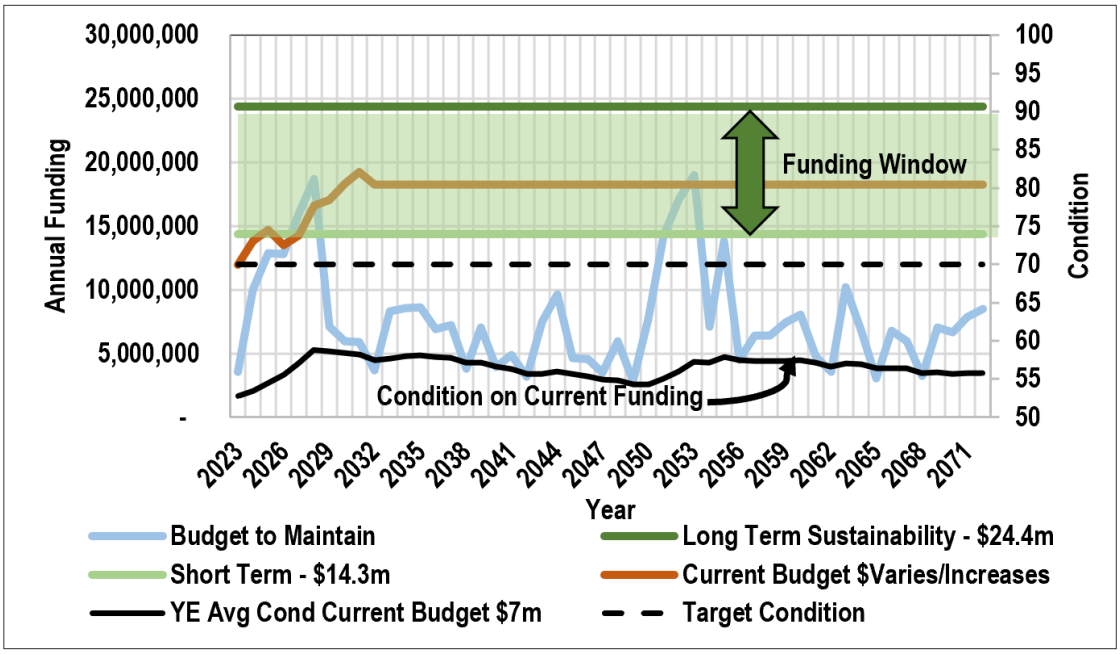


Table ES 16: Good to Very Good Roads by Structural Adequacy

| tructural dequacy | Roadside Rural | | Semi Urban | | Jrban | | Description | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | CL-Km | ane-Km | CL-Km | ane-Km | CL-Km | ane-Km | | CL-Km | ane-Km | CL-Km | ane-Km |
| | | | | | | | Poor | | | | |
| | | | | | | | Poor | | | | |
| | .01 | 0.02 | .73 | .46 | .5 | | Poor | **.240** | **2.480** | .17% | .17% |
| | 5.61 | 1.22 | | | | | Poor | **5.610** | **1.220** | .91% | .91% |
| | 9.15 | 8.3 | | | | | Poor | **9.150** | **8.300** | .66% | .66% |
| | 4.66 | 49.32 | | | .37 | .74 | Poor | **6.030** | **52.060** | 6.46% | 6.46% |
| | 8.49 | 16.98 | | | | | Poor | **8.490** | **16.980** | 0.35% | 0.35% |
| | 6.31 | 2.62 | | | | | Fair | **8.310** | **6.620** | .33% | .33% |
| | 1.735 | 23.47 | | | .82 | .64 | Fair | **3.555** | **27.110** | 2.11% | 2.11% |
| 0 | 4.25 | 68.5 | .71 | 5.42 | .9 | .8 | Fair | **3.860** | **87.720** | .59% | .56% |
| 1 | 5.43 | 0.86 | | | .47 | .94 | Fair | **5.900** | **1.800** | .37% | .36% |
| 2 | | | | | | | Good | | | | |
| 3 | 8.28 | 76.56 | .64 | .28 | .79 | .58 | Good | **4.710** | **89.420** | .67% | .64% |
| 4 | 3.48 | 26.96 | .84 | .36 | .36 | 2.96 | Good | **9.680** | **43.280** | .38% | .54% |
| 5 | | | | | | | Good to Excellent | | | | |
| 6 | 1.73 | 3.46 | | | .51 | 1.02 | Good to Excellent | **7.240** | **4.480** | .33% | .31% |
| 7 | 2.08 | 4.16 | .73 | .46 | .08 | 6.16 | Good to Excellent | **0.890** | **1.780** | .74% | .73% |
| 8 | .74 | 1.48 | .03 | .06 | .85 | .7 | Good to Excellent | **1.620** | **3.240** | .06% | .06% |
| 9 | 6.97 | 3.94 | | | .55 | .1 | Good to Excellent | **8.520** | **7.040** | .70% | .69% |
| 0 | | | | | | | Good to Excellent | | | | |
| **OTAL** | **38.925** | **277.85** | **6.68** | **5.04** | **4.2** | **0.64** | | **89.805** | **383.530** | | |
| % OF TOTAL | 2.62% | 2.36% | .42% | .53% | .96% | .11% | | | | | |
| % Poor | 8.63% | 8.63% | .38% | .17% | .47% | .29% | | 6.89% | 6.82% | | |
| % Fair | 2.51% | 2.51% | 8.21% | 5.42% | 2.25% | 1.86% | | 2.13% | 2.04% | | |
| % Good to Very Good | 8.9% | 8.9% | 7.4% | 0.4% | 2.3% | 2.8% | | 0.98% | 1.14% | | |

***Note: Adjusted for Boundary Roads, Based on Structural Adequacy Rating only***

Table ES 17: 10 Year Program from Performance Model – Proposed Current with Committed Projects -High level Overview (20220825)

| Improvement Type | Year | | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | |
| 1DST2_10 | | | | | | 524,070 | 817,405 | 1,048,521 | | | **2,389,996** |
| 1DST2_20 | 928,200 | 7,002,450 | 5,820,750 | 3,459,369 | 5,458,451 | | | 2,529,853 | 3,410,814 | | **28,609,887** |
| 1MICRO2D | 465,800 | 2,858,350 | 1,415,759 | 3,392,010 | 4,037,771 | 88,276 | | 71,758 | 67,367 | | **12,397,091** |
| 1MILLO1a2 | | | 388,000 | | 261,650 | 935,733 | | | 340,640 | | **1,926,023** |
| 1PR2a | | 1,137,500 | | | 203,750 | | | | | | **1,341,250** |
| 1ROL12 | | | | | | | 258,933 | 577,218 | | 67,910 | **904,061** |
| 1SST1a | | | | 112,710 | 521,220 | | | | | | **633,930** |
| 1SST1a_10 | | | | | | | | | 96,036 | 4,189,820 | **4,285,856** |
| CIR-R2 | | 1,349,300 | | | | | | | 5,290,310 | 7,178,907 | **13,818,517** |
| CIR-U2 | | | | | 1,066,371 | | | 1,087,470 | | | **2,153,841** |
| CRK4rds | | | | | 167,618 | 42,786 | 35,868 | 83,538 | 62,000 | 23,494 | **415,304** |
| FDR-R2 | 10,543,350 | 1,479,375 | 7,072,500 | 6,641,250 | 2,220,000 | 14,406,028 | 14,767,753 | 12,628,866 | 7,989,371 | 6,285,599 | **84,034,092** |
| FDR-U2 | | | | | 338,513 | 624,589 | 1,137,220 | 251,124 | 1,983,445 | 491,686 | **4,826,577** |
| **Grand Total** | **11,937,350** | **13,826,975** | **14,697,009** | **13,605,339** | **14,275,344** | **16,621,482** | **17,017,179** | **18,278,348** | **19,239,983** | **18,237,416** | **157,736,425** |

***Note: Budget levels are not Council Approved***

**Table ES 18: County of Peterborough Improvement Type Abbreviation Summary**

| County of Peterborough Improvement Types | |
|---|---|
| **Code** | **Description** |
| **1DST2** | Double Surface Treatment Rehab |
| **1MICRO2** | Microsurfacing - Single Lift |
| **1MICRO2D** | Microsurfacing - Scratch and Surface Lift |
| **1MILLO1a2** | Grind and Overlay - Urban |
| **1ROL12** | Rural Overlay - County |
| **1SST1a** | Single Surface Treatment - County |
| **CIR-R2** | Cold in Place Recycling - Rural (100mm) |
| **CIR-U2** | Cold in Place Recycling - Urban |
| **CRK4rds** | Crack Sealing |
| **FDR-R2** | Full Depth Expanded Rural |
| **FDR-U2** | Full Depth Expanded - Urban |
| **Hold -1** | Hold 1 Year |
| **Hold -2** | Hold 2 Years |
| **Hold -3** | Hold 3 Years |
| **LCB-REC2** | LCB Full Reconstruct |
| **NONE** | No Action Required |
| **RR-HM-CLA2** | Class A Roads - Rural - Hot Mix - Reconstruction |
| **RR-HM-CLB2** | Class B Roads - Rural - Hot Mix - Reconstruction |
| **RR-HM-CLC2** | Class C Roads - Rural - Hot Mix - Reconstruction |
| **URCONHMBC2** | Class B & C Roads - Urban - Hot Mix Reconstruction |
| **URECONHMA2** | Class A Road - Urban - Hot Mix - Reconstruction |

# 1 SOTI Introduction and Background

## 1.1 Conditional Funding - Historical and Current Context

Road Needs Studies (RNS) were implemented by the Ministry of Transportation Ontario (MTO) in the 1960's, and evolved into the current format by the late 1970's. The most current version of the Inventory Manual is dated 1991, and is the methodology used for this report.

The process was originally created by the MTO as a means to distribute conditional funding on an equitable basis between municipalities. The practice was discontinued by a number of municipalities, when conditional funding for roads was eliminated in the mid 1990's. The RNS process is a sound, consistent asset management practice that still works well today, and in view of the increasing demands on efficiency and asset management, represents a sound business practice that is beneficial to continue.

In August 2012, the Province of Ontario, introduced a requirement for an Asset Management Plan (AMP) as a prerequisite for municipalities seeking funding assistance for capital projects from the province; effectively creating a conditional grant. To qualify for future infrastructure grants, an AMP had to be developed and approved by a municipal council by December 2013. On April 26, 2013 the province announced that it had created a $100 million Infrastructure Fund for small, rural and northern municipalities.

Subsequently, the province has introduced further initiatives for infrastructure funding: Ontario Community Infrastructure Fund (OCIF) and the Small Communities Fund (SCF). An Asset Management Plan (AMP) approved by Council is required as part of the submission for OCIF Applications. Asset Management Plans were to be reviewed for comprehensiveness.

On December 27, 2017, the Province filed Regulation 588/17, Asset Management Planning for Municipal Infrastructure. The regulation identifies provincial requirements and timelines for development and implementation of asset management plans. Initially, AMP's will have to include the 'core' assets; water and waste water linear and treatment, roads, bridge and culvert structures, and storm water linear and treatment. Regulation 588/17 is reported on separately through the County's Asset Management Plan update.

Regulation 588/17 required an Asset Management Plan (AMP) for core assets by July 1, 2021, which was subsequently revised to July 1, 2022. The plan is to be based on condition data that is no more than two years old. This project positions the County well for compliance with the Regulation.

Conditional Grants are not new to Ontario. Until the mid-1990's, Road Needs Studies (RNS) were completed by municipalities and submitted to the Ministry of Transportation (MTO) on an annual basis in order to receive provincial funding for their road programs. The State of the Infrastructure report for Roads is essentially a Road Needs Study.

As an asset management practice, the County of Peterborough updates the condition information for the road system bi-annually. This ensures that pavement management decision making is based upon current data from field survey information.

WSCS Consulting has engaged 4 Roads Management Services Inc. to;

- Provide an analysis of the County of Peterborough (the County) road system based on data provided by the County
- Add or change road sections attribute data to better reflect the constitution of the road system.
- Develop current replacement costs for each road asset.
- Develop recommendations for annual budgets based on current costs for amortization/capital depreciation and major program areas based on updated unit costs provided by the County.
- Develop analysis on the effect of current and recommended budgets on overall system performance.
- Develop a 10 year work plan
- Provide Asset Management Strategy recommendations
- Provide the answers to the basic asset management questions;
    - What you have
    - Where it's located
    - What condition is it in?
    - What is it worth?
    - What will it cost to replace it?
    - Useful remaining life?
    - What service level will be required over the service life?

The 2021 SOTI summarizes the condition data survey conducted by the County during the late summer / fall of 2021.The information provided by the County identified the condition of each road asset by its' PCI rating and recommended maintenance, rehabilitation or reconstruction treatment.

The report also provides an overview of the physical and financial needs of the road system in its entirety as well as by road section. Both information sources are used to develop programming and budgets. However, once a road section reaches the project design stage, further detailed review, investigation, and design will be required to address the specific requirements of each project.

Improvement recommendations made by the County staff and provided to WSCS and 4 Roads were based on the PCI rating, and defects observed. Once a road asset reaches the project level, the municipality may have selected another alternative based on additional information, asset management strategy, development considerations or available funding.

The PCI rating methodology and the Inventory Manual methodology is discussed further in Section 2 of this report and Appendix A.

# 2 Asset Condition Rating Methodology

## 2.1 Regulation 588/17 Requirements - Asset Management Planning for Municipal Assets

Regulation 588/17 Asset Management Planning for Municipal Infrastructure is a very complex regulation with defined deliverables and measures in terms of an Asset Management Plan. With respect to the condition rating methodology, the regulation requires;

> *'v. a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.'*

## 2.2 Asset Condition Rating Methodology

As an asset management practice, the County of Peterborough updates the condition information for the road system bi-annually through a condition update project conducted by its' own staff. This ensures that pavement management decision making is based upon current data from field survey information and is completed in accordance with standard engineering practice.

For the purposes of this project, the road sections have a PCI rating, a Structural Adequacy rating and a Physical Condition rating ( essentially just another PCI with different weightings.)

The PCI ratings are in accordance with the Ministry of Transportation's SP021 and SP024 Manuals for rating Surface Treatment and Hot Mix Asphalt respectively. Structural Adequacy has been approximated based on the PCI ratings.

Having current ratings ensures that pavement management decision making is based upon current data from field survey information and is completed in accordance with standard engineering practice. An Asset Management Plan for Core Assets was required by July 1, 2021, now extended to July 1, 2022.

For the purposes of this report, the condition data has been supplemented with additional attribute data in consultation with County staff. The additional attribute data and conversion of the PCI ratings to a Structural Adequacy (another type of pavement distress measure) allowed a broader reporting and analysis of the road system

## 2.3 Pavement Condition Index (PCI)

The PCI method offers a detailed rating of a road section through identification of the severity and extent of specific defects.

Different pavement types display different failure mechanisms and as such, there are different methodologies for the different surface types. In the County the surface types are hot mix asphalt and surface treatment. Appendix A1 of this report includes an extract of the Ministry of Transportation's Pavement Rehabilitation and Design Manual, Second Edition, 2013 providing detail on the PCI methodology.

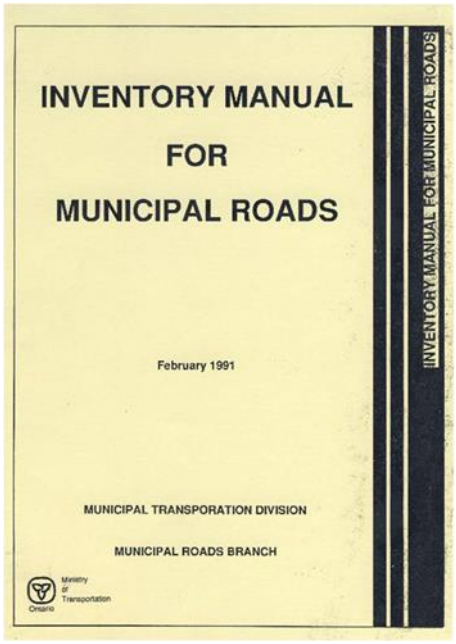
There are many different PCI methodologies that vary by jurisdiction. The same section of road may/will get a different PCI rating using a different methodology as there are changes to the weighting and severity of defects and the weighting of the ride component of the rating.

### 2.3.1 Inventory Manual History

From the 1960's until the mid 1990's, the Ministry of Transportation (MTO) required municipalities to regularly update the condition ratings of their road systems in a number of key areas. The process was originally created by the MTO, as a means to distribute conditional funding, on an equitable basis, between municipalities. The reports were referred to as a 'Road Needs Study' (SOTI) and were required in order to receive a conditional grant to subsidize the municipal road programs. After the introduction in the 1960's by the MTO, the methodology evolved into the current format by the late 1970's. The most current version of the Inventory Manual is dated 1991, and is the methodology used for this report. The practice was discontinued by a number of municipalities, when conditional funding for roads was eliminated in the mid 1990's.

#### 2.3.1.1 Inventory Manual Overview

The Inventory Manual Methodology is a sound, consistent, asset management practice that still works well today, and in view of the increasing demands on efficiency and asset management, represents a sound asset management practice that should be repeated on a cyclical basis. The road section review identifies the condition of each road asset by its time of need and recommended rehabilitation strategy.




The fundamental differences between PCI and the Inventory Manual (IM) is that the IM sets the stage to manage the road - not just the pavement. The type of data collected is much broader in scope, but the distress measure is less detailed (Structural Adequacy).

The County of Peterborough SOTI Report summarizes the road system survey conducted during the fall of 2021 by the County. The SOTI Report provides an overview of the overall condition of the road system by road section, including such factors as PCI, structural adequacy, drainage, and surface condition. Typically, a study following the IM also provides an indication of apparent deficiencies in horizontal and vertical alignment elements, as per the Ministry of Transportation's manual, "Geometric Design Standards for Ontario Highways". However, those data fields were not populated in the County database.

The report provides an overview of the physical and financial needs of the road system, which may be used for programming and budgeting. However, once a road section reaches the project design stage, further detailed review, investigation, and design will be required to address the specific requirements of the project.

Asset Management by its very nature is holistic. Managing a road network based solely on pavement condition would be critically deficient in scope in terms of the information required to make an informed decision as to the improvements required on a road section.

The *Inventory Manual* offers a holistic review of each road section, developing a Time of Need (TON) or an Adequate rating in six areas that are critical to municipal decision making:

- Geometrics
- Surface Type

- Surface Width
- Capacity
- Structural Adequacy
- Drainage

Evaluations of each road section were completed generally in accordance with the MTO's *Inventory Manual for Municipal Roads* (1991). Data collected was entered directly into WorkTech's Asset Foundation software. Condition ratings, Time of Need, Priority Ratings, and associated costs were then calculated by the software, in accordance with the *Inventory Manual*. Unit costs for construction were provided by County of Peterborough staff.

Road sections should be reasonably consistent throughout their length, according to roadside environment, surface type, condition, cross section, speed limit, or a combination of these factors. As an example, section changes should occur as surface type, surface condition, cross-section, or speed limit changes.

The Condition Ratings, developed through the scoring in the *Inventory Manual*, classify roads as 'NOW', '1 to 5', or '6 to 10' year needs for reconstruction. The Time of Need is a prediction of the time until the road requires reconstruction, *not the time frame until action is required*. For example, a road may be categorized as a '6 to 10' year need with a resurfacing recommendation. This road should be resurfaced as soon as possible, to further defer the need to reconstruct.

Field data is obtained through a visual examination of the road system and includes: structural adequacy, level of service, maintenance demand, horizontal and vertical alignment, surface and shoulder width, surface condition, and drainage. The Condition Rating is calculated based upon a combination of other calculations and data.

To best utilize the database information and modern asset management concepts, it has to be understood that the Time of Need (TON) ratings are the estimated time before the road would require reconstruction. NOW needs are still roads that require reconstruction; however, it is not intended that '1 to 5' and '6 to 10' year needs are to be acted on in that timeframe. The '1 to 5' and '6 to 10' year needs are current candidates for resurfacing treatments that will elevate their structural status to 'ADEQ', and offer the greatest return on investment for a road authority (notwithstanding a drainage or capacity need, etc.).

The Time of Need ratings from the Structural Adequacy perspective are described more fully in Appendix A2.

By combining the PCI and Inventory Manual information wherever possible, the best of both systems may be realized

## 2.4 Pavement Condition Index / Inventory Manual Differences and Approximations

Pavement Condition Index -PCI is a generic term. From **ASTM 6433**, Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys, Pavement Condition Index (PCI) is defined as follows;

> *'2.1.4 pavement condition index (PCI)—a numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition and 100 being the best possible condition.*

*4.1 The PCI is a numerical indicator that rates the surface condition of the pavement. The PCI provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety). The PCI cannot measure structural capacity nor does it provide direct measurement of skid resistance or roughness. It provides an objective and rational basis for determining maintenance and repair needs and priorities. Continuous monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI provides feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.'*

There are many different 'PCI' indices across Ontario and North America. Typically, the PCI methodology varies by surface material, as there are different failure mechanisms for the different surface materials. PCI methodologies rate all distresses- structural or otherwise- with the rater assigning a severity and density for each defect. PCI indices also usually include a ride component which is factored in with the distresses to a varying degree based on methodology used.

The Inventory Manual distress rating is Structural Adequacy (SA). It is a measure of the percentage of the road section that is exhibiting structural distress i.e., fatigue, alligator, wheel path cracking. Other defects including non structural pavement defects, surface widths, drainage etc are factored into the improvement recommendation by the rater. Ride (Surface Condition in the IM) is not factored into this rating.

Due to the aforementioned differences between the rating methodologies, a direct mathematical conversion would be difficult. Table 2.1 provides an approximation between the PCI methodology for hot mix asphalt pavements as shown in MTO's Pavement Rehabilitation and Design Manual, Second Edition 2013, and the Inventory Manual for Municipal Roads, 1991. As a further example, PCI ratings from ASTM 6433 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys tend to align more closely with the Physical Condition ratings (Structural Adequacy time 5).

Table 2.1: PCI to Inventory Manual Approximations

| PCI Range | SA | Physical Condition (SA * 5) | % Structural Distress - Inventory Manual | Time of Need - Inventory Manual | Descriptor |
|---|---|---|---|---|---|
| 100 | 20 | 100 | <5 | ADEQ | Good |
| 100 | 19 | 95 | 5-9 | ADEQ | Good |
| 95-99 | 18 | 90 | 5-9 | ADEQ | Good |
| 89-95 | 17 | 85 | 5-9 | ADEQ | Good |
| 85-89 | 16 | 80 | 5-9 | ADEQ | Good |
| 86-86 | 15 | 75 | 5-9 | ADEQ | Good |
| 81-85 | 14 | 70 | 10 | 6 to 10 | Good |
| 75-81 | 13 | 65 | 10-15 | 6 to 10 | Good |
| 74-76 | 12 | 60 | 10-15 | 6 to 10 | Good |
| 73-75 | 11 | 55 | 15 | 1 to 5 | Fair |
| 67-73 | 10 | 50 | 16-19 | 1 to 5 | Fair |

| | | | | | |
|---|---|---|---|---|---|
| 59-67 | 9 | 45 | 16-19 | 1 to 5 | Fair |
| 55-59 | 8 | 40 | 16-19 | 1 to 5 | Fair |
| 52-55 | 7 | 35 | 20 | NOW | Poor |
| 44-53 | 6 | 30 | 33 | NOW | Poor |
| 36-44 | 5 | 25 | 46 | NOW | Poor |
| 28-36 | 4 | 20 | 59 | NOW | Poor |
| 21-28 | 3 | 15 | 72 | NOW | Poor |
| 18-21 | 2 | 10 | 85 | NOW | Poor |
| 10-18 | 1 | 5 | 100 | NOW | Poor |

There is further discussion in Appendix C

## 2.5 Improvement Recommendations

Improvement recommendations were provided by the County and are typically predicated upon the field observations and ratings, dimensional data collected, and traffic information. As a project advances, further design, traffic and geotechnical studies should be undertaken to confirm the nature and extent of the improvement required.

Improvement recommendations are provided to correct the observed (and calculated) deficiencies. The road agency may elect to utilize a holding strategy as an interim measure due to budget constraints or other programming that has been prioritized.

### 2.5.1 Defects and Quality Assurance

As with the production of any product, the goal is to minimize defects to the greatest extent possible.

'Quality Control' is the system or process that the supplier undertakes to ensure that the product is provided as specified.

'Quality Assurance' is the system or process that the receiver of the product employs to assure itself that the product that it is receiving is in fact what was specified.

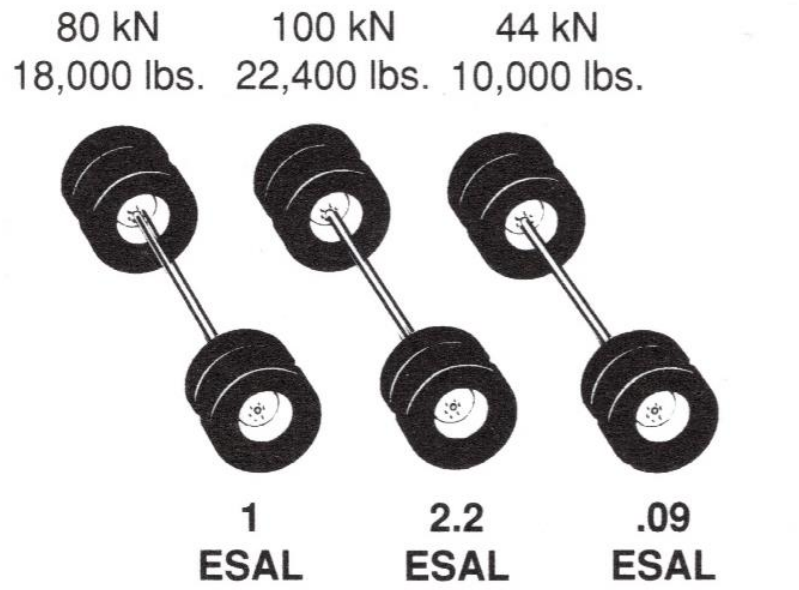
There is an associated cost with quality assurance, but that cost is far outweighed the life cycle cost of receiving product that does not meet standard. *'You get what you inspect – not what you expect.'*

Defects are discussed in greater detail in Appendix B

### 2.5.2 Traffic Impact on Improvement Recommendations

Improvement recommendations are heavily predicated on traffic, and particularly heavy commercial traffic and buses. The number and type of heavy vehicles is critical to pavement design and ultimately, its' performance. Under-designed pavement will not perform as expected.

**Figure 2-1: ESAL Comparison from Asphalt Institute Thickness Design Manual**




When designing a road, the traffic loading from different vehicles has to be converted to, and expressed in, common terms. In Ontario (and across North America) Equivalent Single Axle Loads (ESAL's) are used to design pavement structure and determine the required consensus properties of materials.

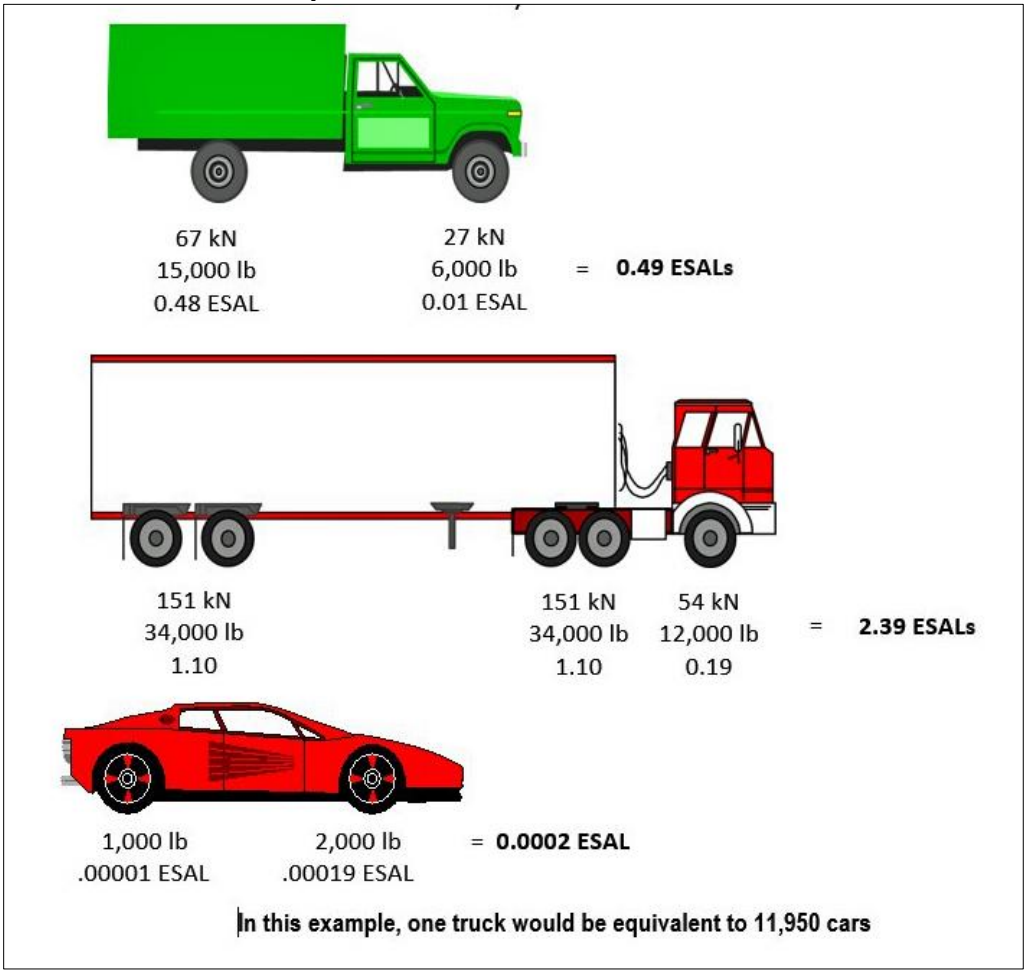
The ESAL measurement has been in use for a significant length of time and has its roots in the older Imperial or Standard measures. The metric system was adopted in Canada in 1977. One ESAL is 18,000 lbs, 18kips or 80 Kilonewtons. In Ontario the maximum load for a single axle is 10 tonnes, which equals 100 Kilonewtons, or 2.2 ESAL's.

The American Association of State Highway and Transportation Officials (AASHTO) and the Asphalt Institute (AI) are often cited references for pavement design. The formula to determine load equivalencies is very complex, however, at a high level, a simplified formula may be used to approximate the load equivalency factor. This formula is sometimes referred to as the Fourth Power Law or the Generalized Fourth Power Law. The Load Equivalency Factor may be used to illustrate the relative difference in damage between particular loadings.

**2-1: Load Equivalency Factor**

$$\text{Load Equivalency Factor} = \left[\frac{\text{Specific Axle Load}}{18{,}000 \text{ lbs}}\right]^4$$

**Figure 2-2: ESAL Comparison (Adapted from Asphalt Institute for Highway and Street Rehabilitation Manual )**



### 2.5.3 Seasonal Half Load Restrictions

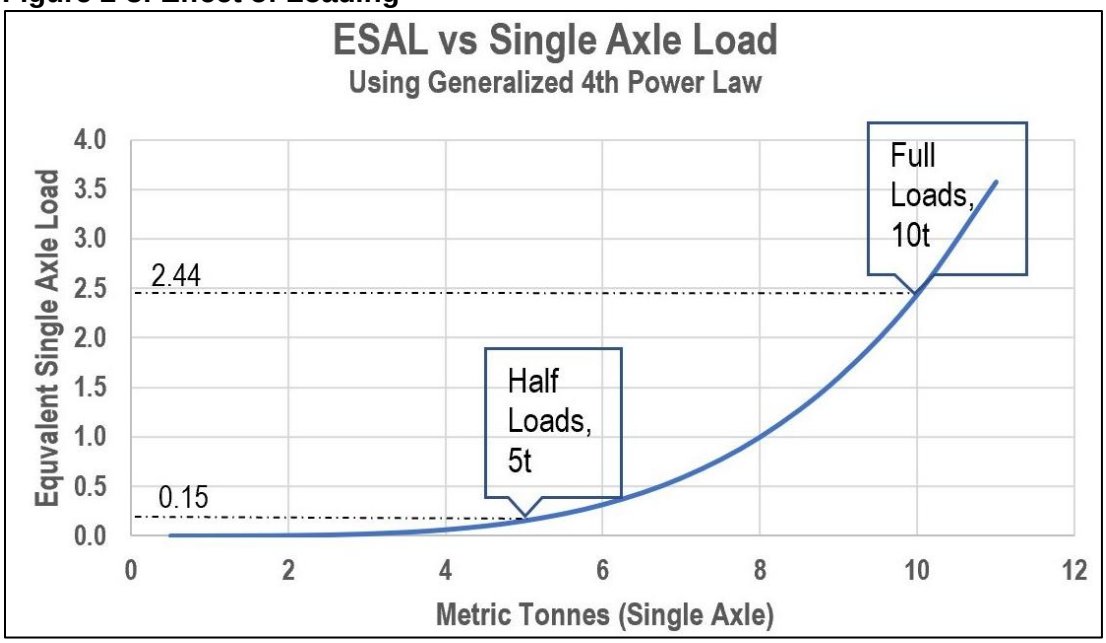
The discussion in the Section 2.3.2 identifies the effect the heavy vehicles have on a pavement structure. During the spring break-up season- typically March 1 to April 30- frost is coming out of the ground which reduces the ability of the road structure to carry loads.

From the paper entitled 'Proposed System for Co-ordinating Spring Load Restrictions in Ontario' presented at the 2013 Transportation Association of Canada Conference, the following provides an easily understood explanation for the need for half load restrictions ;

> *Roads and highways in northern climates are affected by seasonal growth and melting of ice beneath the surface, especially on roads with a non-engineered base beneath the driving surface. Ice growth can be advantageous by increasing the bearing strength of road materials, or disruptive where moisture accumulates locally in frost heaves or boils. Melting of ice can lead to weakening of road materials where melt near the surface is more rapid than at depth, and excess moisture is trapped above a non-permeable subsurface layer, leading to rutting and pavement cracking.*
>
> *The effects of freezing and thawing of low volume roads in Ontario is mitigated through temporary Winter Weight Premiums (WWP) during the frozen season and Half Load Restrictions or Spring Load Restrictions (SLR) during the thaw season on designated road sections (Ontario, 2013). They are intended to provide a balance between the access needed by the trucking and resource industry and the added road repair and maintenance costs borne by the Ministry of Transportation or local municipalities.*

The Highway Traffic Act Section 122 provides authority to a municipality to impose load restrictions. The timing of the imposition of spring load restrictions should be based on the conditions, not just the date. Climate change has introduced significant variability into the commencement the spring thaw, and as such, there should be delegated authority to staff to impose the restrictions as conditions occur. Half Load Restrictions should commence as determined by the conditions and/or the date.

**Figure 2-3: Effect of Loading**




## 2.6 Types of Improvements

This report identifies ratings that are resultant from identification of deficiencies on each road section that equate to a TON in one or more of the six critical areas: Geometry, Surface Type, Surface Width, Capacity, Structural Adequacy, or Drainage. Based on the ratings and the deficiencies noted an improvement type recommendation has been provided by the County.

The key factor in providing an improvement type recommendation is the visual survey. During the visual survey, a determination is made as to whether the appearance and performance of a road relates to an underlying structural problem, or simply to aged surface materials. A road's structural or drainage problem would tend to result in a reconstruction/ replacement treatment recommendation, whereas aged surface materials would result in a resurfacing/rehabilitation treatment recommendation. A determination of the root cause of the problem or the condition is critical; reconstructing a road that should have had some type of resurfacing treatment would be an ineffective use of available resources.

Table 2.2: the County Road Improvement Types

| Inventory Manual Improvements | |
|---|---|
| **Code** | **Description** |
| **1DST2** | Double Surface Treatment Rehab |
| **1MICRO2** | Microsurfacing - Single Lift |
| **1MICRO2D** | Microsurfacing - Scratch and Surface Lift |
| **1MILLO1a2** | Grind and Overlay - Urban |
| **1ROL12** | Rural Overlay - County |
| **1SST1a** | Single Surface Treatment - County |

| | |
|---|---|
| **CIR-R2** | Cold in Place Recycling - Rural (100mm) |
| **CIR-U2** | Cold in Place Recycling - Urban |
| **CRK4rds** | Crack Sealing |
| **FDR-R2** | Full Depth Expanded Rural |
| **FDR-U2** | Full Depth Expanded - Urban |
| **Hold -1** | Hold 1 Year |
| **Hold -2** | Hold 2 Years |
| **Hold -3** | Hold 3 Years |
| **LCB-REC2** | LCB Full Reconstruct |
| **NONE** | No Action Required |
| **RR-HM-CLA2** | Class A Roads - Rural - Hot Mix - Reconstruction |
| **RR-HM-CLB2** | Class B Roads - Rural - Hot Mix - Reconstruction |
| **RR-HM-CLC2** | Class C Roads - Rural - Hot Mix - Reconstruction |
| **URCONHMBC2** | Class B & C Roads - Urban - Hot Mix Reconstruction |
| **URECONHMA2** | Class A Road - Urban - Hot Mix - Reconstruction |

For the purposes of this report, the County standard improvement types and associated costing formulae have been used where applicable. The following table provides a list of road improvements used for the development of this report. Appendix B of this report includes a discussion of pavement structure and defects.

### 2.6.1 County of Peterborough Recommendations and Costing

The bench mark improvements from the Inventory Manual represent a sound methodology for developing a project cost. In the absence of any municipality specific formulae, the bench mark costs work well to produce a representative cost to undertake a specified improvement.

In the Inventory Manual methodology bench mark costing, there are four cost factors that are added to the material and placement costs of a project;

- Basic Construction Factor
- Engineering Factor
- Contingency Factor and,
- Terrain and Soil Type Factor

The County has developed agency specific improvements that incorporate similar concepts. The County treatments tend to be more detailed in the specifics of each treatment , whereas the Inventory Manual has covered of those specifics with more general cost factors as noted above. The County improvements include a few more specifics that the Inventory Manual treatments but also include factors for contingency, engineering and quality assurance.

Appendix B of this report includes a discussion of Pavement Structure and defects.

**Table 2.3: Average Improvement Costs per Kilometre by Improvement Type**

| Improvement Class | Improvement ID | Improvement Description | TOTAL | | % OF TOTAL | | Cost Per Km ($) |
|---|---|---|---|---|---|---|---|
| | | | Imp. Costs | CL-Km | Imp. Costs | CL-Km | |
| County | 1DST2_10% | DST Rehab 10 % base repairs | **4,726,281** | **14.800** | 1.87% | 2.10% | **319,343** |
| County | 1DST2_20% | DST Rehab 20% Base repairs | **12,968,066** | **32.630** | 5.13% | 4.62% | **397,428** |
| County | 1MICRO2D | Microsurfacing - Scratch and Surface Lift | **10,875,154** | **176.300** | 4.30% | 24.96% | **61,686** |
| County | 1MILLO1a2 | Grind and Overlay - Urban | **1,177,250** | **2.790** | 0.47% | 0.40% | **421,953** |
| County | 1ROL12 | Rural Overlay - County | **23,580,912** | **64.200** | 9.32% | 9.09% | **367,304** |
| County | 1SST1a | Single Surface Treatment - County | **203,789** | **3.020** | 0.08% | 0.43% | **67,480** |
| County | 1SST1a_10% | SST with 10% Base repairs | **5,822,769** | **39.700** | 2.30% | 5.62% | **146,669** |
| County | CIR-R2 | Cold in Place Recycling - Rural (100mm) | **6,528,196** | **10.510** | 2.58% | 1.49% | **621,141** |
| County | CIR-U2 | Cold in Place Recycling - Urban | **1,066,371** | **1.370** | 0.42% | 0.19% | **778,373** |
| County | CRK4rds | Crack Sealing | **222,023** | **85.050** | 0.09% | 12.04% | **2,611** |
| County | FDR-R2 | Full Depth Expanded Rural | **91,094,943** | **172.700** | 36.01% | 24.45% | **527,475** |
| County | LCB-REC2 | LCB Full Reconstruct | **88,681,206** | **76.150** | 35.06% | 10.78% | **1,164,560** |
| County | NONE | No Action Required | | **25.320** | 0.00% | 3.58% | **0** |
| County | RR-HM-CLA2 | Class A Roads - Rural - Hot Mix - Reconstruction | **1,044,425** | **0.550** | 0.41% | 0.08% | **1,898,955** |
| County | URCONHMBC2 | Class B & C Roads - Urban - Hot Mix Reconstruction | **4,969,554** | **1.23** | 1.96% | 0.17% | **4,040,287** |

***The recommendations are based on the observed and calculated deficiencies in the road system and are have not been cross asset integrated with other infrastructure***

It was recognized during the development of the performance model that some of the improvement types, particularly those associated with LCB surfaces, did not appear to introduce sufficient structural enhancement to road sections at a lower condition level. The result was the appearance that the system could be sustained at a lower dollar value as a low cost improvement with a significant increase in condition would produce a higher Return on Investment, and this became a preferred selection.

In consultation with County staff the improvements in the software were revised to correct this circumstance and be more consistent with the treatments that were actually undertaken in the field.

# 3 State of the Infrastructure

## 3.1 Scope / Asset Type(s)

This report addresses road assets only. The content will provide review and analysis of the road system from a number of perspectives including condition rating, functional classification, roadside environment, replacement cost, improvement cost and Regulation 239/02 classification. Regulation 588/17 Classifications have also been assigned to the assets.

## 3.2 Asset Identification

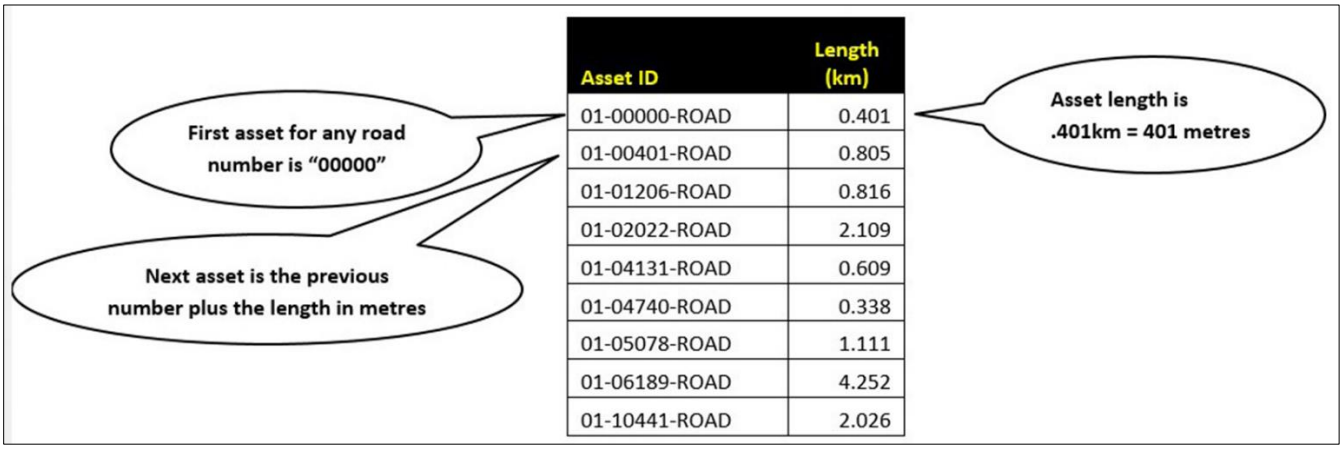
A standardized procedure or nomenclature for identification of assets provides consistency, and avoids duplication of Asset ID's. Most software will not accept a duplicate ID however there are instances where this can occur.

In general terms, the County road asset ID's appear to have been originally identified in a similar scheme as most upper tier agencies were. That methodology used the road number combined with a form of linear referencing that was truncated to the closest 100 metres.

That does not appear to be the case with the current numbering scheme, in a number of instances.

By adopting a number scheme that incorporates linear referencing to the metre, the County would be able to split or combine sections as required in the future and have a consistent repeatable process.

Table 3.1: Sample Sectioning Numbering Scheme




| Asset ID | Length (km) |
|---|---|
| 01-00000-ROAD | 0.401 |
| 01-00401-ROAD | 0.805 |
| 01-01206-ROAD | 0.816 |
| 01-02022-ROAD | 2.109 |
| 01-04131-ROAD | 0.609 |
| 01-04740-ROAD | 0.338 |
| 01-05078-ROAD | 1.111 |
| 01-06189-ROAD | 4.252 |
| 01-10441-ROAD | 2.026 |

**From 4 Roads Inventory Manual Training*

## 3.3 Road Asset Classification

Assets are classified by different measures dependent upon regulation and end usage of the information. The following sections define the road assets by a number of parameters including road surface type, roadside environment, Regulation 239/02andRegulation 588/17.

Road sections within road systems may be classified in a number of ways, to illustrate their roadside environment, surface type, functional classification, and so forth. The classifications provide assistance in developing further information, with respect to the road system, such as replacement costs, performance expectations, regulatory compliance or service delivery.

For performance modeling purposes, 4 Roads has created asset classes that are defined by surface type, roadside environment and traffic. Appendix C of this report provides further discussion on asset classes for performance modeling.

### 3.3.1 Surface Types and Roadside Environment

Roadside environment and surface type criteria of a road section are useful in characterization of the road section, and in determining costs for replacement, reconstruction and rehabilitation treatments.

The *Inventory Manual* classifies the roadside environment as Rural, Semi-Urban or Urban. The classification is determined by length, servicing, and adjacent land use.

- ***Rural Roads*** – within areas of sparse development, or where development is less than 50% of the frontage, including developed areas extending less than 300 m on one side or 200 m on both sides, with no curbs and gutters.
- ***Semi-Urban Roads*** – within areas where development exceeds 50% of the frontage for a minimum of 300 m on one side, or 200 m on both sides, with no curbs and gutters, with or without storm/combination sewers, or for subdivisions where the lot frontages are 30 m or greater.
- ***Urban Roads*** – within areas where there are curbs and gutters on both sides, served with storm or combination sewers, or curb and gutter on one side, served with storm or combination sewers, or reversed paved shoulders with, or served by, storm or combination sewers, or for subdivisions with frontages less than 30 m.

**Table 3.2: Surface Type and Roadside Environment Distribution**

| Material Description | Local Municipality | | Roadside Environment | | | | | | Total | | % of Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rural | | Semi Urban | | Urban | | | | | |
| | ID # | Name | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms |
| High Class Bit.-asphalt | 66615 | Township of Asphodel-Norwood | 5.280 | 10.560 | 0.000 | 0.000 | 1.480 | 2.960 | **6.760** | **13.520** | 0.98% | 0.98% |
| High Class Bit.-asphalt | 66616 | Township of North Kawartha | 19.570 | 39.140 | 0.000 | 0.000 | 1.190 | 2.380 | **20.760** | **41.520** | 3.01% | 3.00% |
| High Class Bit.-asphalt | 66617 | Township of Cavan Monaghan | 36.635 | 73.270 | 0.000 | 0.000 | 5.190 | 10.380 | **41.825** | **83.650** | 6.06% | 6.05% |
| High Class Bit.-asphalt | 66618 | Township of Douro-Dummer | 47.255 | 94.510 | 1.180 | 2.360 | 1.980 | 3.960 | **50.415** | **100.830** | 7.31% | 7.29% |
| High Class Bit.-asphalt | 66619 | Municipality of Trent Lakes | 59.295 | 118.590 | 0.000 | 0.000 | 0.000 | 0.000 | **59.295** | **118.590** | 8.60% | 8.57% |
| High Class Bit.-asphalt | 66620 | Township of Havelock-Belmont-Methuen | 38.110 | 76.220 | 0.730 | 1.460 | 2.260 | 4.520 | **41.100** | **82.200** | 5.96% | 5.94% |
| High Class Bit.-asphalt | 66621 | Township of Otonabee-South Monaghan | 19.890 | 39.780 | 0.000 | 0.000 | 0.000 | 0.000 | **19.890** | **39.780** | 2.88% | 2.88% |
| High Class Bit.-asphalt | 66623 | Township of Selwyn | 36.360 | 72.720 | 3.010 | 7.500 | 6.420 | 12.840 | **45.790** | **93.060** | 6.64% | 6.73% |
| High Class Bituminous with micro | 66615 | Township of Asphodel-Norwood | 26.380 | 52.760 | 0.000 | 0.000 | 1.070 | 2.140 | **27.450** | **54.900** | 3.98% | 3.97% |
| High Class Bituminous with micro | 66616 | Township of North Kawartha | 13.040 | 26.080 | 0.000 | 0.000 | 0.800 | 1.600 | **13.840** | **27.680** | 2.01% | 2.00% |
| High Class Bituminous with micro | 66617 | Township of Cavan Monaghan | 19.170 | 38.340 | 0.000 | 0.000 | 1.310 | 2.620 | **20.480** | **40.960** | 2.97% | 2.96% |
| High Class Bituminous with micro | 66618 | Township of Douro-Dummer | 41.000 | 82.000 | 0.000 | 0.000 | 0.970 | 1.940 | **41.970** | **83.940** | 6.08% | 6.07% |
| High Class Bituminous with micro | 66619 | Municipality of Trent Lakes | 20.700 | 41.400 | 0.000 | 0.000 | 1.940 | 3.880 | **22.640** | **45.280** | 3.28% | 3.27% |
| High Class Bituminous with micro | 66620 | Township of Havelock-Belmont-Methuen | 0.000 | 0.000 | 0.000 | 0.000 | 2.280 | 4.560 | **2.280** | **4.560** | 0.33% | 0.33% |
| High Class Bituminous with micro | 66621 | Township of Otonabee-South Monaghan | 35.490 | 70.980 | 0.510 | 1.020 | 3.670 | 7.340 | **39.670** | **79.340** | 5.75% | 5.73% |
| High Class Bituminous with micro | 66623 | Township of Selwyn | 59.030 | 118.060 | 1.340 | 2.880 | 3.640 | 9.520 | **64.010** | **130.460** | 9.28% | 9.43% |
| Low Class Bit.-surface treated | 66615 | Township of Asphodel-Norwood | 3.945 | 7.890 | 0.000 | 0.000 | 0.000 | 0.000 | **3.945** | **7.890** | 0.57% | 0.57% |
| Low Class Bit.-surface treated | 66616 | Township of North Kawartha | 36.080 | 72.160 | 0.000 | 0.000 | 0.000 | 0.000 | **36.080** | **72.160** | 5.23% | 5.22% |
| Low Class Bit.-surface treated | 66617 | Township of Cavan Monaghan | 16.710 | 33.420 | 0.000 | 0.000 | 0.000 | 0.000 | **16.710** | **33.420** | 2.42% | 2.42% |
| Low Class Bit.-surface treated | 66618 | Township of Douro-Dummer | 20.865 | 41.730 | 0.000 | 0.000 | 0.000 | 0.000 | **20.865** | **41.730** | 3.02% | 3.02% |
| Low Class Bit.-surface treated | 66619 | Municipality of Trent Lakes | 20.740 | 41.480 | 0.000 | 0.000 | 0.000 | 0.000 | **20.740** | **41.480** | 3.01% | 3.00% |

| Material Description | Local Municipality | | Roadside Environment | | | | | | Total | | % of Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Rural | | Semi Urban | | Urban | | | | | |
| | ID # | Name | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms | Cl-km | Lane Kms |
| Low Class Bit.-surface treated | 66620 | Township of Havelock-Belmont-Methuen | 40.880 | 81.760 | 3.300 | 6.600 | 0.000 | 0.000 | **44.180** | **88.360** | 6.40% | 6.39% |
| Low Class Bit.-surface treated | 66621 | Township of Otonabee-South Monaghan | 6.240 | 12.480 | 2.000 | 4.000 | 0.000 | 0.000 | **8.240** | **16.480** | 1.19% | 1.19% |
| Low Class Bit.-surface treated | 66623 | Township of Selwyn | 16.260 | 32.520 | 4.610 | 9.220 | 0.000 | 0.000 | **20.870** | **41.740** | 3.03% | 3.02% |
| **TOTAL** | | | **638.925** | **1,277.850** | **16.680** | **35.040** | **34.200** | **70.640** | **689.805** | **1,383.530** | | |
| **% OF TOTAL** | | | 92.62% | 92.36% | 2.42% | 2.53% | 4.96% | 5.11% | | | | |

***Note: Adjusted for Boundary Roads***
***Minor Differences in Calculated fields due to rounding and sub calculations***

### 3.3.2 Regulation 239/02 Classification- Minimum Maintenance Standards for Municipal Highways

In November 2002, Regulation 239/02, *Minimum Maintenance Standards for Municipal Highways (MMS)* came into effect. Essentially, if a municipality met the standard and documented it, they would not be negligent per Section 44(3)c of the Municipal Act noted above. Regulation 239/02 provided for a review five years after its original implementation. A process to revise Regulation 239/02, chaired by the Ontario Good Roads Association (OGRA), culminated in a revised regulation, Regulation 23/10, coming into effect in February 2010.

In the late fall of 2011, a court decision (Giuliani) was rendered that effectively created case law that negated the protection that the MMS afforded, and in particular, Tables 4 and 5 of the regulation (Tables 4 and 5 address Snow Accumulation and Icy Roads). Essentially, the decision created a new standard that went beyond the MMS. The effect on a municipality is that a higher standard of weather monitoring and documentation and response to monitoring is required.

OGRA re-called the MMS committee to further amend the regulation, to address the outcome of the Giuliani decision. As a result of the committee meetings and discussions with the province, Regulation 47/13 came into effect, amending Regulations 239/02 and 23/10, on January 25, 2013.

As noted, Regulation 239/02 provides for review at 5 year intervals. Effective May 3, 2018, the regulation was again revised. There are a number of revisions in the updated regulation that not only affect the service delivery standards but also affect the classification of the road sections.

The Minimum Maintenance Standards do not have to be adopted by a municipal council per se. The regulation is provincial, applies to all municipalities, and is available for municipalities to use as a defense if they have met the standard and documented it. The more important issue would be to ensure that a municipality has the appropriate Standard Operating Procedures (SOP's) in place, and that they are followed and documented, rather than trying to reword or parallel the language of the regulation into a document that is municipality-specific.

**Table 3.3: O.Reg 239/02 Minimum Maintenance Standard Road Classification, as amended (May 2018)**

| Column 1 Average Daily Traffic (number of motor vehicles) | Column 2 91 - 100 km/h speed limit | Column 3 81 - 90 km/h speed limit | Column 4 71 - 80 km/h speed limit | Column 5 61 - 70 km/h speed limit | Column 6 51 - 60 km/h speed limit | Column 7 41 - 50 km/h speed limit | Column 8 1 - 40 km/h speed limit |
|---|---|---|---|---|---|---|---|
| 53,000 or more | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 23,000 - 52,999 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 15,000 - 22,999 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 12,000 - 14,999 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 10,000 - 11,999 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| 8,000 - 9,999 | 1 | 1 | 2 | 3 | 3 | 3 | 3 |
| 6,000 - 7,999 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 5,000 - 5,999 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 4,000 - 4,999 | 1 | 2 | 3 | 3 | 3 | 4 | 4 |
| 3,000 - 3,999 | 1 | 2 | 3 | 3 | 3 | 4 | 4 |
| 2,000 - 2,999 | 1 | 2 | 3 | 3 | 4 | 5 | 5 |
| 1,000 - 1,999 | 1 | 3 | 3 | 3 | 4 | 5 | 5 |
| 500 - 999 | 1 | 3 | 4 | 4 | 4 | 5 | 5 |
| 200 - 499 | 1 | 3 | 4 | 4 | 5 | 5 | 6 |
| 50 - 199 | 1 | 3 | 4 | 5 | 5 | 6 | 6 |
| 0 - 49 | 1 | 3 | 6 | 6 | 6 | 6 | 6 |

Traffic counts are important for a number of decision making purposes with respect to the road system. Accurate, defensible traffic counts, in conjunction with the posted speed limits, are used in determining the MMS class of the respective road sections. Roads are divided into six service classes by posted speed and traffic count, with Class 1 being the highest service level and Class 6 being the lowest. There are no service standards for Class 6 roads which have less than 50 vehicles per day. Table 3.3 shows the Regulation 239/02's traffic/speed/ classification matrix as updated May 2018, by Regulation 366/18. The County provided traffic information for the 2021 report

As per the Regulation, different road classifications require different response times. For example, the response time that is required to remove snow accumulation is 12 hours for a Class 3 road, and 16 hours for a Class 4. Response time is the time from when the municipality becomes aware that a condition exists, until the time that the condition is corrected or brought within the limits specified in the regulation. This may have a significant impact with respect to the equipment and staffing that may be required to meet the standard, particularly in the case of winter control. The implications are that this increased service level may require the municipality to increase the inspection frequency, staff, and machinery to deliver the service beyond the service delivery hours that may currently exist.

The distribution of the MMS Classes across the road system is detailed in **Error! Reference s ource not found.**.

**Table 3.4: O.Reg 239/02 Minimum Maintenance Standards Class Distribution**

| Lanes | | MMS Class - Regulation 239/02 - Minimum Maintenance Standards for Municipal Highways | | | | | | | | | | TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 2 | | 3 | | 4 | | 5 | | 6 | | | |
| | Roadside | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km |
| 2 | Rural | 72.530 | 145.060 | 411.685 | 818.970 | 144.780 | 289.560 | 6.720 | 13.440 | 3.210 | 6.420 | **638.925** | **1,273.450** |
| 2 | Semi Urban | | | 6.670 | 13.340 | 1.020 | 2.040 | 5.160 | 10.320 | 2.990 | 5.980 | **15.840** | **31.680** |
| 4 | Semi Urban | 0.840 | 3.360 | | | | | | | | | **0.840** | **3.360** |
| 2 | Urban | 0.330 | 0.660 | 6.860 | 13.720 | 14.890 | 29.780 | 11.000 | 22.000 | | | **33.080** | **66.160** |
| 4 | Urban | 1.120 | 4.480 | | | | | | | | | **1.120** | **4.480** |
| **TOTAL** | | | **74.820** | **153.560** | **425.215** | **846.030** | **160.690** | **321.380** | **22.880** | **45.760** | **6.200** | **12.400** | **689.805** |
| **% OF TOTAL** | | | 10.85% | 11.13% | 61.64% | 61.35% | 23.29% | 23.30% | 3.32% | 3.32% | 0.90% | 0.90% | |

***Note: Adjusted for Boundary Roads***

***Minor Differences in Calculated fields due to rounding***

Traffic information for this report was provided by the County of Peterborough.

### 3.3.3 Functional / Existing / Design Classifications

Roads are further classified within the database by classes such as Local, Collector, or Arterial and Residential or Industrial. Items 33 and 105 in the *Inventory Manual* provide further direction on determination of the Existing or Design Classes of road. Generally, the classifications are predicated on the existing use, roadside environment, traffic, and anticipated growth over either the ten- or twenty-year planning horizon.

Table 3.5 identifies the Functional Road Class Distribution. The Inventory Manual Functional Classifications have been aligned with Regulation 588/17 to the greatest extent possible.

**Table 3.5: Functional Road Class Distribution**

| Functional Classification | Lanes | Roadside Environment | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Rural | | Semi Urban | | Urban | | | | | |
| | | Cl-Km | Lane-Km | Cl-Km | Lane-Km | Cl-Km | Lane-Km | Cl-Km | Lane-Km | Cl-Km | Lane-Km |
| 200 | 2 | 11.040 | 22.080 | | | | | **11.040** | **22.080** | 1.60% | 1.60% |
| 300 | 2 | 15.600 | 31.200 | | | | | **15.600** | **31.200** | 2.26% | 2.26% |
| 400 | 2 | 115.520 | 231.040 | | | | | **115.520** | **231.040** | 16.75% | 16.70% |
| 500 | 2 | 211.125 | 422.250 | | | | | **211.125** | **422.250** | 30.61% | 30.52% |
| 600 | 2 | 111.140 | 222.280 | | | | | **111.140** | **222.280** | 16.11% | 16.07% |
| 700 | 2 | 63.950 | 127.900 | | | | | **63.950** | **127.900** | 0.0927 | 0.0924 |
| 800 | 2 | 110.550 | 221.100 | | | | | **110.550** | **221.100** | 16.03% | 15.98% |
| ART | 2 | | | 1.180 | 2.360 | 0.330 | 0.660 | **1.510** | **3.020** | 0.22% | 0.22% |
| ART | 4 | | | 0.840 | 3.360 | 1.120 | 4.480 | **1.960** | **7.840** | 0.28% | 0.57% |
| C/R | 2 | | | 7.640 | 15.280 | 21.270 | 42.540 | **28.910** | **57.820** | 4.19% | 4.18% |
| CCI | 2 | | | | | 10.160 | 20.320 | **10.160** | **20.320** | 1.47% | 1.47% |
| L/R | 2 | | | 7.020 | 14.040 | 1.320 | 2.640 | **8.340** | **16.680** | 1.21% | 1.21% |
| **TOTAL** | | **638.925** | **1,277.850** | **16.680** | **35.040** | **34.200** | **70.640** | **689.805** | **1,383.530** | | |
| **% OF TOTAL** | | 92.62% | 92.36% | 2.42% | 2.53% | 4.96% | 5.11% | | | | |

***Note: Adjusted for Boundary Roads; Minor Differences in Calculated fields due to rounding***

### 3.3.4 Regulation 588/17 Classification (O.Reg 588/17), Asset Management Planning for Municipal Infrastructure

O.Reg 588/17 came into effect December 27, 2017. Road asset are classified by general categories of Arterial, Collector or Local based on the O.Reg 239/02 classification. Class 1 and 2 are Arterial, Class 3 and 4 are Collector and Class 5 and 6 are Local. The following table identifies the O.Reg 588/17 for the County.

Table 3.6: O.Reg 588/17 Classification

| Lanes | Regulation 588/17 Class Asset Management for Municipal Infrastructure | | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Arterial | | Collector | | Local | | | | | |
| | Roadside | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km |
| 2 | Rural | 72.530 | 145.060 | 556.465 | 1,108.530 | 9.930 | 19.860 | **638.925** | **1,273.450** | 92.62% | 92.34% |
| 2 | Semi Urban | | | 7.690 | 15.380 | 8.150 | 16.300 | **15.840** | **31.680** | 2.30% | 2.30% |
| 4 | Semi Urban | 0.840 | 3.360 | 0.000 | 0.000 | 0.000 | 0.000 | **0.840** | **3.360** | 0.12% | 0.24% |
| 2 | Urban | 0.330 | 0.660 | 21.750 | 43.500 | 11.000 | 22.000 | **33.080** | **66.160** | 4.80% | 4.80% |
| 4 | Urban | 1.120 | 4.480 | 0.000 | 0.000 | 0.000 | 0.000 | **1.120** | **4.480** | 0.16% | 0.32% |
| **TOTAL** | | | **74.820** | **153.560** | **585.905** | **1,167.410** | **29.080** | **58.160** | **689.805** | **1,379.130** | |
| **% OF TOTAL** | | | 10.85% | 11.13% | 84.94% | 84.65% | 4.22% | 4.22% | | | |

## 3.4 Horizontal and Vertical Alignment

The changes in direction and elevation of the road are referred to as the horizontal and vertical alignment. The changes in direction should be designed and constructed such that the posted speed limit of the road section may be safely maintained throughout the section. If maintaining the posted speed in safety cannot be achieved, then the horizontal or vertical curve would be identified as substandard.

The County database currently does not identify incidences of potentially substandard horizontal and vertical alignment.

A State of the Infrastructure Report or Road Needs Study Report should not be confused with a road safety audit. A road safety audit is the formal safety performance examination of an existing or future road or intersection, which qualitatively estimates and reports on potential road safety issues, and identifies opportunities for improvements for all road users Typically, and more predominantly in a lower tier, rural municipality on lower volume road sections, the road system has some deficiencies with the existing horizontal and vertical alignment.

Lower volume roads that have not been reconstructed, tend to closely follow (or avoid) the existing contours of the land. In southern Ontario, which is relatively flat, there was a greater tendency to follow the alignments of the original Township surveys. However, where these roads were adjacent to larger streams and rivers, there was still a tendency to follow the topography. The result was/is a road alignment that tends to change vertical and horizontal direction frequently; at times without much notice.

When a new road is designed, one of the considerations is the Safe Stopping Distance (SSD). The calculation of the distance to stop safely from any given speed is based upon several factors, such as posted speed limit, reaction times, and friction. When road sections are evaluated for a road needs study, the number of vertical and horizontal curves that appear to be deficient are identified. The identification is based on whether there is sufficient SSD for the posted speed limit. The following table is an excerpt from the Geometric Design Standards for Ontario Highways, and indicates the SSD's required for various design speeds.

**Table C2-1**
**MINIMUM STOPPING SIGHT DISTANCE ON WET PAVEMENTS**

| Speed *v* | | Perception and Brake Reaction | | Coefficient of friction wet pav't | Braking distance on level | S-Min. Stopping sight distance | |
|---|---|---|---|---|---|---|---|
| Design | Assumed condition | Time | Distance | | | calculated | rounded |
| km/h | km/h | s | m | *f* | m | m | m |
| 40 | 40 | 2.5 | 28 | 0.380 | 17 | 45 | 45 |
| 50 | 50 | 2.5 | 35 | 0.358 | 27 | 62 | 65 |
| 60 | 60 | 2.5 | 42 | 0.337 | 42 | 84 | 85 |
| 70 | 70 | 2.5 | 49 | 0.323 | 60 | 109 | 110 |
| 80 | 79 | 2.5 | 55 | 0.312 | 79 | 134 | 135 |
| 90 | 87 | 2.5 | 60 | 0.304 | 98 | 158 | 160 |
| 100 | 95 | 2.5 | 66 | 0.296 | 120 | 186 | 185 |
| 110 | 102 | 2.5 | 71 | 0.290 | 141 | 212 | 215 |
| 120 | 109 | 2.5 | 76 | 0.283 | 165 | 241 | 245 |
| 130* | 116 | 2.5 | 81 | 0.279 | 190 | 271 | 275 |
| 140* | 122 | 2.5 | 85 | 0.277 | 211 | 296 | 300 |
| 150* | 127 | 2.5 | 88 | 0.273 | 232 | 320 | 320 |
| 160* | 131 | 2.5 | 91 | 0.269 | 251 | 342 | 345 |

**Design Speeds above 120 km/h are beyond the normal range of application*

**Figure 3-1: Safe Stopping Distance**

On rural roads, one of the effects of substandard alignments is a

decrease in the Average Operating Speed through the road section. An Average Operating Speed that is significantly lower than the posted speed will result in a Geometric Need for the road section. The following table from the *Inventory Manual* identifies the limits that will trigger a geometric need for typical posted speed limits.

Table 3.7: Posted Speed vs. Minimum Tolerable Operating Speed

| Item | Speed | | | | | |
|---|---|---|---|---|---|---|
| Legal Speed Limit | 40 | 50 | 60 | 70 | 80 | 90 |
| Minimum Tolerable Operating Speed | 35 | 45 | 50 | 60 | 65 | 75 |

The following pictures were not taken in County, but provide examples of potentially substandard alignments.

**Figure 3-2: Potentially Substandard Vertical and Horizontal Alignment**

Appendix E includes a listing of all of the rural road sections with potentially sub-standard vertical or horizontal alignments that should be reviewed for signage, speed reduction, or correction.

## 3.5 Drainage

Adequate drainage is critical to the performance of a road to maximize its life expectancy. Roads are designed, constructed, and maintained in order to minimize the amount of water that may enter, or flow over, the road structure.

In the case of water flowing over the road, assessment must be made of the circumstances on a site-specific basis. Factors that should be considered include the traffic volumes of the road section, economic impacts to the loss of the use of the road, upgrade costs, and risks.

The County database did not include ratings for drainage. Based on discussion with County staff, only one section was identified as having a periodic water over the road issue and was rated as a 1 to 5 year need. The remainder of the sections were rated as 15/15 (perfect rating) which is generally not the case as there are typically sections where the roadside ditch is less than perfect, and require maintenance work. Conducting an appropriate review and entering the values in the database can be used to assist in development of maintenance activities.

The County database did include populated data fields for the type of drainage. This information is shown in Table 3.9.

Water in a road base can cause different reactions at different times of the year. In non-freezing conditions, the granular road base can become saturated. Too much water displaces the granular material; it removes the material's ability to support the loads for which it was designed. Too much water in the granular material actually acts like a lubricant, and facilitates the displacement of the material under load. In freezing conditions, water in the road structure can cause frost heave, potholes, and pavement break-up as the water freezes and expands. Generally, a saturated granular road base results in structural failure of the road.

Figure 3-3: OPSS 200.10

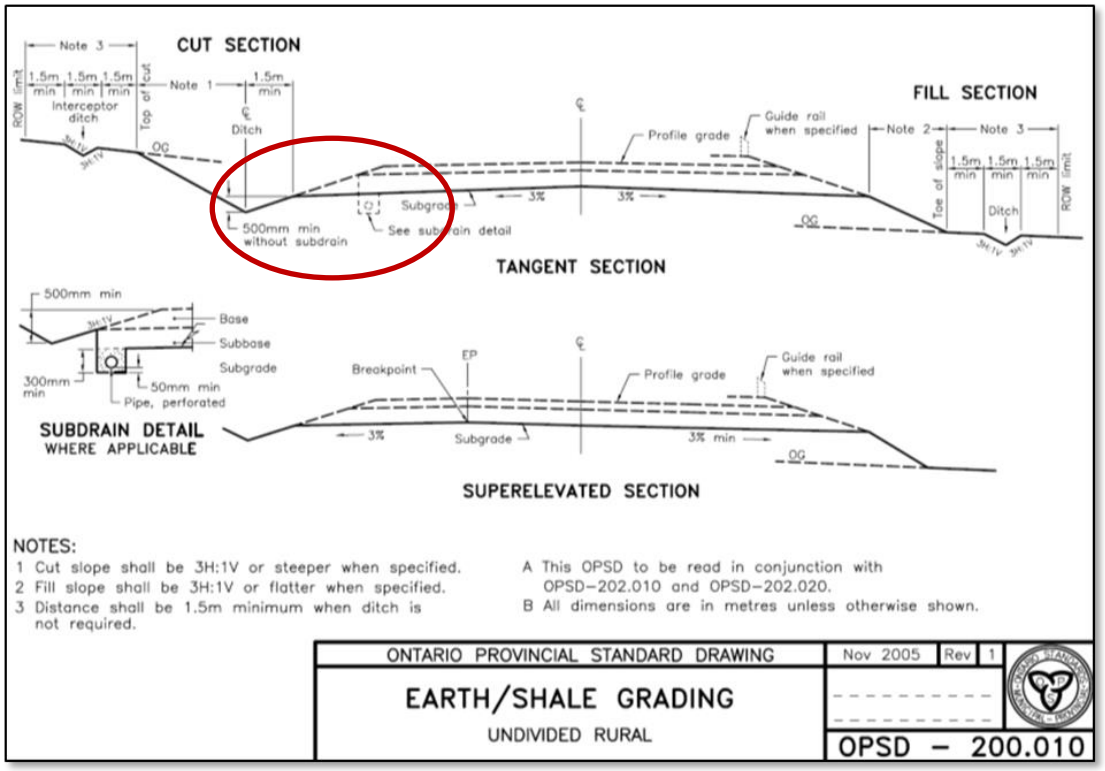


Figure 3-3 provides an example of a rural road, illustrating what the relationship between the gravel road base and the drainage should be. The relationship is the same in an urban system, although not as obvious. Rural road drainage is typically achieved through roadside ditches. Rural road ditches should be a minimum of 500 mm below the granular road base, to ensure that the road base remains free from moisture and maintains its ability to carry loads.

Urban roads typically have a storm sewer pipe network that carries the minor storm event. The roadway itself is often part of the overland flow route for the major event. The drainage of the granular road base is accomplished through sub-drains installed below the curb and gutter, lower than the lowest elevation of the granular base. This satisfies the same purpose as the ditch in a rural cross-section, by providing an outlet to ensure that the granular base remains dry.

Evaluations of the drainage scores were in part predicated upon the structural score. For example, where a road section had virtually no ditch, or very minimal ditching but the road structure did not show any signs of failure typically observed when there is inadequate drainage, then generally a rating was between 12 and 14 and an 'SD- (Spot drainage) improvement noted. Where it was obvious that the inadequate ditch was exacerbating the distress on the road or there was occasional flooding, the score would be further reduced and the improvement type would be some type of major rehabilitation or reconstruction dependent upon the traffic volumes. Table 3.8 provides an overview of the drainage needs of the road system by Time of Need.

Table 3.8: Drainage by Time of Need

| Roadside Environment | Time of Need 1-5 | 6-10 | ADEQ | TOTAL | % OF TOTAL |
|---|---|---|---|---|---|
| Rural | 5.450 | 0 | 633.475 | **638.925** | 92.62% |
| Semi Urban | 0.000 | 0 | 16.680 | **16.680** | 2.42% |
| Urban | 0.000 | 0 | 34.200 | **34.200** | 4.96% |
| **TOTAL** | **5.450** | **0** | **684.355** | **689.805** | |
| **% OF TOTAL** | 0.79% | 0% | 99.21% | | |

***Note: Adjusted for Boundary Roads: Minor Differences in Calculated fields due to rounding***

Table 3.9: Drainage by Roadside Environment and Drainage Type

| Drainage Type | Roadside Environment | | | TOTAL (CL-km) | % OF TOTAL |
|---|---|---|---|---|---|
| | Rural | Semi Urban | Urban | | |
| AC - Adjacent Road, combination sewer | 1.310 | 0.000 | 0.000 | **1.310** | 0.19% |
| CS - Combination Sewer | 0.000 | 0.000 | 2.680 | **2.680** | 0.39% |
| DS - Ditch and Storm Sewer | 0.000 | 0.730 | 3.220 | **3.950** | 0.57% |
| N - None | 24.130 | 0.000 | 0.000 | **24.130** | 3.50% |
| OD - Open Ditch | 613.485 | 15.950 | 4.540 | **633.975** | 91.91% |
| SS - Storm Sewer | 0.000 | 0.000 | 23.760 | **23.760** | 3.44% |
| **TOTAL** | **638.925** | **16.680** | **34.200** | **689.805** | |
| % OF TOTAL | 92.62% | 2.42% | 4.96% | | |

***Note: Adjusted for Boundary Roads; Minor Differences in Calculated fields due to rounding***

Maintenance of the drainage system(s) is critical to the long-term performance of a road system. Low volume rural roads tend to have a winter maintenance program that includes the application of sand to improve traction. Over time, that sand builds up on the edge of the pavement, to a point where it effectively blocks runoff from getting to the ditch. The runoff is trapped at the edge of pavement, where it saturates that area of the road bed, contributing to the early failure of the edge of the pavement. This element of the road cross-section is not scored as part of the overall evaluation.

Figure 3-4: Shoulder Berm

Presence or absence of roadside berms is not evaluated during a road review. This is a maintenance issue, however, if roadside berms are not removed, the effect on the overall pavement is similar to not having a ditch. Water cannot drain from the road and it enters into the granular base potentially saturating it. The saturated base cannot support load.

### 3.5.1 Drainage Outlet and Master Planning

Correcting drainage issues is not quite as simple as digging a ditch or installing a storm sewer. In Ontario, Common law for drainage is such that water cannot simply be collected and directed. It has to be directed to a legal, adequate outlet. There are two primary methodologies to achieve the legal outlet; a Class Environmental Assessment Process or a petition for a Municipal Drain under the Drainage Act. The ‘adequate’ component is an engineering function.

## 3.6 Boundary Roads

Boundary roads, are roads that a municipality would have in common with the abutting municipality. In order to manage the joint responsibilities, a Boundary Road Agreement that identifies the responsibilities of both agencies is created. The agreements are usually in writing; however, some are informal.

The County database had indicated some assets as cost shared. Some of the sections were not Boundary Roads, and some indicated that the cost sharing was with the County. Based on

discussion with the County, it is believed that this has been corrected and accurately reflected in Table 3.10.

Table 3.10: Boundary Roads

| Adjacent Agency | Rural | Semi Urban | Urban | Totals |
|---|---|---|---|---|
| County of Haliburton | 3.49 | 0.00 | 0.00 | 3.49 |
| Municipality of Trent Hills | 3.09 | 0.00 | 0.00 | 3.09 |
| City of Kawartha Lakes | 26.45 | 0.00 | 0.00 | 26.45 |
| **Grand Total** | **33.03** | **0.00** | **0.00** | **33.03** |
| **System Adjustment For Boundary Roads** | | | | **16.515** |

***Note: Not boundary road adjusted. 50% of the total is the adjustment factor applied to the system analysis***

The Boundary Road Agreement should identify costs sharing and responsibility arrangements for maintenance or capital works on the road section. From a risk management perspective, the agreement reduces the risk for one of the parties in the event of a claim, depending upon the content of the agreement.

Boundary road reporting can be dealt with in one of two ways: the length can be split to provide a more accurate depiction of the road system that is actually maintained by the agency, or they may not be adjusted. When MTO was providing subsidy, the roads were adjusted for reporting and accounting purposes. For the purposes of this report adjustment has been made to the road system sizes to account for the 50% sharing of the length of the boundary roads.

When a boundary is reconstructed on a day labour basis by the adjacent municipalities, the project should be treated no differently than if the work were being tendered. The exposure to risk for the municipality is no different. The assignment of the various aspects of the work should be clear and the timing for completion of the tasks clearly identified and adhered to. Table 3.11identifies a summary of the County of Peterborough boundary roads.

Table 3.11: Boundary Roads Summary

| Asset ID | Street Name | From Desc | To Desc | Length (km) | Adj Agency | AADT | Count Year | AADT Code | RDSD |
|---|---|---|---|---|---|---|---|---|---|
| 021-00000 | COUNTY ROAD 21 CAVAN/MANVERS | KING`S HWY 115 | CON. 4/5 CAVAN TOWNSHIP | 0.17 | City of Kawartha Lakes | 1150 | 2019 | AC | R |
| 042-05120 | COUNTY ROAD 42 BELMONT/SEYMOUR | ASPHODEL/SEYMOUR TWP. BDRY. | COUNTY ROAD 30 | 3.09 | Municipality of Trent Hills | 1800 | 2021 | AC | R |
| 049-00000 | COUNTY ROAD 49 HARVEY | COUNTY ROAD 36 BOBCAYGEON | 9.1 km N OF BOBCAYGEON | 8.74 | City of Kawartha Lakes | 2000 | 2016 | AC | R |
| 049-09100 | COUNTY ROAD 49 GALWAY | 9.1 km N BOBCAYGEON-COUNTY ROAD 36 | S JCT COUNTY ROAD 121-UNION CREEK | 8.72 | City of Kawartha Lakes | 2000 | 2016 | AC | R |
| 121-00000 | COUNTY ROAD 121 GALWAY | COUNTY ROAD 49 | KINMOUNT-S JCT COUNTY ROAD 503 | 8.82 | City of Kawartha Lakes | 2000 | 2016 | AC | R |
| 503-02200 | COUNTY ROAD 503 GALWAY | 3.9 km E KINMOUNT-CO. RD. 121 | E JCT PETERBOROUGH / HALIBURTON BDRY | 3.49 | County of Haliburton | 1300 | 2016 | AC | R |
| | | | **Total** | **33.03** | **km** | | | | |

# 4 Road System Condition

## 4.1 Provincial Requirements

Regulation 588/17 requires that;

'3. *For each asset category,*

*i. a summary of the assets in the category,*

*ii. the replacement cost of the assets in the category,*

*iii. the average age of the assets in the category, determined by assessing the average age of the components of the assets,*

*iv. the information available on the condition of the assets in the category, and*

*v. a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.'*

Regulation 588/17 also requires that;

*'2. The current performance of each asset category, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency, and based on data from at most two calendar years prior to the year in which all information required under this section is included in the asset management plan.*

Road system condition and Level of Service measure are inextricably linked and for that reason some of the measures are shown in both areas of this report. For roads, as with most assets, a single measure for condition or level of service may not provide a complete or accurate view of the performance of an asset group.

For the purposes of this project, the road sections have a PCI rating, a Structural Adequacy rating and a Physical Condition rating ( essentially just another PCI with different weightings.)

The PCI ratings are in accordance with the Ministry of Transportation's SP021 and SP024 Manuals for rating Surface Treatment and Hot Mix Asphalt respectively. Structural Adequacy has been approximated based on the PCI ratings.

Having current ratings ensures that pavement management decision making is based upon current data from field survey information and is completed in accordance with standard engineering practice. An Asset Management Plan for Core Assets was required by July 1, 2021, now revised to be July 1, 2022.

For the purposes of this report, the condition data has been supplemented with additional attribute data in consultation with County staff. The additional attribute data and conversion of the PCI ratings to a Structural Adequacy (another type of pavement distress measure) allowed a broader reporting and analysis of the road system

As an asset management practice, the County of Peterborough updates the condition information for the road system bi-annually. This ensures that pavement management decision making is based upon current data from field survey information and is completed in accordance with standard engineering practice

## 4.2 Road System Condition by Time of Need

The Inventory Manual methodology results in overall rating of road sections by Time of Need (TON); NOW, 1 to 5, 6 to 10, or Adeq (Adequate). Table 4-1 below provides a breakdown of the road system by time of Need and MMS Class.

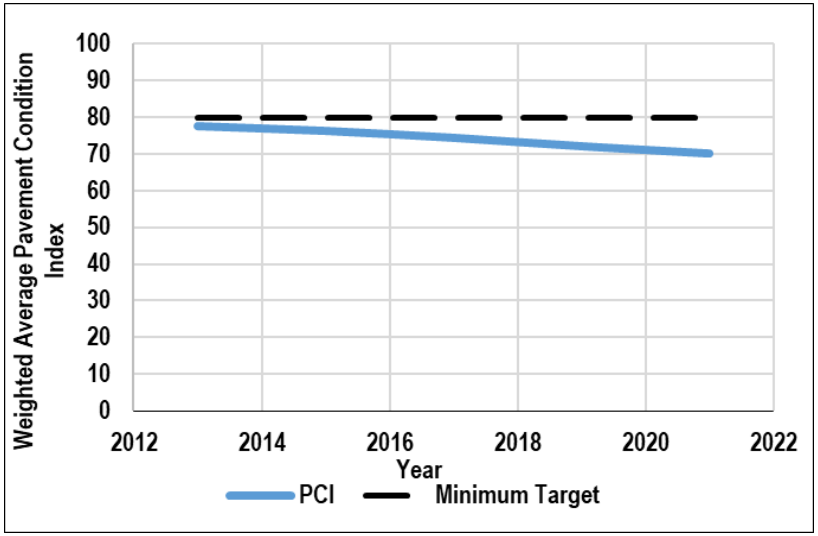
**Table 4.1: Roads System by Time of Need and MMS Class**

| Time of Need | Regulation 239/02 Classification | | | | | | | | | | TOTAL | | % OF TOTAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2 | | 3 | | 4 | | 5 | | 6 | | | | | |
| | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km | CL-Km | Lane-Km |
| 1-5 | 15.91 | 31.82 | 132.785 | 265.57 | 55.89 | 111.78 | 10.57 | 21.14 | 2.99 | 5.98 | **218.145** | **436.290** | 14.24% | 12.97% |
| 6-10 | 41.06 | 86.04 | 77.34 | 154.68 | 39.51 | 79.02 | 2.21 | 4.42 | | | **160.120** | **324.160** | 8.89% | 8.66% |
| ADEQ | 11.56 | 23.12 | 75.08 | 150.16 | 22.87 | 45.74 | 8.01 | 16.02 | | | **117.520** | **235.040** | 35.08% | 44.93% |
| NOW | 6.29 | 12.58 | 140.01 | 275.62 | 42.42 | 84.84 | 2.09 | 4.18 | 3.21 | 6.42 | **194.020** | **383.640** | 41.78% | 33.44% |
| **TOTAL** | **74.82** | **153.56** | **425.215** | **846.03** | **160.69** | **321.38** | **22.88** | **45.76** | **6.2** | **12.4** | **689.805** | **1379.130** | | |
| **% OF TOTAL** | 10.85% | 11.13% | 61.64% | 61.35% | 23.29% | 23.30% | 3.32% | 3.32% | 0.90% | 0.04% | | | | |
| System Adequacy | 91.6% | 91.8% | 67.1% | 67.4% | 73.6% | 73.6% | 90.9% | 90.9% | 48.2% | 48.2% | 71.9% | 72.2% | | |
| Good to Very Good | 70.33% | 71.09% | 35.85% | 36.03% | 38.82% | 38.82% | 44.67% | 44.67% | 0.00% | 0.00% | 40.25% | 40.55% | | |

***Note: Adjusted for Boundary Roads; Minor Differences in Calculated fields due to rounding; Does not include costs or needs of other assets.***

***Includes all potential Time of Needs elements including Capacity, Drainage, Surface Width, Surface Type, Geometry and Structural Adequacy***

Figure 4-1: Weighted Average PCI Rating History



## 4.3 Road System Adequacy

The system adequacy is a measure of the ratio of the 'NOW' needs to the total system, and includes needs from the six critical areas described earlier in the report. The overall TON is the most severe or earliest identified need. For example, a road section may appear to be in good condition, but is identified as a NOW need for capacity, indicating that it requires additional lanes. Similarly, it may be classified as a NOW need for drainage resultant from periodic flooding.

**Equation 4.3: System Adequacy Calculation**

$$\text{System Adequacy} = \frac{\text{Total System (km)} - \text{NOW Deficiencies (km)}}{\text{Total System (km)}} \times 100$$

Based on the current review of the road system, the current system adequacy measure is 71.9% meaning that, 28.1% of the road system is deficient in the 'NOW' time period, or in poor condition. The road system currently measures 689.805 CL-km (adjusted for Boundary Roads; 706.32 km unadjusted) , with 206.040 CL-km rated as deficient in the 'NOW' time period.

The 'NOW' designation includes *all six critical deficiencies*, not just pavement condition. For example, 4.07 km appear to be a 'NOW' need based on capacity.

The System Adequacy is affected directly, the capital program delays and backlog, apparent premature asphalt deterioration, and the number of sections that appear to have a capacity issue.

The traditional target adequacy for upper-tier road systems (Regions and Counties) was 75%, while a lower-tier's target adequacy was 60%. Based on these former MTO targets, which were in effect when the municipal grant system was in place, the target adequacy for the County of Peterborough should be 75%, as a minimum. The minimum target adequacies were established by MTO, to reflect the nature and purpose of the road system.

## 4.4 Road System Improvement Needs

Based on the current unit costs being experienced, the estimated total cost of recommended improvements is **$252,960,939**. The improvement costs include **$160,369,939** for those roads identified as NOW needs and **$92,591** is for road work required in the '1 to 10' year time period or for maintenance. Included in those amounts is **$1,738,068** is for work on road sections that are adequate (Maintenance or Preservation). The unit costs and treatments were provided by the County.

The estimates provided in this report for standard improvements were provided by the County utilizing the County's agency specific treatments and representative unit costs.

The following tables summarize the road system needs by improvement type, time of need and roadside environment.

**Table 4.2: Needs by Improvement Type and Time of Need by Centre Line Kilometre**

| Improvement Class | Improvement ID/Desc | | Time of Need 1-5 | | 6-10 | | ADEQ | | NOW | | TOTAL | | % OF TOTAL | | Cost Per Km ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | Imp. Costs | CL-Km | |
| County | 1DST2_10% | DST Rehab 10 % base repairs | 3,426,558 | 10.190 | 1,299,723 | 4.610 | 0 | 0.000 | 0 | 0.000 | **4,726,281** | **14.800** | 1.87% | 2.10% | 319,343 |
| County | 1DST2_20% | DST Rehab 20% Base repairs | 8,404,477 | 22.770 | 0 | 0.000 | 0 | 0.000 | 4,563,589 | 9.860 | **12,968,066** | **32.630** | 5.13% | 4.62% | 397,428 |
| County | 1MICRO2D | Microsurfacing - Scratch and Surface Lift | 3,036,160 | 51.340 | 7,340,946 | 117.380 | 251,150 | 4.130 | 246,898 | 3.450 | **10,875,154** | **176.300** | 4.30% | 24.96% | 61,686 |
| County | 1MILLO1a2 | Grind and Overlay - Urban | 1,177,250 | 2.790 | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | **1,177,250** | **2.790** | 0.47% | 0.40% | 421,953 |
| County | 1ROL12 | Rural Overlay - County | 22,519,805 | 61.480 | 0 | 0.000 | 1,061,107 | 2.720 | 0 | 0.000 | **23,580,912** | **64.200** | 9.32% | 9.09% | 367,304 |
| County | 1SST1a | Single Surface Treatment - County | 0 | 0.000 | 0 | 0.000 | 203,789 | 3.020 | 0 | 0.000 | **203,789** | **3.020** | 0.08% | 0.43% | 67,480 |
| County | 1SST1a_10% | SST with 10% Base repairs | 0 | 0.000 | 5,603,943 | 38.130 | 0 | 0.000 | 218,826 | 1.570 | **5,822,769** | **39.700** | 2.30% | 5.62% | 146,669 |
| County | CIR-R2 | Cold in Place Recycling - Rural (100mm) | 4,042,066 | 6.490 | 0 | 0.000 | 0 | 0.000 | 2,486,130 | 4.020 | **6,528,196** | **10.510** | 2.58% | 1.49% | 621,141 |
| County | CIR-U2 | Cold in Place Recycling - Urban | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | 1,066,371 | 1.370 | **1,066,371** | **1.370** | 0.42% | 0.19% | 778,373 |
| County | CRK4rds | Crack Sealing | 0 | 0.000 | 0 | 0.000 | 222,023 | 85.050 | 0 | 0.000 | **222,023** | **85.050** | 0.09% | 12.04% | 2,611 |
| County | FDR-R2 | Full Depth Expanded Rural | 34,002,003 | 64.860 | 0 | 0.000 | 0 | 0.000 | 57,092,940 | 107.840 | **91,094,943** | **172.700** | 36.01% | 24.45% | 527,475 |
| County | LCB-REC2 | LCB Full Reconstruct | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | 88,681,206 | 76.150 | **88,681,206** | **76.150** | 35.06% | 10.78% | 1,164,560 |
| County | NONE | No Action Required | 0 | 0.000 | 0 | 0.000 | 0 | 25.320 | 0 | 0.000 | **0** | **25.320** | 0.00% | 3.58% | - |
| County | RR-HM-CLA2 | Class A Roads - Rural - Hot Mix - Reconstruction | 0 | 0.000 | 0 | 0.000 | 0 | 0.000 | 1,044,425 | 0.550 | **1,044,425** | **0.550** | 0.41% | 0.08% | 1,898,955 |
| County | URCONHMBC2 | Class B & C Roads - Urban - Hot Mix Reconstruction | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 4,969,554 | 1.23 | **4,969,554** | **1.23** | 0.02 | 0.00 | 4,040,287 |
| **TOTAL** | | | **76,608,320** | **219.920** | **14,244,612** | **160.120** | **1,738,068** | **120.240** | **160,369,939** | **206.040** | **252,960,939** | **706.320** | | | |
| **% OF TOTAL** | | | 30.28% | 31.14% | 5.63% | 22.67% | 0.69% | 17.02% | 63.40% | 29.17% | | | | | |

**Not adjusted for Boundary Roads*

**Table 4.3: Needs by Improvement Type and Roadside Environment by Centreline Kilometre**

| Improvement Class | Improvement ID | Improvement Description | Roadside Environment Rural Imp. Costs | CL-Km | Semi Urban Imp. Costs | CL-Km | Urban Imp. Costs | CL-Km | TOTAL Imp. Costs | CL-Km | % OF TOTAL Imp. Costs | CL-Km | Cost Per Km ($) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| County | 1DST2_10% | DST Rehab 10 % base repairs | 2,389,996 | 7.780 | 2,336,285 | 7.020 | - | | **4,726,281** | **14.800** | 1.87% | 2.10% | **319,343** |
| County | 1DST2_20% | DST Rehab 20% Base repairs | 12,202,784 | 30.630 | 765,283 | 2.000 | - | | **12,968,066** | **32.630** | 5.13% | 4.62% | **397,428** |
| County | 1MICRO2D | Microsurfacing - Scratch and Surface Lift | 9,796,151 | 161.610 | 162,405 | 1.860 | 916,598 | 12.830 | **10,875,154** | **176.300** | 4.30% | 24.96% | **61,686** |
| County | 1MILLO1a2 | Grind and Overlay - Urban | - | - | - | - | 1,177,250 | 2.790 | **1,177,250** | **2.790** | 0.47% | 0.40% | **421,953** |
| County | 1ROL12 | Rural Overlay - County | 22,733,858 | 61.890 | 847,054 | 2.310 | - | | **23,580,912** | **64.200** | 9.32% | 9.09% | **367,304** |
| County | 1SST1a | Single Surface Treatment - County | 203,789 | 3.020 | - | - | - | | **203,789** | **3.020** | 0.08% | 0.43% | **67,480** |
| County | 1SST1a_10% | SST with 10% Base repairs | 5,822,769 | 39.700 | - | - | - | | **5,822,769** | **39.700** | 2.30% | 5.62% | **146,669** |
| County | CIR-R2 | Cold in Place Recycling - Rural (100mm) | 6,528,196 | 10.510 | - | - | - | | **6,528,196** | **10.510** | 2.58% | 1.49% | **621,141** |
| County | CIR-U2 | Cold in Place Recycling - Urban | - | | - | - | 1,066,371 | 1.370 | **1,066,371** | **1.370** | 0.42% | 0.19% | **778,373** |
| County | CRK4rds | Crack Sealing | 188,165 | 72.080 | 1,906 | 0.730 | 31,953 | 12.240 | **222,023** | **85.050** | 0.09% | 12.04% | **2,610** |
| County | FDR-R2 | Full Depth Expanded Rural | 91,094,943 | 172.700 | - | - | - | | **91,094,943** | **172.700** | 36.01% | 24.45% | **527,475** |
| County | LCB-REC2 | LCB Full Reconstruct | 88,681,206 | 76.150 | - | - | - | | **88,681,206** | **76.150** | 35.06% | 10.78% | **1,164,560** |
| County | NONE | No Action Required | - | 18.820 | - | 2.030 | - | 4.470 | **-** | **25.320** | 0.00% | 3.58% | **0** |
| County | RR-HM-CLA2 | Class A Roads - Rural - Hot Mix - Reconstruction | 1044425.00 | 0.55 | 0.00 | 0.00 | 0.00 | 0.00 | **1,044,425** | **0.55** | 0.4% | 0.1% | **1,898,955** |
| County | URCONHMBC2 | Class B & C Roads - Urban - Hot Mix Reconstruction | 0.00 | 0.00 | 3,603,958 | 0.73 | 1,365,595 | 0.50 | **4,969,554** | **1.23** | 2.0% | 0.2% | **4,040,288** |
| **TOTAL** | | | **240,686,283** | **655.440** | **7,716,890** | **16.680** | **4,557,766** | **34.200** | **252,960,939** | **706.320** | | | |
| % OF TOTAL | | | 95.15% | 92.80% | 3.05% | 2.36% | 1.80% | 4.84% | | | | | |

**Not adjusted for Boundary Roads*

### 4.4.1 Pavement Condition Index

The Weighted Average PCI of the road system is currently 70.2 measured in centreline kilometres.

### 4.4.2 Physical Condition

The Physical Condition is an alternate method of describing the condition of a road section or the average condition of the road system.(an alternate index) The value is the Structural Adequacy converted to be expressed as a value out of 100, instead of 20. This methodology lends itself to modeling and comparators that may be more easily understood. There isn't a 1:1 relationship between the weighted average physical condition and the system adequacy.

The Weighted Average Physical Condition of the road system is currently 53.3 measured in centreline kilometres.

### 4.4.3 MPMP – Measurement of Good to Very Good Roads (by Structural Adequacy)

The province requires annual reporting on the percentage of roads that are rated as good to very good. It has been assumed that the 6-10 and adequate roads are good to very good and this has been expressed as a percentage of the system. Good to very good roads represent 41.0% of the road system based on CL-km.

## 4.5 Record of Assumptions –TON, Improvement and Replacement Costs

The methodology of this report is such that the County's agency specific standards forms the basis of a large number of assumptions in terms of;

- Dimensional requirements for the development of improvement and replacement costs
- Structural requirements based on road classification (i.e., material depths)
- the County Unit Costs
- Time of Need had been determined by approximating PCI to Structural Adequacy

# 5 Replacement Cost Valuation

Program funding recommendations are a function of the dimensional information, surface type, roadside environment, and functional class of the individual assets. Recommended funding for the road system should include sufficient capital expenditures that would allow the replacement of infrastructure as the end of design life is approached, in addition to sufficient funding for maintenance, to ensure that that full life expectancy may be realized.

Budgetary recommendations in this report do not include items related to development and growth or roads under the Ministry of Transportation's jurisdiction. The County should consider those items as additional to the recommendations in this report. Generally, that type of improvement or expansion to the system would be funded from a different source, such as Development Charges.

The budget recommendations bear a direct relationship to the value of the road system. 4 Roads estimates the cost to replace the road system, to its current standard, at **$1,218,806,100,** based on the County's unit costs  standardized formulae.

Table 5.1: Replacement Costs by Asset Class

| Asset Class | Roadside Environment Rural | | Semi Urban | | Urban | | TOTAL | | % OF TOTAL | | Cost /km |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Repl. Cost | Cl km | Repl. Cost | Cl km | Repl. Cost | Cl km | Repl. Cost | Cl km | Repl. Cost | Cl km | |
| CLA_R_HCB | 155,200,219 | 73.94 | 5,246,555 | 2.02 | 0.00 | 0.00 | **160,446,774** | **75.96** | 13.16% | 10.75% | 2,112,253 |
| CLA_U_HCB | 0.00 | 0.00 | 0.00 | 0.00 | 31,149,453 | 10.65 | **31,149,453** | **10.65** | 2.56% | 1.51% | 2,924,831 |
| CLB_LCB | 80,273,086 | 68.93 | 4,215,705 | 3.62 | 0.00 | 0.00 | **84,488,791** | **72.55** | 6.93% | 10.27% | 1,164,559 |
| CLB_R_HCB | 657,553,575 | 370.41 | 7,029,603 | 4.02 | 0.00 | 0.00 | **664,583,178** | **374.43** | 54.53% | 53.01% | 1,774,920 |
| CLB_U_HCB | 0.00 | 0.00 | 0.00 | 0.00 | 70,603,107 | 20.87 | **70,603,107** | **20.87** | 5.79% | 2.95% | 3,382,995 |
| CLC_LCB | 108,059,475 | 92.79 | 7,325,079 | 6.29 | 0.00 | 0.00 | **115,384,554** | **99.08** | 9.47% | 14.03% | 1,164,559 |
| CLC_R_HCB | 81,691,350 | 49.37 | 1,199,058 | 0.73 | 0.00 | 0.00 | **82,890,408** | **50.10** | 6.80% | 7.09% | 1,654,499 |
| CLC_U_HCB | 0.00 | 0.00 | 0.00 | 0.00 | 9,259,851 | 2.68 | **9,259,851** | **2.68** | 0.76% | 0.38% | 3,455,168 |
| **TOTAL** | **1,082,777,705** | **655.44** | **25,016,000** | **16.68** | **111,012,411** | **34.20** | **1,218,806,116** | **706.32** | | | |
| % OF TOTAL | 88.84% | 92.80% | 2.05% | 2.36% | 9.11% | 4.84% | | | | | |

Table 5.2: Replacement Cost by Functional Classification

| Functional Classification / Subtype | Lanes | Roadside Environment Rural | | Semi Urban | | Urban | | TOTAL | | % OF TOTAL | | Cost /km |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Repl. Cost | Length (km) | Repl. Cost | Length (km) | Repl. Cost | Length (km) | Repl. Cost | Length (km) | Repl. Cost | Length (km) | |
| 200 | 2 | 12,856,737 | 11.04 | 0.00 | 0.00 | 0.00 | 0.00 | **12,856,737** | **11.04** | 1.05% | 1.56% | 1,164,560 |
| 300 | 2 | 18,167,128 | 15.60 | 0.00 | 0.00 | 0.00 | 0.00 | **18,167,128** | **15.60** | 1.49% | 2.21% | 1,164,559 |
| 400 | 2 | 158,726,960 | 115.52 | 0.00 | 0.00 | 0.00 | 0.00 | **158,726,960** | **115.52** | 13.02 % | 16.36 % | 1,374,021 |
| 500 | 2 | 345,866,839 | 214.50 | 0.00 | 0.00 | 0 | 0.00 | **345,866,839** | **214.50** | 28.38 % | 30.37 % | 1,612,433 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 600 | 2 | 212,902,244 | 124.28 | 0.00 | 0.00 | 0.00 | 0.00 | **212,902,244** | **124.28** | 17.47 % | 17.60 % | 1,713,085 |
| 700 | 2 | 114,245,522 | 63.95 | 0.00 | 0.00 | 0.00 | 0.00 | **114,245,522** | **63.95** | 9.37% | 9.05% | 1,786,482 |
| 800 | 2 | 220,012,275 | 110.55 | 0.00 | 0.00 | 0.00 | 0.00 | **220,012,275** | **110.55** | 18.05 % | 15.65 % | 1,990,161 |
| ART | 2 | 0.00 | 0.00 | 2,559,672 | 1.18 | 951,379 | 0.33 | **3,511,051** | **1.51** | 0.29% | 0.21% | 2,325,199 |
| ART | 4 | 0.00 | 0.00 | 2,686,883 | 0.84 | 4,088,175 | 1.12 | **6,775,058** | **1.96** | 0.56% | 0.28% | 3,456,662 |
| C/R | 2 | 0.00 | 0.00 | 11,245,308 | 7.64 | 70,023,521 | 21.27 | **81,268,829** | **28.91** | 6.67% | 4.09% | 2,811,098 |
| CCI | 2 | 0.00 | 0.00 | 0.00 | 0.00 | 31,435,753 | 10.16 | **31,435,753** | **10.16** | 2.58% | 1.44% | 3,094,070 |
| L/R | 2 | 0.00 | 0.00 | 8,524,137 | 7.02 | 4,513,583 | 1.32 | **13,037,720** | **8.34** | 1.07% | 1.18% | 1,563,276 |
| **TOTAL** | | **1,082,777,705** | **655.44** | **25,016,000** | **16.68** | **111,012,411** | **34.20** | **1,218,806,116** | **706.32** | | | |
| % OF TOTAL | | 88.84% | 92.80 % | 2.05% | 2.36% | 9.11% | 4.84% | | | | | |

# 6 Asset Condition Assessment and Plan Updates

## 6.1 Condition Assessment Cycle Recommendation

The County's practice has been to update the condition of the road system bi-annually. 4 Roads would recommend continuing with that practice.

Regulation 588/17 requires that condition information be current within 2 years of the preparation of the Asset Management Plan for core assets required for July 1, 2022 (Originally July 1, 2021).

The current practices of the County satisfy that requirement.

# 7 Asset Condition as a Measure of Level of Service (LOS)

As noted in Section 4 of this report, road system condition and Level of Service (LOS) measures are inextricably linked, and for that reason, some of the measures are shown in both areas of this report. For roads, as with most assets, a single measure for condition or level of service may not provide a complete or accurate view of the performance of an asset group.

Level of Service has a different meaning for different interests. For instance, the cost per unit may not have an impact to a ratepayer whose chief concern may be actual service delivery itself. Similarly, cost or expenditure per unit may not illustrate the condition of the asset to the end user.

Regulatory compliance with Regulation 239/02 may also be considered a level of service. The regulation provides for correction/resolution to identified defects with specified time periods dependent upon posted speed limit and traffic count.

4 Roads believes that multiple service measures may be required to adequately relate the condition of an asset to the various user groups; condition, operating costs, and end user. The following sections identify various measurements of service of the road system.

Regulation 588/17, Asset Management Planning for Municipal Infrastructure, requires that hard topped surfaces be rated using a Pavement Condition Index (PCI). The regulation is non-specific as to the PCI methodology. Table 4 from the regulation is shown below.

**Table 7.1: Regulation 588/17, Table 4**

| Column 1 Service attribute | Column 2 Community levels of service (qualitative descriptions) | Column 3 Technical levels of service (technical metrics) |
|---|---|---|
| Scope | Description, which may include maps, of the road network in the municipality and its level of connectivity. | Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality. |
| Quality | Description or images that illustrate the different levels of road class pavement condition. | 1. For paved roads in the municipality, the average pavement condition index value. 2. For unpaved roads in the municipality, the average surface condition (e.g., excellent, good, fair or poor). |

From **ASTM 6433**, Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys;

> *2.1.4 pavement condition index (PCI)—a numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition and 100 being the best possible condition.*
>
> *4.1 The PCI is a numerical indicator that rates the surface condition of the pavement. The PCI provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety). The PCI cannot measure structural capacity nor does it provide direct measurement of skid resistance or roughness. It provides an objective and rational basis for determining maintenance and repair needs and priorities. Continuous monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of*

*major rehabilitation needs. The PCI provides feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.*

There is also a significant difference in the weighting of ride in the PCI measure. In some of the MTO methodologies it is significantly weighted whereas, for example, in ASTM 6344, ride is rated indirectly on four of nineteen distresses. In the Inventory Manual methodology, 'ride' (Surface Condition) is not a trigger for any improvement or time of need. Further, there is not necessarily a relationship between ride and distress.

In WorkTech, Physical Condition is the Structural Adequacy multiplied by 5 to produce a score from 5 to 100; effectively a PCI by definition.

There a number of PCI methodologies in use in Ontario.

The different methodologies can produce a different 'PCI' for the same section of road. As such, it is critical for an agency to understand the methodology used, and trigger points for treatments. There is further explanation of this concept in Appendix C of this report.

A PCI is one type of measure for level of service.

## 7.1 Current Level of Service (LOS) Measurements

### 7.1.1 System Adequacy

As described earlier in the report, the system adequacy is the ratio of the roads that are not "NOW' need roads to the total system. This is a holistic measure as, using the Inventory Manual Methodology, needs are identified in six critical areas, not just the distress on the road surface.

System Adequacy measure for the County road system is 71.9% by boundary adjusted centreline kilometres (CL-km).

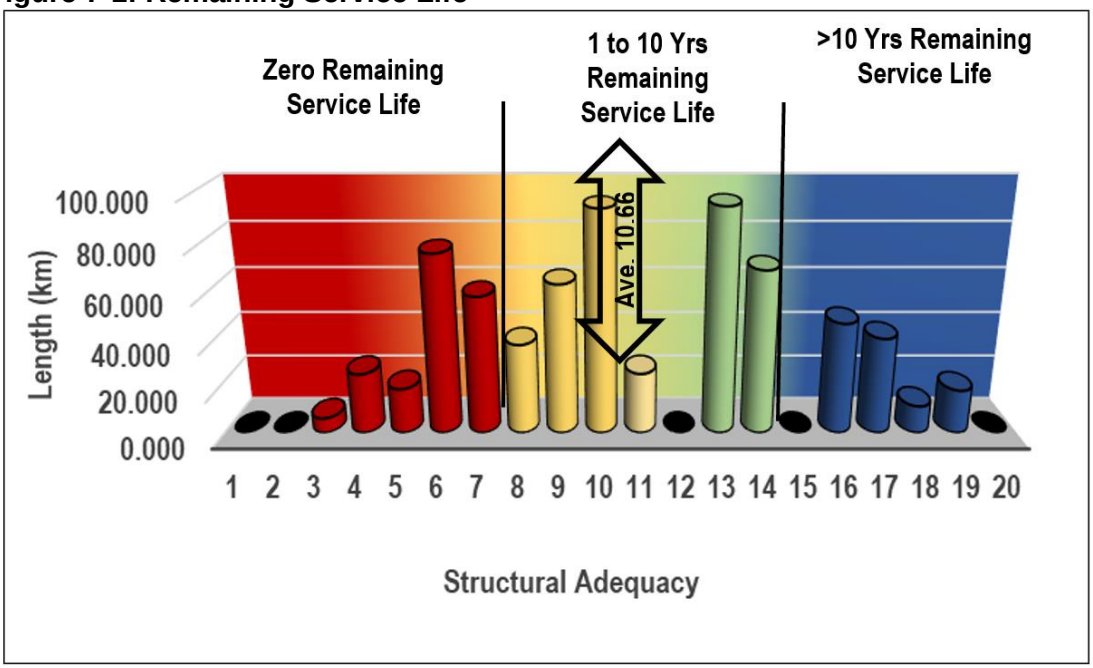
The System Adequacy should be maintained at 75% or higher by centreline kilometres. This was the target for upper tier municipalities when the province provided conditional grants.

System Adequacy as a sole measure of the system performance or a Level of Service Measure can be misleading. For example, if every road section were 1 point above failure, the system would be 100% adequate. Within a year or 2 it would be 0%. 4 Roads recommends more than 1 LOS measure

### 7.1.2 Estimated Remaining Service Life

As indicated previously, the Time of Need is really a prediction model in terms of an estimate based on current condition to the time for reconstruction. The TON then also provides an estimate of the remaining life in the road system/section. The following figure summarizes the structural adequacy ratings of the road system and illustrates the estimated remaining service life of the road system.

**Figure 7-1: Remaining Service Life**




If there were no further funds expended on the road system, the average condition of the entire road system would be in poor condition in approximately 12 years.

### 7.1.3 Pavement Condition Index

The weighted average pavement index for the County road system is 70.2, using the MTO's SP021 and SP024 rating methodologies.

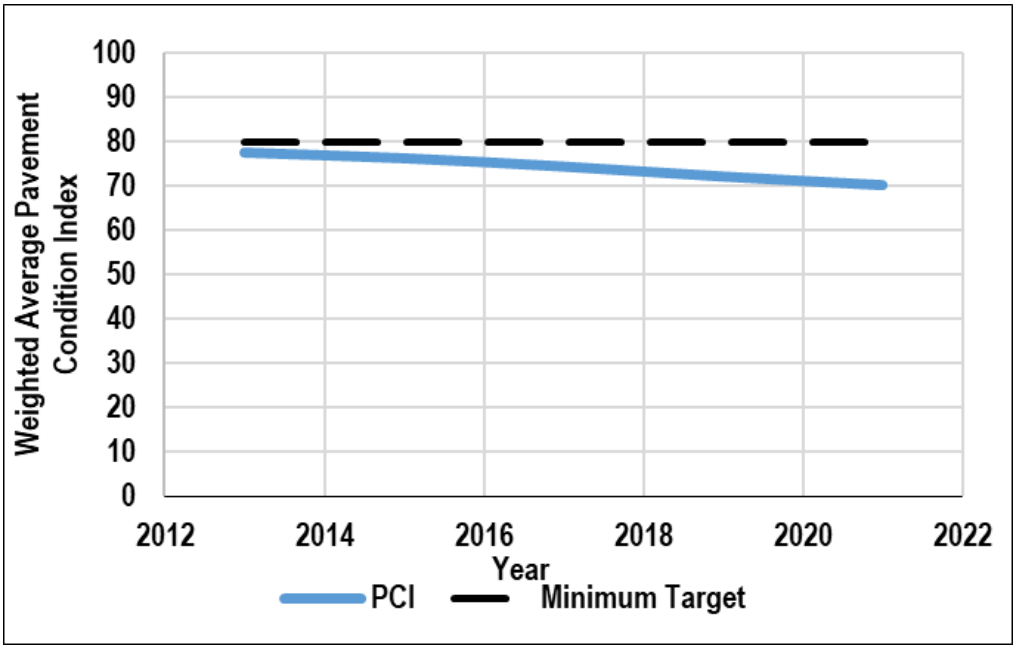
Section 8.3 of this report provides further discussion on pavement management and optimal programming based on condition. Appendix C provides further discussion on rating methodologies and performance modeling.

The weighted average Physical Condition should be at 80 or higher.

#### 7.1.3.1 Pavement Condition Index History

Historically, the County has measured the condition of the road system on a bi-annual basis. The following graph depicts the condition history information provided by the County.

Figure 7-2: Weighted Average Pavement Condition History




### 7.1.4 Physical Condition

The Physical Condition is by definition a Pavement Condition Index and a method of describing the condition of a road section or the average condition of the road system. Physical condition is the Structural Adequacy rating multiplied by five to produce a rating of between 5 and 100. This is a measure of the amount of distress on the road however the scale is not linear.

The current weighted average Physical Condition of the road system is **53.3** by CI-km (Approximately 70.2 PCI). This would indicate that the average road section has anticipated 12 years' service life remaining (approximately) until reconstruction or major rehabilitation is required, dependent upon asset class.

Section 8.3 of this report provides further discussion on pavement management and optimal programming based on condition. Appendix C provides further discussion on rating methodologies and performance modeling.

The weighted average Physical Condition should be at 70 or higher.

### 7.1.5 MPMP Good to Very Good

The province requires annual reporting on the percentage of roads that are rated as good to very good. It has been assumed that the 6-10 year and adequate roads are good to very good and this has been expressed as a percentage of the system.

Good to very good roads represent **40.3** by Cl km for all six critical areas, and **41** by Cl-km based only on the Structural Adequacy of the road system. The measure varies dependent on whether all six areas that may generate a Time of Need or just Structural Adequacy.

When all six critical areas are analyzed, the length of road sections with potential capacity needs, drives the rating lower.

4 Roads recommends that the Good to Very Good roads should be at 60% or higher.

### 7.1.6 Road System Capacity Needs

The Inventory Manual provides Time of Need (TON) Calculations in six critical areas, one of the areas being capacity.

The Time of Need ratings are either dependent upon a single rating such as Structural Adequacy or Drainage, or a calculation that utilizes data from several data fields such as the TON for Capacity. The TON calculation(s) for capacity are identified in Appendices C, D, and E of the Ministry of Transportation Inventory Manual for Municipal Roads, 1991.

Potential Capacity Needs exist on 0.58% of the County road system.

Table 7.2 summarizes the potential capacity needs.

Table 7.2: Time of Need Capacity

| Roadside Environment | Time of Need 1 to 5 (km) | 6 to 10 (km) | ADEQ (km) | NOW (km) | TOTAL (km) | % OF TOTAL |
|---|---|---|---|---|---|---|
| Rural | 0 | 0 | 654.05 | 1.39 | **655.44** | 92.79% |
| Semi Urban | 0 | 0 | 16.68 | 0 | **16.68** | 2.36% |
| Urban | 0 | 0 | 31.52 | 2.68 | **34.2** | 4.84% |
| **TOTAL** | **0** | **0** | **702.25** | **4.07** | **706.32** | |
| % OF TOTAL | 0.00% | 0.00% | 99.42% | 0.58% | | |

***Not Adjusted for Boundary Roads***

# 8 Asset Management Strategy

## 8.1 Asset Management Overview

Asset management has almost as many definitions as there are agencies that manage assets. The American Association of State Highway and Transportation Officials (AASHTO) defines asset management as

> "... a strategic approach to managing transportation infrastructure. It focuses on business processes for resource allocation and utilization with the objective of better decision-making based upon quality information and well-defined objectives."

The document entitled *Managing Public Infrastructure Assets, 2001*, prepared by AMSA, AMWA, WEF, and AWWA, defines asset management as;

> 'managing infrastructure assets to minimize the total cost of owning and operating them, while continuously delivering the service levels customers desire, at an acceptable level of risk.'

The Province of Ontario's document *'Building Together- Guide for Municipal Asset Management Plans'* indicates

> 'The asset management strategy is the set of actions that, taken together, has the lowest total cost- not the set of actions that each has the lowest cost individually'

Regardless of the source of the definition, the key themes that keep being repeated are;

- Managing
- Strategic
- Effective
- Efficient
- $$$$$ !!
- Service
- Optimizing asset life cycle
- Risk Management

As an absolute minimum, the objective of any asset management plan, or strategy, should be to ensure that the overall condition of an asset group does not diminish over time. The asset management strategy of an agency is heavily predicated, and inextricably linked to the available funding.

Most agencies are not fully funded, and a large number are not even funded sufficiently as to maintain the current condition of their system. In those circumstances, the strategy should be twofold

- Focus should be on a pavement management strategy that utilizes available funding on preservation and resurfacing programs as a priority. Reconstruction and replacement candidates will remain reconstruction and replacement candidates and cost increases will be incremental with inflation. Preservation and resurfacing opportunities that are missed will escalate in cost by several hundred percent depending on site specifics.
- Develop the financial plan in order that there is sufficient funding to maintain the condition of the road system.

## 8.2 Priority Rating vs. Condition Rating

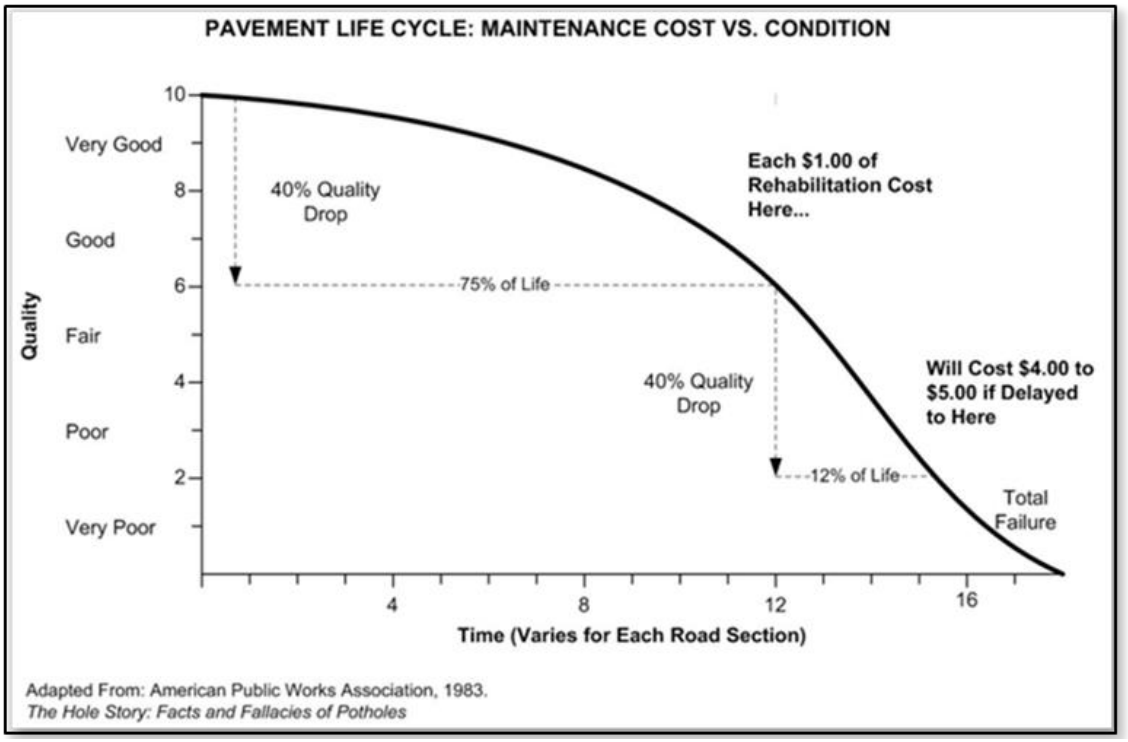
Information in a database may be sorted and analyzed in numerous ways. Understanding what information a data field represents, is key to the analysis. The Inventory Manual has many rated and calculated data fields and thus provides for many ways to sort data. Some commonly used representations, or sorting of information, from the database include:

- Priority Rating
- Priority Guide Number
- Structural Adequacy (Condition)

Priority Rating is a calculated field in the Inventory Manual, and is a function of the traffic count and the overall condition rating of the road section. This approach adds weight to the traffic count of the section. Although the word 'priority' is included in the field name, a road section that has a higher calculated 'Priority Rating' is not necessarily a higher priority in the broader sense of asset management.

Similarly, a municipality may choose to sort the road sections based on condition and cost per vehicle. The Priority Guide Number data field would assist in providing that analysis, as sorting on that parameter would prioritize road sections that have higher traffic and thus a lower cost per vehicle.

Figure 8-1: Treatment Cost vs. Deterioration



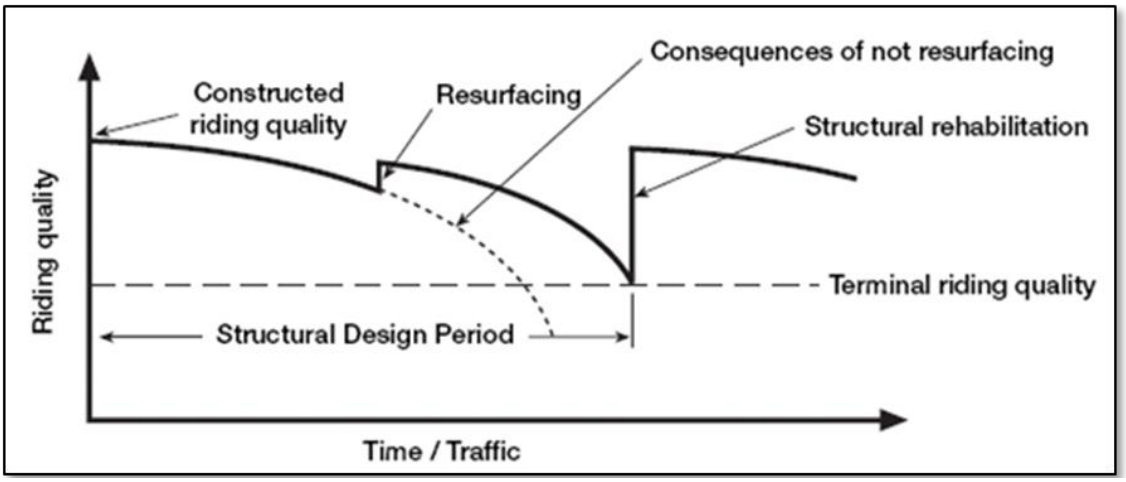

Developing a road capital program around the Priority Rating or Priority Guide Number fields will result in programming that would lead to a less efficient expenditure of funds and reduced system performance per budget dollar, as road sections with high traffic and in poor condition would be selected first, as opposed to selecting the best rehabilitation candidates at the appropriate time in

their life cycles. The exception to this statement would be cases where rehabilitation funding is at a high enough level to ensure that the preservation program requirements can be met.

From a more current asset management perspective, project selection should be predicated by condition; Structural Adequacy, PCI or PQI depending on agency. Figure 8-1 clearly illustrates the financial advantages of managing the road system by performing the right treatment at the right time of the asset life cycle. If appropriate strategies are not undertaken at the correct time, there is a less effective usage of the available funding.

Ideally, if a road is constructed and maintained with timely appropriate maintenance and resurfacing, the road system will reach a point where the majority of the activities will be preservation and resurfacing. Figure 8-2 clearly illustrates the effect the life span of a pavement by applying the correct treatment at the correction time in the life cycle.

Figure 8-2: Pavement Management- The Right Treatment at the Right Time

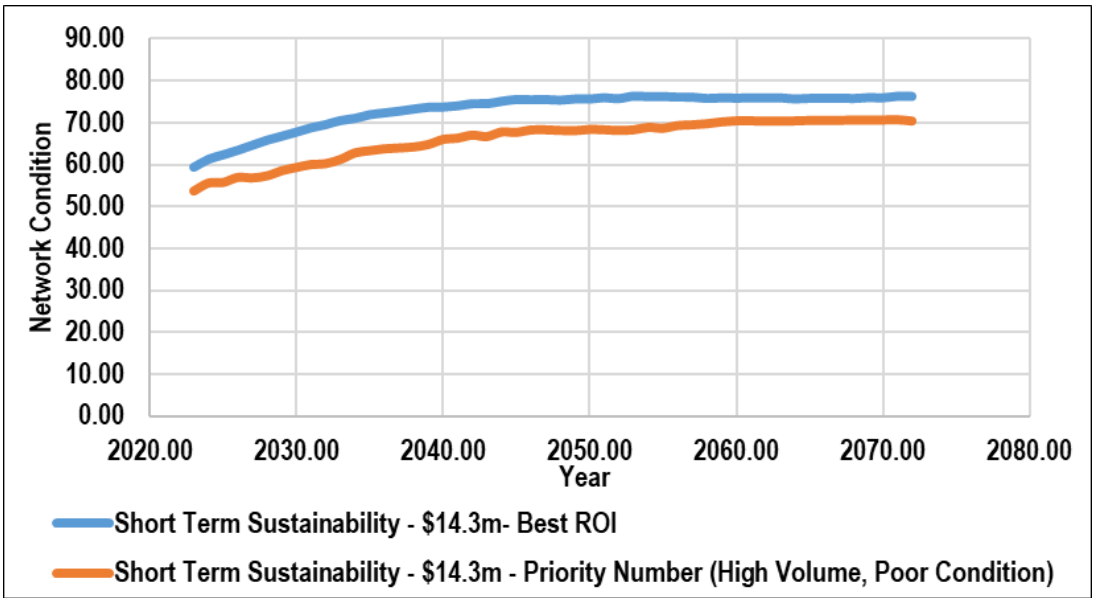



***Source: Wirtgen Cold Recycling Manual***

If an agency's budget is fully funded, the programming will include reconstruction, resurfacing, and preservation programs. Prioritization within the different programs will vary as demands are different. However, within the resurfacing and preservation programs, the pavement condition should drive the decision making.

Figure 8-3 illustrates the difference in system performance over time where best Return on Investment drives the project selection rather than worst first. When available funding is limited, treatment / project selection is critical. Prioritizing worst first projects will result in a considerably poorer performance of the road system over time.

**Figure 8-3: System Performance –Priority Number vs Best Return on Investment**




***The model is based only on the existing system and recommendations in the report, and does not include other assets***

The blue line is system performance based on a model that selects projects by best Return on Investment(ROI) and the orange line is the system performance based on the priority number. The priority number is a function of condition and traffic – a poor condition road with high traffic would generate a higher priority number. The differences in performance are more dramatic when annual budgets are minimal.

Where funding is limited, resurfacing and preservation programs should be prioritized over the construction program. The effect of this approach will be that 'NOW' need roads will remain 'NOW' needs. However, by virtue of their 'NOW' need condition, 'NOW' need roads will require increased maintenance and likely generate increased complaints from the driving public. To deal with this eventuality, a municipality should create a *'maintenance paving budget',* over and above the resurfacing budget. The purpose of this budget is to defer the reconstruction needs, and reduce maintenance efforts and complaints until the road can be reconstructed.

## 8.3 Optimal Programming and Network Condition

Section 7.1.2 of this report provides information on the current weighted average physical condition of the road system. Figure 8-4 from the Transportation Association of Canada's Pavement Asset Design and Management Guide provides a visual representation of various measures of road network and individual section performance.

**Figure 8-4: Service Levels and Triggers for Pavement Improvements**



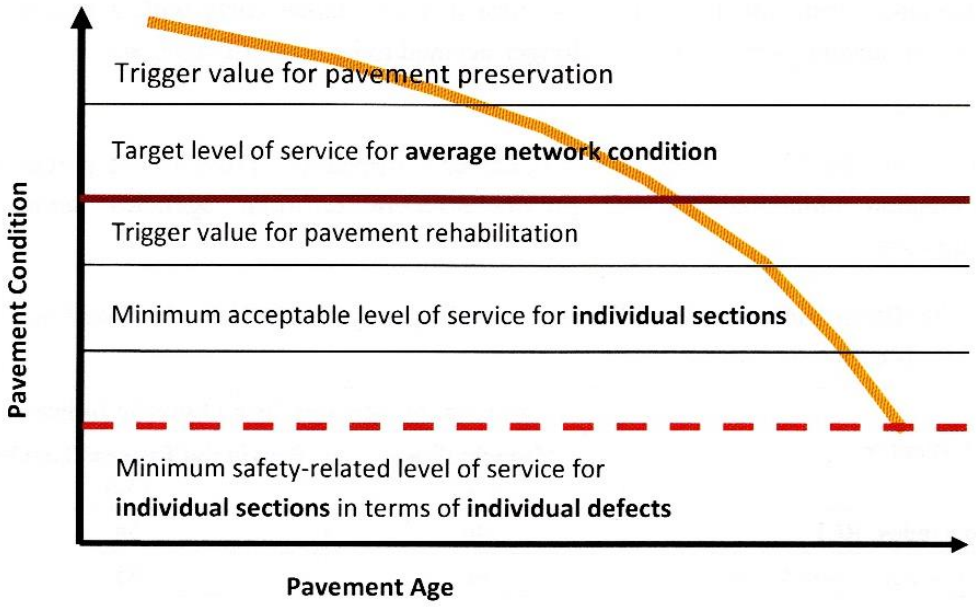



**Figure 5.3 – Types of Service Levels and Trigger Levels for Pavements [Adapted from FCM 2003]**

4 Roads has recommended that the weighted average Physical Condition of the Network be a minimum of 70 and the weighted average PCI be 80. Both the recommendations approximate each other in terms of the condition of the road. Figure 8-4 supports that recommendation based on the following analysis. Using the Inventory Manual methodology, the trigger for pavement rehabilitation is a Structural Adequacy of 14, which is a Physical Condition of 70. From the graph, the average network condition should be higher than the trigger value for network rehabilitation; supporting 4 Roads recommendation that the weighted average Physical Condition be greater than 70.

## 8.4 Cross Asset Integration and Project Prioritization

Prioritizing projects from a purely asset management perspective is a relatively straightforward exercise, regardless of funding level. Complications arise when the specific needs, commitments of the agency, and priorities of other utilities factor into the decision making process.

The road system is, in reality, a utility corridor. Multiple utilities in both urban and rural roadside environments will present conflicting demands and priorities in advancing projects. The Road Needs Study provides ratings that deal strictly with the condition of various factors as they relate to the road section. Those factors have to be considered in conjunction with needs and priorities that may exist for other utilities or pending development. In fact, the condition of other

infrastructure within the road allowance may be the key element in the prioritization. For example, a road rated as a reconstruction project may have a relatively low priority rating, but a trunk storm sewer servicing a greater area may require immediate installation. The priority of the road is then dictated by the other utility, and should be integrated into the capital plan, to best serve all interests.

Less tangible priorities may also be project prioritization tools for some agencies. For example, an agency may want to advance projects that also include bus routes or bike lanes.

As a municipal road program is developed, opportunities to complete work on smaller sections adjacent to the main project, at a lesser cost than if completed as a stand-alone project, should be considered to realize economies of scale, and complete improvements that may otherwise be passed over.

## 8.5 Road Rationalization

In reviewing the road system data, it appeared that there were a number of sections with a relatively low traffic count to the point that the road may not meet the criteria for an upper tier road system.

There are 181.97km of road sections with a traffic count of 1,000 AADT or less and 64.73km of road sections with an AADT of 500 or less.

4 Roads understands that there is currently a road rationalization study in progress. This a good asset management exercise to undertake.

Appendix E includes criteria for determination of an upper tier road that has been used many times across the province.

One of the critical flaws in these studies is that it appears that it may be misconstrued that the outcome be some exchange of equal lengths of road between the two tiers of government. The purpose would be to make a determination if the criteria is met or not.

## 8.6 Conversion to Hot Mix Asphalt Surface

During the course of discussions with this project, the subject of surface type selection has arisen.

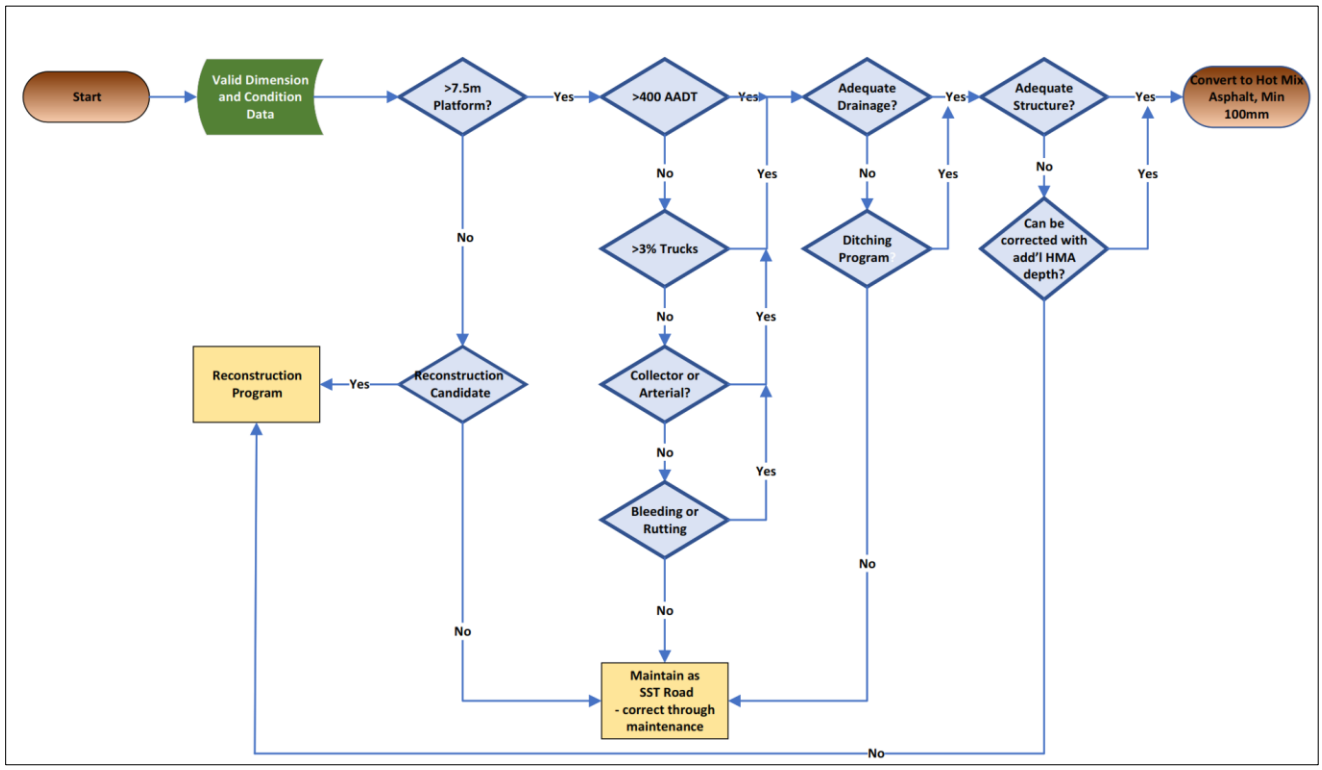
The analysis of conversion of a gravel road to surface treatment surface is simpler as the traffic and truck volumes are similar – and lower.

Conversion of a surface treated road to hot mix asphalt includes more variables, as typically the AADT is higher, truck counts may be higher, and growth may be predicted.

There is also a fundamental difference in the structural value of surface treatment vs hot mix asphalt. From the MTO Pavement Rehabilitation and Design Manual – Second Edition page 213, '*For design purposes, Open Graded Drainage Layer (OGDL) and Surface Treatment are assumed to have no structural strength'*

Figure 8.5 depicts a very simple decision matrix to assist in decision making with respect to conversion of a surface treated road to hot mix asphalt.

Figure 8-5: Surface Treatment to Hot Mix Asphalt Decision Matrix



# 9 Program Funding Recommendations

## 9.1 Overview

Program funding recommendations are a function of the dimensional information, surface type, roadside environment, functional class of the individual assets and current unit costing. Recommended funding for the road system should include sufficient capital expenditures that would allow the replacement of infrastructure as the end of design life is approached, in addition to sufficient funding for maintenance, to ensure that that full life expectancy may be realized.

Budgetary recommendations in this report do not include items related to development and growth; those should be considered as additional. Generally, that type of improvement or expansion to the system would be funded from a different source, such as Development Charges.

The budget recommendations bear a direct relationship to the value of the road system. 4 Roads estimates the cost to replace the road system, to its current standard, at **$1,218,806,100** based on current unit costs and the standardized calculations in the Inventory Manual, modified to be more reflective of County's standards. The budget recommendations provided in this report are based on the constitution of the road system. This represents an opportunity to develop a financial plan in concert with the asset management plan, for a phased implementation.

## 9.2 Long Term Sustainability / Capital Depreciation

The estimated replacement/depreciation value of the County road system to the current standard is **$1,218,806,100 .** This equates to an annual capital depreciation of **$24,376,100** based on a 50 year depreciation period**.** The annual capital depreciation is strictly a function of the replacement cost and the design life, and would best be described as an *'Accountaneering'* number. This estimate does not include bridges, culverts, cross culverts less than 3 m, sidewalks, or street lighting. If the typical design life for a road structure is 50 years before reconstruction/replacement, then 2% of the replacement cost should be the annual contribution to the capital reserve, to ensure that it can be reconstructed in that time frame.

However, in an urban setting in particular, with the underground utilities typically having an expected life in the 75 year range, it would seem more pragmatic to match the lifecycles of the road and utility assets. Road assets can be designed to last 75 years with only resurfacing required. Rural cross sections should be treated similarly.

Regardless of the lifecycle, it can only be a reality if maintenance and preservation treatments such as crack sealing, reclamite, microsurfacing and hot mix asphalt overlays are delivered at the appropriate time. Inadequate maintenance and preservation will result in premature failure, increased life cycle costs and reduced life cycle.

Analogies to houses and cars sometimes make road maintenance easier to understand. If a house does not have the roof renewed within the correct time frame, there will be damage to the structure, below the roof, and if this is not dealt with, it will result in a rapid deterioration of the house. Similarly, roads require crack sealing and resurfacing at the appropriate time, during the life cycle, in order to maximize the life expectancy of the asset. Preservation and maintenance extend the useful life of the pavement, reducing life cycle costs. *If these activities are not*

*undertaken, then end of service life of the pavement, will be between 15 and 35 years, depending on traffic volumes.*

## 9.3 Hot Mix Resurfacing

Roads require major maintenance throughout the life cycle, in order to optimize and maximize the asset life span. Roads require resurfacing at the appropriate interval, for the respective class of road. Different agencies categorize the expense differently, usually dependent upon the dollar value; however, resurfacing is essentially a maintenance activity.

Resurfacing schedules are dependent upon traffic loading and the percentage of commercial traffic. Higher traffic volumes and percentages of commercial traffic shorten the interval between resurfacings. Optimal resurfacing intervals will vary from ten to twenty years (or more), depending upon the road function, classification, and quality of design and construction.

The Hot Mix Asphalt Resurfacing recommendation in this report is based upon the distribution of the County's hot mix asphalt inventory. As such, the optimal budget calculation will focus on the 16.55-year interval, for hot mix roads. This would represent an average of 32.31 CL-km of resurfacing annually.

Table 9.1: Hot Mix Asphalt Roads by Asset Class and Life Cycle (unadjusted length)

| Asset Class | Life Cycle Yrs | Asset Qty. (CL-km) | Weighted Average |
|---|---|---|---|
| CLA_R_HCB | 13 | 75.96 | 1.846827 |
| CLA_U_HCB | 13 | 10.65 | 0.258935 |
| CLB_R_HCB | 17 | 374.43 | 11.90467 |
| CLB_U_HCB | 17 | 20.87 | 0.663543 |
| CLC_R_HCB | 19 | 50.1 | 1.780284 |
| CLC_U_HCB | 19 | 2.68 | 0.095233 |
| **Totals** | | **534.69** | **16.5495** |
| **Average Annual Paving Length** | | **32.31** | |

Given the aforementioned, and the information with respect to surface type contained in Table 3.2 , the funding for the annual resurfacing program should be **$12,470,100** per year on average, in order to maintain the system at its current adequacy level. This estimate is for the major resurfacing work only, and does not include any estimated costs for other pavement preservation activities or programs. Table 9.1 identifies the distribution of hot asphalt roads by asset class and the basis for the recommendation for the annual program budget recommendation.

## 9.4 Surface Treatment Resurfacing

Most agencies report that the average life of surface treated road is seven years. Similar to the concept applied to the development of the hot mix resurfacing recommendations, the surface-

treated road network should be completely resurfaced every seven years, or approximately 14% of the surface treated inventory in each calendar year.

At a unit cost of $4.75 per square metre, the annual program size should be **$1,628,300**, on average.

### 9.5 Crack Sealing

Crack sealing is a preservation activity that extends the life of a hot mix asphalt surface. A program estimate is provided based on crack sealing one metre per two lane metre of pavement every 5 years at the unit cost provided by the County. Based on that premise, and the current unit cost of $1.95 the average budget for crack sealing is **$280,200**.

## 9.6 Short Term Sustainable / Preservation Budget Concept

Typically, municipalities, and more particularly public works departments, prepare annual budgets that have specific line items for capital, operational and maintenance expenditures. The definitions for capital and operational costs can vary between municipalities and it also varies between agencies.

From a pure asset management perspective, project selection and annual programming should be driven by asset condition, rather than a fixed line item amount. Section 8 of this report, provided a review of this asset management philosophy.

Rather than have a fixed line item for certain activities, 4 Road recommends that a 'funding window' be determined and that the annual re-investment amount should be in the 'window'. Annual expenditures will meet the overall bottom line, however, when projects and programs are driven by condition, the annual line items will vary.

Using the recommendations developed in this report, 4 Roads has created a funding level described as the 'Short Term Sustainability Funding Level''. The Short Term Sustainability Funding Level represents an annual funding level that will sustain or preserve the condition of the road system over a shorter term; up to 5 to 10 years.

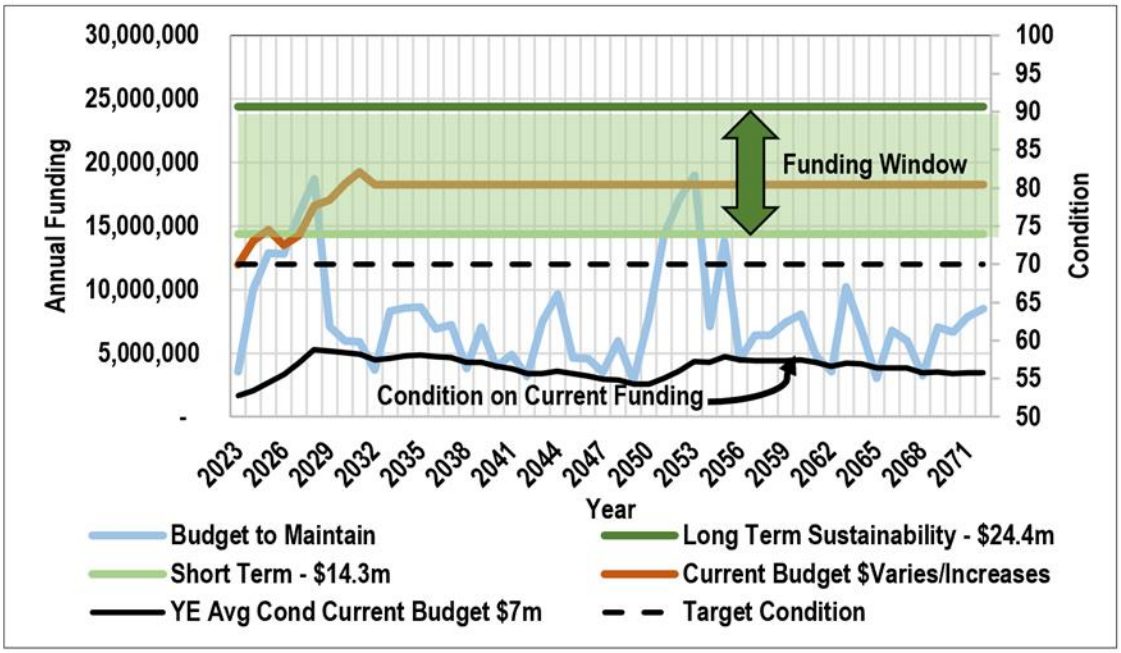
The Short Term Sustainability Funding Level is the total of the recommended annualized funding for hot mix resurfacing, single surface treatment, and crack sealing: **$14,350,700**. The premise being that if the maintenance and resurfacing programs are adequately funded, then the system should be sustained. Adequately funded maintenance and resurfacing programs will reduce overall costs and defer the need to reconstruct. The funding recommendation is based on the current system and does not include future expansion.

Based on a 50 year depreciation period, 4 Roads has calculated that the annualized Long Term Sustainability Funding Level is **$24,376,100.**

The 'funding window' is the range between the Short and Long Term Sustainable Funding Levels. Re-stated, instead of the traditional capital and maintenance line items, consider the gross budget as the *annual reinvestment level*, with program funding levels fluctuating within the gross amounts, but driven by asset condition.

Figure 9-1 illustrates the concept of the funding window.

**Figure 9-1: The Funding Window**




The model is based only on the existing system and recommendations in the report, and does not include other assets, or expansions to the system.

To clarify, the required funding level to sustain or improve the road system is *not* the total of all of the budget recommendations. Sustainable funding has to be between the Short and Long Term Sustainability Funding Levels.

**Theoretically, the 'Maintain' funding level would work. Practically, that would rely on every assumption and rating to absolutely correct, and the program adhered to explicitly.**

Municipal pavement and asset management strategies are critical to managing the performance of the road system, more so, if funding is limited. Funding constraints should push the strategy toward those programs that extend the life cycle of the road by providing the correct treatment at the optimum time. Resurfacing, rehabilitation, and preservation projects should be a higher priority than reconstruction projects. The objective is to "keep the good roads good".

The preservation budget and performance model thereof are computer derived. Intangible values and decisions and the effects of other external forces cannot be incorporated into the model. As such the preservation model is the minimum required to maintain the system- in theory. From a more pragmatic perspective and to deal with the real life realities of maintaining a road system, it should be greater.

As the municipality advances the development of their Asset Management Plan (AMP), a paradigm shift will be required in the way that we approach management of assets. Traditionally, municipalities have spent a fixed amount on capital and maintenance each year. As evidenced by Table 9.4, programs are not at a consistent funding level on an annual basis. The annual budget overall is met, however, the distribution of costs between traditional capital and

maintenance activities varies. That variance is being driven by the demands of the road system based on condition and project selection is based on condition and best Return on Investment. This concept can and should be applied to all assets.

## 9.7 Annual Budget Adjustments

### 9.7.1 Inflation

The typical approach to annual budget adjustments is to adjust with some reference or consideration to the Consumer Price Index (CPI). Public Works Departments have not fared well with this approach, as a large portion of the Public Works Budget is expended on commodities and services that typically vary/increase at a rate significantly higher than the CPI. Public Works Departments' annual increases based solely on CPI, will generally result in a continual downward spiral in overall condition of the road system and service levels. Decreasing service levels increase risk. Ontario is becoming much more litigious; therefore, the reduction in service levels increases the risk for a municipality, and the cost of service provision versus the cost of litigation should be considered.

In recent years, increases and decreases in fuel, asphalt, and salt have been disproportionate to the CPI. As such, consideration should be given to annual adjustments in road funding, which are more reflective of the actual experience. Some municipalities provide for such disproportionate changes in their budget process, in order that the specific impacts of a commodity price increase and service delivery are considered.

### 9.7.2 Plant Adjustment

Most municipalities experience development-related growth. Growth comes at a cost, both in the longer-term, with additional resurfacing and replacement requirements, and in the shorter-term, with operational budgets. Operational budgets should be adjusted on a pro-rata basis to account for the additional length of road that has to be maintained.

Capital budgets and forecasts should also be adjusted annually, to reflect any changes in the system, and integrated into the longer-term financial plan.

## 9.8 Performance Modeling- Budget Effect on System Performance

### 9.8.1 Asset Management Plan and Strategy Analysis

The asset management plan is a function of the strategy and available financing. The development process for all elements is iterative, concurrent and holistic on a number of levels. It is complex.

From Regulation 588/17;

> *"4. For each asset category, the lifecycle activities that would need to be undertaken to maintain the current levels of service as described in paragraph 1 for each of the 10 years following the year for which the current levels of service under paragraph 1 are determined and the costs of providing those activities based on an assessment of the following:*
>
> *i. The full lifecycle of the assets.*

ii. *The options for which lifecycle activities could potentially be undertaken to maintain the current levels of service.*

iii. *The risks associated with the options referred to in subparagraph ii.*

iv. *The lifecycle activities referred to in subparagraph ii that can be undertaken for the lowest cost to maintain the current levels of service."*

***Underlined by 4 Roads**

Also, from Regulation 588/17;

***Endorsement and approval required***

*"**8.** Every asset management plan prepared under section 5 or 6, or updated under section 7, must be,*

*(a) endorsed by the executive lead of the municipality; and*

*(b) approved by a resolution passed by the municipal council."*

***Underlined by 4 Roads**

To paraphrase the foregoing, the work plan must be funded sufficiently as to sustain the asset group and be approved the Executive Lead and Council.

A work plan and lifecycle activities – a Performance Model – may be developed using appropriate software.

Performance models may be developed with as many variables for weighting of attributes that may be included in the database. A model that develops a work plan based on a Return on Investment (ROI) (or the greatest area under the curve) scenario, produces a work plan, in terms of project selection, that is consistent with the regulatory requirements. From available funding, the treatments offering the best ROI are selected as a priority. Those treatments are typically crack sealing, preservation and resurfacing.

The provincial guidelines for the preparation of an AMP indicate that the following must be considered;

- Options must be compared on Lifecycle cost- the total cost of constructing, maintaining, renewing and operating an infrastructure asset throughout its service life. Future costs must be discounted and inflation must be incorporated.
- Assessment of all other relevant direct and indirect costs and benefits associated with each option.
    - Direct benefits and Costs
        - Efficiencies and network effects
        - Investment scheduling to appropriately time expansion in asset lifecycles
        - Safety
        - Environmental
        - Vulnerability to climate change
    - Indirect Benefits and Costs
        - Municipal wellbeing and costs
        - Amenity values
        - Value of culturally or historically significant sites
        - Municipal image
- Assessment of Risks associated with all potential options. Each option must be evaluated based on its potential risk, using an approach that allows for comparative analysis. Risks

associated with each option can be scored based on quantitative measures when reasonable estimates can be made of the probability of the risk event happening and the cost associated with the risk event. Qualitative measures can be used when reasonable estimates of probability and cost associated with the risk event cannot be made.

Significant effort (and expense) will be required to meet all of these requirements.

### 9.8.2 Performance Model Overview

A properly developed performance model will satisfy the majority of the requirements identified in the foregoing. Key elements of a Performance Model will include;

- Deterioration Curves identifying anticipated deterioration of an appropriately constructed asset over the life cycle of the asset
- 'Trigger' points throughout the deterioration curve identifying appropriate treatments at condition ranges
- Current costing for all treatments identified

To capture the essence of the provincial requirements, development and use of a Performance Model is recommended. Through modeling and the resultant outputs, the following may be addressed;

- Review of options and lifecycle effects based on a Return on Investment Analysis
- Efficiencies and network effects
- Budget requirements to achieve LOS goals

As noted in section 9.8.1, Regulation 588/17 requires a work program that considers the lifecycle activities of each asset over a 10 year period and results in a program that maintains the average condition of the asset group. The most effective means to achieve this goal is through a performance model. WorkTech Asset Manager Foundation includes a performance modeling capability, which has been used to develop the work plan for this project.

Through performance modeling, appropriate budget levels, programming and associated costs can be determined, delivering key elements of any plan that can be refined or revisited as circumstances change. Once a model is developed, then the effect of any alternatives may also be measured.

It is respectfully suggested that a 10 year AMP can be developed through a Performance model, however, 4 Roads is of the opinion a number of other requirements that the province has identified should not be addressed until they reach the project stage. Further, a number of those requirements would be addressed through a Class Environmental Assessment process.

This particular series of Performance Models is based on the road system in the condition that it exists today in terms of the currents pavement distress information and the current dimensional information. Section 10.8 of this report discusses performance models at varying funding levels.

Through performance modeling appropriate budget levels, programming and associated costs can be determined, delivering key elements of any plan that can be refined or revisited as circumstances change. Once a model is developed, then the effect of any alternatives may also be measured.

This particular series of Performance Models is based on the road system in the condition that it exists today in terms of the currents pavement distress information and the current dimensional information. Section 8.9 of this report discusses a 10 year performance model that incorporates the proposed 10 year Capital Plan.

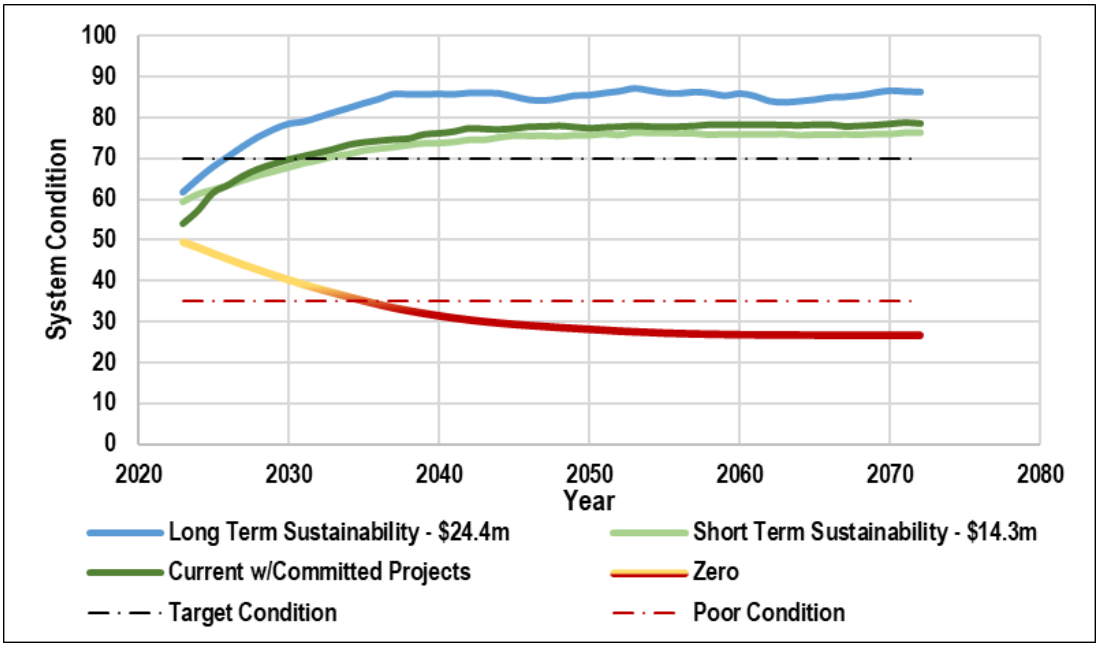
## 9.9 System Performance at Various Budget Levels

This report includes budget recommendations for various aspects of the programming that are typical to road departments. The budget recommendations do not include the expansion program related to growth and development. System performance can be predicted based on the level of funding.

4 Roads has prepared four different 50-year performance models for the road system. The models have been prepared with the following parameters:

- Zero budget – demonstrates the effect of no work being performed on the road system and how quickly it will deteriorate
- Current - $Varies / Increases
- Short Term Sustainability budget – $14.3m-This includes the total dollar value of the budget recommendations for Hot Mix Asphalt resurfacing, surface treatment, and crack sealing.
- Long Term Sustainability budget- $24.4m full replacement cost of the road system annualized.

**Figure 9-2: Performance Modeling at Various Budget Levels**




The current budget is only proposed at this time and has not been approved by Council.

The Average Physical Condition of the road system is currently 53.3 (PCI is 70.2) by centreline kilometres. The performance model calculations all begin with the current Physical Condition and

for purposes of the graphing, the year-end Physical Condition is displayed based on the effects that the improvements have had on the overall condition of the road system.

In reviewing the results of the performance models, it should be understood that, with the methodology being used, the trigger for a resurfacing activity is a Physical condition of 70.

At appropriate funding levels the system condition improves over time. Development growth and widening in conjunction with other programs has influenced the program and condition of the system

The deterioration curves that have been used consider an average/typical performance for the various road classes. When used in the model at a reasonable funding level the overall average system condition will remain at a similar level as the model will treat the pavements as perpetual. This concept is illustrated in Table 9.2 using County of Peterborough Section 049-09100, County Road 49, 9.1 km N Bobcaygeon -County Road 36-to-S Jct County Road 21 – Union Creek.

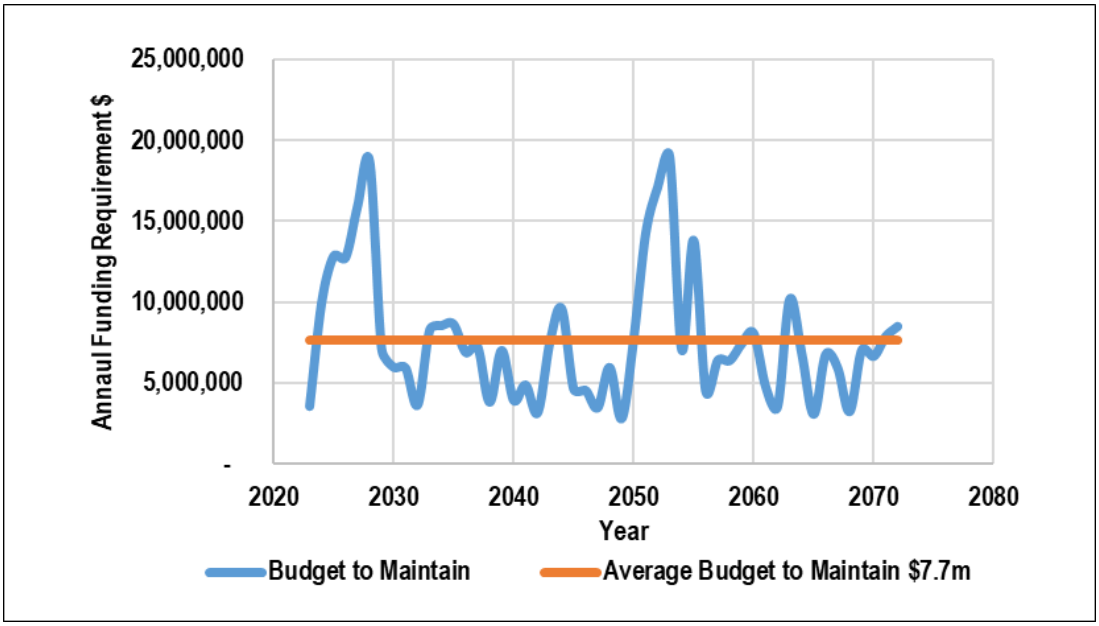
For the purposes of a short to mid-term plan considering the pavement as performing as a perpetual pavement does not pose a problem. The aggregate road base will deteriorate over time however, the time frame where that may be contributory to the road decline would be beyond 50 years. Condition data is collected regularly and monitoring and analysis would alert the municipality to changes that are occurring.

Table 9.2: Sample Section Life Cycle (from 2021 Study)

| Sample Section 049-09100, County Road 49, 9.1 km N BOBCAYGEON-COUNTY ROAD 36-to-S JCT COUNTY ROAD 121-UNION CREEK | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Improvement | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | ROI |
| 2024 | FDR-R2 | 4,571,346 | 34.13 | 100.00 | | 5,467,388 | 16,019,303 | 2.34 |
| 2029 | CRK4rds | 22,764 | 94.47 | 94.47 | 2.00 | 15,133,436 | 15,133,436 | 10.34 |
| 2040 | 1MICRO2D | 530,266 | 82.89 | 82.89 | 4.00 | 13,278,400 | 13,278,400 | 0.56 |
| 2049 | 1ROL12 | 3,401,783 | 73.31 | 90.31 | | 11,743,751 | 14,467,033 | 0.89 |
| 2050 | CRK4rds | 22,764 | 90.31 | 90.31 | 2.00 | 14,467,033 | 14,467,033 | 3.17 |
| 2055 | 1MICRO2D | 530,266 | 81.02 | 81.02 | 4.00 | 12,978,839 | 12,978,839 | 0.57 |
| 2066 | 1ROL12 | 3,401,783 | 73.31 | 90.31 | | 11,743,751 | 14,467,033 | 0.89 |
| 2067 | CRK4rds | 22,764 | 90.31 | 90.31 | 2.00 | 14,467,033 | 14,467,033 | 3.17 |
| 2070 | 1MICRO2D | 530,266 | 88.20 | 88.20 | 4.00 | 14,129,025 | 14,129,025 | 0.52 |

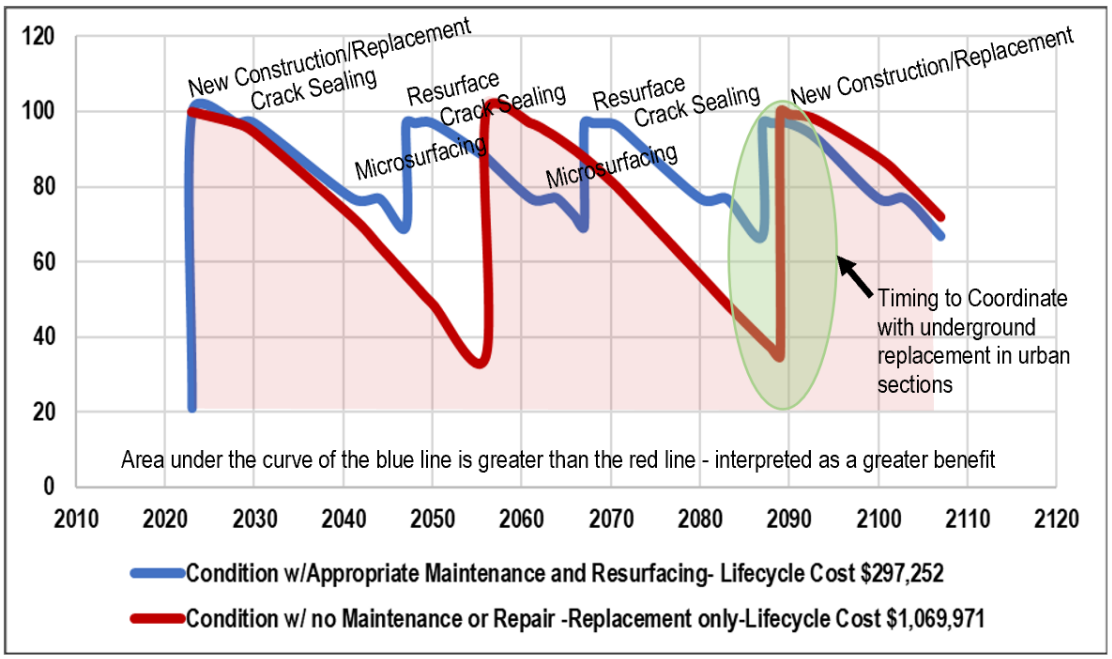
Figure 9.3 illustrates the typical effect on budget requirements by holding the condition of the system at a specified level. If the orange line represented the average annual expense, the budget years above that line would require debt financing or funding from reserves. Conversely, in those years where the funding requirement is less than the annual average then the unspent funds would accumulate in a reserve.

Figure 9-3: Annual Expenditures Budget to Maintain Condition




Deterioration curves developed by 4 Roads have been utilized for development of funding and prediction models, and based on our experience with a large cross-section of municipalities and resultant feedback, we believe that those deterioration profiles are representative. The models indicate that the overall condition of a road system will continue to increase over time to a point where the average physical condition will be in the mid 70's to low 80's range dependent upon system constitution when appropriately funded. A physical condition beyond that level may be indicating an over-expenditure/inefficiency in the programming. An average physical condition above 70 would indicate that the average road only requires maintenance.

Figure 9-4: Graphical Representation of a Typical Life Cycle




***Note: Life cycle with appropriate maintenance includes crack sealing, microsurfacing, resurfacing and reconstruction.***

## 9.10 Record of Assumptions -Performance Modeling

### 9.10.1 Pavement Classification for Modeling

In order to develop budget recommendations, 4 Roads recommends adds an additional classification of roads differentiated by surface type, roadside environment and traffic volume. Peterborough County has undertaken this exercise also. It is anticipated that each road classification will deteriorate at a different rate. Differentiation by roadside environment within a classification permits calculation of the different replacement costs to reflect the servicing and feature differences. Table 9-3 summarizes the Peterborough County Asset Classes.

Figure 9-5 illustrates treatment selection by time and asset classes for hot mix roads. Typical treatments and/or improvements have been superimposed over the deterioration curves, to illustrate the general timelines for implementing the treatments. Other road asset classes have been treated similarly. An important concept to remember is that as a road deteriorates the cost of rehabilitation increases. The deterioration curves, improvement types, current unit costs and current condition ratings are essentially the assumptions used to develop budget and programming recommendations in this report. Appendix C provides detail on the deterioration curves for all road asset classes.

Table 9.3: Road Asset Classes

| Asset Class | Subtype | Material | Roadside Envt | AADT Low | AADT High |
|---|---|---|---|---|---|
| CLA_R_HCB | All | HCB | R | 5,000 | 100,000 |
| CLA_R_HCB | All | HCB | S | 5,000 | 100,000 |
| CLA_R_HCB | All | HCB - micro | R | 5,000 | 100,000 |
| CLA_R_HCB | All | HCB - micro | S | 5,000 | 100,000 |
| CLA_U_HCB | All | HCB | U | 5,000 | 100,000 |
| CLA_U_HCB | All | HCB - micro | U | 5,000 | 100,000 |
| CLB_LCB | All | LCB | All | 1,000 | 10,000 |
| CLB_R_HCB | All | HCB | R | 1,000 | 4,999 |
| CLB_R_HCB | All | HCB | S | 1,000 | 4,999 |
| CLB_R_HCB | All | HCB - micro | R | 1,000 | 4,999 |
| CLB_R_HCB | All | HCB - micro | S | 1,000 | 4,999 |
| CLB_U_HCB | All | HCB | U | 1,000 | 4,999 |
| CLB_U_HCB | All | HCB - micro | U | 1,000 | 4,999 |
| CLC_LCB | All | LCB | All | 1 | 999 |
| CLC_R_HCB | All | HCB | R | 1 | 999 |
| CLC_R_HCB | All | HCB | S | 1 | 999 |
| CLC_R_HCB | All | HCB - micro | R | 1 | 999 |
| CLC_R_HCB | All | HCB - micro | S | 1 | 999 |
| CLC_U_HCB | All | HCB | U | 1 | 999 |
| CLC_U_HCB | All | HCB - micro | U | 1 | 999 |

Figure 9-5: Peterborough County Treatment Selection vs. Condition for Hot Mix Asphalt Roads

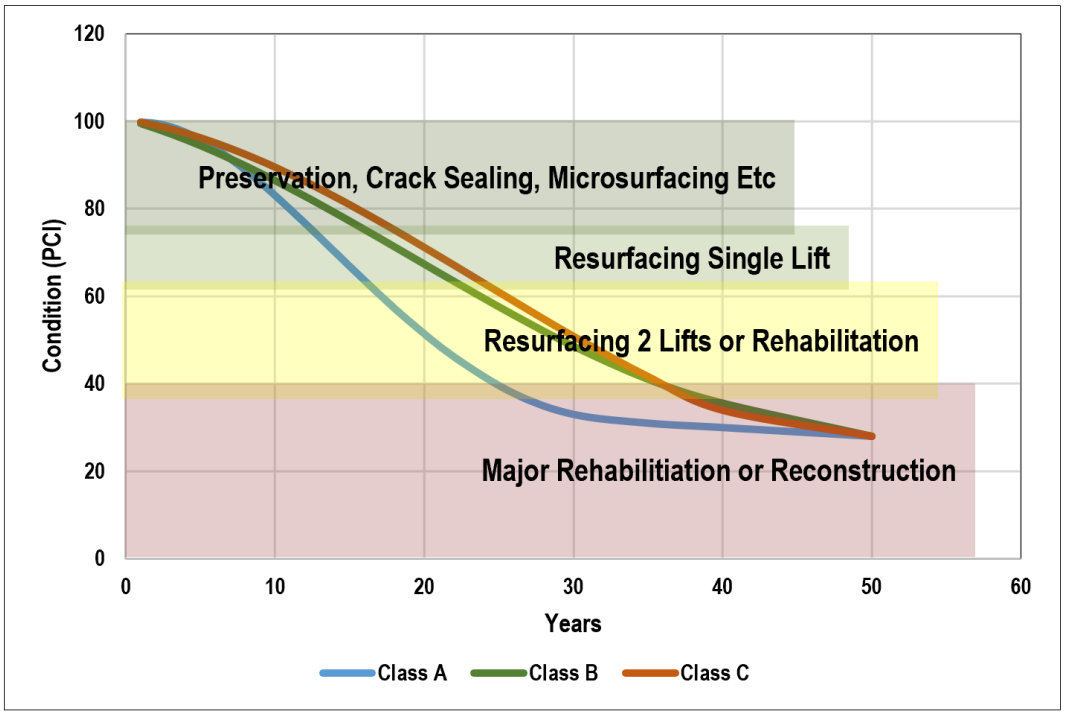
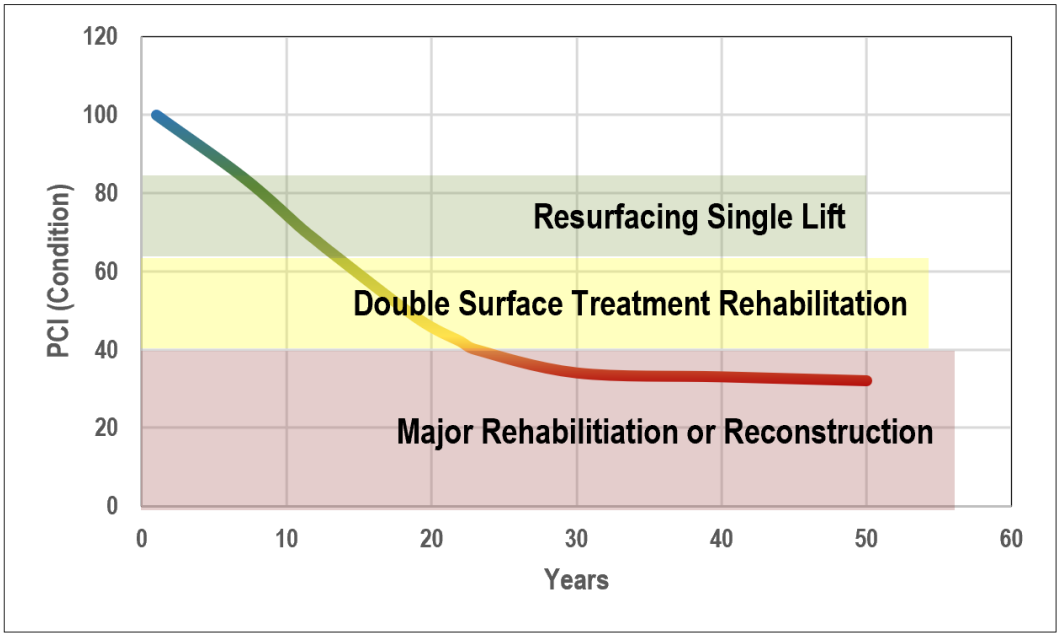



Figure 9-6: Peterborough County Treatment Selection vs. Condition for Surface Treated Roads



## 9.11 10 Year Program Performance Model

Table 9.4 provides a high level summary of the results of a 10 Year Performance Model developed based on project selection by best Return on Investment (ROI). The funding is at the Short Term Sustainability level.

The resultant project selection from the model may vary from the current operational programs and forecast as the model will select projects based on best ROI initially and then expend remaining funds on other projects. The model can be a starting point for program development but has to be metered with decisions than cannot be easily introduced into a model. The model does not include any new/additional road sections; only work on existing road sections.

The detailed output of the performance model is included in the Excel file submitted as a deliverable.

Table 9.4:10 Year Program from Performance Model – Proposed Current with Committed Projects -High level Overview (20220825)

| Improvement Type | Year | | | | | | | | | | Grand Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | |
| 1DST2_10 | | | | | | 524,070 | 817,405 | 1,048,521 | | | **2,389,996** |
| 1DST2_20 | 928,200 | 7,002,450 | 5,820,750 | 3,459,369 | 5,458,451 | | | 2,529,853 | 3,410,814 | | **28,609,887** |
| 1MICRO2D | 465,800 | 2,858,350 | 1,415,759 | 3,392,010 | 4,037,771 | 88,276 | | 71,758 | 67,367 | | **12,397,091** |
| 1MILLO1a2 | | | 388,000 | | 261,650 | 935,733 | | | 340,640 | | **1,926,023** |
| 1PR2a | | 1,137,500 | | | 203,750 | | | | | | **1,341,250** |
| 1ROL12 | | | | | | | 258,933 | 577,218 | | 67,910 | **904,061** |
| 1SST1a | | | | 112,710 | 521,220 | | | | | | **633,930** |
| 1SST1a_10 | | | | | | | | | 96,036 | 4,189,820 | **4,285,856** |
| CIR-R2 | | 1,349,300 | | | | | | | 5,290,310 | 7,178,907 | **13,818,517** |
| CIR-U2 | | | | | 1,066,371 | | | 1,087,470 | | | **2,153,841** |
| CRK4rds | | | | | 167,618 | 42,786 | 35,868 | 83,538 | 62,000 | 23,494 | **415,304** |
| FDR-R2 | 10,543,350 | 1,479,375 | 7,072,500 | 6,641,250 | 2,220,000 | 14,406,028 | 14,767,753 | 12,628,866 | 7,989,371 | 6,285,599 | **84,034,092** |
| FDR-U2 | | | | | 338,513 | 624,589 | 1,137,220 | 251,124 | 1,983,445 | 491,686 | **4,826,577** |
| **Grand Total** | **11,937,350** | **13,826,975** | **14,697,009** | **13,605,339** | **14,275,344** | **16,621,482** | **17,017,179** | **18,278,348** | **19,239,983** | **18,237,416** | **157,736,425** |

***Note: Budget levels are not Council Approved***

***Does not include any new/additional road sections; only work on existing road sections.***

# 10 Recommendations

In addition to the budgetary recommendations, the following recommendations are provided for the management of the road inventory.

1. The information and budget recommendations included in this report be used to further develop corporate Asset Management Planning.
2. Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those sections that are not going to be affected by upgrade due to development demands.
3. The funding level should be increased to the Long Term Sustainability limit over a ten year period.
4. Funding levels to be adjusted annually to accommodate growth / system expansion.
5. Funding should be adjusted annually to accommodate inflation.
6. The work plan should
    a. Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those sections that are not going to be affected by upgrade due to development demands.
    b. The work plan should cross integrate assets.
    c. The work plan should be followed to optimize investments and performance of the road system.
7. The road system inspection interval should continue at the current 2 year interval.
8. Traffic counts should continue to be updated and repeated on a regular basis. The counting should include the percentage of truck traffic.
9. The data with respect to the number of potentially substandard vertical and horizontal curves should be entered into the database. A Roadside Safety Audit should be undertaken to assess the potential safety requirements on rural road sections with potentially substandard alignment.
10. The status of the Boundary Road Agreements should be reviewed.
11. The Level of Service for System Adequacy should be a Minimum of 75%.
12. The Level of Service for Weighted Average Physical Condition should be a minimum of 70.
13. The Level of Service for Weighted Average Pavement Condition Index should be a minimum of 80
14. The Level of Service for Good to Very Good Roads should be a minimum of 60%.
15. Develop a corporate asset management system throughout the organization with the development of a Standard Operating Procedure (SOP) for asset management.

16. Consideration should be given to development of the storm sewer system as a rate supported utility.
17. Improve the understanding of the evaluation systems being used for various assets.
18. The County should review the road asset identification scheme
19. The roadside drainage should be evaluated and recorded in the database

# Chapter 3

# State of the Infrastructure for Structures

WILLS

4 ROADS MANAGEMENT SERVICES

# SOTI for Structures

## 153

**127 Bridges, 26 Culverts >3 metres**

## ~70

**Average bridge condition index (71.2) culverts condition (69.4)**

## 59.4%

**Structures in good to very good condition**
**(Bridges = 60%, Culverts = 52% of group)**

## $12 million

**NOW needs = backog ($2022)**

## $48.9 million

**Improvement costs over 10 years ($2022)**

## $5.3 million

**Annual recommended budget based upon 50 useful life ($2022)**

## $263.5 million

**Replacement costs ($2022) - Up from $145.6 ($2018) -**
**Forecasted to Grow to $346 million in $2032**

## SOTI for Structures Contents

## List of Tables



## List of Figures



## List of Appendices: Appendix 2: Structures

# 1 SOTI for Structures Summary

## 1.1 AMP Overview and Scope

The County of Peterborough is developing an Asset Management Plan for core assets as required by Ontario Regulation 588/17, Asset Management Planning for Municipal Infrastructure (O.Reg 588/17). Roads, structures with a greater than 3m span, and storm water linear and treatment assets are considered to be core assets in accordance with O.Reg 588/17, that the County would be responsible for.

O.Reg 588/17, requires that all lifecycle activities are to be considered in the development of a 10 year plan that will maintain or improve the average condition of the asset group.

This plan summarizes the State of the Infrastructure (SotI) for bridge and culvert assets through current condition data as provided by the County, and provides current and recommended Levels of Service and funding levels The report provides analysis on the current database.

The following documents and data were reviewed and/or relied upon for the preparation of this report;

- The County's 2021 OSIM Inspections WorkTech database and additional supplementary information as provided by the County and/or D.M.Wills Associates Limited including dimensional and condition information, improvement recommendations, 10 year program associated improvement costs, recommendations and replacement costs.

## 1.2 Asset Condition Rating Methodology

With respect to O.Reg 588/17' the regulation includes a requirement to provide *'a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate'*.

O.Reg104/97 and O.Reg 472/10 require that bridge and culvert structures with a greater than 3m span be inspected at a no greater than 2 year interval following and in accordance with the Ontario Structure Inspection Manual (OSIM). We are advised that bridge and culvert inspections were completed and reported on to this standard.

## 1.3 Asset Condition by Asset Group

Condition ratings are discussed in more detail in the body of the report. In general, the structure assets have a condition rating methodology that may be expressed on a 1 to 100 scale and referred to as the Bridge Condition Index (BCI). Whereas the word 'condition' is in the acronym, the BCI is a measure of the residual value of the structure and should not be relied upon solely to make a decision with respect to structure improvements.

From the ratings obtained during the evaluations, a Bridge Condition Index (BCI) may be calculated. From the Ministry of Transportation of Ontario (MTO) Engineering Standards Branch 2009;

*"The Bridge Condition Index (BCI) was developed as a means of combining the inspection information into a single value. This number, the BCI value, gives an indication of the overall condition of the bridge.*

*The BCI is calculated using asset management principals based on the remaining economic worth of the bridge. It is based on the premise that a bridge starts at a new condition and deteriorates to a lower condition with time. It uses actual inspection data from the various bridge elements and as the elements deteriorate they have a lower economic value. Essentially, the BCI is a weighted average of all elements (since all elements are not of equal value to the bridge) and all Condition States (since each condition state represents a certain degree of loss of value of the element). The BCI begins at 100 when the bridge is in new condition and theoretically becomes 0 as al elements become fully in Poor condition. Practically, it is impossible for the BCI to fal to 0 since the entire bridge does not become poor before rehabilitation work is performed.*

*The BCI is based on the current value and replacement value of al elements in a bridge. The current value of the element is determined based on the depreciated value of the portions of the element that are in each of the four Condition States (Excellent, Good, Fair, Poor).*

> *BCI ratings interpretation, from the MTO website:*
>
> *Good - BCI Range 70 -100 For a bridge with a BCI greater than 70, maintenance work is not usually required within the next five years.*
>
> *Fair - BCI Range 60 -70 For a bridge with a BCI between 60 and 70 the maintenance work is usually scheduled within the next five years. This is the ideal time to schedule major bridge repairs from an economic perspective.*
>
> *Poor - BCI Less than 60 - For a bridge with a BCI rating of less than 60, maintenance work is usually scheduled within approximately one year."*

**Table 1.1: Bridge and Culvert Condition Measures**

| Condition Measure | Bridges | Culverts |
|---|---|---|
| Poor % (BCI<60) | 6.0 | 15.0 |
| Fair % (BCI 60-70) | 24.2 | 29.6 |
| Good to Excellent % (BCI>70) | 69.8 | 55.4 |
| Weighted Average Asset Group Condition (by deck area) | 71.2 | 69.4 |
| Average Group Condition | 69.9 | 69.4 |
| **Recommended Minimum Asset Group Condition** | **70** | **70** |

## 1.4 Bridge and Culvert Asset Replacement Costs

The replacement cost for the County of Peterborough Bridge and Culvert assets is estimated to be $263,540,383.

The estimated costs were updated in the summer of 2022 to reflect the most current experience with recently closed tenders.

**Table 1.2: Bridge and Culvert Replacement Costs**

| Asset | Estimated Replacement Cost ($) | Average Cost per Square Metre ($) |
|---|---|---|
| Bridges | 246,016,910 | $10,500 |
| Culverts | 17,523,473 | $5,150 |
| **Total** | **263,540,383** | |

### 1.4.1 Bridge and Culvert Needs

From the WorkTech database provided, Tables 1.3 and 1.4 identify the improvement needs for the asset management plan for the entire the bridge and culvert inventory. In some cases, "None" was identified as an improvement type or no improvement type was identified with costs of $750k in the WorkTech database.

The 10-year program provided by D.M.Wills is contained in Appendix 2:B which was utilized in the following tables as total .

**Table 1.3: Bridge Improvement Needs**

| Improvement Type | Deck Area (m2) | Number of Structures | Total Cost | Imp Cost /m2 |
|---|---|---|---|---|
| MajorRehab | 3,881.93 | 7 | **8,030,142** | 2,069 |
| MinBRH | 513.33 | 2 | **866,120** | 1,687 |
| MinorRehab | 11,040.85 | 60 | **24,536,593** | 2,222 |
| None | 7,337.64 | 45 | **750,622** | 102 |
| Replace | 1,435.33 | 13 | **14,026,899** | 9,773 |
| **Grand Total** | **24,209.08** | **127** | **48,210,376** | |

**Table 1.4: Culvert Improvement Needs**

| Imp Type | Footprint (m2) | Number of Structures | ImpCost | OtherCost | Total Cost | Cost / m2 |
|---|---|---|---|---|---|---|
| cREHAB | 217 | 2 | 2,836,200 | 191,100 | **3,027,300** | 13,951 |
| MinorRehab | 2556.07 | 17 | 10,907,850 | 1,934,830 | **12,842,680** | 5,024 |
| None | 523.35 | 5 | | | | |
| Replace | 202.9 | 2 | 2,169,240 | 2,802,640 | **4,971,880** | 24,504 |
| **Grand Total** | **3499.32** | **26** | **15,913,290** | **4,928,570** | **20,841,860** | |

## 1.5 Annualized Funding Recommendations

O.Reg 588/17 requires a work plan that will sustain/maintain the condition of the assets over a 10 year period. Adequate funding is critical to meeting this requirement. If the funding is not adequate, the assets are not sustainable.

Asset Management is critical to service delivery. A large number of municipalities do not appear to be funding asset management at an appropriate level. The implementation of O.Reg 588/17, and the financial implications that it brings, may seem at first as an insurmountable task. Instead, it should perhaps be viewed as an opportunity to review the sustainability of services that are provided and allow for analysis of what services should be delivered and how best they should be delivered.

The recommended approach to the structures financial management is different than other assets such as roads.

The rationale is that, whereas an annualized funding level can -and is- established, an individual structure may exceed, said funding level. Instead, the recommendation would be to create a creating a Discretionary / Non Obligatory Reserve fund that would ensure funding is available when required for every asset group. The funding contribution to the reserve should be the annualized life cycle costing. See further discussion in sections 5 and 6 of this report.

The recommendation would be to contribute **$5,270,800** annually to a reserve for structures projects.

This recommendation is based on the replacement costs over a 50 year life cycle. The design life of structures is typically 75yrs. However, considering the overall condition of the asset group and providing an allowance for rehabilitations, a life cycle of 50 years was utilized.

## 1.6 O.Reg 588/17 Level of Service (LOS) Measures

O.Reg 588/17 includes performance measures for the core assets. Section 4 of this plan provides the detail of the measures required by the regulation.

To be clear, there are no targets in the regulation- only measures. O.Reg 588/17 requires that the municipality establish its own target Level of Service Measures. The municipal specific LOS should be based in part on the current LOS as measured through a condition assessment of the assets that is no greater than 2 years old.

More than a single LOS measure is typically required to accurately quantify the condition of an asset or asset group. The details of the current level of service measures are provided in section 4 of this plan/report.

## 1.7 Asset Management Strategy

Section 5 of the plan provides further detail on the asset management strategy.

However, on the most basic level, the strategy and the funding are inextricably tied.

O.Reg 588/17 requires a 10-year plan that selects the lowest cost life cycle activity that will maintain the condition of the assets or asset group over the plan period. Delivering this service in a static system with no growth and a single asset is reasonably simple. However, the road allowance is a utilities corridor shared by many users. As such, cross asset integration and coordination with other levels of government and service providers, has to be part of the strategy.

The asset management strategy has to

- Maintain the condition of each asset group, selecting the lowest cost activity to sustain the condition of the asset group whenever possible
- Ensure cross integration of assets
- Ensure that development needs are integrated

- Be regulatory compliant
- Be adequately funded

# 2 Introduction and Background

Asset Management Planning is not new to Ontario and has roots extending at least back to the 1970's. As an example, until 1995, the province required municipalities to provide condition evaluations of the road and structures inventories as a condition of grant funding; in effect a State of the Infrastructure report following prescribed methodologies.

More recently, in August 2012, the Province of Ontario, introduced a requirement for an Asset Management Plan (AMP) as a prerequisite for municipalities seeking funding assistance for capital projects from the province; effectively creating a conditional grant. To qualify for future infrastructure grants, an AMP had to be developed and approved by a municipal council by December 2013. On April 26, 2013 the province announced that it had created a $100 million Infrastructure Fund for small, rural and northern municipalities.

Subsequently, the province has introduced further initiatives for infrastructure funding: Ontario Community Infrastructure Fund (OCIF) and the Small Communities Fund (SCF). An Asset Management Plan (AMP) approved by Council is required as part of the submission for OCIF Applications. Asset Management Plans were to be reviewed for comprehensiveness.

On December 27, 2017, the Province filed Regulation 588/17, Asset Management Planning for Municipal Infrastructure. The regulation identifies provincial requirements and timelines for development and implementation of asset management plans. Initially, AMP's were to include the 'core' assets; water and waste water linear and treatment, roads, bridge and culvert structures, and storm water linear and treatment, and then ultimately evolve to include all assets.

Regulation 588/17 required an Asset Management Plan (AMP) for core assets by July 1, 2021 which is based on condition data that is no more than two years old. The date was subsequently revised to July 1, 2022.

The assumption was/is that a valid AMP will be a requirement for some provincial grants in the future.

More recently, it appears that the province has tied the OCIF Funding to Current Replacement Values (CRV) which would be part of any SotI.

If the Ministry of Infrastructure (MOI) did not receive an updated asset management plan by July 29, 2022, MOI will use current replacement values (CRVs) from the most recent asset management plan that is available to inform OCIF allocations. If a previous asset management plan is not available, MOI will be deriving its own CRV estimates to inform the municipality's 2023 OCIF allocation. Changes in OCIF would be limited to ±15 per cent of 2022 allocations for 2023.

It is important to note that failing to meet the regulatory timelines under O.Reg. 588/17 could result in funding and eligibility implications under both OCIF and the Investing in Canada Infrastructure Program.

Core assets for the County of Peterborough include;

- Roads
- Bridge and Culvert Structures
- Stormwater Sewer and Facilities

# 3 State of the Local Infrastructure

State of the Infrastructure (SotI) is a condition measure of the asset group, by individual asset and by the group.

The SotI should provide condition ratings, and improvement and replacement costs. From those elements a work plan and recommended funding levels can be developed.

## 3.1 Bridge and Culvert Structures

### 3.1.1 Condition Evaluation Methodology

The County bridge and culvert inventory was reviewed using the Ontario Structure Inspection Manual (OSIM).

O.Reg 104/97, Standards for Bridges requires inspections in accordance with the OSIM manual every two years. The structures inventory was inspected in 2021 (D.M.Wills Associates Limited). Pertinent data was entered into the County's software and a copy of the database provided to 4 Roads.

OSIM (O.Reg 104/97) is the required regulatory standard, and as such, meets the requirements of O.Reg 588/17.Summary of Bridge and Culvert Condition is shown in the following tables.

**Table 3.1: Bridge Condition Information by Structure Type**

| Structure Type | Deck Area | Number of Structures | Average BCI |
|---|---|---|---|
| BC - Box, Closed Footing | 337.85 | 4 | 73.0 |
| BO - Box, Open Footing | 1,109.53 | 12 | 71.5 |
| BT - Box/Trapizoidal | 1,978.82 | 9 | 73.5 |
| HT - Half-Through Truss | 1,547.88 | 9 | 71.6 |
| IB - I-Beams or Girders | 11,571.81 | 39 | 69.3 |
| RF - Rigid Frame, Vert. Legs | 3,816.85 | 29 | 69.1 |
| SC - Slab, Circular Voids | 562.53 | 4 | 70.3 |
| SS - Solid Slab | 1,526.84 | 11 | 66.9 |
| TB - T-Beams | 755.62 | 7 | 67.8 |
| TM - Temporary Modular | 226.46 | 2 | 74.3 |
| TT - Through Truss | 774.90 | 1 | 73.8 |
| **Grand Total** | **24,209.08** | **127** | **69.9** |

**** Notes: Some firms and jurisdictions make a distinction that any structure with more than 600 mm of fill is classified as a culvert.***

**Table 3.2: Culvert Condition Information by Structure Type**

| Structure Type | Footprint Area | Number of Structures | Average BCI |
|---|---|---|---|
| BOX - Box | 898.51 | 8 | 68.94 |
| FRA - Frames, Articulated | 586.88 | 5 | 64.41 |
| FRR - Frames, Rigid | 345.26 | 1 | 73.76 |
| OTH - Other | 55.47 | 1 | 88.54 |
| PA - Pipe Arch | 918.46 | 7 | 69.21 |
| PAS - Pipe Arch w Stiffener | 98.9 | 1 | 63.24 |
| PR - Pipe Round | 595.84 | 3 | 73.99 |
| **Grand Total** | **3499.32** | **26** | **69.44** |

The average age of the bridge inventory is 54 years.

The average age of the culvert inventory is 52 years.

**Figure 3-1: Bridge Inventory Condition**

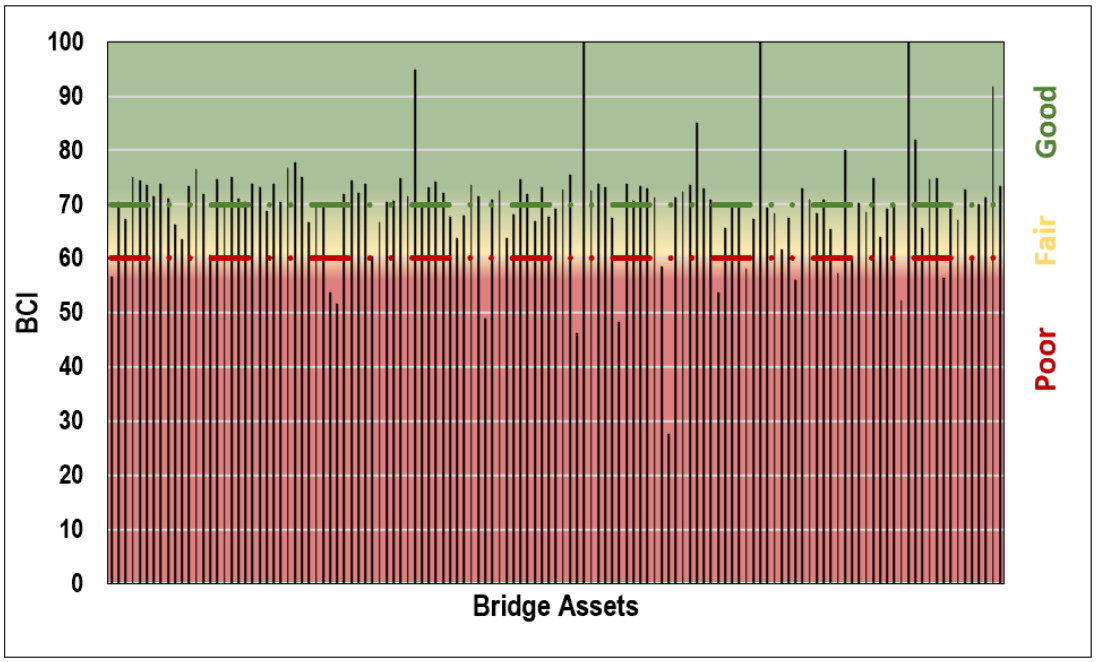
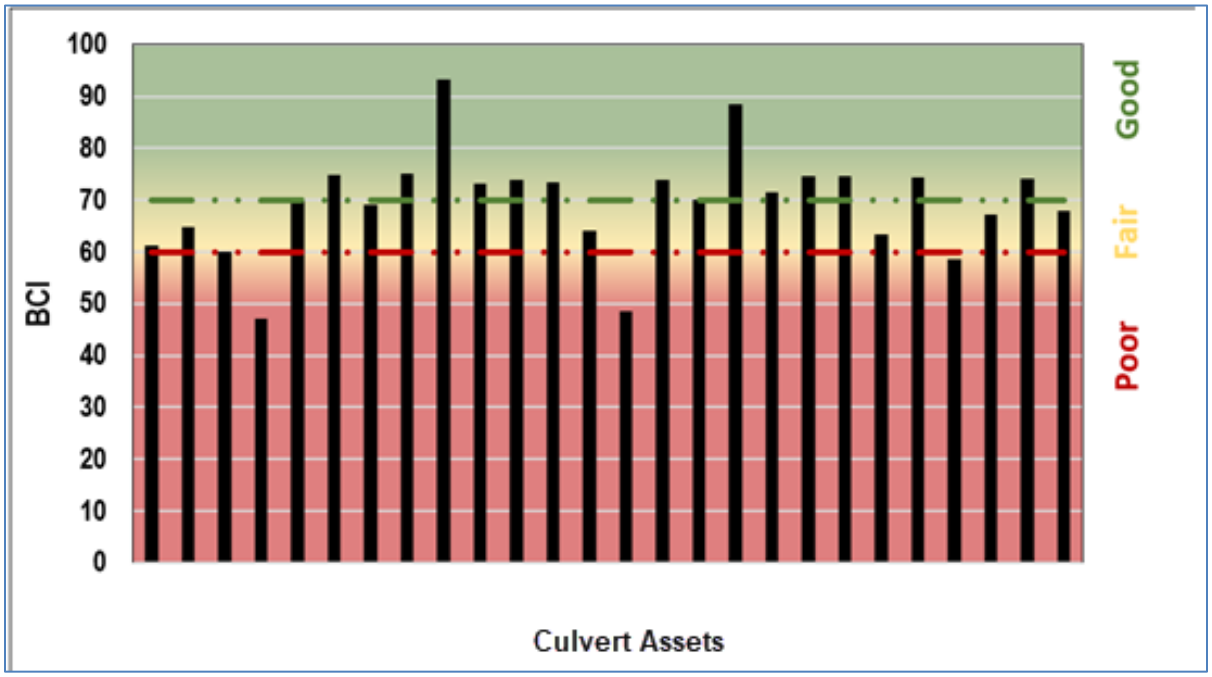



**Figure 3-2: Culvert Inventory Condition (BCI)**



### 3.1.2 Bridge and Culvert Replacement Costs

**Table 3.3: Bridge and Culvert Inventory Replacement Costs**

| Asset | Estimated Replacement Cost ($) | Average Cost per Square Metre ($) |
|---|---|---|
| Bridges | 246,016,910 | $10,500 |
| Culverts | 17,523,473 | $5,150 |
| **Total** | **263,540,383** | |

***Note: 2022 Replacement Costs includes engineering and contingencies***

Given that structures funding may not be required each year to sustain the asset group, it serves to illustrate the merit in creating a Discretionary / Non Obligatory Reserve fund that would ensure funding is available when required. This is discussed further in section 5 of the plan.

# 4 Expected Levels of Service

O.Reg 588/17 section 6.1(1) indicates;

> *'Asset management plans, proposed levels of service*
>
> ***6.****(1) Subject to subsection (2), by July 1, 2024, every asset management plan prepared under section 5 must include the following additional information:*
>
> *1. For each asset category, the levels of service that the municipality proposes to provide for each of the 10 years following the year in which all information required under section 5 and this section is included in the asset management plan, determined in accordance with the following qualitative descriptions and technical metrics:'*

To that end, this report proposes LOS targets for the structure assets.

## 4.1 O.Reg 588/17 LOS Measures - Structures

O.Reg 588/17 Table 5, provides 2 LOS measures; the BCI and the percentage of bridges with loading or dimensional restrictions. The MTO Bridge Condition Index Manual (2008) notes that:

> *'The BCI is calculated using asset management principals based on the remaining economic worth of the bridge. It is based on the premise that a bridge starts at a new condition and deteriorates to a lower condition with time. It uses actual inspection data from the various bridge elements and as the elements deteriorate, they have a lower economic value. Essentially, the BCI is a weighted average of all elements (since all elements are not of equal value to the bridge) and all Condition States (since each condition state represents a certain degree of loss of value of the element). The BCI begins at 100 when the bridge is in new condition and theoretically becomes 0 as all elements become fully in Poor condition. Practically, it is impossible for the BCI to fall to 0 since the entire bridge does not become poor before rehabilitation work is performed.*
>
> *The BCI is based on the current value and replacement value of all elements in a bridge. The current value of the element is determined based on the depreciated value of the portions of the element that are in each of the four Condition States (Excellent, Good, Fair, Poor).'*

It must be stressed that the BCI must not be considered as a measure of safety of a bridge. Some elements of a bridge can exhibit severe deterioration without compromising structural integrity while other elements may be more susceptible to deterioration. Additionally, in the event that a critical element has been under-designed, it may fail even if it is in as-new condition.

The BCI could also be described as a measure of the residual value of the structure.

**Table 4.1: O.Reg 588/17 Table 5 Structures**

| Column 1 Service attribute | Column 2 Community levels of service (qualitative descriptions) | Column 3 Technical levels of service (technical metrics) |
|---|---|---|
| Scope | Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists). | Percentage of bridges in the municipality with loading or dimensional restrictions. **21.3% (Based upon information provided in the WorkTech database as at July 15, 2022).** |
| Quality | 1. Description or images of the condition of bridges and how this would affect use of the bridges.<br>2. Description or images of the condition of culverts and how this would affect use of the culverts. | 1. For bridges in the municipality, the average bridge condition index value **69.88**<br>2. For structural culverts in the municipality, the average bridge condition index value **69.44** |

The O.Reg 588/17 LOS measure are particularly important as narrow structures and load restricted structure pose a significant impediment to service delivery, particularly for emergency services and public works. As an example, a tandem dump truck with plow blade and loaded with salt weighs approximately 25 tonnes; a Pumper Fire truck may be in the 30 tonne range.

Table 4.3 summarizing the widths only summarizes structures with a with of less than 6m. Depending on the actual AADT of the road section, there may be additional structures that should be included on this list.

The following tables summarize the structures with load and width restrictions. There is overlap between the two tables. There did not appear to be any culvert structures with a load restriction.

**Table 4.2: Structures with Load Restrictions (as provided in the WorkTech database July 15, 2022)**

| Asset ID | Description | Deck Area | Load Restriction | L1 | L2 | L3 |
|---|---|---|---|---|---|---|
| 021001 | FIREHALL BRIDGE, LOT 13, CONC IV/V | 156.25 | 5T | | | |
| 035004 | SOUTH GRAYSTOCK CULVERT | 70.35 | 5T | | | |
| 99009 | MacINTOSH BRIDGE | 59.78 | Triple Posting | 23 | 18 | 9 |
| 099014 | HOPE'S BRIDGE | 110.86 | Triple Posting | 35 | 25 | 18 |
| 099017 | INDIAN RIVER BRIDGE | 129.85 | Triple Posting | 28 | 23 | 18 |
| 099026 | GIRVEN'S BRIDGE | 66.56 | Triple Posting | 20 | 12 | 4 |
| 099034 | TULLY'S BRIDGE | 72.25 | Triple Posting | 44 | 25 | 10 |
| 099043 | OLD CANAL BRIDGE | 52.46 | Triple Posting | 24 | 15 | 7 |
| 099047 | BURNT MILL BRIDGE | 107.31 | 5T | | | |
| 099055 | NICHOLS COVE (HALLS) BRIDGE | 105.8 | Triple Posting | 22 | 16 | 8 |
| 099056 | MISKWAA ZIIBI RIVER BRIDGE | 132.48 | 5T | | | |
| 099061 | RACCOON'S BRIDGE | 99.56 | 5T | | | |
| 099066 | UNION CREEK BRIDGE | 45.1 | Triple Posting | 17 | 9 | 3 |
| 099070 | McCALL BRIDGE | 51.04 | Triple Posting | 23 | 19 | 11 |
| 099071 | BOOTHS BRIDGE | 76.25 | 5T | | | |
| 099077 | SQUIRREL CREEK BRIDGE | 85.28 | Triple Posting | 31 | 21 | 7 |
| 099090 | ROTARY TRAIL BRIDGE | 23.68 | 5T | | | |

**Table 4.3: Bridge Structures with Apparent Substandard Width (as provided in the WorkTech database July 15, 2022)**

| Asset ID | Description | Deck Area | Deck Length | Deck Width |
|---|---|---|---|---|
| 039002 | BENSFORT ROAD | 19.76 | 3.8 | 1.86 |
| 099002 | GILLIS BRIDGE | 47.04 | 9.8 | 4.8 |
| 99009 | MacINTOSH BRIDGE | 59.78 | 12.2 | 4.9 |
| 099014 | HOPE'S BRIDGE | 110.86 | 24.1 | 4.6 |
| 099015 | ARMSTRONG'S BRIDGE | 122.5 | 25 | 4.9 |
| 099017 | INDIAN RIVER BRIDGE | 129.85 | 26.5 | 4.9 |
| 099019 | BIRDSALL BRIDGE | 103.96 | 22.6 | 4.6 |
| 099023 | BOLAND'S BRIDGE | 72.8 | 13 | 5.6 |
| 099041 | SPENCER'S BRIDGE | 118.32 | 23.2 | 5.1 |
| 099043 | OLD CANAL BRIDGE | 52.46 | 12.2 | 4.3 |
| 099047 | BURNT MILL BRIDGE | 107.31 | 21.9 | 4.9 |
| 099049 | DEER RIVER HATCHERY BRIDGE | 124.4 | 31.1 | 4 |
| 099055 | NICHOLS COVE (HALLS) BRIDGE | 105.8 | 23 | 4.6 |
| 099066 | UNION CREEK BRIDGE | 45.1 | 8.2 | 5.5 |
| 099070 | McCALL BRIDGE | 51.04 | 8.8 | 5.8 |
| 099073 | GARRET'S CREEK BRIDGE | 48.4 | 8.8 | 5.5 |
| 099074 | PETER'S ISLAND BRIDGE | 49.4 | 9.5 | 5.2 |
| 099090 | ROTARY TRAIL BRIDGE | 23.68 | 8 | 2.96 |
| 099011-2019 | KEENE STATION BRIDGE | 141.68 | 25.3 | 5.6 |

## 4.2 Additional LOS Measures

A single LOS measure may not depict the entire condition or trend of an asset group.

### 4.2.1 Structure Inventory Minimum BCI Level of Service Recommendation Rationale

Development of a recommendation for a target condition level for any asset is going to be dependent upon a number of factors, such as

- The condition rating methodology itself
  - How that translates into a Good / Fair / Poor descriptor
- Ease of understanding by both technical and non-technical users
- Usefulness
  - Does the measure translate into a deliverable or measurable improvement?

Figure 4.1 from the Transportation Association of Canada's Pavement Asset Design and Management Guide provides a visual representation of various measures of road network and individual section performance. Whereas this does relate specifically to roads, 4 Roads believes that this concept in terms of a level of service target and improvement trigger may be applied to a number of assets. The graphic is a schematic that does not have values on the axes. As such, regardless of the evaluation methodology the concept may be applied.

**Figure 4-1: Service Levels and Triggers for Pavement Improvements**

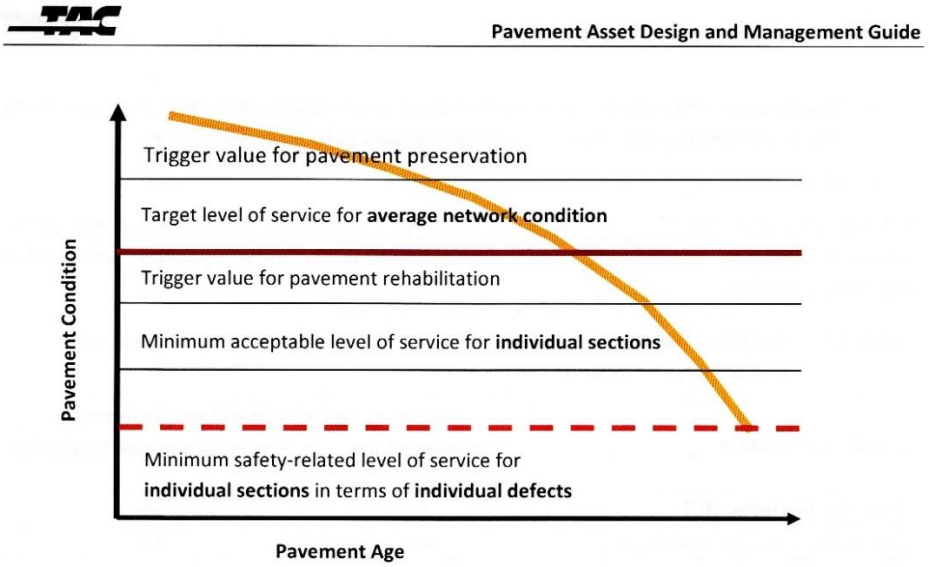



**Figure 5.3 – Types of Service Levels and Trigger Levels for Pavements [Adapted from FCM 2003]**

For bridge and culvert structures, Bridge Condition Index (BCI) ratings interpretation from the MTO website are as follows:

> *'Good - BCI Range 70 -100 For a bridge with a BCI greater than 70, maintenance work is not usually required within the next five years.*
>
> *Fair - BCI Range 60 -70 For a bridge with a BCI between 60 and 70 the maintenance work is usually scheduled within the next five years. This is the ideal time to schedule major bridge repairs from an economic perspective.*
>
> *Poor - BCI Less than 60 - For a bridge with a BCI rating of less than 60, maintenance work is usually scheduled within approximately one year.'*

A number of consulting firms in the province recommend a minor rehabilitation when the BCI is in the 70 to 75 range; A patch pave and waterproof improvement may occur when the rating is in the med 80 range, sometime between 15 and 20 years.

Based on the foregoing discussion, for the core **asset the recommendation is a condition rating of 70 or higher for the structure asset groups be maintained**. This would be characterized as the average asset being in 'Good' condition.

### 4.2.2 LOS Recommendation- Load and Width Restricted Structures

Peterborough County is an upper tier road system, and such some consideration should be given to other LOS measure such as a minimum BCI or 0% structures with a load or width restriction.

# 5 Asset Management Strategy

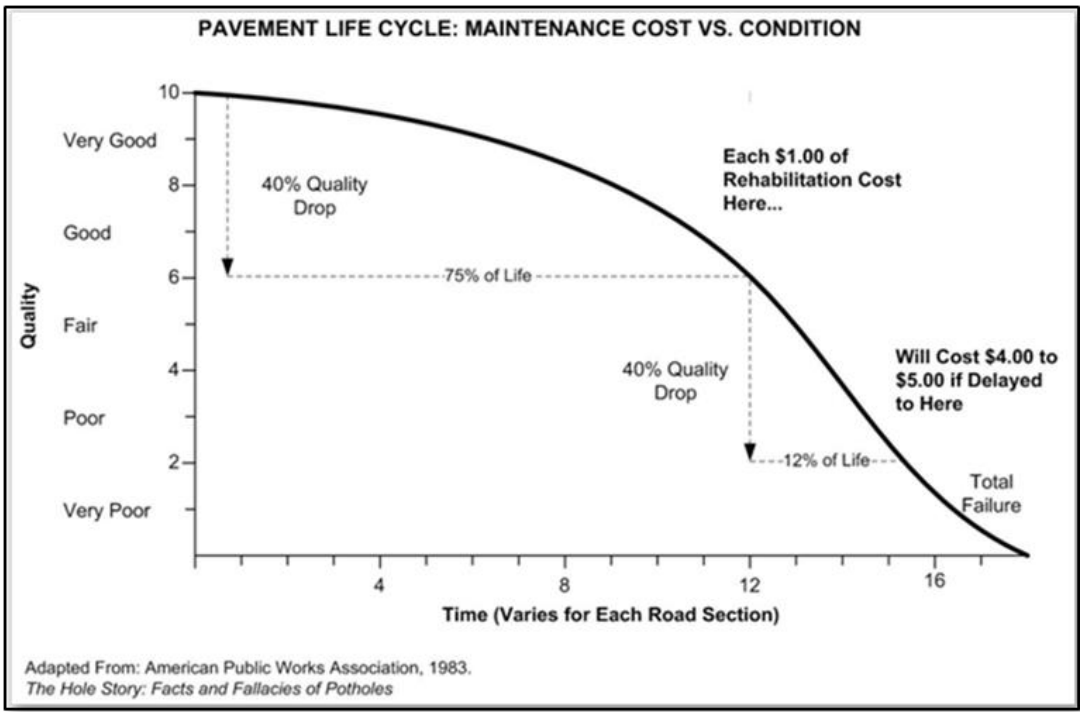
## 5.1 Project Selection and Program Development,

O.Reg 588/17 requires a 10-year plan that selects the lowest cost life cycle activity that will maintain the condition of the assets over the plan period. Delivering this service in a static system with no growth and a single asset group is reasonably simple. As other parameters, assets and stakeholders are added the complexity of service delivery increases.

The asset management strategy has to

- Maintain the condition of each asset group, selecting the lowest cost activity to sustain the condition of the asset group whenever possible
- Ensure cross integration of assets
- Ensure that development needs are integrated
- Be regulatory compliant
- Be adequately funded

**Figure 5-1: Pavement Deterioration – Cost vs Condition**




This approach to asset management is not new. Whereas Figure 5.1illustrates the increased costs with the deferral of treatment for road assets, the concepts may be applied to many other assets, such as the bridge and culvert inventories.

Improvements and maintenance undertaken on the asset at the higher end of the deterioration curve, extend the life of the asset, at the least cost, optimizing available funding. This is in essence, the requirement / direction of O.Reg 588/17. Figure 5-3 illustrates the concept of applying the right treatment at the right time/condition to optimize available funding for structures.

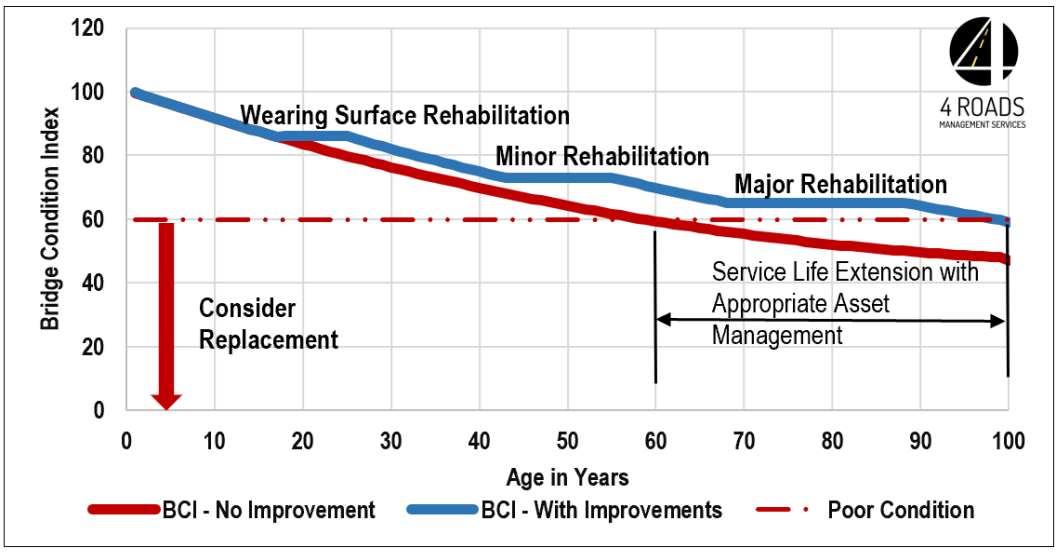
The general perception/ expectation is that an improvement to an asset will improve the condition, and be reflected in the condition rating. From an OSIM inspection perspective, the age of an

element, or the length of time that it has been exposed to the environment, limits the increase to the condition/rating that may be applied, as OSIM requires that elements be degraded from Excellent to Good over time, even in the absence of obvious material defects.

The principles are the same as previously stated in terms of asset management, but the appearance of the deterioration curve will be different. Applying the same concept to structures- right treatment at the right time- the useful life of structures may easily be stretched to 100 years with appropriate maintenance and rehabilitation.

Figure 5-3 provides and graphic representation of this and it is further discussed in Appendix A.

**Figure 5-2: Structure Management Strategy**




Developing a work plan with the aforementioned strategies requires an appropriate software solution typically referred to as a performance model. To capitalize on the utilization of the software, accurate costs, anticipated deterioration and the effect of a treatment on an asset have to be understood.

## 5.2 Asset Management Funding Strategy

Ontario Regulation 588/17 provides significant guidance in the development of the asset management plan and states in part

> *"4. For each asset category, the lifecycle activities that would need to be undertaken to maintain the current levels of service as described in paragraph 1 for each of the 10 years following the year for which the current levels of service under paragraph 1 are determined and the costs of providing those activities based on an assessment of the following:*
>
> *i. The full lifecycle of the assets.*
>
> *ii. The options for which lifecycle activities could potentially be undertaken to maintain the current levels of service.*
>
> *iii. The risks associated with the options referred to in subparagraph ii.*
>
> *iv. The lifecycle activities referred to in subparagraph ii that can be undertaken for the lowest cost to maintain the current levels of service."*

4 Roads' recommendation would be that every asset should be treated in a similar method as the rate supported assets. For rate supported assets, revenues go to a reserve for the purpose of funding works that are required to maintain the condition of that asset group. The entire revenue is not expended in any given year. However, the revenue received should equate to the amount that represents the full life cycle costs of the asset group. (Section 6 of the report discusses this further)

**Figure 5-3: Funding Concept**

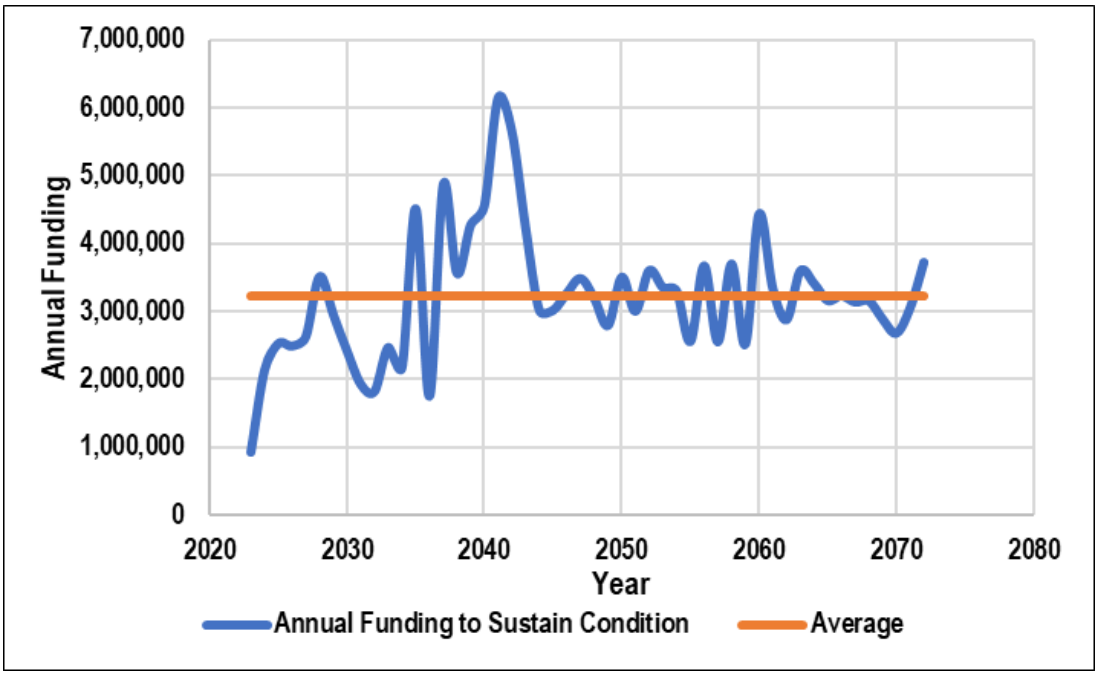



Figure 5-4 illustrates the concept of a revenue stream that would go to the respective reserve. To maintain the condition of the asset group, the same amount of funding is not required each year. However, on those years where maintaining the asset group requires increased funding, the amount is available to be drawn upon from the reserve.

Conceptually, where the annual expenses are less than the revenue (below the orange line), the funding remains in the reserve and accumulates. On the years where additional funding is required, and expenses are above the average revenue (again the orange line), the funding is available and drawn from the reserve.

This is particularly significant for the structures inventory as there are a number of structures with their individual replacement costs exceeding the average annualized amount.

Similarly, with other asset groups, funding demands to maintain condition may not be required each year to sustain the asset group. Using the earlier example, it serves to illustrate the merit in creating a Discretionary / Non Obligatory Reserve fund that would ensure funding is available when required for every asset group. The funding contribution to the reserve should be the annualized life cycle costing. See further discussion in section 6 of the plan.

## 5.3 Asset Management Strategy and Work Plan Development

O.Reg 588/17 requires a work plan that will sustain the condition of the assets over a 10 year period, which would imply sufficient funding do so. The work plan is to be developed utilizing the lowest cost life cycle activity to maintain the condition of the assets.

O.Reg 588/17 also requires that the plan be based on condition data that is no more than 2 years old.

Given that the plan selection is to be based on condition, it does not seem reasonable to adhere to the plan where with regular condition updates, priorities may shift over the course of the plan, given the directive to select the lowest cost lifecycle activity based on current condition data.

From the writers' perspective, it makes more sense that the plan is adequately funded over the plan period and the plan is updated as more current condition data is provided.

The strategy recommendation combines the above noted required in concept. The County's asset management strategy should be development an appropriate funding level for the assets and update the work plan annually to address the current demands based on condition ratings.

## 5.4 Performance Modeling

Work plan development through software utilization can confirm the adequacy of the funding levels and the effectiveness of the proposed work plan.

There are many variations to model development, which can favour project selection by a number of variables. For the purposes of O.Reg 588/17 compliance, the 'Return on Investment' scenario best emulates the requirements of the regulation in that the lowest cost life cycle alternative will be selected at the appropriate condition.

The County provided a proposed work plan for the next 10 year period. The first 5 years of the plan were entered into a model as 'committed projects'. Line item dollar values was included in the budget for structures that were less than a 3m span that were not attributed to specific assets, and were not included in the model.

From the model it appears that the O.Reg 588/17 requirement to sustain the asset groups over the 10 year work plan period appears to be met, however, it also appears that increased funding will be required to sustain the assets over the entire life cycle.

Figure 5.4 illustrates a predicted outcome if the funding is maintained at a consistent level. It also illustrates

- the complexities of managing an asset group with single assets of significant cost.
- maintaining asset group condition over time on fixed funding level, may not result in the best overall performance of the asset group.

**Figure 5-4: Structures Inventory Performance and Fixed Budget vs Time**

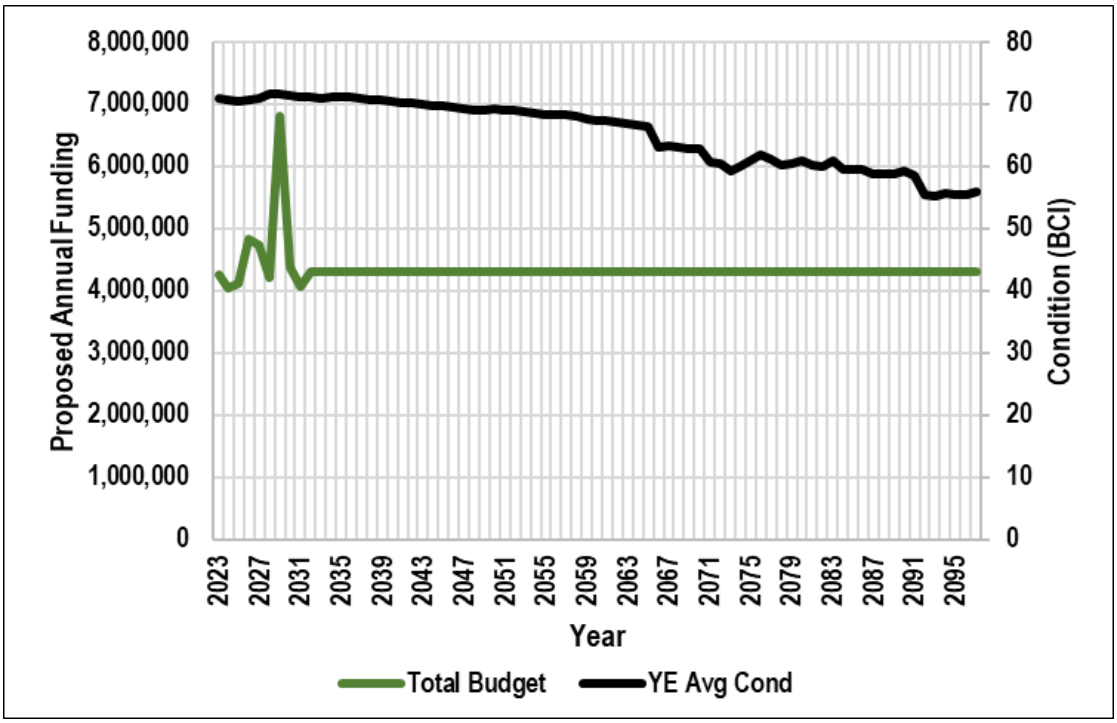



**Figure 5-5:Structures Inventory Performance and Variable Budget to Maintain Condition**

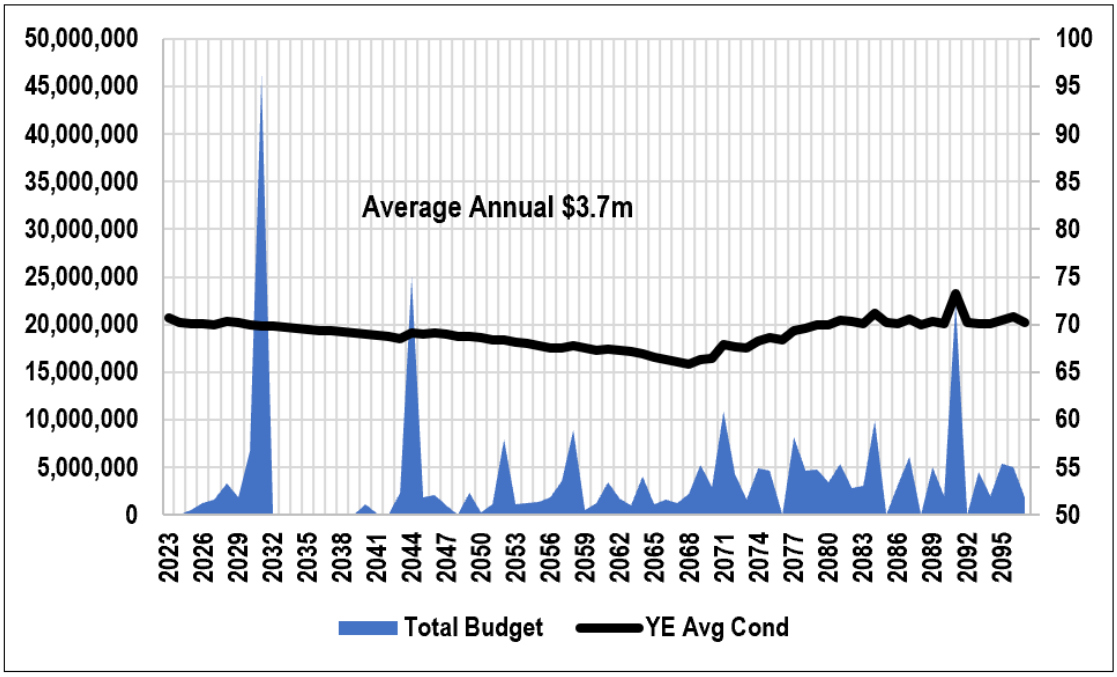



Figure 5.5 illustrates model output where the target is a condition level not limited by an annual funding level. The overall annualized cost is lower, however, there are significant expenses in some years and no expenses in others.

Section 5.2 of the report discusses a Discretionary / Non Obligatory Reserve fund. The preceding model outputs are trying to illustrate that an average annual reserve fund contribution should be at a level that provides a funding source for those years when a greater expenditure is required to sustain the condition of the asset group.

This is discussed further in section 6 of the report.

# 6 Financing Strategy / Funding Recommendations

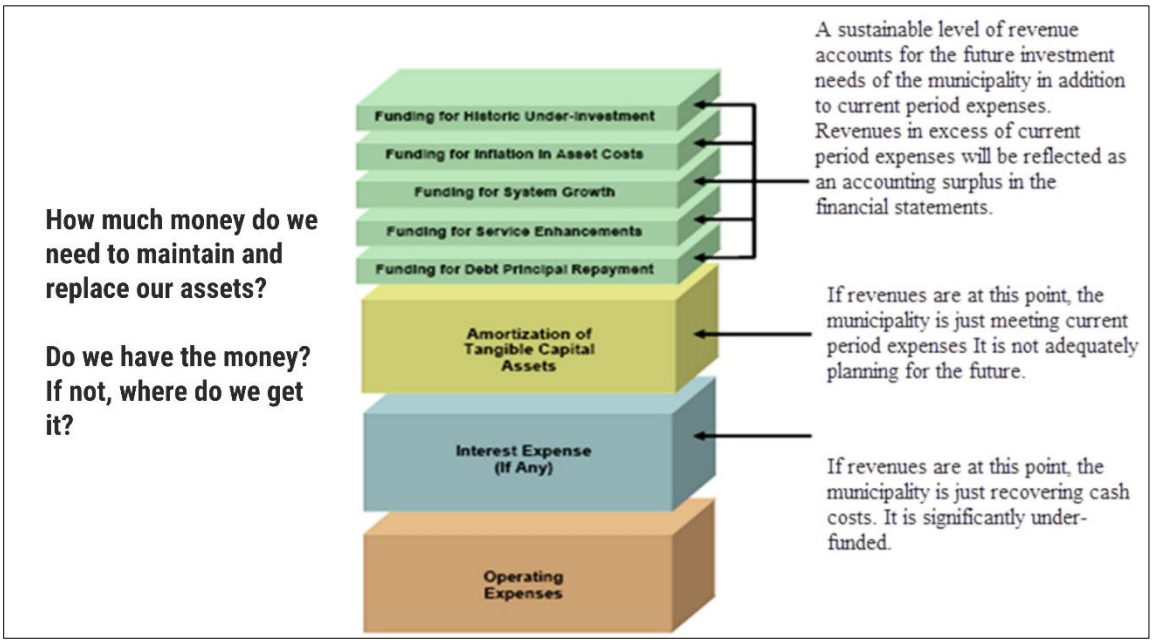
## 6.1 Municipal Responsibility

For a significant proportion of municipalities, adequate funding to sustain assets is not available. Reasons for this vary between municipalities, however the end result is the same; the continuing deterioration of assets.

O.Reg 588/17 basically requires municipalities to maintain assets in the same condition over a 10 year period (O.Reg 588/17) Section 44(1) of the Municipal Act states *'The municipality that has jurisdiction over a highway or bridge shall keep it in a state of repair that is reasonable in the circumstances, including the character and location of the highway or bridge. 2001, c. 25, s. 44 (1)'* . Similar obligations reside in other regulations such as the Safe Drinking Water Act, O.Reg 104/97 and O.Reg 453/07.

This reports' focus and funding recommendations are centred around annualized replacement and major maintenance activities. Full cost of service delivery is illustrated in the following figure. For a total composite asset management plan all costs have to be included as shown in Figure ES1.

**Figure 6-1: Total Lifecycle Asset Costs, Ministry of the Environment**




***Note: Adapted from Toward Financially Sustainable Drinking Water and Waste Water Systems, Ministry of the Environment, August 2007***

## 6.2 Funding Sources

Municipalities may draw on a number of resources to support programming, such as

- Tax Levy
- Reserves- specific or general
- Grants /Subsidies

For the purposes of funding for structures, the majority of the funding will be from the tax levy, reserves and grants.

## 6.3 Funding Recommendations

Executive summary Section 1.5 of this report provides a recommendation to contribute **$5,270,800** annually to a reserve for structures projects.

This recommendation is based on the replacement costs over a 50 year life cycle. The design life of structures is typically 75yrs. However, considering the overall condition of the asset group and providing an allowance for rehabilitations, a life cycle of 50 years was utilized.

The models in Section 5.4 of this report have annualized funding levels that are less than this recommendation. However, in the first instance the target condition of the system is not maintained and in the second instance there are some years in the program with significant funding requirements.

It is recommended that a reserve be established to normalize annual funding contribution, but at the same time provide a buffer for the years when additional funding is required to maintain the condition of the asset group.

## 6.4 Asset Management Plan Approval

Section 8 of O.Reg 588/17 states:

***'Endorsement and approval required***

***8.*** *Every asset management plan prepared under section 5 or 6, or updated under section 7, must be,*

*(a) endorsed by the executive lead of the municipality; and*

*(b) approved by a resolution passed by the municipal council.'*

Given the other content of the regulation and this plan, the minimum outcome of the plan to be approved would be a plan that sustains the work plan for the core assets and is adequately funded.

# 7 Recommendations to Move Forward

In addition to the funding recommendations

1. The funding level should be increased and maintained at $5,270,800 for a ten year period.
2. Funding levels to be adjusted annually to accommodate growth / system expansion.
3. Funding should be adjusted annually to accommodate inflation.
4. The work plan should

- Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those assets that are not going to be affected by upgrade due to development demands.
- Cross integrate assets.

5. Develop a corporate asset management system throughout the organization with the development of a Standard Operating Procedure (SOP) for asset management.
6. The concepts in this plan should be applied to the remainder of the assets for the development of the 2024 Asset Management Plan.

# Chapter 4

# Transportation Master Plan

Peterborough County is seeing growth, particularly since COVID provided opportunities for people to live outside the GTA and commute. The extension of the 407 ETR also provides easy access to the County which borders the Region of Durham.

One main factor that municipalities must consider in asset management planning is the impact of future growth on meeting goals and objectives. The County monitors trends in its population to ensure that its impacts on service levels are well understood and that strategies are developed to address additional demands due to growth and demographic changes.

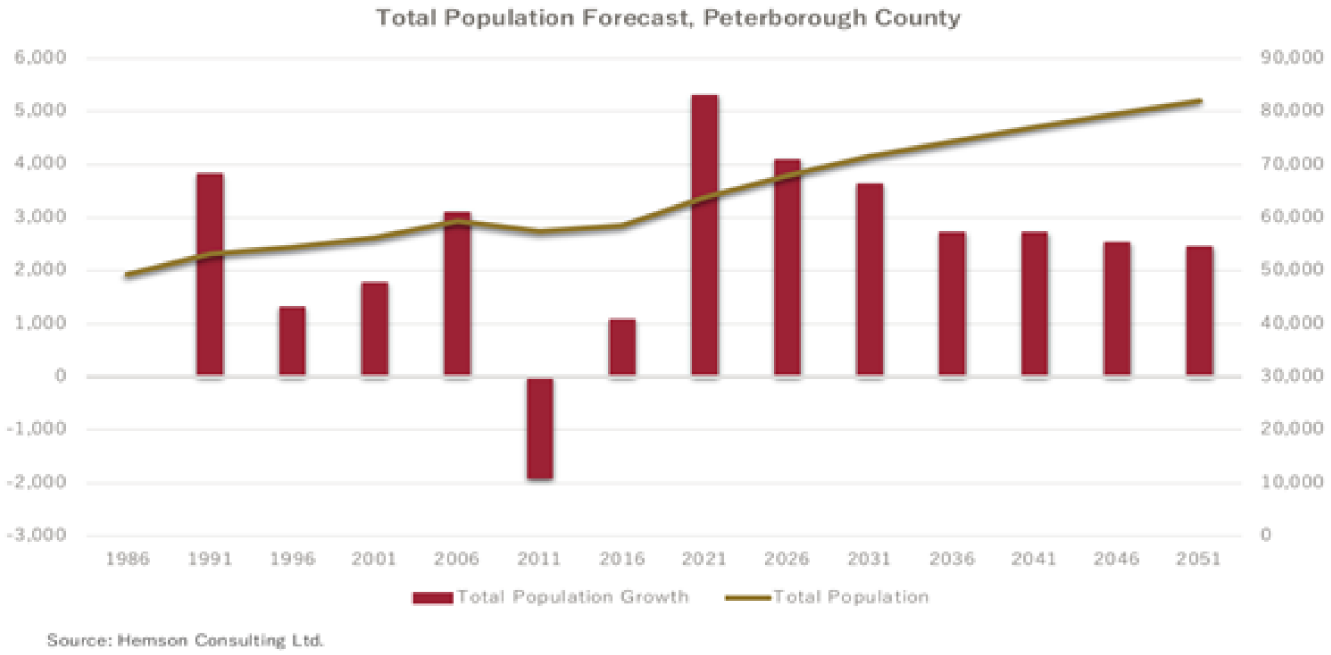
The recent Official Plan and Development Charges Study forecast growth in population to 82,000 and employment to 26,410 by 2051. Historic population data is based on Census information up to 2021, at which time the population in the County was 63,800.

# Growth Forecast

| Year | Population Total | Growth | Rate |
|---|---|---|---|
| 2011 | 57,400 | | |
| 2016 | 58,500 | 1,100 | 0.4% |
| 2021 | 63,800 | 5,300 | 1.7% |
| 2026 | 67,890 | 4,090 | 1.3% |
| 2031 | 71,520 | 3,630 | 1.0% |
| 2036 | 74,270 | 2,750 | 0.8% |
| 2041 | 76,990 | 2,720 | 0.7% |
| 2046 | 79,560 | 2,570 | 0.7% |
| 2051 | 82,000 | 2,440 | 0.6% |
| **2021-51 Growth** | | **18,200** | **0.8%** |

| Year | Employment Total | Growth | Rate |
|---|---|---|---|
| 2016 | 15,910 | | |
| 2021 | 15,980 | 70 | 0.1% |
| 2026 | 18,090 | 2,110 | 2.5% |
| 2031 | 19,810 | 1,720 | 1.8% |
| 2036 | 21,430 | 1,620 | 1.6% |
| 2041 | 23,100 | 1,670 | 1.5% |
| 2046 | 24,750 | 1,650 | 1.4% |
| 2051 | 26,410 | 1,660 | 1.3% |
| **2021-51 Growth** | | **10,430** | **1.7%** |

Hemson Consulting Growth Forecast
2022 Development Charges Study




Source: Hemson Consulting Ltd.

# Transportation Master Plan

## Growth Projects

At the time of this report, the Transportation Master Plan was completed but not presented/approved by County Council. However, the growth projects related to highway services was estimated to be $143 million in 2022$ of which 13% or approximately $640k annually are 'ineligible' for development charge funding. Additional $1.5 million is affected by Bill 23 (November 2022).

The table below provides the summary from the Development Charge Study completed by Hemson in 2022 with all of the projects at gross costs and costs that must be funded from sources other than development charges.

The complete list of projects can be found in Appendix C.

| Services Related to Highways (30 YEARS) | Gross Project Cost | Ineligible Costs |
|---|---|---|
| 1.1 Buildings, Land & Furnishings | $2,721,000 | |
| 1.2 Vehicles & Equipment | $996,000 | |
| 1.3 Studies | $4,180,000 | $37,500 |
| 1.4 Intersection Improvements | $6,755,000 | $1,663,750 |
| 1.5 Roadway Upgrades/Capacity Expansion | $119,124,000 | $13,913,000 |
| 1.6 James A. Gifford Causeway | $3,540,000 | $750,000 |
| 1.7 Other Infrastructure & Committed Projects | $5,650,000 | $2,812,500 |
| **Grand Total** | **$142,966,000** | **$19,176,750** |
| **Average Annual Costs (total/30 years)** | **$4,765,533** | **$639,225** |

# Chapter 5

# Levels of Service

# Levels of Service (LOS)

O.Reg. 588/17 requires municipalities to include, in its Asset Management Plan the current Levels of Service (LOS) for core assets, which for the County, includes roads and structures. This requirement extends to all other municipal infrastructure by July 1st, 2024. By July 1st, 2025, a more advanced Asset Management Plan (Proposed Levels of Service) is required for all assets.

Expected Levels of Service come in different forms and from different stakeholders all of which must be balanced.

Corporate LOS

Legislated LOS

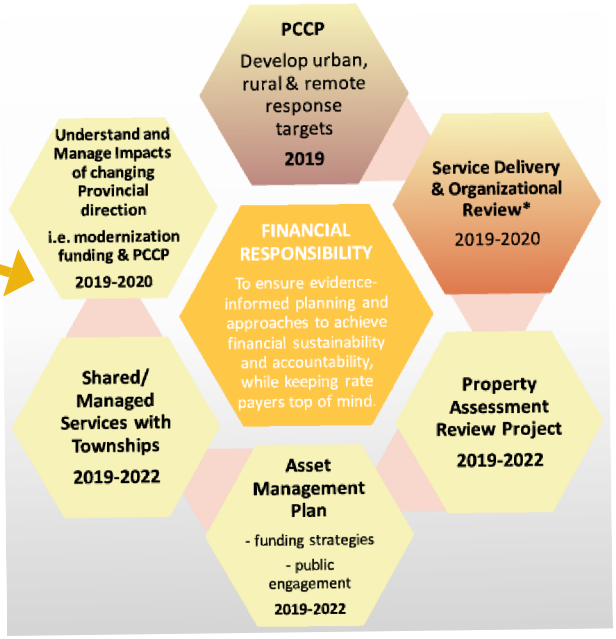
Customer or Community LOS

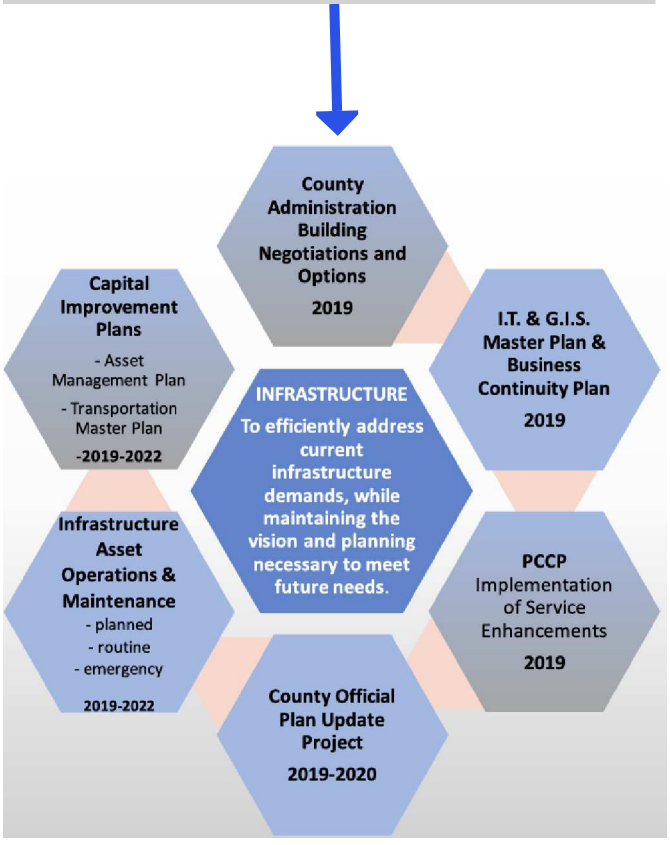
Technical LOS

# Corporate (LOS)

The County's Strategic Priorities, 2019 to 2022, provide focus to the Council term and direct the allocation of resources through the budget process. It outlines the Corporate LOS.


***VISION: Peterborough County is a very special place for people, and growth of local business and stewardship protect a diverse landscape, lifestyle and sense of community.***



# Legislated (LOS)

O.Reg. 588/17 requires municipalities to develop an AMP based on current Levels of Service by July 1st, 2022, for core assets (Roads, Bridges and Culverts), and by July 1st, 2024 for other municipal infrastructure assets. By July 1st, 2025, a more advanced AMP (Proposed Levels of Service) is required for all assets. Other legislation also have levels of service such as O.Reg. 239/02, Minimum Maintenance Standards for Highways among others.

The levels of service requirements for Asset Management Plans are required for current (2022) and proposed (2025)levels of service. For core municipal infrastructure assets, the qualitative descriptions set out in the tables to the regulation. There are no legislated LOS for facilities.

| Service | Service attribute | **Community levels of service (Qualitative descriptions)** | **Technical levels of service (Technical metrics)** |
|---|---|---|---|
| **Roads** | **Scope** | Description, which may include maps, of the road network in the municipality and its level of connectivity. | Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality. |
| **Roads** | **Quality** | Description or images that illustrate the different levels of road class pavement condition. | 1. For paved roads in the municipality, the average pavement condition index value. |
| **Roads** | **Quality** | | 2. For unpaved roads in the municipality, the average surface condition (e.g., excellent, good, fair or poor). |
| **Structures** | **Scope** | Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists). | Percentage of bridges in the municipality with loading or dimensional restrictions. |
| **Structures** | **Quality** | 1. Description or images of the condition of bridges and how this would affect use of the bridges. | 1. For bridges in the municipality, the average bridge condition index value. |
| **Structures** | **Quality** | 1. Description or images of the condition of culverts and how this would affect use of the culverts. | 2. For structural culverts in the municipality, the average bridge condition index value |

# Legislated (LOS) for Roads

Below is the County's current level of service as per O.Reg. 588/17 for both community and technical metrics for roads as of 2022 in comparison to 2018.

| Service attribute | **Community levels of service (Qualitative descriptions)** | **Technical levels of service (Technical metrics)** | **2018 LOS Measure** | **2022 LOS Measure** | **Trend** |
|---|---|---|---|---|---|
| **Scope** | County maps are included on the website and in Appendix 4. | Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.3,769.29 sq. km | Arterial Roads = 4.07**%** Collector Roads = 30.95**%** Local Roads = 1.54**%** | Arterial Roads = 4.07% Collector Roads = 30.95% Local Roads = 1.54% |  |
| **Quality** | Description or images that illustrate the different levels of road class pavement condition in Appendix 4. | 1. For paved roads in the municipality, the average pavement condition index value. | Weighted Average Overall road condition is = 70.2Weighted average paved road condition is =74.5 | Weighted Average Overall road condition is = 70.2Weighted average paved road condition is =70.2 |  Down 6% |
| **Quality** | | 2. For unpaved roads in the municipality, the average surface condition (e.g., excellent, good, fair or poor). | | | |

# Legislated (LOS) for Structures

Below is the County's current level of service as per O.Reg. 588/17 for both community and technical metrics for structures. Note: this information was provided by DM Wills in the WorkTech database and was being reviewed at the time of this report.

| Service attribute | **Community levels of service (Qualitative descriptions)** | **Technical levels of service (Technical metrics)** | **2018 LOS Measure** | **2022 LOS Measure** | **Trend** |
|---|---|---|---|---|---|
| **Scope** | Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists). | Percentage of bridges in the municipality with loading or dimensional restrictions. | Percentage of bridges in the municipality with loading or dimensional restrictions: 21.3% | Percentage of bridges in the municipality with loading or dimensional restrictions: 21.3% |  |
| **Quality** | 1. Description or images of the condition of bridges and how this would affect use of the bridges. | 1. For bridges in the municipality, the average bridge condition index value. | For bridges in the municipality, the average bridge condition index value:74.1 | For bridges in the municipality, the average bridge condition index value:69.88 |  Down 6% |
| **Quality** | 1. Description or images of the condition of culverts and how this would affect use of the culverts. | 2. For structural culverts in the municipality, the average bridge condition index value | For structural culverts in the municipality, the average bridge condition index value 66.16 | For structural culverts in the municipality, the average bridge condition index value 69.44 |  Up 5% |

# Community (LOS)

While there are 'legislated' Community LOS, other elements of customer satisfaction are important. Customer levels of service measure how the community receives the service and whether the organization is providing community value. Customer levels of service are typically grouped into four service attribute categories: capacity, function, quality, and affordability.

| Service attribute | **Service Measure** | **Description** |
|---|---|---|
| **Capacity** | Capacity | Sufficient capacity and is convenient and accessible to the community |
| **Capacity** | Availability | Available always to enable travel to destinations in a timely manner for roads/bridges and able to access County facilities. |
| **Function** | Regulatory Compliance | Compliant with legislative requirements and corporate policies/by-laws |
| **Function** | Safety | Safe for all users and modes of transport and access to buildings. |
| **Function** | Resilience | Resilient to any disruptions caused by external hazards and climate change. |
| **Function** | Enhanced Environment | Contributes to an enhanced environment and supports a sustainable County. |
| **Quality** | Reliability | Kept functioning as expected within operating conditions. |
| **Quality** | Customer Satisfaction | Customers kept informed and satisfied. |
| **Affordability** | Financial Sustainability | Affordable, provided at the lowest cost for both current and future customers |

# Community and Technical (LOS) Recommended Transportation Performance Measures

| Service Measure | Good to Very Good (ADEQ) | Fair (6-10) | Poor (1-5) | Very Poor (NOW) |
|---|---|---|---|---|
| Capacity | Assets provide sufficient current and near future capacity, convenience and accessibility. | Assets can handle most volumes with some issues. | Assets provide lower than intended capacity, convenience and accessibility to the community | Assets provide much lower than intended capacity. Many instances of gridlock, traffic and slow downs (transportation). |
| Availability | Assets are always available and enable travel plans through the County efficiently. It meets both current and near future needs | Assets are usually available but some closures are evident. | Assets are mostly available but increasing issues are evident. | Assets are not available on a regular basis. |
| Regulatory Compliance | Assets are in compliance with applicable legislation, including known upcoming legislative changes | Assets are in compliance with applicable current legislation | Assets are somewhat in compliance with applicable legislation but risks exist. | Assets are not in compliance with applicable legislation |
| Safety | Assets are safe for all current and potential near future users and modes of transport | Assets are safe but enhancements should be made to mitigate risk. | Assets are somewhat safe but nearing significant issues. | Assets are not safe for all users and modes of transport |
| Resilience | Assets are resilient to any current and potential near future disruptions caused by external hazards | Assets are resilient to any current disruptions caused by external hazards | Assets are mostly resilient to any disruptions caused by external hazards | Assets are somewhat resilient to any disruptions caused by external hazards |
| Enhanced Environment | Assets contribute to an enhanced environment and support a sustainable County, both now and into the near future | Assets contribute to an enhanced environment and support a sustainable County, for now | Assets are not harmful but do not contribute to an enhanced environment and support a sustainable County | Assets do not support a sustainable County |
| Condition | Assets are in very good condition/ like new | Assets are in good condition physically sound with minimal deterioration, early to mid-range of expected life | Assets are in fair condition medium deterioration, mid- to later stage of expected life | Assets are in poor condition: significant deterioration, approaching end of expected life |
| Maintenance | Maintenance work is always done as and when required Costs are well within normal levels. | Maintenance work is mostly done as and when required Costs are within normal levels, but increasing | Maintenance work is mostly done mostly as and when required Costs are marginally above normal levels, and increasing | Maintenance work is sometimes done as and when required Costs are above normal levels, and increasing |
| Customer Satisfaction | Customers are kept very well informed and are very satisfied | Customers are kept well informed and are quite satisfied | Customers are kept mostly informed and are mostly satisfied | Customers are kept somewhat informed and are somewhat satisfied |

# Community and Technical (LOS) Recommended Facilities Performance Measures

| Service Measure | Good to Very Good (ADEQ) | Fair (6-10) | Poor (1-5) | Very Poor (NOW) |
|---|---|---|---|---|
| Capacity | Assets provide sufficient current and near future capacity, convenience and accessibility. | Assets can handle some growth of the municipality. | Assets provide lower than intended capacity, convenience and accessibility to the community | Assets provide much lower than intended capacity. Many instances of crowding. |
| Reliability | Assets are always available and enable County to provide services efficiently. It meets both current and near future needs | Assets are usually reliable but some closures are evident. | Assets are mostly reliable but increasing issues are evident. | Assets are not reliable and are closed on a regular basis. |
| Regulatory Compliance | Assets are in compliance with applicable legislation, including known upcoming legislative changes | Assets are in compliance with applicable current legislation | Assets are somewhat in compliance with applicable legislation but risks exist. | Assets are not in compliance with applicable legislation |
| Safety | Assets are safe for all current and potential near future users. | Assets are safe but enhancements should be made to mitigate risk. | Assets are somewhat safe but nearing significant issues. | Assets are not safe for all users and modes of transport |
| Resilience | Assets are resilient to any current and potential near future disruptions caused by external hazards | Assets are resilient to any current disruptions caused by external hazards | Assets are mostly resilient to any disruptions caused by external hazards | Assets are somewhat resilient to any disruptions caused by external hazards |
| Enhanced Environment | Assets contribute to an enhanced environment and support a sustainable County, both now and into the near future. LEED certified standards are met. | Assets contribute to an enhanced environment and support a sustainable County - lower emissions. | Assets are not harmful but do not contribute to an enhanced environment and support a sustainable County | Assets do not support a sustainable County |
| Condition | Assets are in very good condition/ like new | Assets are in good condition physically sound with minimal deterioration, early to mid-range of expected life | Assets are in fair condition medium deterioration, mid- to later stage of expected life | Assets are in poor condition: significant deterioration, approaching end of expected life |
| Maintenance | Maintenance work is always done as and when required Costs are well within normal levels. | Maintenance work is mostly done as and when required Costs are within normal levels, but increasing | Maintenance work is mostly done mostly as and when required Costs are marginally above normal levels, and increasing | Maintenance work is sometimes done as and when required Costs are above normal levels, and increasing |
| Customer Satisfaction | Customers are kept very well informed and are very satisfied | Customers are kept well informed and are quite satisfied | Customers are kept mostly informed and are mostly satisfied | Customers are kept somewhat informed and are somewhat satisfied |

# Community and Technical (LOS) Recommended Confidence Grades

Performance Measures must be tracked and analyzed using sound analytical techniques and solid, consistent accurate, up-to-date data. When undertaking performance analysis, the County must be confident in its data in order to make decision making. If the County is very confident in the information and performance, it is able to rely on the data to make decisions affecting its infrastructure. If the data is unreliable, it must be backed up through additional analysis including observation, interviews, compliance assessments, testing, auditing and analytical procedures.

Reliance on 'no complaints' as an indicator of good performance is not confidence.

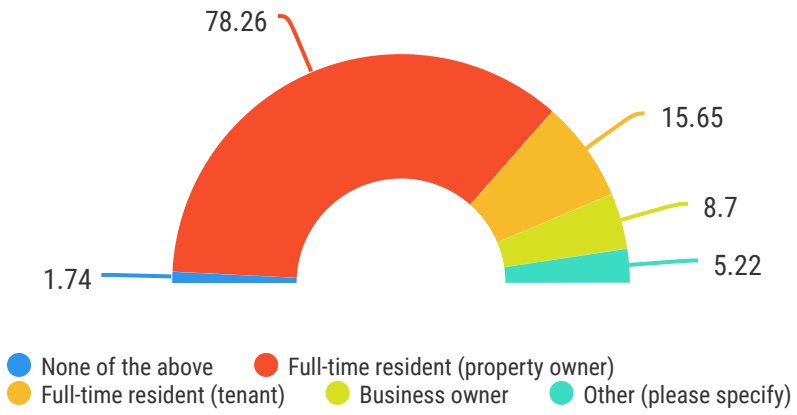
| High | Moderate | Poor | Very Poor |
|---|---|---|---|
| Performance data is based on repeatable/reproduceable records in accordance with policies, documented standard operating procedures, observation, audits, inspections and analysis, documented properly and agreed as the best method of assessment. Dataset is complete and estimated to be accurate ± 2% | Performance data is partially based on data but has some gaps and errors. It is documented in accordance with procedures but has some minor shortcomings that do not change the decision. Dataset is complete and estimated to be accurate ± 10% | Performance data is not based on sound records, violates procedures or no procedures are in place Inspections, audits and analysis is not verified. Data is out of date, incomplete and/or unsupported. Dataset is not substantially complete and up to 50% is extrapolated data and estimated Accuracy ± 25% | Performance is based on confirmed verbal reports and anecdotal. Staff turnover has resulted in a loss of knowledgeable staff or history. Dataset is complete, and most data is estimated or extrapolated. Accuracy ± 40% |

# Community (LOS)

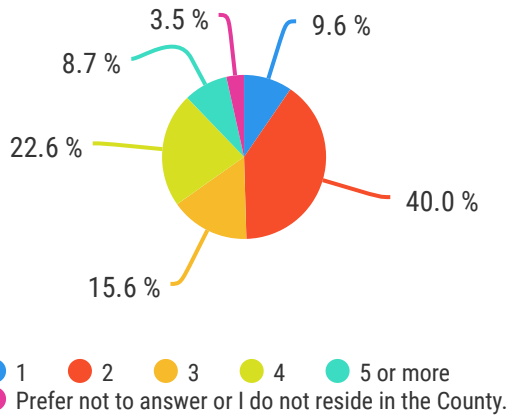
The County undertook a Community Survey with respect to the Asset Management Plan and Levels of Service. This was the first attempt to get feedback and provide some public education on the state of the County assets. Only 116 out of 63,800 (0.18%) people living or own a business in the County responded to the survey so it is not representative of the views of the community. 95% of the respondents are residents or property owners in the County. After the release of this AMP, the County will communicate with the community with the hope that it will get more feedback. Below is a summary of the results. The complete survey results can be found in Appendix 3.

## Demographics of Respondents

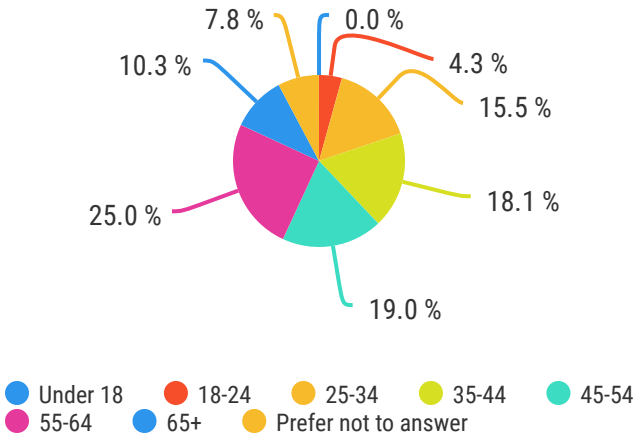
### Respondent Resident Type (%)



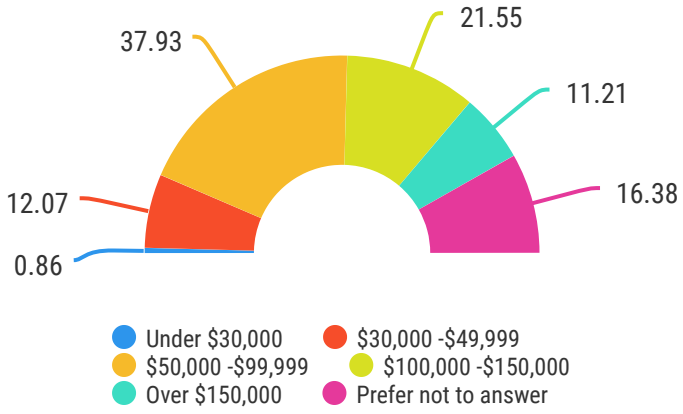

### # in Household



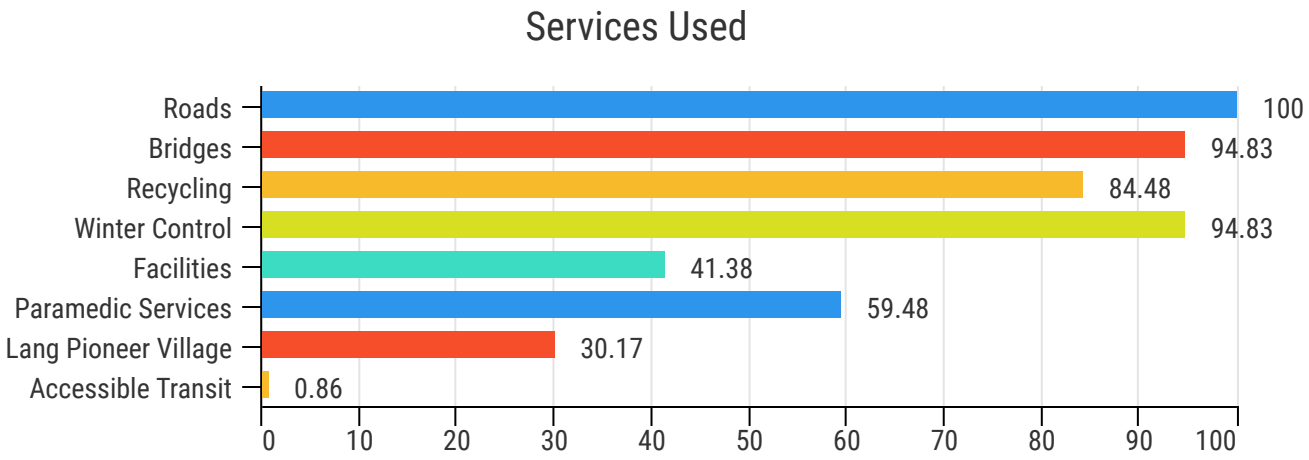

### Age Range (%)

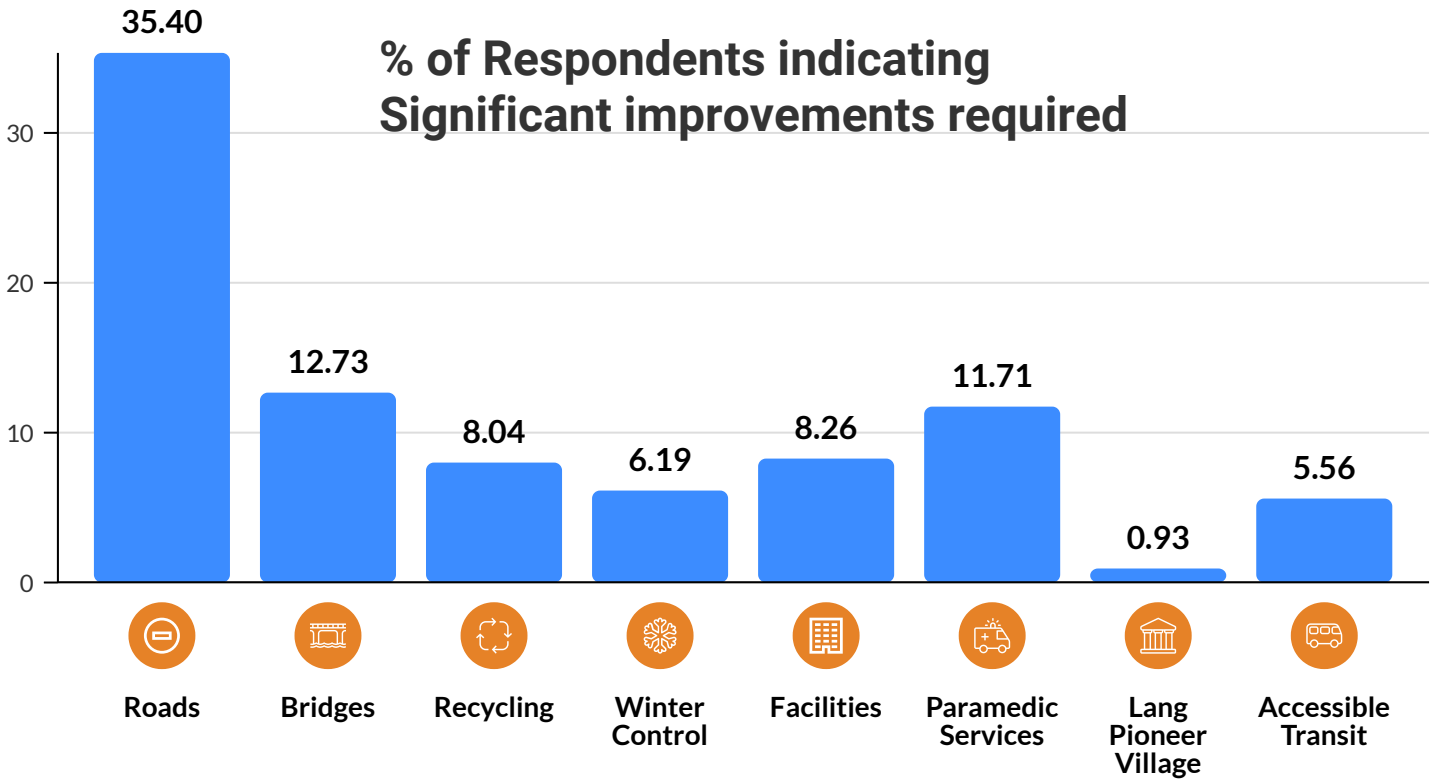



### Annual Income



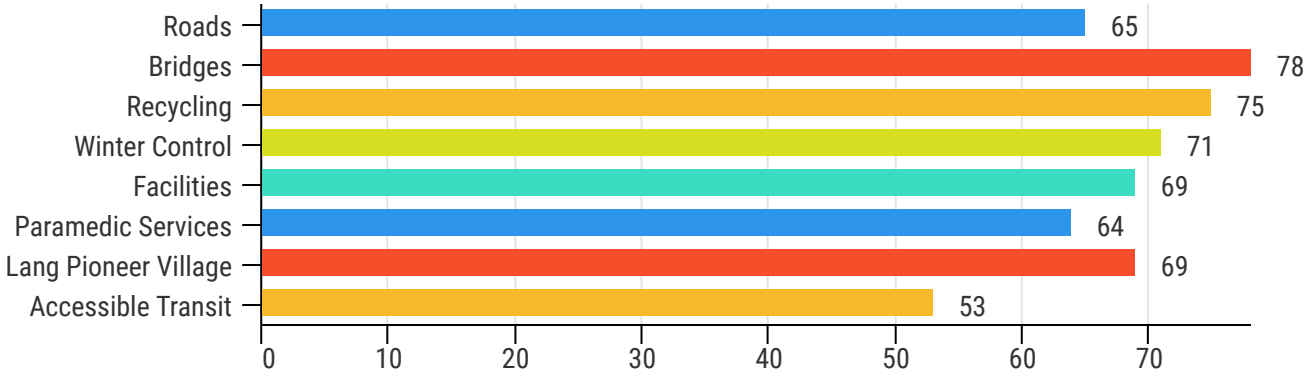
# Community (LOS)



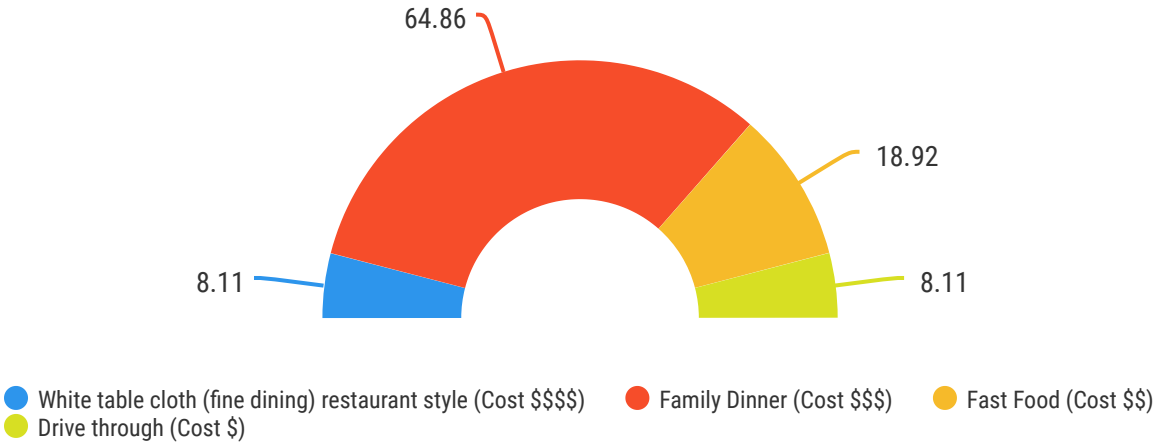



# Community (LOS)

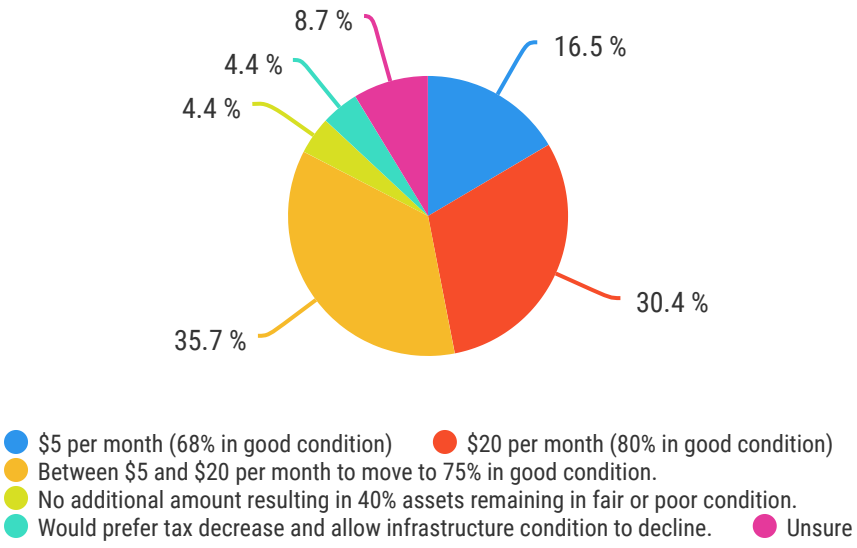
## %age of Satisfied or Very Satisfied by Service




## Thinking about County services like a restaurant, which of the following best describes how you would prefer to receive and pay for services:




## Amount Willing to pay for Infrastructure



# Current and Proposed (LOS) - Roads

As explored in Chapter 2 (SOTI Section), 4 Roads Management Services Inc. explains how "road system condition and Level of Service (LOS) measures are inextricably linked, and for that reason, some of the measures are shown in both areas of this report." For roads, as with most assets, a single measure for condition or level of service may not provide a complete or accurate view of the performance of an asset group.

## Current Levels of Service

- System Adequacy measure for the County road system is 71.9% by centreline kilometres. System Adequacy includes all six critical measures; it is not solely pavement condition.
- System Adequacy by Structural Adequacy alone is 73.1%. Some of the Structural Adequacy Needs are also identified as Capacity needs. As such there is not a simple mathematical correlation to the overall System Adequacy.
- Weighted Average PCI is 70.2.
- Weighted Average Condition is 53.3 The cost to raise the current system condition to 70 is estimated to be $100,551,800 based on the most recent unit costs provided August 2022. The estimate does not include costs for other assets.
- Good to Very Good roads for the entire system is 40.3% by centreline kilometres (All metrics considered in the six critical areas, by In-km.) to 41% (Structural Adequacy Only.)

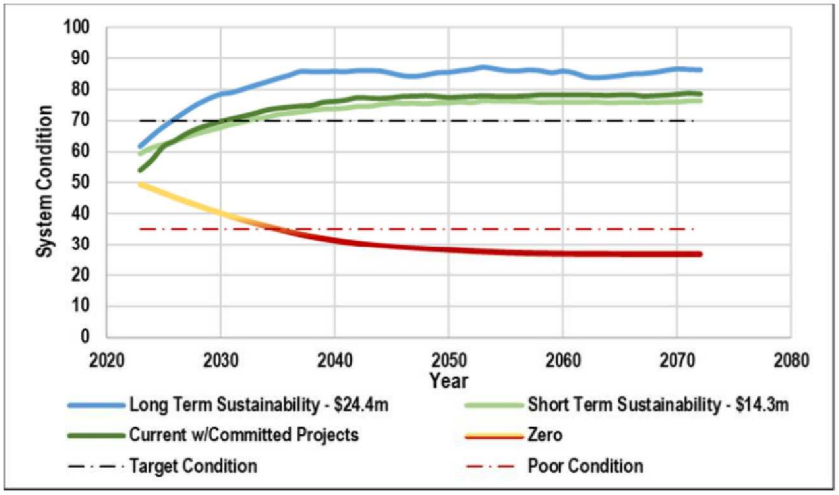
## Proposed Levels of Service

4 Roads Management Services Inc. recommends:

- System Adequacy should be a Minimum of 75%.
- Weighted Average Physical Condition should be a minimum of 70.
- Weighted Average Pavement Condition Index should be a minimum of 80
- Good to Very Good Roads should be a minimum of 60%.

The chart reproduced from the SOTI for Roads section indicates that for short term sustainability, the County would need to invest $14.4 million ($2022) annually but the recommendation would be to move to long term sustainability at $24.4 million ($2022) annually. These figures need to be adjusted for inflation annually.

**Figure 9-2: Performance Modeling at Various Budget Levels**




The current budget is only proposed at this time and has not been approved by Council.

# Current and Proposed (LOS) - Structures

O.Reg 104/97: Standards for Bridges under the Public Transportation and Highway Improvement Act, requires that "Every bridge shall be kept safe and in good repair". It further states that ***"The structural integrity, safety and condition of every bridge shall be determined through the performance of at least one inspection in every second calendar year under the direction of a professional engineer and in accordance with the Ontario Structure Inspection Manual (OSIM)".***

As explored in Chapter 3 (SOTI for Structures), 4 Roads Management Services Inc. explains the Bridge Condition Index (BCI) which is used for the levels of service in O.Reg. 588/17. Essentially, the BCI is a weighted average of all elements (since all elements are not of equal value to the bridge) and all Condition States (since each condition state represents a certain degree of loss of value of the element). The BCI begins at 100 when the bridge is in new condition and theoretically becomes 0 as all elements become fully in Poor condition. Practically, it is impossible for the BCI to fall to 0 since the entire bridge does not become poor before rehabilitation work is performed.

O.Reg 588/17 LOS measure are particularly important as narrow structures and load restricted structure pose a significant impediment to service delivery, particularly for emergency services and public works. As an example, a tandem dump truck with plow blade and loaded with salt weighs approximately 25 tonnes; a Pumper Fire truck may be in the 30 tonne range.

## Current Levels of Service

- Percentage of bridges in the municipality with loading or dimensional restrictions is 21.3% (based upon the WorkTech database provided by DM Wills. This is being reviewed).
- For bridges in the municipality, the average bridge condition index value is 69.88
- For structural culverts in the municipality, the average bridge condition index value is 69.44

## Proposed Levels of Service

Based upon research, it is recommended that a condition rating of 70 or higher for the structure asset groups be maintained. This would be characterized as the average asset being in 'Good' condition. This should be further explored by the County and D.M. Wills as a proposed level of service.

A target for reduction in load restrictions should be developed such as 0% structures with a load or width restriction. However, the cost of such recommendation is currently unknown and requires further work by an engineering consultant. This should be considered before July 1, 2025 when proposed LOS are required under O.Reg 588/17 with appropriate engineering assessments and costing. It is noted that 9 of the 27 bridges in this category have been identified in the D.M. Wills recommended program for replacement in the next 10 years. However, a structure-by-structure review is needed as these recommendations were based upon the data provided.

To achieve the proposed level of service based upon a condition rating of 70, the recommendation would be to contribute **$5,270,800** annually (adjusted for inflation) to a reserve for structures projects. There are some years where it would make more sense to contribute to the reserve and undertake projects at the optimal time. This recommendation is based on the replacement costs over a 50 year life cycle. The design life of structures is typically 75yrs. However, considering the overall condition of the asset group and providing an allowance for rehabilitations, a life cycle of 50 years was utilized.

# Chapter 6

# Climate Change Strategy

# Climate Change Impacts on Roads Bridges and Culverts

## Climate Impacts on Roads, Bridges and Culverts

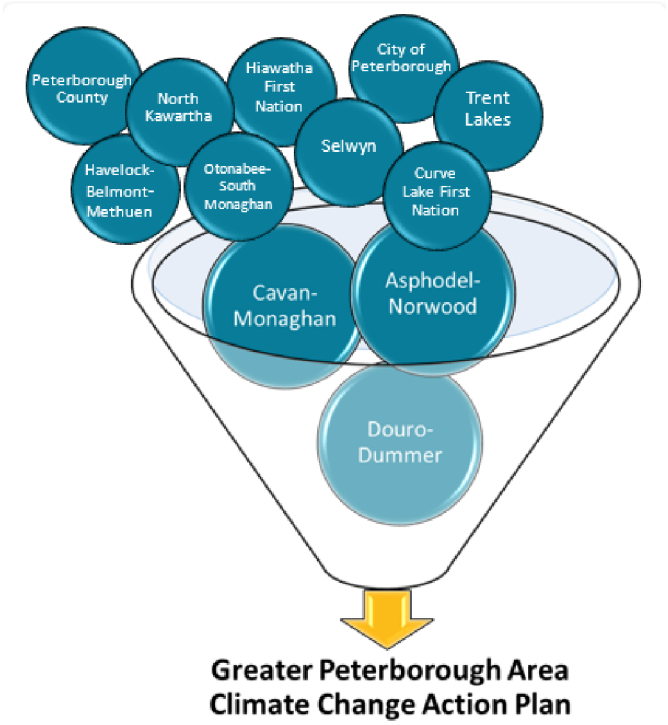
In a 2016 study by NRCan the following table summarizes the risk factors, impacts/opportunities and adaptation strategies for roads.

**Table 3: Climate risks, impacts, and adaptation practices for road transportation.**

| Climate / environmental risk factors | Impacts and opportunities | Adaptation actions |
|---|---|---|
| **Warmer air temperatures (summer and winter; more variability)** | • Increased freeze-thaw cycles<br>• Thermal expansion of bridges, causing detours and traffic disruptions<br>• Pavement rutting, softening, flushing, and bleeding in heat<br>• Reduced operating season/load capacities for winter roads<br>• Longer construction season (opportunity)<br>• Reduced winter road maintenance requirements (opportunity) | • Increase use of road de-icing materials (i.e. salt, sand, brine)<br>• Increase ongoing maintenance<br>• Use more heat-resistant pavement materials (i.e. "SuperPave" technology"); more frequent monitoring/maintenance<br>• Seasonal scheduling adjustments/ modal shift to air for northern shipping |
| **Precipitation (changing seasonal patterns, increasing intensity and extremes)** | • Increased likelihood of road washouts and flooding<br>• More extreme rainfall and flooding<br>• More rapid asphalt/concrete deterioration<br>• Increased risk (>45%) of vehicular accidents during heavy precipitation events, especially freezing rain | • Improvements to stormwater management infrastructure<br>• Regular monitoring and clearing of culverts<br>• Change to engineering design criteria to consider higher precipitation volumes<br>• ITS applications, warning motorists of safety hazards; RWIS, informing maintenance activities<br>• Selection of more robust pavement materials<br>• Increase in road de-icing materials (salt, sand, brine) |
| **Changing patterns of lake ice** | • Increased risk of flooding, especially from earlier and increased river ice breakup-induced flooding<br>• Shorter winter road operating season | • Investment in flood prevention infrastructure<br>• Modal shift to air transportation |
| **Wind (changes in average wind speeds and extremes)** | • Increased runoff from road-treatment chemical dispersion<br>• Loss of visibility, stability, maneuverability in drifting snow; disruptions to signaling equipment and tall structures | • No adaptations identified in the literature<br>• Design structures for more turbulent conditions; "living snow fences" in rural areas |
| **Changing water levels (lakes and rivers)** | • Risk of roadway inundation exceeding stormwater capacity of culvert infrastructure | • Relocation or elevation of roadways away from floodplains |

# Sustainable Peterborough Climate Change Action Plan

Sustainable Peterborough has developed a Climate Change Action Plan (CCAP) for the Greater Peterborough Area (GPA). The overall objective of the CCAP is to reduce our greenhouse gas (GHG) emissions, reduce the use of fossil fuels, lower our energy consumption, and adapt to our changing climate. The plan has identified goals, actions, and emissions reduction targets that fit with and address the unique needs of each Municipal and First Nation partner.



**Greater Peterborough Area Climate Change Action Plan**

## Our Goals

***"We will reduce our contributions to climate change while increasing our ability to adapt to climate change conditions.***

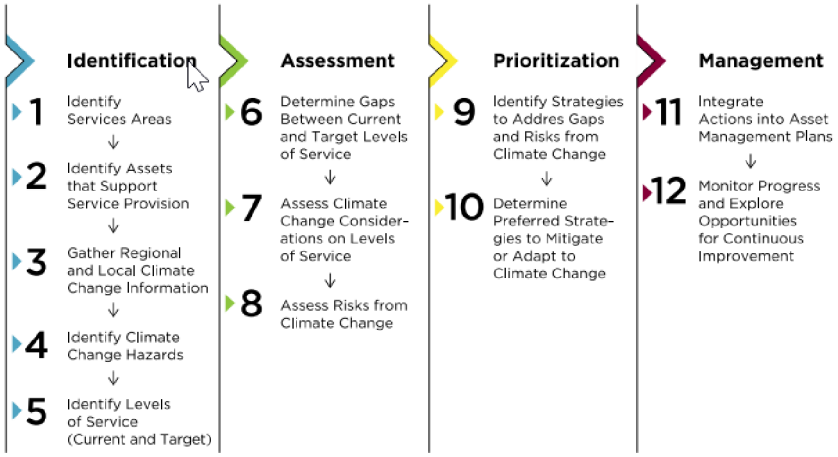
## Climate change mitigation strategies

- Establish a multidisciplinary review team to assess provincial and local land use planning legislation and tools and make recommendations to decision-makers on how to best implement an ecosystem-based approach to the development application process (partnership amongst all communities).
- Integrate climate change policies into Official Plans
- Continue to implement land use policy that supports building complete communities that are mixed-use, compact, and higher density to achieve intensification targets outlined in the Provincial Growth Plan
- Conduct a Greater Peterborough Area-wide vulnerability assessment of expected climate change impacts (including drought and lake levels) (coordinated amongst all communities).
- Develop and implement a Natural Heritage System Plan (City and County with Townships)

## Climate change adaptation strategies that were identified in the Plan to increase the resilience of a community to the impacts of climate change

- Sustainability metrics tool to predict, measure and report the sustainability performance (including GHG emissions) of proposed developments focusing on the built environment, mobility, natural environment, and infrastructure and buildings (e.g. Richmond Hill/Vaughan/Brampton)
- Continue/enhance education opportunities on the need for increased housing density and implications related to climate change at all points of contact with decision-makers, stakeholders, and the public
- *Adopt the Low Impact Development Stormwater Management Planning and Design Guide (CVC/TRCA) for landscape-based stormwater management planning and low impact development stormwater management practices*
- Update engineering design standards to improve climate change readiness of new infrastructure by taking a green infrastructure approach first and increasing flood standards to a 200-year storm standard rather than the current 100-year standard
- Place restrictions on cutting down trees on private property and/or a tree replacement policy
- Update Official Plan policies to require greater buffers around wetlands to protect them from surrounding land uses (the new County OP has specific climate change adaption and principles aligned with the Climate Change Action Plan)
- Support and promote local Conservation Authorities' tree planting programs to encourage planting trees on public and private property
- Support local Conservation Authorities to deliver planting and restoration projects at strategic high priority areas with climate ready species.

Note: the financial impacts of these initiatives have not been developed and need to be reviewed to determine feasibility. The Federation of Canadian Municipalities provides a framework in its "Guide for Integrating Climate Change into Municipal Asset Management" as follows:



Peterborough County

# Chapter 7

# Financing Strategy

WSCS Consulting
Think Beyond

4 ROADS MANAGEMENT SERVICES

# Financing Strategy Overview

The financing strategy for an asset management plan outlines the key funding sources used to finance asset management related costs, including methodologies and strategies proposed for each funding source. The main objective is to fund the recommended asset management strategy costs outlined in Chapters 2 and 3 to maintain the current levels of service and explore options for the proposed/recommended of service. However, funding availability is a legitimate barrier to meeting levels of service expectations.

Being an upper tier, the County has limited 'rate supported' assets and services. For the most part, the County must rely on its own source revenues for funding its infrastructure. While debt is an option, it clearly must be paid back which, of course, comes from property tax revenues. Reserves are allocated to types of expenditures and projects but are part of the County's equity, which generally, was raised through taxation revenue and simply is historical tax.

Grants from other governments are not sustainable and are not predictable. Municipalities that rely on grants to manage their infrastructure are very vulnerable.

In this section, historical trends as well as forecasts are explored with recommended strategies to close the funding gap which is estimated to be $2.8 million in 2023 ($2022) and $7.8 million for the recommended 10 year program to maintain current level of service ($11.8 million annually adjusted for inflation).

# Financing Strategy
# Funding Sources

To fund the needs identified contained in the asset management strategy, the County has the following funding sources, representing both own source revenues and external sources:

## Own Source Revenues

### Property Taxes

Levy on properties. The primary source of funds - approximately $6.9 million on average over 5 years ($9.1 million in 2022)

### Infrastructure Levy

Dedicated Infrastructure Levy - Still a Tax Levy but segregated in a reserve Currently at 2.5%

### Reserves & Investments

Equity - Allocation for Reserve that were either raised through taxes or grants

Investments earned and allocated to infrastructure

## External Revenues

### Federal Gas Tax

Canada Community Building Fund Only 'stable' grant currently. Typically $1.7 million annually.

### Other Grants

Ontario Community Investment Fund - Average $500k annually - Assume $400k

Other Capital Grants based upon eligible projects

### Debt

Debt is limited to the Annual Repayment Limit (ARL) set each year based upon 25% of the County's own source revenue. For 2022, the County's ARL is $11.7 million.

### Development Charges

Development Charges are fees charged to developers and must only by used for growth projects. Bill 23, More Homes Built Faster Act, 2022 has had an impact on what types of developments are DC eligible.

## Risk

Reduction due to transition to reduce CO2 emissions..

OCIF Fluctuates based upon a formula.

Grants not guaranteed

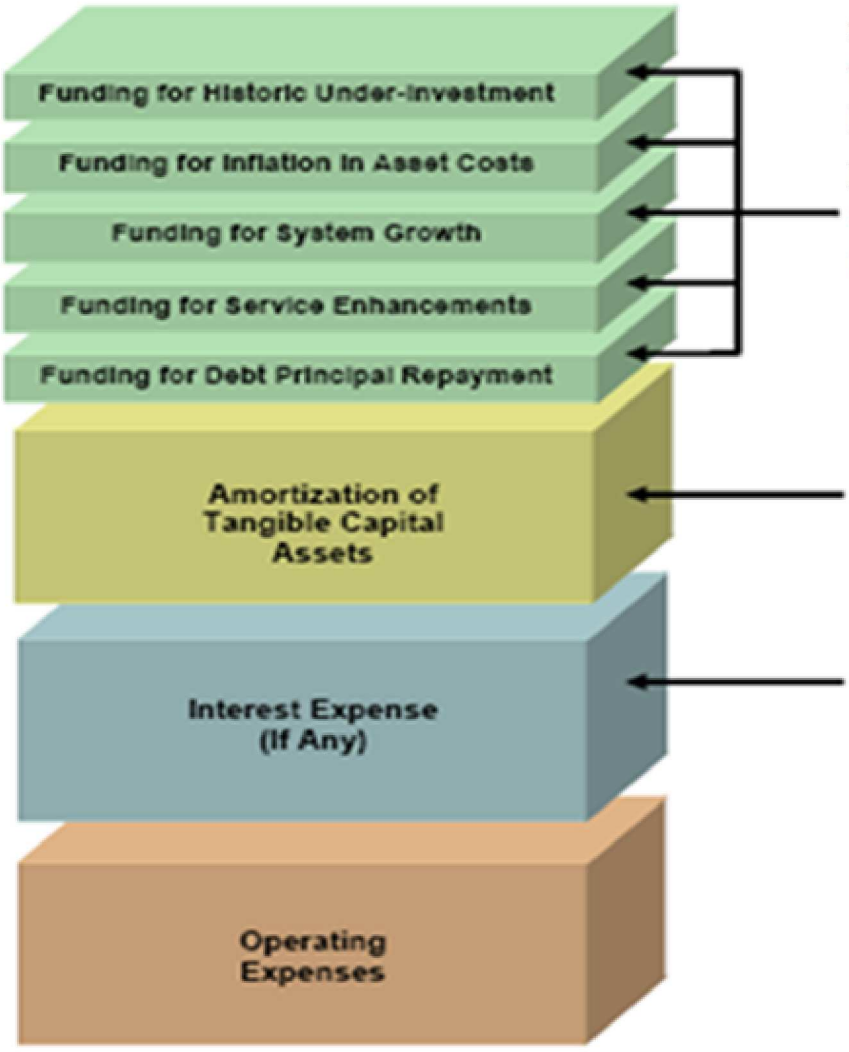
Interest Rate Fluctuations

Restricted to growth.

# Financing Strategy

**How much money do we need to maintain and replace our assets?**

**Do we have the money? If not, where do we get it?**



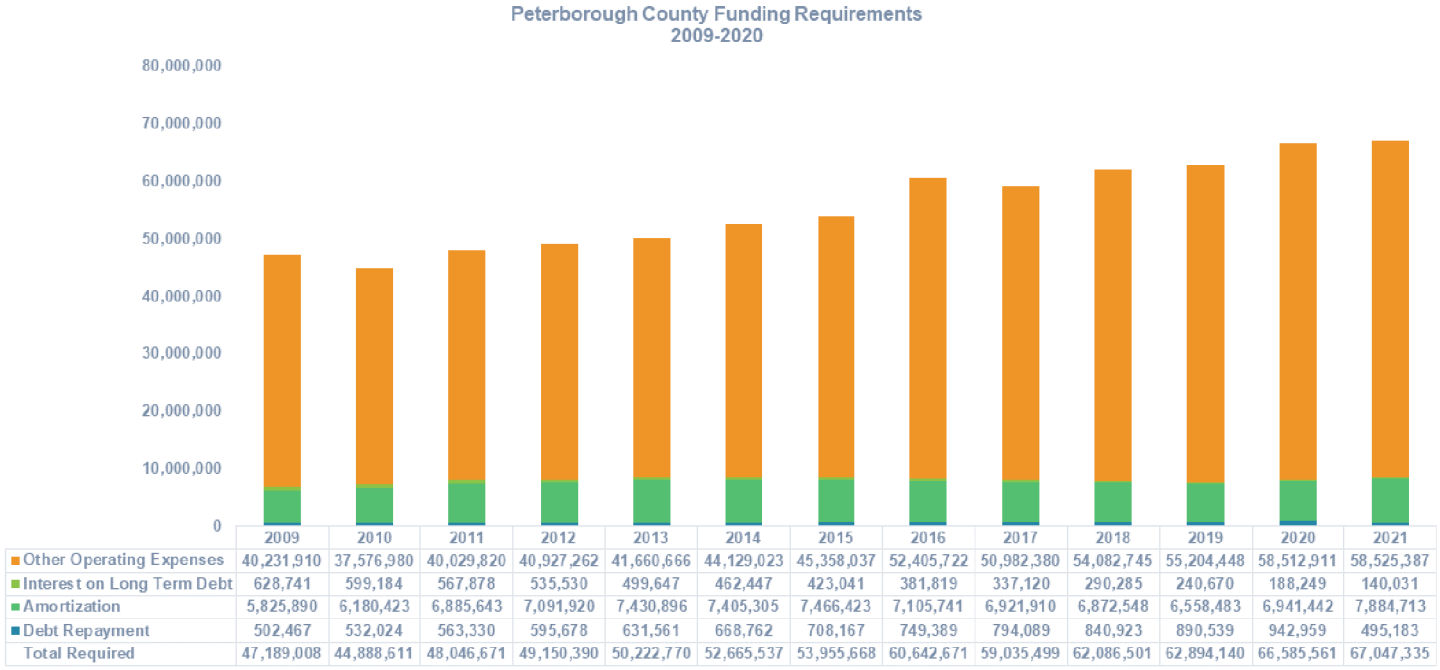

A sustainable level of revenue accounts for the future investment needs of the municipality in addition to current period expenses. Revenues in excess of current period expenses will be reflected as an accounting surplus in the financial statements.

If revenues are at this point, the municipality is just meeting current period expenses It is not adequately planning for the future.

If revenues are at this point, the municipality is just recovering cash costs. It is significantly under-funded.

# Financing Strategy

## County's Historical Funding Requirements



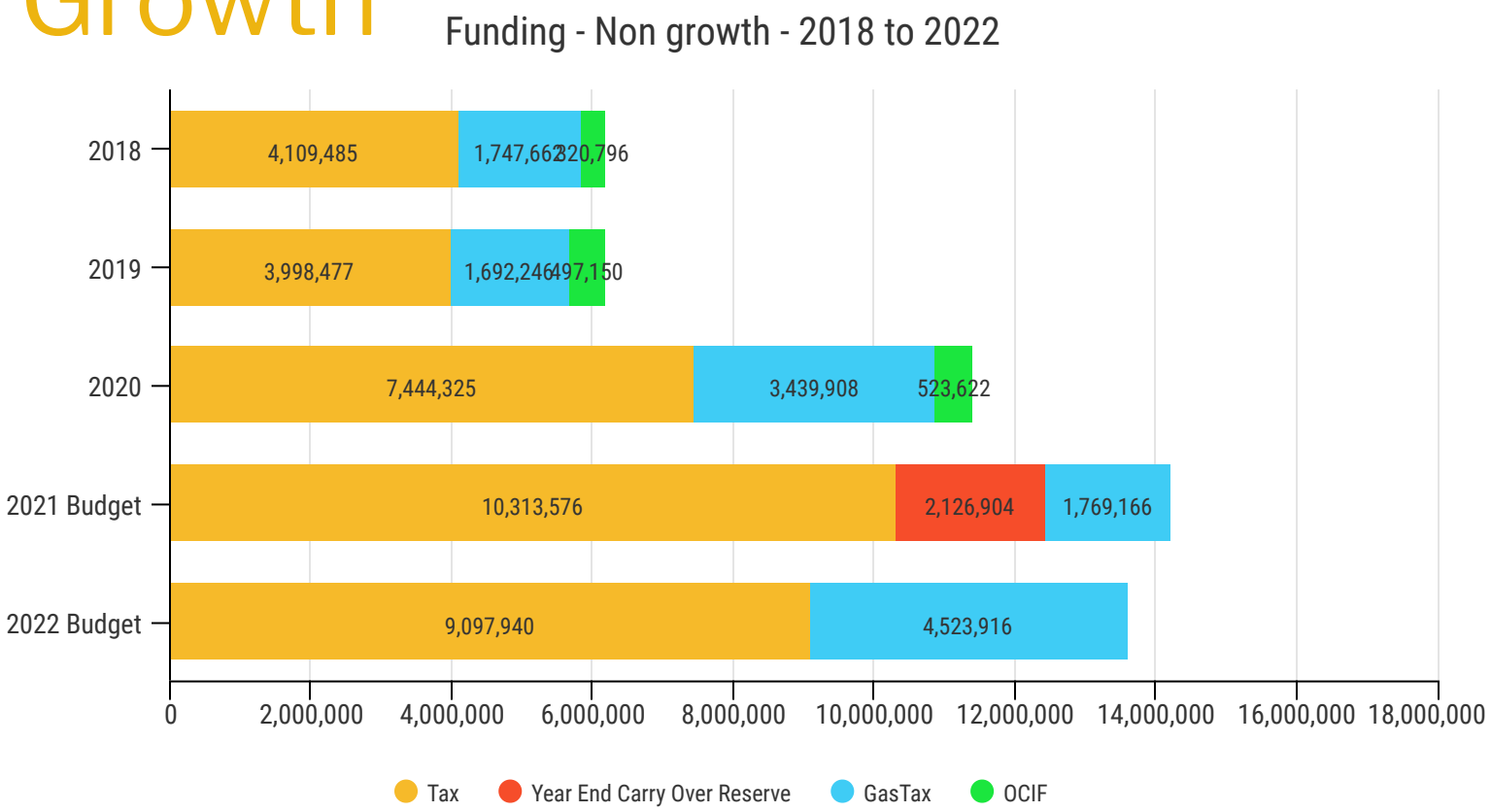

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Other Operating Expenses | 40,231,910 | 37,576,980 | 40,029,820 | 40,927,262 | 41,660,666 | 44,129,023 | 45,358,037 | 52,405,722 | 50,982,380 | 54,082,745 | 55,204,448 | 58,512,911 | 58,525,387 |
| Interest on Long Term Debt | 628,741 | 599,184 | 567,878 | 535,530 | 499,647 | 462,447 | 423,041 | 381,819 | 337,120 | 290,285 | 240,670 | 188,249 | 140,031 |
| Amortization | 5,825,890 | 6,180,423 | 6,885,643 | 7,091,920 | 7,430,896 | 7,405,305 | 7,466,423 | 7,105,741 | 6,921,910 | 6,872,548 | 6,558,483 | 6,941,442 | 7,884,713 |
| Debt Repayment | 502,467 | 532,024 | 563,330 | 595,678 | 631,561 | 668,762 | 708,167 | 749,389 | 794,089 | 840,923 | 890,539 | 942,959 | 495,183 |
| Total Required | 47,189,008 | 44,888,611 | 48,046,671 | 49,150,390 | 50,222,770 | 52,665,537 | 53,955,668 | 60,642,671 | 59,035,499 | 62,086,501 | 62,894,140 | 66,585,561 | 67,047,335 |

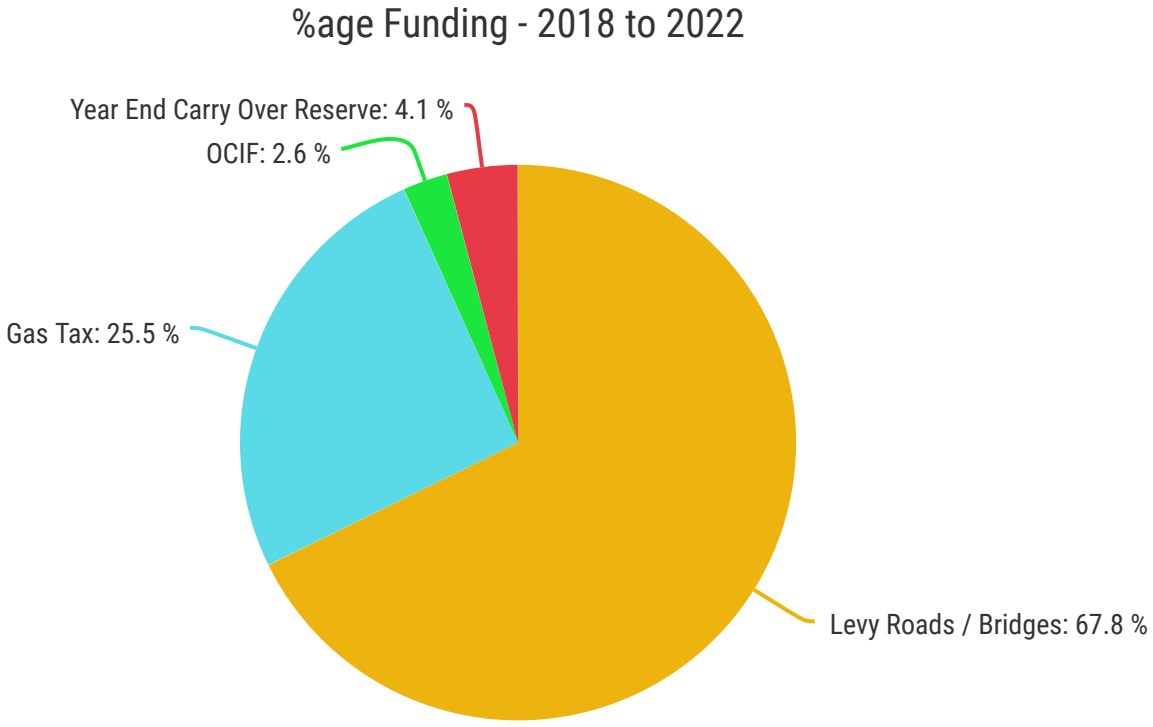

| | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Own Source Revenue Shortfall | -$14,645,383 | -$11,481,579 | -$13,731,219 | -$13,882,294 | -$13,967,521 | -$15,390,077 | -$15,420,010 | -$20,128,070 | -$16,120,692 | -$17,345,289 | -$15,986,081 | -$16,901,053 | -$13,461,244 |
| Shortfall after Operating Grants | -$8,539,819 | -$4,857,961 | -$6,666,201 | -$6,454,299 | -$6,449,529 | -$7,581,866 | -$7,032,572 | -$11,514,983 | -$7,225,022 | -$7,551,926 | -$5,347,906 | -$4,827,080 | $14,427,908 |

Source: FIR

# Financing Strategy

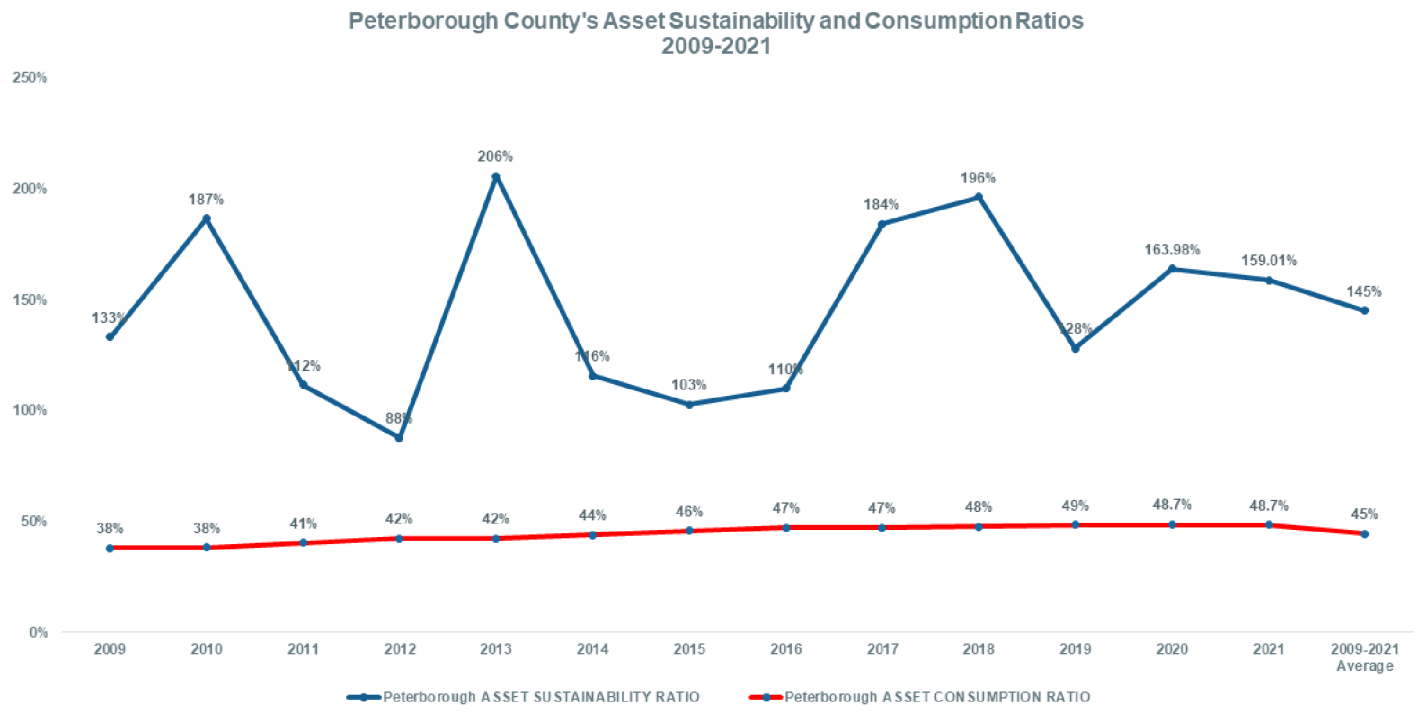
## Historical Funding - Non Growth



# Financing Strategy

## Historical Funding - Asset Metrics



# Financing Strategy

## Grant Funding Assumptions

The Table below provides the historical grants received from the county Canada Community-Building Fund (CCBF), formerly known as Federal Gas Tax Funding, has stayed relatively stable with a few years with increases. There were a few years (2009 and 2020) where “top-ups” to this funding was also provided. It is expected that the 2023 amount will be similar to 2022. This is considered to be the only current 'stable' grant but there is a risk that it could decline should a reduction in fuel occur.

At the end of 2022, the balance in the Federal Gas Tax "reserve" as part of the Public Works Long Term Planning reserve was $4.5 million. The assumption in the financing strategy is $1.77 million, the amount received in 2022. Any additional funds should be allocated to the Long Term Planning Reserve for sustainability.

| Year | Federal Gas Tax | Federal Gas Tax earned | OCIF |
|---|---|---|---|
| 2009 | $ 2,551,589 | | |
| 2010 | $ 1,752,415 | | |
| 2011 | $ 1,725,000 | $ 1,725,000 | |
| 2012 | $ 1,785,126 | $ 1,785,126 | |
| 2013 | $ 1,646,556 | $ 1,646,556 | |
| 2014 | $ 2,094,146 | $ 2,094,146 | |
| 2015 | $ 1,247,234 | $ 1,247,234 | $ 120,715 |
| 2016 | $ 1,588,784 | $ 1,588,784 | $ 120,715 |
| 2017 | $ 1,667,568 | $ 1,667,568 | $ 225,061 |
| 2018 | $ 1,747,662 | $ 1,747,662 | $ 320,796 |
| 2019 | $ 1,692,246 | $ 1,692,246 | $ 497,150 |
| 2020 | $ 3,439,908 | $ 3,439,908 | $ 523,622 |
| 2021 | $ 1,769,166 | $ 1,769,166 | $ 523,622 |
| 2022 | $ 1,769,166 | $ 1,769,166 | $ 1,253,648 |
| Average | $ 1,891,183 | $ 1,847,714 | $ 448,166 |

Ontario Community Infrastructure Funding (OCIF) was established in 2015) and typically about $450k with a top up in 2022. The province has announced that $1billion in additional OCIF funding will be provided over the next five years, and funding formulas will be tied to asset replacement values in each municipality’s asset management plan. This should not be viewed as a stable grant and reduce by 15%per year. The recommendation is that these funds NOT be used in the financing strategy but rather be used to reduce the inyear eligible expenditures with the allocated revenues to be put in reserves. However, for the purposes of this AMP, we have included $400k as a conservative amount.

Other capital grant opportunities present themselves from time to time but they should NOT be used as an infrastructure financing strategy. The funding for projects should be based upon its own funding and allocate any additional funding to the long term planning infrastructure reserve.

# Transportation Master Plan

# Growth Funding

As indicated in Chapter 5, the Transportation Master Plan was completed but not presented/approved by County Council. However, the growth projects related to highway services was estimated to be $143 million in 2022$ of which 13% or approximately $640k annually are 'ineligible' for development charge funding. Note Bill 23 has had a $1.5 million impact on DCs that will likely require tax levy to fund.

The County's assessment growth over the last four years has ranged from 1.5% to 1.67% with an average of 1.39% yielding an average additional taxation review of approximately $600k. Consequently, transferring the assessment growth to the TMP reserve would further support the policy of 'growth pays for growth'. The average annual requirement for the TMP costs that are not eligible for development charges.

| Services Related to Highways (30 YEARS) | Gross Project Cost | Ineligible Costs |
|---|---|---|
| **Grand Total** | **$142,966,000** | **$19,176,750** |
| **Average Annual Costs (total/30 years)** | **$4,765,533** | **$639,225** |

| YEAR | 2018 | 2019 | 2020 | 2021 | AVERAGE |
|---|---|---|---|---|---|
| # Of Properties | 47,170 | 47,478 | 47,564 | 47,900 | |
| Current Value Assessment | $14,339,162,133 | $14,579,278,642 | $14,734,169,042 | $14,928,007,742 | |
| Growth | 1.50% | 1.67% | 1.06% | 1.32% | **1.39%** |
| Taxation Revenues | $41,900,349 | $44,271,950 | $47,247,915 | $48,693,076 | |
| Tax Revenue Change | $2,031,638 | $2,371,601 | $2,975,965 | $1,445,161 | |
| %Age Increase in Tax Revenue | 5.10% | 5.66% | 6.72% | 3.06% | **5.13%** |
| **Tax Attributable To Growth (Estimate)** | **$597,087.74** | **$701,642.50** | **$470,345.63** | **$621,580.65** | **$597,664.13** |

# Financing Strategy

## Reserves

As provided by the County, it has several reserves. It is recommended that a reserve policy be developed to support this asset management plan based upon the Long Term Sustainability scenario outline in this AMP. This will require regular annual tax levy allocations to build the reserves to maintain its critical infrastructure. Currently the County only has enough in its reserve $6,254,996 with to handle the current year funding gap. It is also note that both growth and preservation are in this reserve. The initial opening balances should reflect percentage of replacements costs ($1.482 billion) in each category. It is important to note that current reserves only represent 0.42% of total replacement costs or only 11% of one year of replacement costs. This means that the County is very vulnerable to risks should its infrastructure experience any unforeseen failure. One year replacement cost = $54 million.

It is recommended that three reserves be created with each reserve with the specific purpose and transfers based upon funding sources as follows:

1. Long term sustainability - Roads Preservation-Opening Balance = $4,741,438 with the initial 2.5% infrastructure levy. and an additional 2% for the next 10 years.
2. Long term sustainability - Structures -Opening Balance =$1,025,233 - Allocate all Gas tax to Structures and a 1% general levy. Gas Tax could be allocated to roads in specific years whereby no significant structures are replaced/rehabilitated.
3. Transportation Master Plan - Growth - Opening Balance = $488,325 - Allocate all assessment growth to this reserve (estimated at 1.3% annually).

Other options would see the amounts each year grow by 2.5% cumulatively with a balance at the end of 2032 of $106 million.

Details can be found in Appendix 4.

# Financing Strategy
# 10 Year Plan

As provided by the County, it has several reserves. It is recommended that a reserve policy be developed to support this asset management plan based upon the Long Term Sustainability scenario outline in this AMP. This will require regular annual tax levy allocations to build the reserves to maintain its critical infrastructure. Currently the County only has enough in its reserve $6.3 million with to handle the current year funding gap. It is also note that both growth and preservation are in this reserve.

| Asset Category | Additional Renewal Backlog ($2022) | Current Average Annual Investment (2018-2022) | Average Annual from 10 Year Program Recommended | Short Term Sustainability $2022) | Long Term Sustainability ($2022) | Current Annual Gap compared to 10 year plan |
|---|---|---|---|---|---|---|
| Roads | $160.3 | $6.7 | $15.7 | $14.4 | $24.4 | $8.6 |
| Structures | $9.7 | $4.8 | $4.9 | $4.6 | $5.3 | $0.1 |
| Facilities | Unknown | $0.6 | $0.7 | $0.7 | Unknown | $0.1 |
| Totals | $170 | $12.1 | $21.3 | $19.7 | $29.7 | $8.8 |

**10 Year Recommended Program: Roads, Structures (updated) and Facilities (2018 AMP)**

| Asset | Average over 10 years | Total 10 years |
|---|---|---|
| Roads -Recommended 10 year Program | $15,773,643 | $157,736,425 |
| Bridges and Culverts (Recommended 10 Year program from Wills) | $4,899,034 | $48,990,340 |
| Facilies (average annual estimate from 2018 AMP) | $756,632 | $7,566,320 |
| Total Requirements ($2022) | $21,429,309 | $214,293,085 |
| Levy (Preservation 2022) | $9,719,254 | $97,192,540 |
| 2.5% Infrastructure Levy | $1,339,365 | $13,393,655 |
| Gas Tax | $ 1,769,166 | $17,691,660 |
| OCIF Funding (unknown) | $ 400,000 | $4,000,000 |
| Total Funding Available ($2022) | $13,227,785 | $132,277,855 |
| Funding Gap ($2022) | $8,201,523 | $82,015,230 |
| Funding Gap % ($2022) | 62% | 62% |
| Assumed Inflation Rate (Construction index) | 0.00% | |
| Total Requirements (Adjusted for Inflation) | $25,614,504 | $256,145,041 |
| Funding Gap (Adjusted For inflation - Assumes no additional funding) | $12,386,719 | $123,867,187 |
| Cumulative Levy impact ($2022 = 47,820,042) | 25.90% | 259.03% |
| Cost per household (2022) | $221.36 | $2,213.64 |
| Cost per household (Assumes inflation) | $334.32 | $3,343.24 |
| Levy ($2022 ) with 2.5% Infrastructure Levy | $54,913,984 | $549,139,841 |

Detailed calculations can be found in Appendix 4.

# Financing Strategy

# 10 Year Tax Impact by Program

The 10 Year Program has a funding gap of $82 million ($2022) or an average of $8.2 million annually $12.4 million with inflation. The Short Term Sustainability Program yields a slightly smaller gap due to a total program that is $1.7 million less than the recommended 10 year program proposed. The Long Term Sustainability gap is $17 million annually. The three scenarios below show the impacts if fully funded from taxation over 10 years.

Option 3 represents the cost of the "proposed level of service".

| Program | | Average over 10 years | Total 10 years |
|---|---|---|---|
| Option A1: 10 Year Plan | Total Requirements ($2022) | $21,429,309 | $214,293,085 |
| | Funding Gap ($2022) | $8,201,523 | $82,015,230 |
| | %age increase from prior year | 10.51% | 171.51% |
| | $ per household annual | $221.36 | $2,213.64 |
| | $ per household annual with inflation | $334.32 | $3,343.24 |
| | Condition Roads 2032 | 64.98 | 71.37 |
| | Condition Structures 2032 | 70.12 | 69.79 |
| | Option 2: Short Term Sustainability | | |
| Option A2: Short Term Sustainability | Total Requirements | $19,710,732 | $197,107,320 |
| | Funding Gap ($2022) | $6,482,947 | $64,829,465 |
| | %age increase from prior year | 8.97% | 135.57% |
| | $ per household annual | $174.98 | $1,749.78 |
| | $ per household annual with inflation | $273.22 | $2,732.22 |
| | Condition Roads 2032 | 64.98 | 69.59 |
| | Condition Structures 2032 | 70.12 | 69.79 |
| Option A3: Long Term Sustainability | Total Requirements | $30,410,732 | $304,107,320 |
| | Funding Gap ($2022) | $17,182,947 | $171,829,465 |
| | %age increase from prior year | 16.76% | 359.33% |
| | $ per household annual | $463.78 | $4,637.77 |
| | $ per household annual with inflation | $615.35 | $6,153.52 |
| | Condition Roads2032 | 72.70 | 79.97 |
| | Condition Structures 2032 | 70.12 | 69.79 |

# Financing Strategy

# 10 Year Plan - Taxation Scenarios

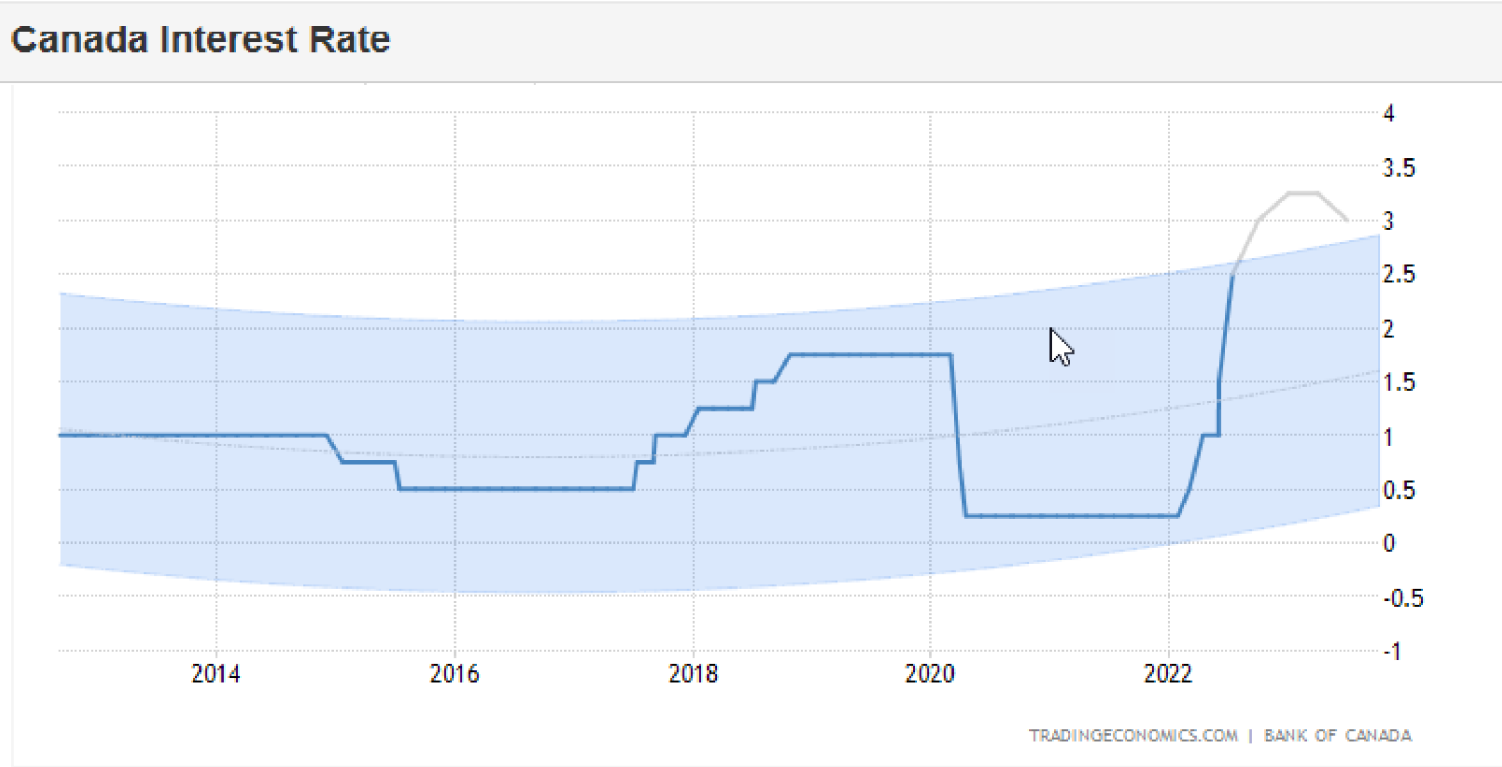
The 10 Year Program has a funding gap of $82 million ($2022) or an average of $8.2 million annually $12.1 million with inflation. If this gap was only funded by taxation, there are several scenarios. All scenarios except for Number 1 will result in level of service challenges.

| Scenarios to Fund the Gap | Funding Investment impact 10 Years | Equivalent Average Tax rate 2023-2032 | Remaining Gap over 10 years ($2022 in millions) |
|---|---|---|---|
| **Scenario 1: Optimal Funding in 10 Years** | **100%** | **10.40%** | **0** |
| **Scenario 2: Optimal Funding in 20 Years** | **52%** | **6.50%** | **$38.7** |
| **Scenario 3: Optimal Funding in 30 Years** | **38%** | **5.00%** | **$50.4** |
| **Scenario 4: 3% Capital Investment** | **20%** | **3.00%** | **$64.2** |
| **Scenario 5: 2.5% Levy Increase** | **17%** | **2.50%** | **$67.3** |
| Scenario 6: 2% Capital Investment | 13% | 2.00% | $70.2 |
| 10 Year Additional Capital Investment Required | | | $82 |

# Financing Strategy

## 10 Year Plan - Debt Scenarios

Municipalities are only able to borrow up to the Annual Repayment Limit (ARL) under O.Reg 403/02 which is calculated each year based upon the prior year Financial information Return. Basically, municipalities are only able to finance up to 25% of their own source revenues less any existing debt. The County's has limited debt charges of $1.1 million. As such, the County's ARL for 2022 would allow for $11,721,280 in debt charges. It is clear that entering into debt restricts the County's flexibility and adds to its vulnerability should rates change. The past year has seen rate raise several times and the forecast for 2023 is to increase again. There is a slowing of the economy and therefore, some economists expect the increases to be moderate in coming years. The prime rate at the time of this report was 4.7% which is the amount utilized for these debt scenarios. However, each one percent change will result in an additional 17k per $100k of debt.



# Financing Strategy

# 10 Year Plan - Debt/Levy Scenarios

Three scenarios have been developed for consideration to reduce the immediate impact on the taxpayer. It should be noted that these scenarios assume that the interest rates at the time of issuance is 4.7%. Any changes up or down will provide additional costs or savings. The scenarios have assumed a 25 year amortization but in practice, the useful life of the asset should serve as a guide for the amount of years to finance. For example, bridges have a 50 to 75 year lifespan, so the County could finance a longer period of time and reduce the payments. However, it should be noted that all debt scenarios are more expensive the longer the repayment term.

The three scenarios below provide some illustrations as options for the 10 year program:

Option B1:Increase the taxation levy by 2% and debt finance the remainder of the funding gap. Total debt payments over 10 years would be $20.8 million with total debt issued at $69.4 million. Annual payments are well under the County's ARL. This would result in an average of 5.8% increase in the tax levy over the 10 years with total interest costs of $49.7 million or $5 million annually.

| Program | | Average over 10 years | Total 10 years |
|---|---|---|---|
| Option B1: Levy Increase at 2% annually for infrastructure, Debt issuance for remainder | Tax Levy (2%) | $1,123,720 | $11,237,197 |
| | Total Debt issued | $7,077,803 | $70,778,033 |
| | Debt payments (P&I) (levy requirement) | $2,087,737 | $20,877,366 |
| | Total Levy (2% levy + debt) | $58,125,440 | $581,254,404 |
| | %age increase from prior year | 5.82% | 148.01% |
| | $ per household annual | $86.68 | $866.79 |
| | Condition Roads 2032 | 64.98 | 71.37 |
| | Condition Structures 2032 | 70.12 | 69.79 |
| | Interest Cost for 25 years | $4,966,664 | $49,666,637 |
| | Prinicipal for 25 years | $7,077,803 | $70,778,033 |
| | Total | $12,044,467 | $120,444,671 |

# Financing Strategy

# 10 Year Plan - Debt Scenarios

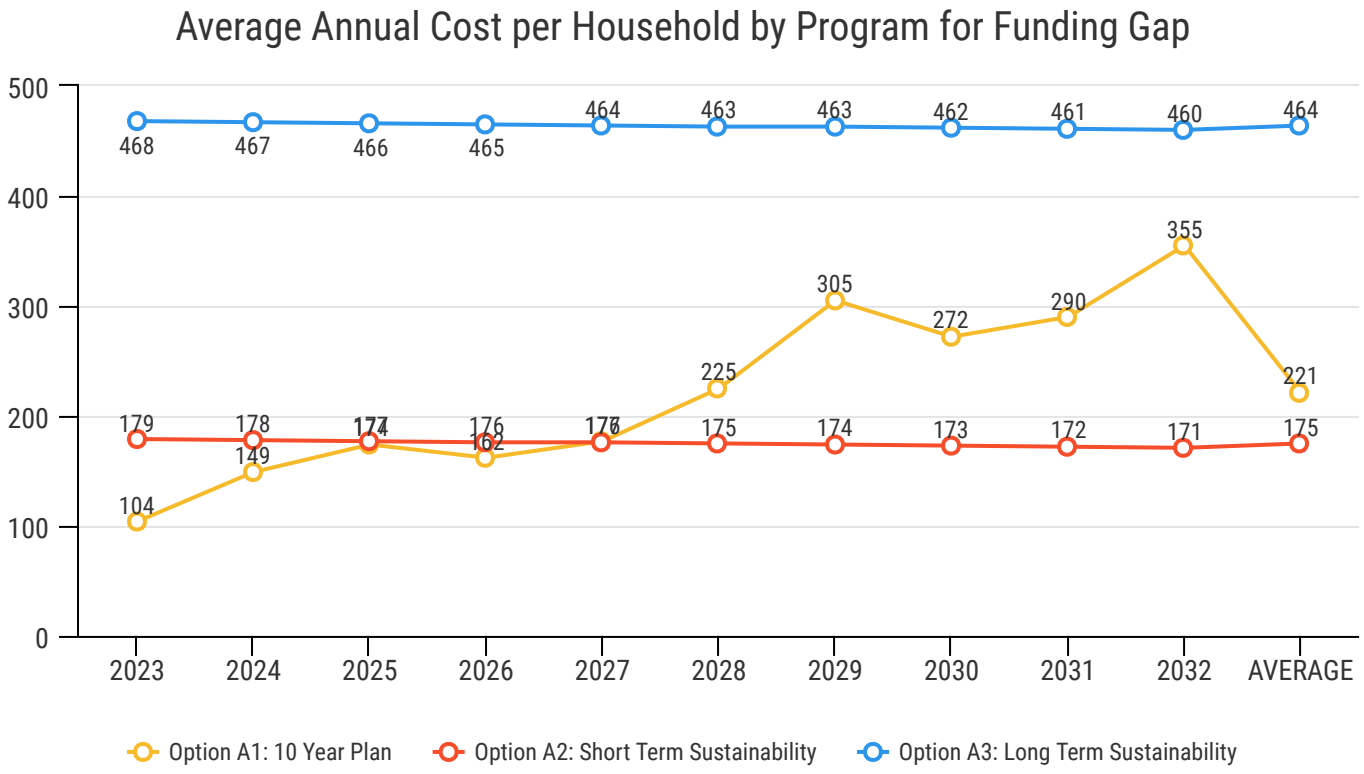
Option B2: Provides for longer term sustainability by increasing the levy by 3% and putting the funds into reserves. Reserves can earn interest if properly invested. The entire program would be debt financed but at the end of the 10 year period, the County can move to more self - financing. Total debt payments would be $25.4 million on a total issue of $82 million. Annual payments of $2.5 million are below the ARL but the tax levy change would be 8%. Total contribution to reserves = $16 million (resulting in 1.5% funded replacement costs).

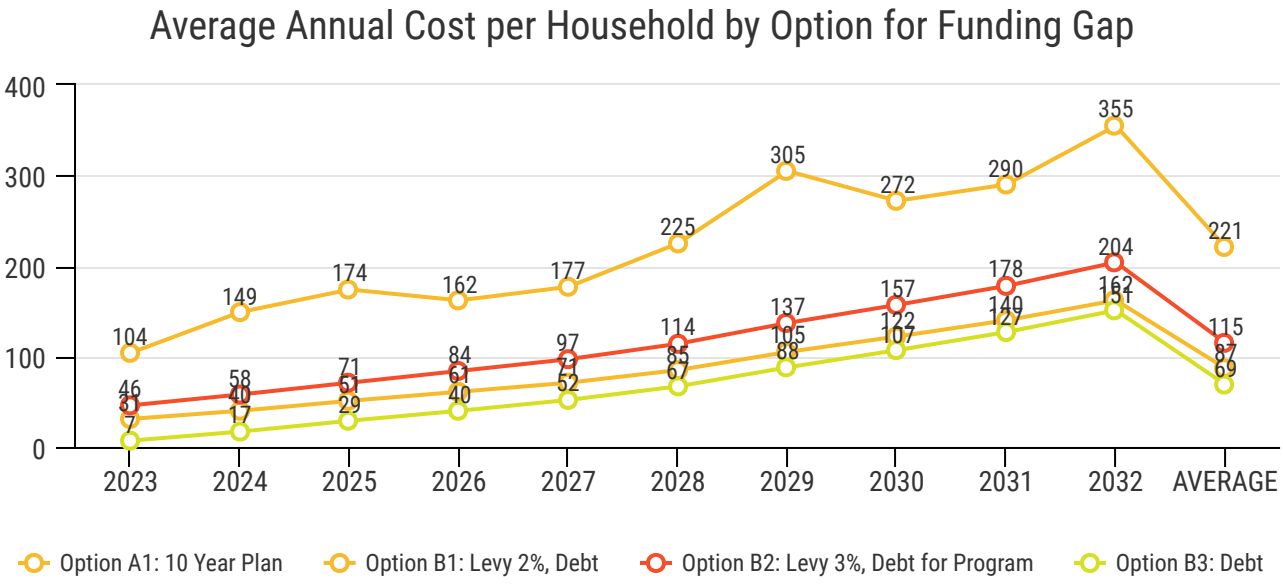
Option B3: The entire program would be debt financed but at the end of the 10 year period, but no additional resources to reserves. Total debt payments would be $25.4 million on a total issue of $82 million. Annual payments of $2.5 million are below the ARL but the tax levy change would be 4.4%. Total contribution to reserves = $16 million (resulting in 1.5% funded replacement costs).

Both Options B2 and B3 would have a total of $57 million in interest costs over 25 years ($5.8 million annually).

| Program | | Average over 10 years | Total 10 years |
|---|---|---|---|
| Option B2: Debt inssuance for entire Program for 10 years, put 3% levy increase into reserve to finance future program | Tax Levy (3%) before Debt Payments | $1,712,070 | $17,120,695 |
| | Total Debt issued | $8,201,523 | $82,015,230 |
| | Debt payments (P&I) (levy requirement) | $2,539,567 | $25,395,670 |
| | Total Levy (3% levy + debt) | $59,165,621 | $591,656,206 |
| | %age levy increase from prior year | 7.98% | 171.51% |
| | $ per household annual | $114.75 | $1,147.54 |
| | Condition Roads | 64.98 | 71.37 |
| | Condition Structures | 70.12 | 69.79 |
| Option B3: Debt inssuance for entire Program for 10 years no other levy increases | Tax Levy (0%) | $0 | $0 |
| | Total Debt issued | $8,201,523 | $82,015,230 |
| | Debt payments (P&I) (levy requirement) | $2,539,567 | $25,395,670 |
| | Total Levy | $56,960,429 | $569,604,294 |
| | %age increase from prior year | 4.38% | 171.51% |
| | $ per household annual | $68.54 | $685.44 |
| | Condition Roads | 64.98 | 71.37 |
| | Condition Structures | 70.12 | 69.79 |
| | Interest Cost for 25 years | $5,755,205 | $57,552,047 |
| | Prinicipal for 25 years | $8,201,523 | $82,015,230 |
| | Total | $13,956,728 | $139,567,278 |

# Financing Strategy
# Options Compared



# Chapter 8

# Summary of Recommendations

# Summary of Recommendations

Asset Management is not a job, a system or a project. It needs to be built into every activity, daily processes and policies. It is important that everyone manage the assets and understand their responsibilities. This updated AMP is just the beginning. Ongoing updates need to be part of the County's workplan and everyone needs to work together. Through the development of the County's AMP, the asset management planning practices were explored. Because of many changes over the years, there were data management challenges and a lack of coordination between departments. While A better understanding of the services and service levels expected providing these services was gained, the proposed levels of service require consultation and assessment. A balance is required between providing high levels of service and the costs associated with those services. From an asset funding perspective, a balance is needed between financing the cost of implementing asset management recommendations and the risk associated with deferring lifecycle costs. Asset management planning is a journey that with evolve over time as new data, assumptions and strategies are brought forward. Recommendations are provided that will assist in this evolution and will ensure the Township is constantly moving forward with this initiative.

## Recommendations - Roads

In addition to the budgetary recommendations, the following recommendations are provided for the management of the road inventory.

1. The information and budget recommendations included in this report be used to further develop corporate Asset Management Planning.
2. Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those sections that are not going to be affected by upgrade due to development demands.
3. The funding level should be increased to the Long Term Sustainability limit over a ten year period.
4. Funding levels to be adjusted annually to accommodate growth / system expansion.
5. Funding should be adjusted annually to accommodate inflation.
6. The work plan should

a. Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those sections that are not going to be affected by upgrade due to development demands.
b. The work plan should cross integrate assets.
c. The work plan should be followed to optimize investments and performance of the road system.

7. The road system inspection interval should continue at the current 2 year interval.
8. Traffic counts should continue to be updated and repeated on a regular basis. The counting should include the percentage of truck traffic.
9. The data with respect to the number of potentially substandard vertical and horizontal curves should be entered into the database. A Roadside Safety Audit should be undertaken to assess the potential safety requirements on rural road sections with potentially substandard alignment.
10. The status of the Boundary Road Agreements should be reviewed.
11. The Level of Service for System Adequacy should be a Minimum of 75%.
12. The Level of Service for Weighted Average Physical Condition should be a minimum of 70.
13. The Level of Service for Weighted Average Pavement Condition Index should be a minimum of 80
14. The Level of Service for Good to Very Good Roads should be a minimum of 60%.
15. Develop a corporate asset management system throughout the organization with the development of a Standard Operating Procedure (SOP) for asset management.
16. Consideration should be given to development of the storm sewer system as a rate supported utility.
17. Improve the understanding of the evaluation systems being used for various assets.
18. The County should review the road asset identification scheme
19. The roadside drainage should be evaluated and recorded in the database

# Summary of Recommendations

## Recommendations - Structures

In addition to the budgetary recommendations, the following recommendations are provided for the management of the structures inventory.
1. The funding level should be increased to the Short Term Sustainability level over a ten year period. The current reserve should be segregated for structures with a consistent allocation to the reserve, adjusted for inflation, to better manage priorities based upon the best return on investment.
2. Funding levels to be adjusted annually to accommodate growth / system expansion.
3. Funding should be adjusted annually to accommodate inflation.
4. The work plan should:
• Ensure that the preservation and resurfacing programs are optimized. This is particularly critical for those assets that are not going to be affected by upgrade due to development demands.
• Cross integrate assets.
5. Develop a corporate asset management system throughout the organization with the development of a Standard Operating Procedure (SOP) for asset management.
6. The concepts in this plan should be applied to the remainder of the assets for the development of the 2024 Asset Management Plan.

## Recommendations - Levels of Service

In addition to the funding recommendations for current and proposed levels of service:
1. The County should expand its communication and community engagement by releasing this plan for consultation.
2. The performance measures recommended in this report should be developed and monitored on a regular basis.
3. An annual report should be report on the state of the infrastructure and initiatives.
4. The condition data and pictures of assets should be displayed on the GIS and easily readable format for the community.

## Recommendations - Financing Strategy

In addition to the funding recommendations for current and proposed levels of service:
1. The County should no longer create its budget separate from the Asset Management Plan. The AMP should be informing the budget and the budget should not stand on its own.
2. The County should move to multi-year budgeting based upon the AMP with regular updates..
3. The County should create the plan then determine how to finance it based upon the best return on investment. The decisions on what projects to include in the budget should not be based on a set dollar amount. Council needs to understand the needs with full information and then make decisions on projects understanding the full impacts on the future costs, risks, condition of the assets.
4. The County needs to look at additional funding through taxation to ensure that its assets do not decline.
5. The County should segregate its reserves between preservation and growth with specific purposes to ensure that the funding is allocated to the AMP and the TMP appropriately.
6. The County's TMP that is not funded by development charges should be funded by assessment growth through an annual allocation to the reserve.

# Appendix 1

## Road Appendices A-J

4 ROADS MANAGEMENT SERVICES

# Appendix A: Inventory Manual Methodology Overview

# Asset Condition Rating Methodology
# The Inventory Manual for Municipal Roads

## Regulatory Requirements in Ontario

Regulation 588/17 Asset Management Planning for Municipal Infrastructure requires;

> '*v. a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.'*

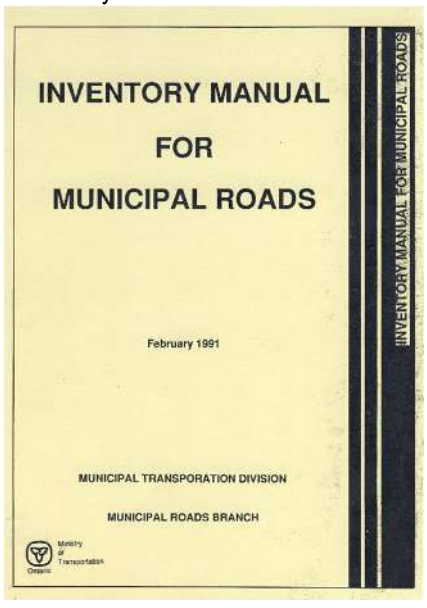
Data collection and road ratings were completed generally in accordance with the Ministry of Transportation Ontario (MTO) *Inventory Manual for Municipal Roads* from 1991. (*Inventory Manual or IM*). The ratings are either a standalone value or incorporated into calculations performed by the software. The ratings or calculations then classify the road section as a 'NOW', '1 to 5', or '6 to 10' year need for maintenance, rehabilitation or reconstruction in six critical areas.

## Inventory Manual History

From the 1960's until the mid-1990's, the Ministry of Transportation (MTO) required municipalities to regularly update the condition ratings of their road systems in a number of key areas. The process was originally created by the MTO as a means to distribute conditional funding between municipalities, on an equitable basis. The reports were referred to as a 'Road Need Study' (RNS) and were required in order to receive a conditional grant to subsidize municipal road programs. After the introduction in the 1960's by the MTO, the methodology evolved into the current format by the late 1970's. The most current version of the Inventory Manual is dated 1991, and is the methodology used for this report and supported by WorkTech Asset Manager Foundation Software. The practice was discontinued by a number of municipalities when conditional funding for roads was eliminated in the mid 1990's.

## Inventory Manual Overview

The Inventory Manual Methodology is a sound, consistent, asset management practice that still works well today, and in view of the increasing demands on efficiency and asset management, represents a sound road asset inventorying and management system. Road system reviews should be repeated on a cyclical basis. The road section review identifies the condition of each road asset by its time of need and recommended rehabilitation treatment.




In addition to condition ratings, the Inventory Manual also provides guidance in terms of data fields that should be included in a road system database in order to make comprehensive decisions with respect to improvements. There is more to an improvement recommendation than just condition.

To put terminology in a more current context, the past Road Needs Study is now *'The State of the Infrastructure Report (SotI)'.* The SotI analyzes and summarizes the road system survey data collected (or provided) and provides an overview of the overall condition of the road system by road section, including such factors as structural adequacy, drainage, and surface condition. The study also provides an indication of apparent deficiencies in horizontal, and vertical alignment elements, as per the Ministry of Transportation's manual, "Geometric Design Standards for Ontario Highways".

The report provides an overview of the physical and financial needs of the road system, which may be used for programming and budgeting. However, once a road section reaches the project design stage, further detailed review, investigation, and design will be required to address the specific requirements of the project.

# Asset Condition Rating Methodology
# The Inventory Manual for Municipal Roads

Asset Management by its' very nature is holistic. Managing a road network based solely on pavement condition would be critically deficient in scope in terms of the information required to make an informed decision as to the improvements required on a road section.

The *Inventory Manual* offers a holistic review of each road section, developing a Time of Need (TON) or an Adequate rating in six areas that are critical to municipal decision making:

- Geometrics
- Surface Type
- Surface Width
- Capacity
- Structural Adequacy
- Drainage

Evaluations of each road section were completed generally in accordance with the MTO's *Inventory Manual for Municipal Roads* (1991). Data collected was entered directly into WorkTech's Asset Manager Foundation software. Condition ratings, Time of Need, Priority Ratings, and associated costs were then calculated by the software, in accordance with the *Inventory Manual*. Unit costs for construction are typically provided by municipal staff.

Road sections should be reasonably consistent throughout their length, according to roadside environment, surface type, condition, cross section, speed limit, or a combination of these factors. As an example, section changes should occur as surface type, surface condition, cross-section, or speed limit changes.

Field data is obtained through a visual examination of the road system and includes: structural adequacy, level of service, maintenance demand, horizontal and vertical alignment, surface and shoulder width, surface condition, and drainage. The Condition Rating is calculated based upon a combination of other calculations and data.

The Condition Ratings, developed through the scoring in the *Inventory Manual*, classify roads as 'NOW', '1 to 5', or '6 to 10' year needs for reconstruction. **The Time of Need is a prediction of the time until the road requires reconstruction, *not the time frame until action is required***. It is in essence, a prediction model. For example, a road may be categorized as a '6 to 10' year need with a resurfacing recommendation. This road should be resurfaced as soon as possible, to raise the condition, and to further defer the need to reconstruct. Graph 1 provides a graphical explanation.

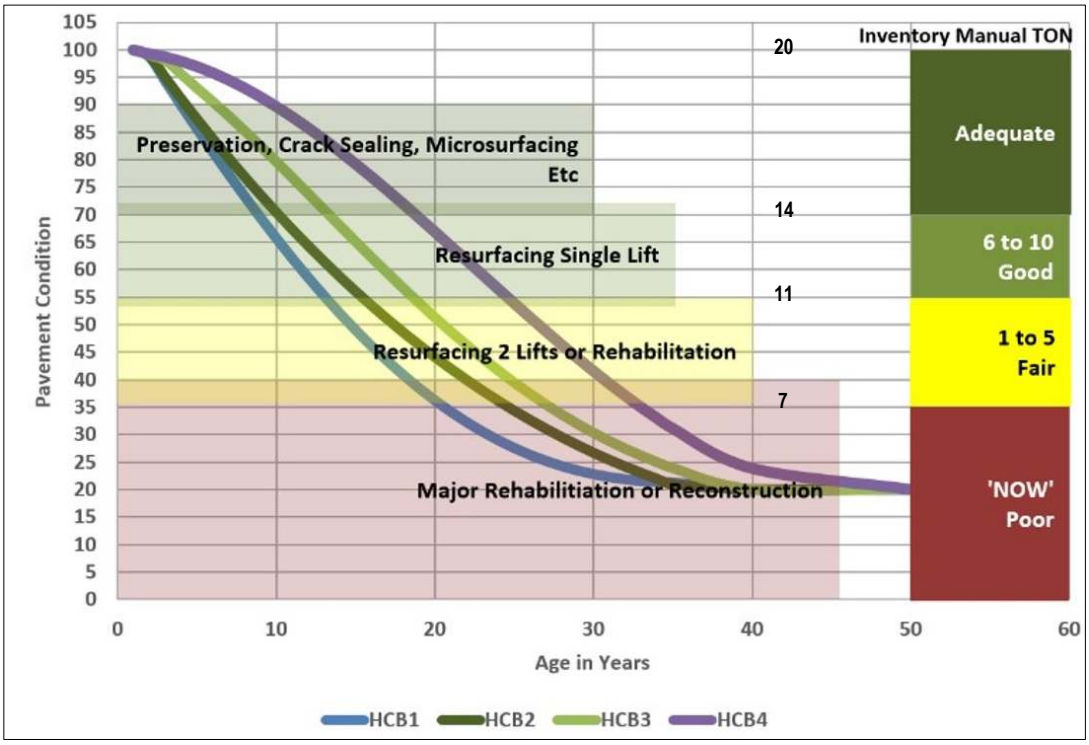
To best utilize the database information and modern asset management concepts, it has to be understood that the Time of Need (TON) ratings are the estimated time before the road would require reconstruction. NOW needs are still roads that require reconstruction; however, it is not intended that '1 to 5' and '6 to 10' year needs are to be acted on in that timeframe for resurfacing recommendations. The '1 to 5' and '6 to 10' year needs are current candidates for resurfacing treatments that will elevate their structural status to 'ADEQ', and offer the greatest return on investment for a road authority (notwithstanding a drainage or capacity need, etc.).

O.Reg 588/17 also requires Level of Service measures for hard topped roads by Pavement Condition Index (PCI). By definition, a PCI is a rating of the road condition between 1 and 100. (ASTM 6433). O.Reg 588/17 is non specific as to the PCI methodology. This is discussed in further detail in Appendix C.

The structural or distress rating in the Inventory Manual has a maximum score of 20, which can be a bit more difficult to relate to than a 1 to 10 or 1 to 100 rating. For the purposes of Graph 1, the Structural Adequacy rating (distress) has been multiplied by 5 to produce a rating on a 1 to 100 scale which may be more readily understood.

When the Structural Adequacy rating is depicted as a 1 to 100 rating, and shown graphically, it is obvious that even given the vintage of the origins of the Inventory Manual (late 1970's), the pavement management concepts of the Ministry of Transportation were well evolved even at that time. Graph 1 is very much in keeping with what are considered to be modern pavement management concepts.

**Graph 1: Time of Need vs. Typical Improvement For Hot Mix Asphalt Surface**




## 'NOW' Needs

***'NOW'*** needs represent the backlog of work required on the road system. A 'NOW' need is not necessarily the highest priority from asset management or return on investment perspectives. Construction improvements identified within this time period are representative of roads that have little or no service life left and are in poor condition. Theoretically a resurfacing strategy is never a 'NOW' need, with the exceptions of a PR1 or PR2 treatment recommendation (Pulverize and resurface one or two lifts of asphalt) and where the surface type is inadequate for the traffic volume.

If a road with an improvement recommendation of "resurface" deteriorates too far, it becomes a 'NOW' construction need. A 'NOW' need rating may be triggered by substandard ratings in any of the Structural Adequacy, Surface Type, Surface Width, Capacity, Drainage, or Geometrics data fields.

These roads would be described as being on 'Poor' condition and exhibit distress over greater than 20% of the surface area of the section.

## '1 to 5' Year Needs

***'1 to 5'*** Identifies road sections where reconstruction is anticipated within the next five years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other deficiencies), thus deferring the need to reconstruct.

These roads would be described as being in 'Fair' condition and exhibit distress over 15% to 20% of the surface area of the section.

## '6 to 10' Year Needs

***'6 to 10'*** Identifies road sections where reconstruction improvements are anticipated within six to ten years, based upon a review of their current condition. These roads can be good candidates for resurfacing treatments that would extend the life of the road (depending on any other deficiencies), thus deferring the need to reconstruct.

These roads would be described as being in 'Good' condition and exhibit distress over 10% to 15% of the surface area of the section.

Needs with a 1 to 5, or 6 to 10 year, 'Time of Need' rating are prime candidates for resurfacing or rehabilitation treatments and should be acted on in the very near future.

The 1 to 5 and 6 to 10 year 'Time of Need' ratings may be misleading without adding some context to the discussion. This is a prediction of the time to when reconstruction would be anticipated, if no action is taken, not the time to act on the current recommendation.

## ADEQ'

An ***'ADEQ'*** rating encompasses a wide range of conditions that include the following:

- Roads with a traffic volume of less than 50 vehicles per day will be deemed adequate, and deficiencies on those roads are to be corrected with the maintenance budgets
- Gravel Roads with a structural adequacy rating that is not a 'NOW' need (more than 25% distress) is adequate; there is no further differentiation by time period
- Roads that do not require improvement other than maintenance and exhibit distress over 0% to 10% of the surface area of the section.

These roads would be described as being in good to excellent condition, with the potential exception the ADEQ rating of roads with less than 50 AADT. Roads with less than 50 AADT may be ADEQ but be in poor condition

## INVENTORY MANUAL TREATMENTS

**Table A.1: Road Improvement Types**

| Inventory Manual Improvements | |
|---|---|
| **Code** | **Description** |
| **R1** | Basic Resurfacing |
| **R2** | Basic Resurfacing – Double Lift |
| **RM** | Major Resurfacing – removes existing asphalt and replace with existing plus and additional lift. |
| **PR1** | Pulverizing and Resurfacing – Single Lift |
| **PR2** | Pulverizing and Resurfacing – Double Lift |
| **BS** | Tolerable standard for lower volume roads: – Rural and Semi-Urban Cross sections only. Improves drainage and adds structure (granular base) and a surface but not to a reconstruct standard. Typically specified where width is to an acceptable standard. |
| **RW** | Resurface and Widen- adds additional lanes and resurfaces the entire road |
| **REC** | Reconstruction |
| **RNS** | Reconstruction Nominal Storm Sewers (Urban: no new sewer, adjust manholes, catch basins, add sub-drain, remove and replace curb and gutter, granular, and hot mix) |
| **RSS** | Reconstruction including Installation of Storm Sewers (New storm sewers, and manholes in addition to the above) |
| **NC** | Proposed Road Construction |
| **SRR** | Storm Sewer Installation and Road Reinstatement |
| **SD** | Spot Drainage |
| **SR** | Spot Road |
| **SI** | Spot Intersection |

| Inventory Manual Improvements | |
|---|---|
| **Code** | **Description** |
| **CO** | Carry Over project |
| **Additional Treatments*** | |
| **CRK** | Crack sealing |
| **CRKsd** | Crack Sealing and Spot Drainage |
| **DST** | Double Surface Treatment. Typically specified where it appears that the gravel road surface is adequate and may be a converted to a hard top surface. |
| **DSTrehab** | Pulverize and existing surface treated road, add 75mm of gravel, double surface treat, and spot drainage improvements. Typically specified where the road appears to be structurally sound but the surface treatment is deteriorated beyond the point where it should not be re surface treated, |
| **DSTrehab2** | In addition to DSTrehab components, base stabilization with magnesium chloride and fog seal over the DST |
| **Fog Seal** | Thin spray of bituminous material over surface treated roads to reduce aggregate loss |
| **GRR** | Gravel road resurfacing 75mm |
| **GRRsd** | Gravel road resurfacing 75mm and spot drainage |
| **GRR2** | Gravel road resurfacing 150mm |
| **GRRsd** | Gravel road resurfacing 150mm and Spot Drainage |
| **MICRO** | Microsurfacing |
| **Slurry** | Slurry Seal |
| **SST** | Single Surface Treatment |
| **SSTsd** | Single Surface Treatment and spot drainage |
| **R2Urehab** | Urban resurfacing with 2 lifts, CB and MH adjustments (Very similar to R2 in an urban environment.) |

***Additional Improvement Types developed by 4 Roads not included in the Inventory Manual***

## Inventory Manual Improvement Types

For each Type of Improvement **(Item 104)**, there are a number of specific road improvements that are included in the total cost relative to the Roadside Environment **(Item 32)** and the Design Class **(Item 105)**. The computer will check a number of Items on the appraisal sheet in order to select the appropriate factors and cross section standards and then calculate the Bench Mark Cost. For example, a Resurfacing and Widening improvement coded under Item 104 is a significantly different road cross section and cost when applied to a rural road vs. an urban arterial. The computer will make all of the necessary checks to arrive at the recommended improvement cost.

Described in the following pages are the road improvements and associated construction activities costed for each Type of Improvement listed under Item 104. Please note, that the Codes **(CO)** – Carry Over, **(SR)** – Spot Road, **(SI)** – Spot Intersection and **(SD)** – Spot Drainage are direct cost inputs and **are not** included in the Bench Mark Cost system.

**(R1) - BASIC RESURFACING**

(Single Lift of Hot Mix – 50 mm)

*Rural and Semi-Urban Roads (Cross Section A)*

(a) Hot mix padding for 20% of area to be resurfaced
(b) Single life of hot mix (50 mm)
(c) Granular material to raise shoulders to new surface grade

*Urban Roads – Granular Base (Cross Section B-1)*
*– Concrete Base (Cross Section C-1)*

(a) Minor base repairs for 10% of area to be resurfaced
(b) Hot mix padding for 20% of area to be resurfaced
(c) Curb removal and replacement on both sides for 50% of section length
(d) Planning 1.0m of existing pavement along both curbs
(e) Adjust manholes and catch basins to new surface grade
(f) Single lift of hot mix (50 mm)

**(R2) - BASIC RESURFACING**

(Double Lift of Hot Mix – 100 mm)

*Rural and Semi-Urban Roads (Cross Section A)*

(a) Hot mix padding for 20% of area to be resurfaced
(b) Double lift of hot mix (100 mm)
(c) Granular materials to raise shoulder to new surface grade

*Urban Roads – Granular Base (Cross Section B-1)*
*– Concrete Base (Cross Section C-1)*

(a) Minor base repairs for 10% of area to be resurfaced
(b) Hot mix padding for 20% of area to be resurfaced
(c) Curb removal and replacement on both sides for 50% of section length
(d) Planning 1.0 m of existing pavement along both curbs
(e) Adjust manholes and catch basins to new surface grade
(f) Double lift of hot mix (100 mm)

**(RM) - MAJOR RESURFACING**

(Double Lift of Hot Mix – 100 mm)

*Urban Roads (Arterials and Collectors) – Granular Base (Cross Section B-1)*
*– Concrete Base (Cross Section C-1)*

(a) Base repairs for 50% of area to be resurfaced
(b) Planning for 50% of area to be resurfaced
(c) Curb removal and replacement on both sides for 50% of section length
(d) Adjust manholes and catch basins to new surface grade
(e) Double lift of hot mix (100 mm)

**(PR1) - PULVERIZING AND RESURFACING**

(Single lift of Hot Mix – 50 mm)

*Rural Roads (Cross Section A)*

(a) Pulverize existing hard top surface
(b) Single lift of hot mix (50 mm)
(c) Granular material to raise shoulders to new surface grade

**(PR2) - PULVERIZING AND RESURFACING (Double Lift of Hot Mix – 100 mm)**

*Rural Roads (Cross Section A)*

(a) Pulverize existing hard top surface
(b) Double lift of hot mix (100 mm)
(c) Granular material to raise shoulders to new surface grade

**(BS) - BASE AND SURFACE**

*Rural Roads – Tolerable Standard (50 to 100 AADT) (Cross Section D)*

(a) Granular material for base
(b) Granular material for loose top surface
(c) Minimal shoulder widening
(d) Minor Ditching

*Rural Roads – Design Standard (200 to 399 AADT) (Cross Section D)*

(a) Placing granular material
(b) Minimal shoulder widening
(c) Double surface treatment
(d) Minor ditching

*Rural Roads – Design Standard (400 plus AADT) (Cross Section D) and Semi-Urban Roads – Design Standard (Cross Section D)*

(a) Placing granular material
(b) Minimal shoulder widening
(c) Hot mix (50/100 mm, see table F-1)
(d) Minor ditching

**(RW) - RESURFACE AND WIDEN**

*Rural Roads – Tolerable Standard (50 to 199 AADT) (Cross Section E)*

(a) Excavating for widening
(b) Ditching and side culvert replacement
(c) Granular material for widening base
(d) Granular material for loose top surface

*Rural Roads – Design Standard (200 to 399 AADT) (Cross Section E)*

(a) Excavating for widening
(b) Ditching and side culvert replacement
(c) Granular material for widening base
(d) Double surface treatment

*Rural Road – Design Standard (400 plus AADT) (Cross Section E) and Semi-Urban Roads – Design Standard (Cross Section E)*

(a) Excavating for widening
(b) Ditching and side culvert replacement
(c) Granular material for widening base
(d) Base Course of hot mix for widening
(e) Hot mix Padding for 20% of existing surface area
(f) Single life of hot mix (50 mm)

*Urban Roads – Design Standard – Granular Base (Cross Section F)*

(a) Excavating for widening
(b) Curb and Gutter removal
(c) Catch Basin removal
(d) Base repair 10% of existing surface area
(e) Granular material for widening
(f) Place catch basins and leads
(g) New curb and gutter
(h) New sub-drains
(i) Base course of hot mix for widening
(j) Hot mix padding for 20% of existing surface area
(k) Adjust manholes to new surface grade
(l) Single lift of hot mix (50 mm) curb to curb

*Urban Roads – Design Standard – Concrete Base (Cross section G)*

(a) Excavating for widening
(b) Curb and gutter removal
(c) Catch basin removal
(d) Base repair for 10% of existing surface area
(e) Place new catch basins and leads
(f) Granular material for widening
(g) Concrete base for widening
(h) New curb and gutter
(i) New subdrains
(j) Base course of hot mix for widening
(k) Hot mix padding for 20% of existing surface area
(l) Adjust manholes to new surface grade
(m) Single lift of hot mix (50 mm) curb to curb

**(REC) - RECONSTRUCTION (RURAL and SEMI-URBAN)**

*Rural Roads – Design Standard (200 to 399 AADT) (Cross Section H)*

(a) Excavate base material
(b) Ditching and side culvert replacement
(c) Grading
(d) Granular material
(e) Double surface treatment

*Rural Roads – Design Standard (400 plus AADT) Cross Section H*
*and*
*Semi-Urban Roads – Design Standard (Cross Section H)*

(a) Excavate base material
(b) Ditching and side culvert replacement
(c) Grading
(d) Granular material
(e) Hot mix (50/100 mm, see Table F-1)

*Rural and Semi-Urban Roads – Design Standard (Concrete Surface)*
*(Cross Section P)*

(a) Excavate base material
(b) Ditching and side culvert replacement
(c) Grading
(d) Granular Material
(e) Concrete base and surface

**(RNS) - RECONSTRUCTION NOMINAL STORM SEWERS (URBAN)**

*Urban Roads – Design Standard – Granular Base (Cross Section I)*

(a) Excavate base material
(b) Curb and gutter removal
(c) Granular base
(d) New curb and gutter
(e) New sub-drains
(f) Adjust manholes and catch basins
(g) Hot mix (50/100 mm, see Table F-1)

*Urban Roads – Design Standard – Concrete Base (Cross Section J)*

(a) Excavate base material
(b) Curb and gutter removal
(c) Granular base
(d) Concrete base
(e) New curb and gutter
(f) New sub-drains
(g) Adjust manholes and catch basins
(h) Hot mix (50/100 mm, see Table H-5)

*Urban Roads – Design Standard – Concrete Surface (Cross Section O)*

(a) Excavate base material
(b) Curb and gutter removal
(c) Granular base
(d) Concrete base and surface
(e) New curb and gutter
(f) New sub-drains
(g) Adjust manholes and catch basins

**(RSS) - RECONSTRUCTION INCLUDING INSTALLATION OF STORM SEWERS**

*Urban Roads – Design Standard – Granular Base (Cross Section K)*

(a) Excavate base material
(b) Curb and gutter removal
(c) Storm sewer removal
(d) Manhole and Catch Basin removal including leads
(e) New storm sewers
(f) New manhole and catch basins including leads
(g) New curb and gutter
(h) New sub-drains
(i) Granular base
(j) Hot mix (100/150 mm, see Table F-1

*Urban Roads – Design Standard – Concrete Base (Cross Section L)*

(a) Excavate base material
(b) Curb and gutter removal
(c) Storm sewer removal
(d) Manhole and Catch Basin removal including leads
(e) New storm sewers
(f) New manhole and catch basins including leads
(g) New curb and gutter
(h) New sub-drains
(i) Granular base
(j) Concrete base
(k) Hot mix (50/100 mm, see Table F-1)

*Urban Roads – Design Standard – Concrete Surface (Cross Section Q)*

(a) Excavate base material
(b) Curb and gutter removal
(c) Storm sewer removal
(d) Manhole and Catch Basin removal including leads
(e) New storm sewers
(f) New manhole and catch basins including leads
(g) New curb and gutter
(h) New sub-drains
(i) Granular base
**(j)** Concrete base and surface

**(NC) - PROPOSED ROAD CONSTRUCTION**

*Rural Roads – Design Standard (200 – 399 AADT) (Cross Section H)*

(a) Grading
(b) Ditching and cross culverts
(c) Granular base
(d) Double surface treatment

*Rural Roads – Design Standard (400 plus AADT) (Cross Section H)*

(a) Grading
(b) Ditching and cross culverts
(c) Granular base
(d) Hot mix (50.100 mm, see Table F-1)

*Semi-Urban Roads*

New Construction does not apply to semi-urban roads as there is no existing frontage development.

*Urban Roads – Design Standard – Granular Base (Cross Section K)*

(a) Grading
(b) Storm Sewers
(c) Manholes and catch basins including leads
(d) Curb and gutter
(e) Sub-drains
(f) Granular base
(g) Hot mix (100 mm/150 mm, see Table F-1)

*Urban Roads – Design Standard – Concrete Base (Cross Section L)*

(a) Grading
(b) Storm Sewers
(c) Manholes and catch basins including leads
(d) Curb and gutter
(e) Sub-drains
(f) Granular base
(g) Concrete base
(h) Hot mix (50 mm/100 mm , see Table F-1)

**(SRR) - STORM SEWER INSTALLATION AND ROAD REINSTATEMENT (URBAN AND SEMI-URBAN)**

*Urban and Semi-Urban Roads – Granular Base (Cross Section M)*

(a) Trenching and removal of existing storm sewers
(b) New manholes and adjust catch basin leads
(c) New storm sewer including bedding
(d) Granular materials in trench
(e) Hot mix to restore surface grade (100/150 mm, see Table F-1)

*Urban and Semi-Urban Roads – Concrete Base (Cross Section N)*

(a) Trenching and removal of existing storm sewers
(b) New manholes and adjust catch basin leads
(c) New storm sewers including bedding
(d) Granular material in trench
(e) Concrete base for trenched area
(f) Hot mix to restore surface grade (50/100 mm, See Table F-1)

*Urban and Semi-Urban Roads – Concrete Surface (Cross Section R)*

(a) Trenching and removal of existing storm sewers
(b) New manholes and adjust catch basin leads
(c) New storm sewers including bedding
(d) Granular material in trench
(e) Concrete base and surface for trenched area

**(MICRO) SINGLE LIFT OF MICROSURFACING**

*Urban, Semi-Urban and Rural Roads with a HCB (High Class Bituminous) surface type*

(a) Unit cost per square metre of Microsurfacing

**(SST) SINGLE LIFT OF SURFACE TREATMENT**

*Urban, Semi-Urban and Rural Roads with a LCB (Low Class Bituminous) surface type*

(a) Unit cost per square metre of Single Surface Treatment

**(SSTplus) SINGLE LIFT OF SURFACE TREATMENT, GEOMETRIC CORRECTION DITCHING IMPROVEMENTS**

*Semi-Urban and Rural Roads with a LCB (Low Class Bituminous) surface type*

(a) Unit cost per square metre of Single Surface Treatment
(b) 20% Surface area padding to 50mm to correct geometric deficiencies
(c) Earth Excavation allowance to provide for minor ditch improvements and berm removal

**(DST) DOUBLE LIFT OF SURFACE TREATMENT**

*Urban, Semi-Urban and Rural Roads with a LCB (Low Class Bituminous) surface type*

(a) Unit cost per square metre of Double Surface Treatment

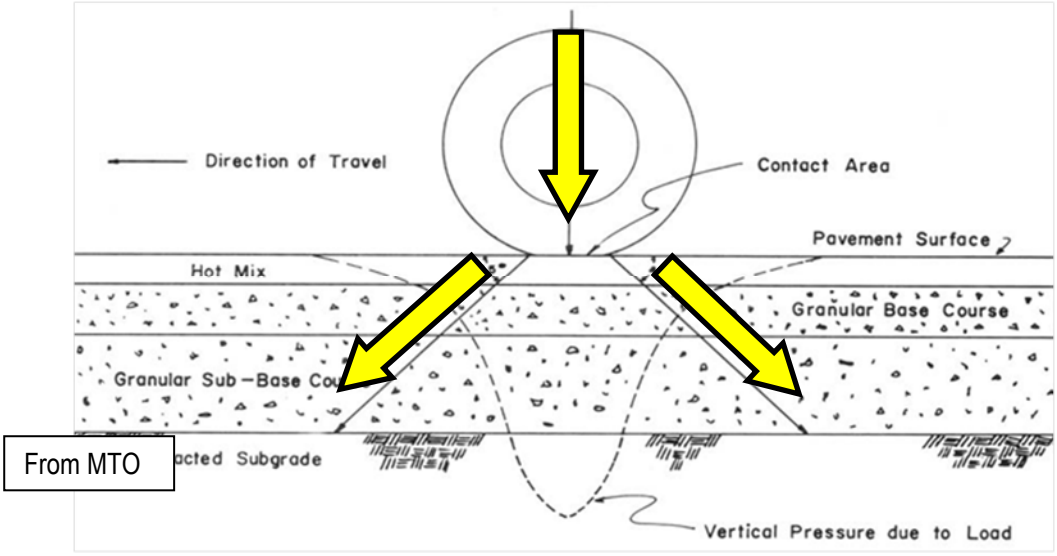
# Appendix B: Pavement Structure and Defects

To assist in understanding the content and methodology and recommendations of the report, the following discussion provides an overview of how flexible and rigid pavement structures are designed and function. The majority of municipal roads would be described as having a flexible pavement structure. Hot mix asphalt, surface treatment, and gravel road surfaces are typical flexible pavement road structures. Other pavement structure types include rigid and composite, and are more typically found on 400 series highways, or on arterial roads of larger urban centres.

## Flexible Pavement Road Structure

Load is applied to the pavement structure, and ultimately to the native sub-grade, via wheel loads of vehicles. The pavement structure between the native sub-grade and the load application point has to be designed such that the load that is transmitted to the sub-grade is not greater than the sub-grade's ability to support the load. The figure below shows a typical flexible pavement structure and how applied load dissipates.

**Figure 1: Load Distribution though Pavement Structure**




From MTO

**Table 1: Stress vs Depth**

| Depth Below Surface | Stress (psi) | Stress (Kpa) |
|---|---|---|
| At Surface | 90 | 620.50 |
| 8" (200 mm) Below | 11 | 75.84 |
| 11" (275 mm) Below | 7 | 48.26 |
| 16" (400 mm) Below | 4 | 27.58 |

If the road structure is insufficient to support the imposed load, then dependent on the sufficiency of the native soil, the soil may deform and migrate into the granular base. The granular base is then contaminated -from a geotechnical perspective- and will have reduced capacity to support load.

Surface materials experience the highest loading at the point of contact with the vehicle's tire. Radial truck tires, running from 110 psi to 120 psi (760 kpa to 830 kpa), can have an impact 20 times higher at the surface, than at the

compacted sub-grade, as shown in the above table. The loading actually occurs in three dimensions, in a conical fashion, dissipating both vertically and horizontally as it passes through the pavement structure. Loading decreases exponentially as it passes through the road structure. Therefore, materials of lesser strength, or lesser quality, may be used deeper in the road structure.

As a rule of thumb, the closer the road building materials are placed to the surface of the road, the higher the quality of the material required. Similarly, the poorer the sub-grade, or native material, the deeper/stronger the road structure has to be to carry the same loads.

Traffic counts, particularly the percentage of trucks, are critical to structural design of the pavement. Pavements are designed based on the estimated number of Equivalent Single Axle Loads (ESAL's) over the design period. One ESAL is 8 tonnes, or 80 kN. Depending upon the source, the effect of a single EASL on the pavement structure can be equivalent of up to 12,000 passenger cars. The effect of farm machinery would be very similar to that of heavy trucks. However, the Highway Traffic Act does permit certain types of farm machinery and equipment to use the roads, even during half load season, so this is an additional consideration when designing road structure and particularly low volume rural roads with farm equipment.

**Figure 2: Structurally Inadequate Low Volume Road**

Pavement evaluation involves a review of each road section and an assessment of the type and extent of the distress(es) observed. Treatment recommendations are predicated by whether the cause of the major distress(es) is structural or non-structural, while also considering other factors such as truck count, drainage, pavement width, etc...

Flexible pavements will have age-related distresses and wearing such as thermal cracking and oxidation. These distresses are non-structural; however, once a crack develops and water enters the pavement structure, deterioration will accelerate. Poor construction practices, quality control, or materials may produce other non-structural surface defects, such as segregation and raveling, which will also result in a reduced life expectancy of the surface asphalt.

**Figure 3: Wheelpath Fatigue Cracking**

Fatigue cracking indicates structural failure and can manifest itself in many forms, such as wheel path, alligator, and edge cracking. It can be localized or throughout a road section. When roads that have exhibited fatigue cracking are rehabilitated, there should be particular attention paid to the rehabilitation treatment, to ensure that the upgraded facility has sufficient structure.

## Flexible Pavement Road Structure Design

There are a number of flexible pavement structural design methodologies and associated software. The simplest way to describe structural design may be the Granular Base Equivalency (GBE) Methodology. This GBE methodology is still used in Ontario by a number of agencies, and is frequently used as a cross-check where more sophisticated analysis has been undertaken.

The measurement is unit-less and relates to the structural value of one millimetre of Granular 'A' material. The relationship of the typical road building materials is expressed in either of the two following ways:

- **1 mm of HMA = 2 mm of Granular A = 3 mm of Granular B**

Or

- **HMA = 2, Granular A = 1, Granular B = 0.67**

To gain some perspective on what this means in terms of typical construction activities, the following table indicates a typical subdivision road construction as expressed in GBE.

**Table 2 Granular Base Equivalency**

| Material | Example 1 Depth | Granular Base Equivalency | Example 2 Depth | Granular Base Equivalency |
|---|---|---|---|---|
| Hot Mix Asphalt (HMA) | 100 | 200 | 150 | 300 |
| Granular A | 150 | 150 | 300 | 300 |
| Granular B | 300 | 200 | 0 | 0 |
| **TOTAL GBE** | **550** | **550** | **600** | **600** |

When reconstruction and rehabilitation projects are undertaken, and use of alternate materials and/or road structure is contemplated, the GBE concept is important to bear in mind, as different treatments such as Expanded Asphalt and Cold in Place recycling, also have a structural value. For design purposes, it may be prudent to use a conservative equivalency of 1.5 for these products (although, some sources indicate GBE's of up to 1.8).

As an example, if a 200 mm pavement is replaced with 150 mm of Expanded Asphalt or Cold in Place Recycling, with a 50 mm overlay of Hot Mix asphalt, a pavement structure with a GBE of 400 is replaced by a pavement structure with a GBE of 325; a significant difference. (Using a GBE of 1.5 for the Expanded or Cold in Place.) Premature failure will be the result of an under-designed pavement structure, wasting quality resources and available funding.

The purpose of this example is to illustrate the different structural values that products have. Expanded Asphalt and Cold in Place recycling are both excellent products to rehabilitate pavement structures when used appropriately.

The MTO's *Pavement Design and Rehabilitation Manual Second Edition 2013* is an excellent resource for use in pavement structure design and rehabilitation, and is available from the online MTO Catalog.

## Thin Lift Pavements

Hot mix asphalt mixes are designed in Ontario either by the Marshall Method or the Superpave Method. Through time, this has resulted in a number of commonly used mixes that are typically sorted by size. One of the parameters used to describe that sizing is the Nominal Maximum Aggregate Size (NMAS).

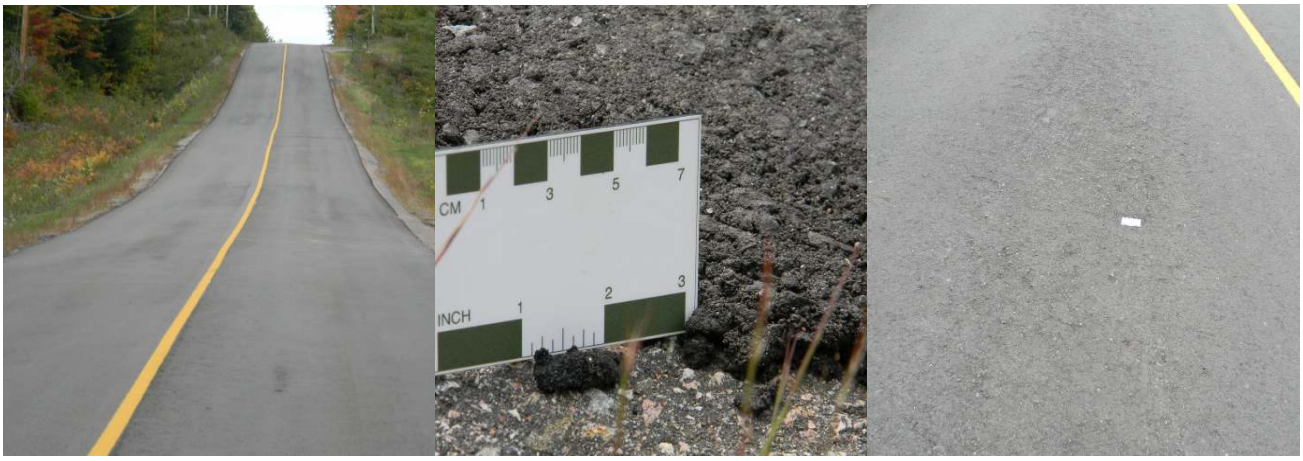
In the Marshall Mix Method, typical mix designations are HL1, HL2, HL3, HL4, and HL8. In the Superpave mix design methodology, mixes are designated by the NMAS. The NMAS is one sieve size larger than the first sieve to retain 10% or more.

The following table identifies the NMAS for the more commonly used mixes, and indicates recommended minimum lift thicknesses for them.

**Table 3: Recommended Minimum Lift Thicknesses**

| Mix Type | NMAS (mm) | Lift Thickness Range (mm) |
|---|---|---|
| SP 9.5 | 9.5 | 30 to 40 |
| SP 12.5 | 12.5 | 40 to 50 |
| SP 19 | 19.0 | 60 to 80 |
| HL3 | 13.2 | 40 to 55 |
| HL4 | 16.0 | 50 to 65 |
| HL8 | 19.0 | 60 to 80 |

**Figure 4: Thin Lift Pavement**




***Thin lift with inappropriate aggregate size***

## Rigid Pavement Structure

Rigid Pavements are constructed of concrete, or concrete with an asphalt wearing surface. The fundamental difference between a flexible pavement and a rigid pavement is the method in which the load is transferred. Whereas the flexible pavement distributes load through the pavement structure in a conical fashion, with a higher point load directly beneath the loading point, the rigid pavement structure distributes that load in a beam-like fashion, more evenly across the pavement structure. Rigid pavements may have an exposed concrete wearing surface, or they may be covered with an asphaltic concrete wearing surface.

The resulting rigid pavement structure is usually thinner overall, when compared to a flexible pavement, designed to accommodate the same traffic loading. This does not necessarily translate into a reduced cost of construction. Any comparison of costs between flexible and rigid pavements should be on a life cycle basis, for the most accurate assessment.

Older concrete pavements were prone to failure at joints, as load transfer caused a slight movement in the concrete slab, and with the intrusion of water, a structural failure. Newer concrete pavements are designed with improved load transfer technology.

**Figure 5 Flexible vs. Rigid Pavement Structure(s)**

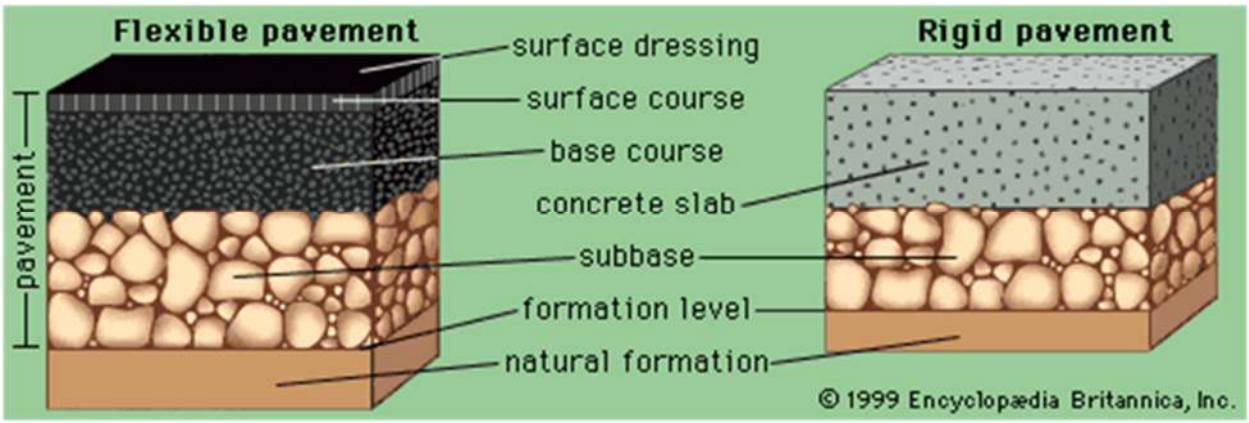
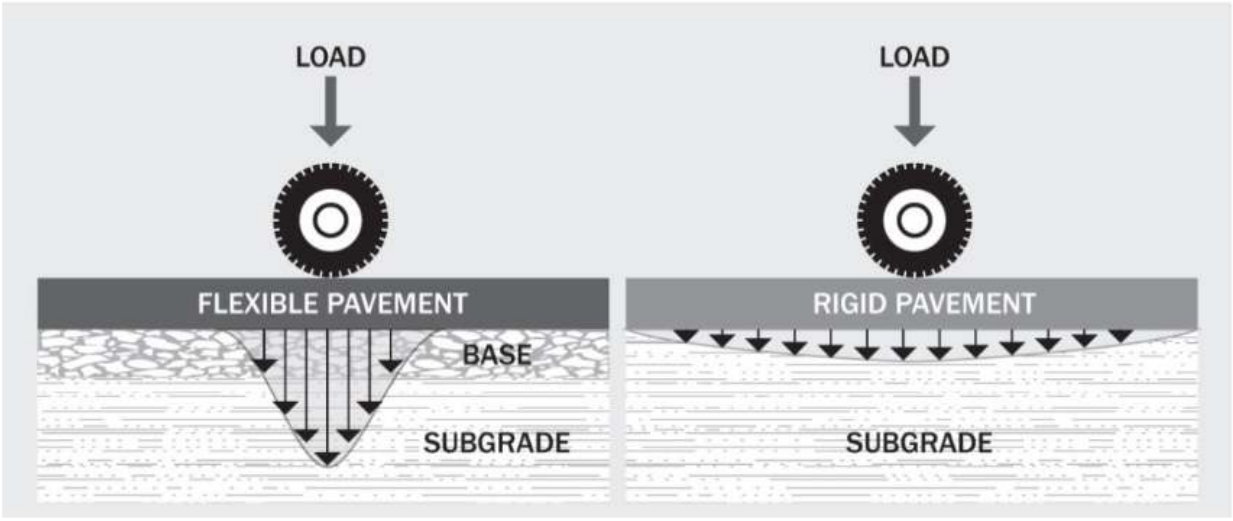



**Figure 6: Flexible vs Rigid Pavement Load Distribution (CTAA Hot Mix Asphalt)**




## Flexible Pavement Distresses and Treatment Selection

Treatment recommendation is dependent upon the condition of the road section at the time of the review.

## Treatment Selection – Critical Area Analysis

When using the Inventory Manual methodology all of the 'holistic' needs are considered in the recommendation. For example, a road may appear to require only a resurfacing, however, when the other critical areas are reviewed, there

may be a capacity problem which would then result in a recommendation to resurface and widen (RW) that would address both the pavement condition and the need for additional lanes.

Another example would be where the pavement is exhibiting some type of distress but there is also poor drainage. The recommendation would then be to reconstruct (REC if rural, RSS if urban).

## Treatment Selection for Non-Structural Rehabilitation

Resurfacing recommendations are predicated upon the type and extent of distress noted. For example, all pavements will develop thermal/transverse cracking as they age. As the age of the pavement increases, the frequency of the cracking increases. If the spacing of the cracks is still greater than 10m, then the R1 – resurface with one lift of asphalt – treatment will typically be sufficient to restore the road as the treatment provides for overlay and base asphalt repair. However, if the frequency of transverse cracking , which may have become transverse alligator cracking if left unattended too long, then the recommendation will be more extensive, such as a PR2- Pulverize and resurface with 2 lifts of asphalt.  The following illustrates transverse cracking.

**Figure 7: Transverse /Thermal Cracking (Non Structural)**

## Reflective Cracking

Paving over an active crack(s) will result in a crack(s) in the same location within 2 to 3 years. As a rule of thumb, the crack will migrate through at approximately 25mm per year. Therefore it would be anticipated that if a 50mm overlay is placed, then the cracking would reappear in approximately 2 years. This is not an efficient usage of available funding.

**Figure 8: Reflective Transverse Cracking on Newer Pavement**

## Treatment Selection for Structural Rehabilitation

Road sections exhibiting structural failure such as fatigue cracking require a more extensive rehabilitation to restore the performance of the road section. In simple terms, placing a single lift of asphalt over structurally failed asphalt will guarantee the same failure in a very short time period. Unless the single lift overlay is placed knowingly as a holding strategy, it should be avoided on structurally deficient pavements. For pavements that have failed structurally or have too frequent transverse cracking, the recommendation is typically PR2 as a minimum provided the drainage is adequate or requires only minor improvement.

**Figure 9: Overlay on Failed Pavement and Resultant Reflective Cracking**

The above figures illustrate a pavement that has failed both structurally and has very frequent severe transverse cracks. Placement of a 50mm overlay over this type of pavement condition will result in rapid failure and is not recommended, other than if a holding treatment is absolutely necessary. The figure above and to the right illustrates a newer pavement that already has very frequent transverse cracks appearing, likely the result of paving over a failed pavement. Under normal circumstances, the first transverse / thermal cracks generally appear in approximately 4 to 6 years and the cracks are 40m to 50m or more apart. Reflective cracking is dependent on overlay thickness. As a rule of thumb, the cracks will reappear on the surface at approximately 25mm/year. A 50mm overly over a cracked surface will should the underlying defects in approximately 2 years.

# Appendix C: Deterioration Curve Detail

# Asset Classes and Deterioration Curves
# Peterborough County Roads

## Asset Classes

In order to utilize the Best Practice and Performance Modeling modules of WorkTech Asset Manager Foundation (WT), assets must be defined by an asset class.

Conventional wisdom has been to define road assets by their functional classes such as Arterial, Collector or Local, and then further differentiate by usage, such as residential or commercial. From a performance modeling perspective, using the functional classification will only work to a point, as the traffic on a functional class can vary significantly between agencies.

Functional classifications also vary dependent on the methodology being utilized. Commonly used classification systems have been developed a number of agencies including the Transportation Association of Canada (TAC) and the Ontario Ministry of Transportation (MTO). Both utilize combinations of roadside environment, functional classifications, and in some cases speed limit.

In Ontario, Regulation 239/02, Minimum Maintenance Standards for Municipal Highways, and Regulation 588/17, Asset Management Planning for Municipal Infrastructure also provide for road asset classifications.

The various classifications all serve a purpose. However, within any given functional classification, such as may be found in O.Reg 239/02, O.Reg 588/17 or the Inventory Manual, roadside environment, surface material, traffic count and commercial traffic counts can vary significantly. Those parameters result in varying performance, replacement and treatment costs.

To develop more accurate pavement performance prediction models, parameters that are common to a group of assets have to be accommodated in the road asset classification (and are not accommodated in the aforementioned regulatory classification methodologies.) The performance/deterioration of a road section is more predictable based on surface type and traffic volume rather than by functional class.

Peterborough County (PC) deterioration follows a similar philosophy. The asphalt surface roads have the same trigger points for improvements, but are differentiated by design/construction standard, surface type, roadside environment and traffic.

Through the development of the 2018 Strategic Asset Management Policy and Asset Management Plan, road asset classifications based on by Surface Type, Traffic Volume and Roadside Environment were developed and enhanced with PC staff input and discussion. The curves have been updated by PC staff since 2018. The 2018 are included at the end of this appendix for reference purposes.

Typically, the traffic range for surface treated surface (LCB) is quite limited. However, road assets with a hot mix asphalt surface (HCB), may have a significant variance in traffic volume and a resultant difference in anticipated performance. As such, road assets with more limited traffic ranges have been differentiated by surface type and roadside environment. For HCB road assets the profiles are subdivided by road side environment, and further subdivided into three traffic ranges.

**Table 1: Road Asset Surface Materials**

| Acronym | Description | Acronym | Description |
|---|---|---|---|
| ETH | Earth | C/M | Cold Mix |
| G/S | Gravel Stone or Other Loose Top | HCB | High Class Bituminous |
| HFL | High Float, similar to LCB | CON | Concrete |
| LCB | Low Class Bituminous (Surface Treatment) | A/C | Asphalt over Concrete |
| ICB | Intermediate Class Bituminous | OTH | Other |

# Asset Classes and Deterioration Curves
# Peterborough County Roads

Table 2 identifies the road asset classes that have been developed for use in WT by the County.

**Table 2: Peterborough County Road Asset Classes**

| Asset Class | Subtype | Material | Roadside Envt | AADT Low | AADT High |
|---|---|---|---|---|---|
| CLA_R_HCB | All | HCB | R | 5,000 | 100,000 |
| CLA_R_HCB | All | HCB | S | 5,000 | 100,000 |
| CLA_U_HCB | All | HCB | U | 5,000 | 100,000 |
| CLB_LCB | All | LCB | All | 1,000 | 10,000 |
| CLB_R_HCB | All | HCB | R | 1,000 | 4,999 |
| CLB_R_HCB | All | HCB | S | 1,000 | 4,999 |
| CLB_U_HCB | All | HCB | U | 1,000 | 4,999 |
| CLC_LCB | All | LCB | All | 1 | 999 |
| CLC_R_HCB | All | HCB | R | 1 | 999 |
| CLC_R_HCB | All | HCB | S | 1 | 999 |
| CLC_U_HCB | All | HCB | U | 1 | 999 |

## Deterioration Curves

Deterioration curves are required for performance modeling. A deterioration curve is the anticipated performance of an asset over time provided that quality is appropriate throughout the life cycle; design, construction, materials and maintenance.

From **ASTM 6433**, Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys;

> *2.1.4 pavement condition index (PCI)—a numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition and 100 being the best possible condition.*
>
> *4.1 The PCI is a numerical indicator that rates the surface condition of the pavement. The PCI provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety). The PCI cannot measure structural capacity nor does it provide direct measurement of skid resistance or roughness. It provides an objective and rational basis for determining maintenance and repair needs and priorities. Continuous monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI provides feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.*

There are many different 'PCI' indices across Ontario and North America. Typically, the PCI methodology varies by surface material, as there are different failure mechanisms for the different surface materials. PCI methodologies rate all distresses- structural or otherwise- with the rater assigning a severity and density for each defect. PCI indices also usually include a ride component which is factored in with the distresses to a varying degree based on methodology used.

The Inventory Manual distress rating is Structural Adequacy (SA). It is a measure of the percentage of the road section that is exhibiting structural distress i.e., fatigue, alligator, wheel path cracking. Other defects including non

structural pavement defects, surface widths, drainage etc are factored into the improvement recommendation by the rater. Ride (Surface Condition in the IM) is not factored into this rating.

Due to the aforementioned differences between the rating methodologies, a direct mathematical conversion would be difficult. Table 3 provides an approximation between the PCI methodology for hot mix asphalt pavements as shown in MTO's Pavement Rehabilitation and Design Manual, Second Edition 2013, and the Inventory Manual for Municipal Roads, 1991. As a further example, PCI ratings from ASTM 6433 Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys tend to align more closely with the Physical Condition ratings (Structural Adequacy time 5)

**Table 3: PCI to Structural Adequacy Approximations**

| PCI Range | SA | Physical Condition (SA * 5) | % Structural Distress - Inventory Manual | Time of Need - Inventory Manual | Descriptor |
|---|---|---|---|---|---|
| 100 | 20 | 100 | <5 | ADEQ | Good |
| 100 | 19 | 95 | 5-9 | ADEQ | Good |
| 95-99 | 18 | 90 | 5-9 | ADEQ | Good |
| 89-95 | 17 | 85 | 5-9 | ADEQ | Good |
| 85-89 | 16 | 80 | 5-9 | ADEQ | Good |
| 86-86 | 15 | 75 | 5-9 | ADEQ | Good |
| 81-85 | 14 | 70 | 10 | 6 to 10 | Good |
| 75-81 | 13 | 65 | 11-14 | 6 to 10 | Good |
| 74-76 | 12 | 60 | 11-14 | 6 to 10 | Good |
| 73-75 | 11 | 55 | 15 | 1 to 5 | Fair |
| 67-73 | 10 | 50 | 16-19 | 1 to 5 | Fair |
| 59-67 | 9 | 45 | 16-19 | 1 to 5 | Fair |
| 55-59 | 8 | 40 | 16-19 | 1 to 5 | Fair |
| 52-55 | 7 | 35 | 20 | NOW | Poor |
| 44-53 | 6 | 30 | 33 | NOW | Poor |
| 36-44 | 5 | 25 | 46 | NOW | Poor |
| 28-36 | 4 | 20 | 59 | NOW | Poor |
| 21-28 | 3 | 15 | 72 | NOW | Poor |
| 18-21 | 2 | 10 | 85 | NOW | Poor |
| 10-18 | 1 | 5 | 100 | NOW | Poor |

In WorkTech, Physical Condition is the Structural Adequacy multiplied by 5 to produce a score from 5 to 100; very much a parallel to the PCI and its' inherent usage as identified above.

PC currently uses Ministry of Transportation of Ontario Pavement Condition Index methodologies developed in the mid 1980's; SP021 for Low Class Bituminous Road Surfaces and SP024 for High Class Bituminous Road Surfaces.

When using the Inventory Manual (IM) methodology, Structural Adequacy is a measurement of the percentage of the surface of the road that is exhibiting structural distress. The rater will consider the type of distress as well as the other critical areas (surface width, capacity, geometry, drainage, and surface type) in order to provide a recommendation for an improvement. In the IM, any, or multiple of the critical areas, may produce a Time of Need (TON). The overall

TON of the road section is the worst of all of the TON's. For example, if five of the TON's are ADEQ, and one is NOW, the section is a NOW need.

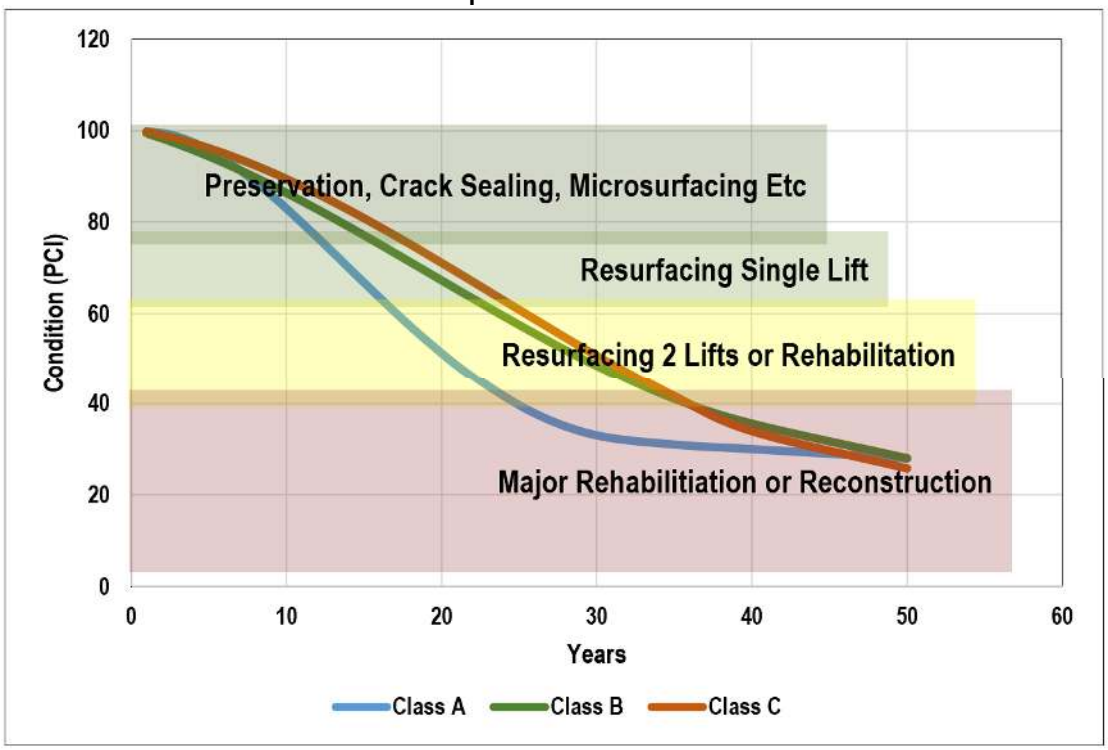
All deterioration curves relate to the 'Physical Condition' data field in WorkTech. The Physical Condition deterioration curve is specific to the Inventory Manual and therefore the trigger points and definition of the curve will be different than other methodologies. It should be noted that different evaluation methodologies will produce varying deterioration curves and trigger points. Familiarity with the rating system being utilized is essential.

It would be possible, but very difficult, to develop performance models around all of the critical areas. So, for the purposes of the performance modeling, Structural Adequacy (distress) has been selected to be the driver in the decisions with respect to the model. This is typical with most performance modeling software.

Models can be configured to weight factors, such as condition, and traffic in project selection to develop a program. From a pure asset management perspective, weighting project selection for best return on investment (ROI) will produce a work plan that most effectively utilizes available funding.

Models may also be configured to select the improvement recommended from the field review or use the deterioration curve based on just the structural rating. Typically, 4 Roads uses the recommended treatment as that should address all of the defects, not just the pavement defects. In the early years of the model, if a project is selected that has a recommended improvement type resultant from the field review, that improvement will be used for the project in the year that it is selected based on the model configuration and available funding. In the later years, presumably after all current deficiencies have been corrected, the model will revert to the assigned asset class for deterioration and project selection based on estimated condition.

**Figure 1: County of Peterborough Pavement Condition Index versus Improvement Selection by Hot Mix Asphalt Asset Class**

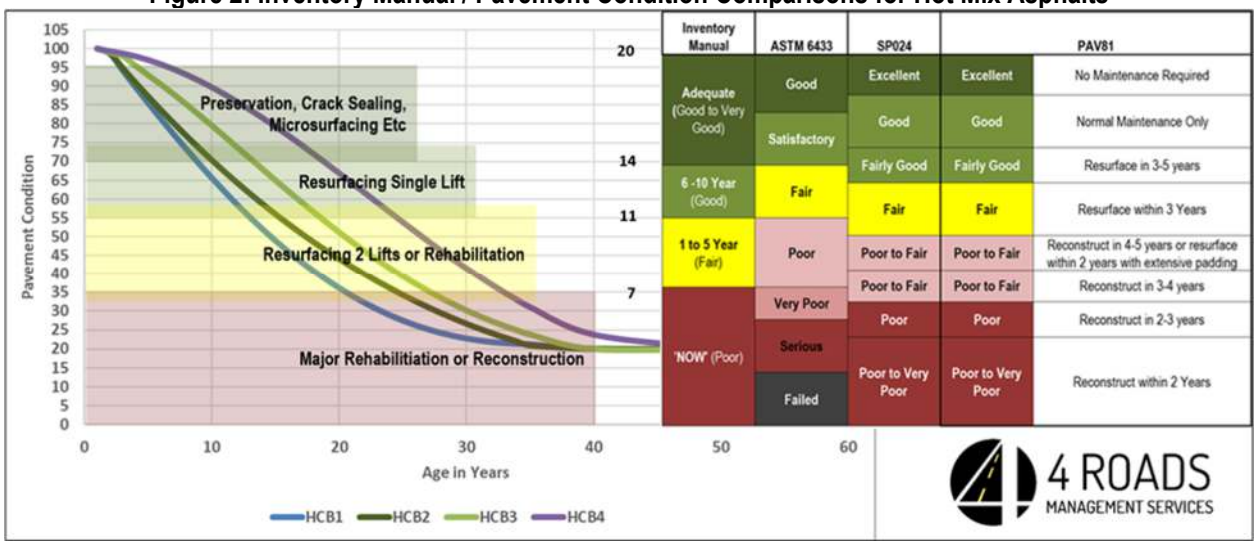



The deterioration curves are the same for each asset class regardless of roadside environment. The difference is the improvement and replacement costs; urban treatments are more expensive. For example, for urban sections, the

replacement improvement is URECONHMA2- Reconstruction with Storm Sewers, rather than RR-HM-CLA2-Reconstruction Rural, used for rural and semi urban cross sections.

In the PC WorkTech database, all deterioration curves relate to the calculated PCI data field in WorkTech. The PCI deterioration curve and trigger points are specific to PC and therefore the trigger points and definition of the curve will be different than other methodologies. It should be noted that different evaluation methodologies will produce varying deterioration curves and trigger points. (See Table 3) Familiarity with the rating system being utilized is essential.

**Figure 2: Inventory Manual / Pavement Condition Comparisons for Hot Mix Asphalts**




***Notes:** Deterioration curves were developed by 4 Roads for HCB Roads using the Inventory Manual Methodology*
*The 'Good', 'Fair', 'Poor' descriptors were taken from the respective rating methodology documents*

**Figure 3:Inventory Manual / Physical Condition Comparison to SP021 (for LCB Roads)**

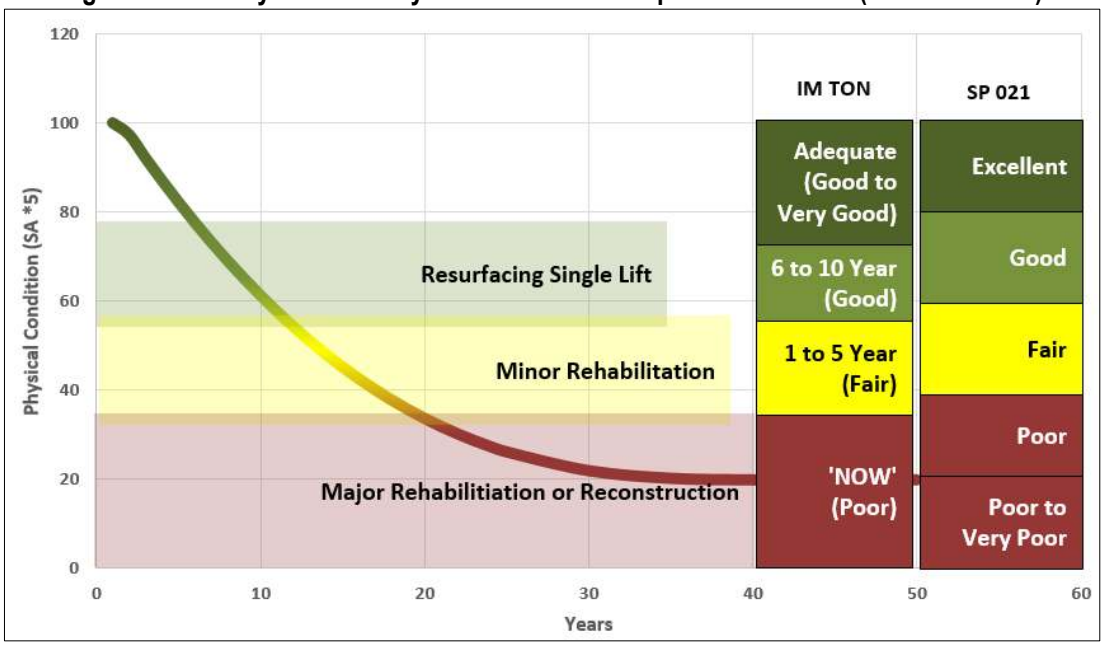
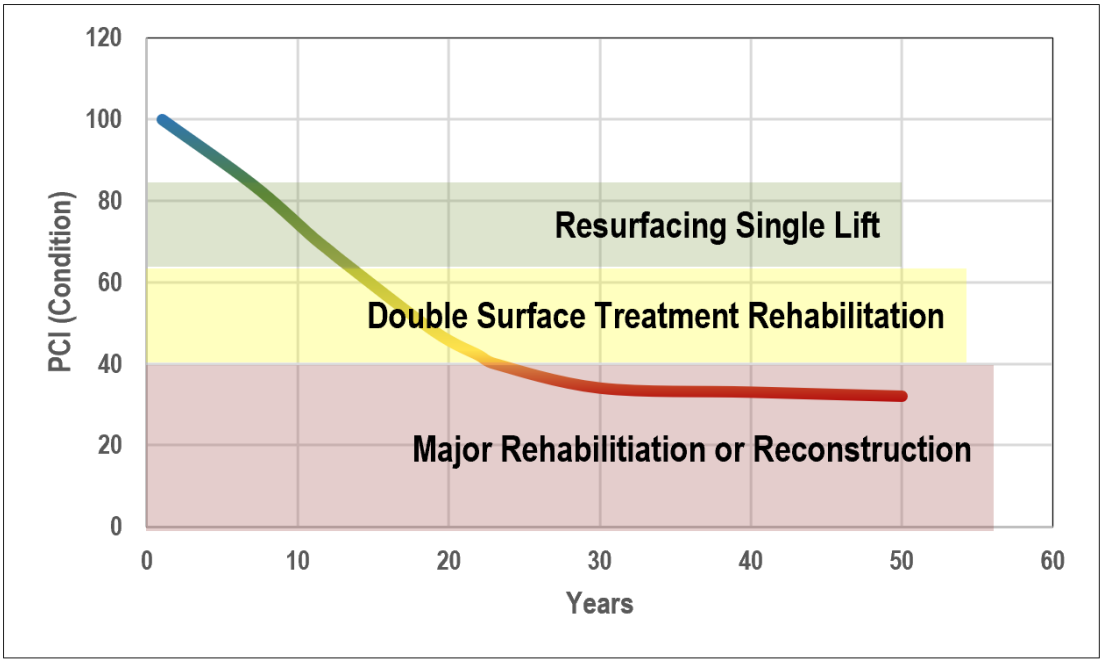


**Figure 4: Peterborough County Deterioration Curve and Treatment for LCB Roads**




## Improvement Types- Effect on the Asset

In WorkTech there is no restriction on what may be developed as an improvement type for a road agency. However, regardless of the improvement types that are used, the effect that the improvement has on the asset, has to be understood and accurately identified in order to use performance modeling.

The following table identifies a number of PC improvement types and further identifies the effect that they have on a road asset. A similar approach may be taken with other assets.

**Table 4: Treatment Effect on the Asset**

| Improvement Type | Description | Effect on the Asset |
|---|---|---|
| NONE | No Action Required | Holds the Condition for 1 Year |
| Crack Sealing- County | Crack Sealing- County | Holds the Condition for 2 years |
| 1MICRO2 | Microsurfacing | Holds the Condition for 4 Years |
| 1MILLO1a2 | Grind and Overlay - Urban | Increases the Condition by 17 |
| 1ROL12 | Rural Overlay - County | Increases the Condition by 17 |
| CIR-U2 | Cold in Place Recycling - Urban | Increases Condition to 97 |
| CIR-R2 | Cold in Place Recycling – Rural 100mm | Increases Condition to 100 |
| 1SST1a | Single Surface Treatment | Increases condition to 95 |
| 1DST+PLV1 | Pulverize and Double Surface Treatment | Increases condition to 97 |
| LCB-REC2 | LCB Full Reconstruct / Replacement Cost | Increases Condition to 100 |
| RR-HM-CLA2 | Class A Roads - Rural - Hot Mix - Recons | Increases Condition to 100 |
| RR-HM-CLB2 | Class B Roads - Rural - Hot Mix - Recons | Increases Condition to 100 |
| URECONHMA2 | Class A Road - Urban - Hot Mix - Reconstruction | Increases Condition to 100 |
| URCONHMBC2 | Class B & C Roads - Urban - Hot Mix Reconstruction | Increases Condition to 100 |

**Table 5: Hot Mix Asphalt Asset Treatment Condition Ranges**

| Condition | Treatment |
|---|---|
| >95 | No Treatment |
| 90 - 95 | Crack Sealing |
| 74-89 | Microsurfacing |
| 64-73 | Hot Mix Resurfacing |
| 41-63 | CIP or Rehabilitation |
| <40 | Major Rehabilitation or Reconstruction |

**Table 6: Surface Treated Asset Treatment Condition Ranges**

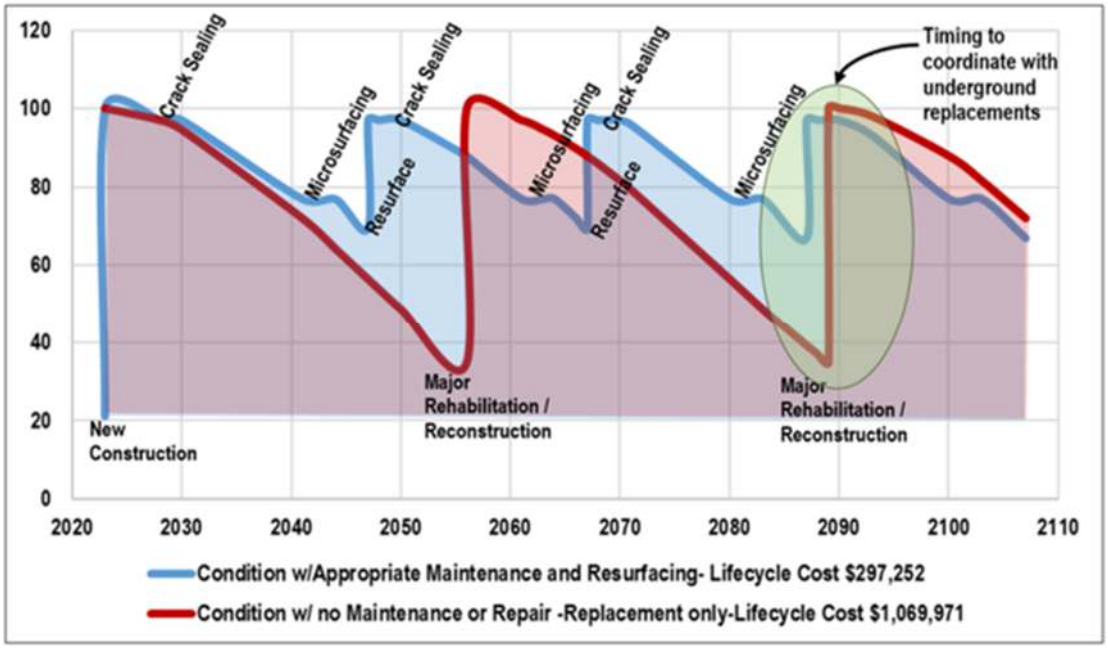
| Condition | Treatment |
|---|---|
| >85 | No Treatment |
| 66 - 86 | Single Surface Treatment |
| 41-65 | Double Surface Treatment Rehab |
| <40 | Major Rehabilitation or Reconstruction |

The effect that a treatment has on an asset is critical to the analysis. Inaccurate determination of the effect of a treatment on an asset will produce an inaccurate – and indefensible- result.

The following figure is a comparison of the deterioration of a road section without any treatment applied versus a road section that has appropriate treatment at the optimal condition, producing a more cost effective life cycle.

**Error! Reference source not found.**Figure 5, shown following, illustrates several different aspects of performance model output including the effect of a treatment on an asset and the effect of multiple treatments undertaken at the optimal asset condition to produce a cost effective management strategy.

**Figure 5: Performance Model – Effect of Treatment on Asset**




## Performance Modeling

O.Reg 588/17 requires the development of an Asset Management Plan that has two primary directives

1. Maintain the Condition of the Asset Group over time
2. Select the lowest cost treatment alternative to maintain the condition of the asset.

To clarify, the lowest cost treatment alternative at the correct condition.

The asset classes, and the deterioration curves are required for the development of a performance model. The additional parameter is the effect of the treatment on the asset. From that, the model runs million of calculations, to select the most effective program to sustain the asset condition, and the asset group condition

WorkTech has three different initial selections for a performance model within the preference section under the Analysis tab. This option only applies to manually set improvements as follows;

- The *'No Change'* selection sets the software to utilize the rater's recommended improvement, and the identified effect on the asset. Once the improvement is completed in the model, the asset condition is restored to the level identified in the improvement type.
- The *'Remove Manual Flag, allow system to deteriorate*' setting ignores the manually set improvement recommendation and deteriorates the system according to the respective deterioration profile.
- The *'Always reset improvement using deterioration profile'* setting uses the deterioration profile to reset the condition after an improvement has been invoked.

Within any given model there are additional variables for duration, objective, budget, and committed projects.

In the early years of the model, if a project is selected that has an identified improvement type, that improvement will be used for the project in the year that it is selected. In the later years, presumably after all current deficiencies have been corrected the model will revert to the assigned asset class for deterioration and project selection based on estimated condition.

## Performance Model Project Selection

From a pure asset/pavement management perspective, 4 Roads believes that project selection based on return on investment of the improvement type will produce a work plan that optimizes available funding. Typically, if the return on investment (ROI) scenario is selected, the preservation and resurfacing activities offer the highest ROI and are prioritized within the work plan model.

Similar calculations are utilized to determine the scenario ROI and the improvement type ROI. The following is excerpted for the WorkTech Manual.

***Scenario Return on Investment***

$$ROI = \frac{(End\ of\ Scenario\ Asset\ Value - Do\ Nothing\ Asset\ Value)}{Total\ Budget\ (all\ years)}$$

***Improvement Type Return on Investment***

$$ROI = \frac{(Value\ if\ Funded - Do\ Nothing\ Value)}{Improvement\ Cost.}$$

*Within any given scenario, weightings may be applied that will affect project selection. Weighting factors may be applied for best condition, worst condition*

***Calculation Methods (from the WorkTech Manual)***

*The calculation Method choice tells the program whether to determine budget needs or, optimize a given budget. Choices are as follows*

- ***Calculate Budget to Maintain Current Average Condition**. The program will determine the budget and work plan to keep the average condition for each service class at the current level. For example, if Arterial Roads are at an average condition of 72, the program will determine what is needed to maintain the average condition of 72.*
- ***Calculate Budget to Produce Desired Average Condition**. The program will determine the budget and work plan required to produce the entered average condition value at the end of the scenario.*

- ***Calculate Results for Entered Budgets***. *You will enter the available budget by year and the program will optimize this based on your spending objective.*

***Spending Objective (from the WorkTech Manual)***

*With any of the above Calculation Methods the program needs to make choices on which improvements to fund. The program will do this based on your spending objective. You have the option of selecting one of several pre-defined objectives or, creating a custom spending priority objective. Options for your spending objective are as follows;*

***Return on Investment*** *The program will prioritize work that results in the highest return on investment.*

$$ROI = \frac{\text{(Asset Value if Work is Funded - Do Nothing Asset Value)}}{\text{Cost of Required Work}}$$

***Needs Savings*** *The program will prioritize work which results in the highest reduction in Needs.*

$$\text{Needs Savings Percent} = \frac{\text{(Current Needs - Next Year Needs if work is Funded)}}{\text{Cost of Required Work}}$$

***Best Condition*** *The program will prioritize assets based on condition value.*

***Lowest Condition*** *The program will prioritize assets based on inverse condition (1 / condition)*

***Custom*** *Displays the Custom Priority Setup Group Box. May be defined by one or more weighting formulas.*

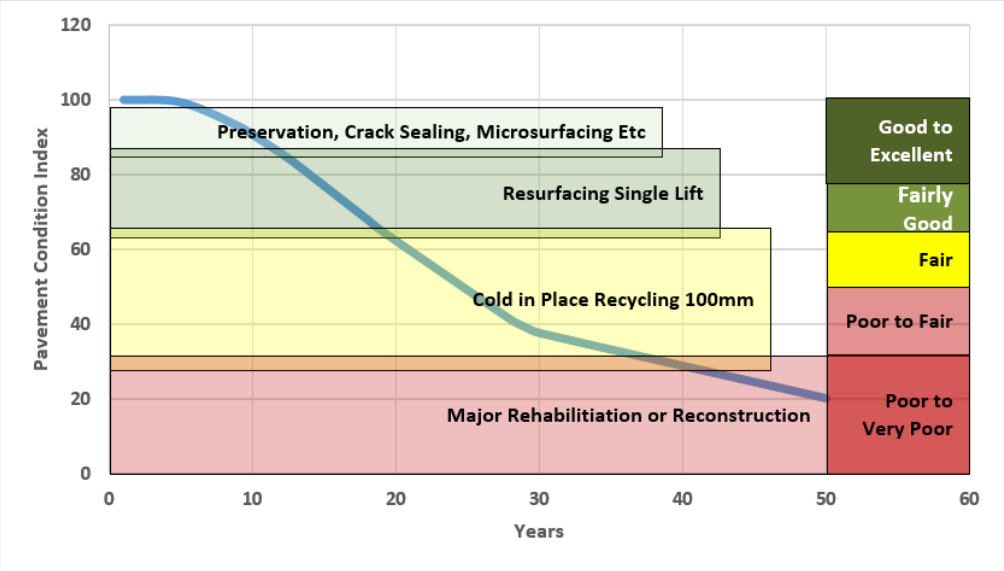
*Weighting types may include ROI, Needs Savings, Inverse Condition, Service Class and AADT or combinations thereof.*

## Historical References

In 2018, PC used the same rating methodology, regardless of surface type. This has been changed subsequent to the 2018 AMP development.

In 2018 PC WorkTech database, deterioration curves for all HCB roads are the same and were differentiated by roadside environment and traffic count. The changes in roadside environment and traffic count, invoke different replacement costs.

**Figure 6: Pavement Condition Index vs. Improvement Selection for Asphalt Surfaced Roads, for Peterborough County Roads Circa 2018**



# Appendix D: Sample Road Section

# MUNICIPAL ROAD APPRAISAL

Run: JAN 26,2022 11:41AM

## A. IDENTIFICATION

Road Name: COUNTY ROAD 1 SMITH WARD
From: COUNTY ROAD 18
To: 2.57km WEST OF COUNTY RD 18 (MICRO LIMIT)
Owner: 66000
☐ Shared?
Shared With:
Owner Share: 100.00
Adjacent Road Section No.:

Road Value: 5,948,579
Special Designation: NSD

Road Section No.: 001-00000
Length: 4.02 km:
Old Section No.:
Local Munic 66623
Patrol: 00000
Ward
Year Assumed: 97

## B. EXISTING CONDITIONS

**Horizontal Alignment**
Substandard Curves:
Substandard S.S.D.:

**Vertical Alignment**
Substandard Grades:
Substandard S.S.D.:

**Right of Way Width**
Existing: 37 m
Desirable: 37 m
Terrain: NR - Non R
Drainage: OD - Open Ditch

Roadside Env.: R
Existing Class: 800
Number of Lanes: 2.00
Surface Type: HCB
Platform Width: 13.50 m
Surface Width: 7.500 m
Median Width:
Shoulder Type: GST
Shoulder Width: 3.00

Curb/Gutter
Left: GST
Right: GST
Sidewalk Width Left: Right:
Boulevard Width Left: Right:
Parking:

Existing Surface Depth: 100
Existing Gran "A" Depth: 150
Existing Gran "B" Depth: 450

## C. TRAFFIC DATA

Legal Speed Limit: 80
Avg. Operating Speed: 80
Traffic Operation: 2W
Route Designations
☐ Bus ☐ Truck Route
☐ School ☐ Bicycle
Load Restrictions: NR

| Traffic Count | | 10 Year Traffic Forecast | |
|---|---|---|---|
| Year: | A-2020-C | Year: | 2030 |
| AADT: | 7,350 | AADT: | 7,497 |
| DHV Factor: | 12.0 % | DHV Factor: | 12.0 % |
| DHV: | 882 vph | DHV: | 899 vph |
| Trucks: | 7.00 % | Trucks: | 7.0 % |
| Peak Directional Split: | % | Capacity: | 1,333 vph |
| 10 Year Growth Factor: | 1.02 | | |

## D. APPROVALS

Date: 2022-01-19 Inspected By: David Anderson Approved By:



Municipality:

**Road Section No.: 001-00000**

**E. ROAD NEEDS**

| Field | Max Points | Rating | Comments |
|---|---|---|---|
| Horiz. Alignment | 10.0 | 10 | |
| Vert. Alignment | 10.0 | 10 | |
| Surface Condition | 10.0 | 6 | |
| Shoulder Width | 10.0 | 10 | |
| Surface Width | 15.0 | 15 | |
| Structural Adequacy | 20.0 | 6 | |
| Drainage | 15.0 | 15 | |
| Maint. Demand | 10.0 | 6 | |
| | 0.0 | 0 | |

**F. FUNCTIONAL NEEDS**

| Field | Existing | Min Tolerable | Time of Need | Comments |
|---|---|---|---|---|
| Structural Adequacy | 6 | 8 | NOW | |
| Geometrics | 80 | 65 | ADEQ | |
| Surface Type | HCB | Hardtop | ADEQ | |
| Surface Width | 7.5 | 6.5 | ADEQ | |
| Capacity | C | E | ADEQ | |
| Drainage | 15 | 8 | ADEQ | |

| Impr.Class | Improvement | Description | Override? | Percent | Time of Need | Year | Base/ Const Cost |
|---|---|---|---|---|---|---|---|
| County | CIR-R2 | Cold in Place Recycling - Rural (100mm) | ☐ Override | 100.00 | NOW | | 1,792,402.49 |
| | | | | | County Subtotal: | | **1,792,402.49** |

G. ENGINEERING RECOMMENDATIONS

Year (Re)Constructed: 1980
Design Class: 800
Design Width: 7.00 m Pvmt:
Design Resurf: 40
Improvement Length: 4.020 km
☐ Set Values Manually?
Time of Need: NOW
Improvement Type: CIR-R2 Cold in Place Recycling - Rural (100mm)

**Ratings**

| | |
|---|---|
| Priority Rating: | 39 |
| Guide Number: | 11 |
| $/Vehicle km: | 0.02 |

H. IMPROVEMENT COSTS

| | |
|---|---|
| Total Base/Construction: | **1,792,402.49** |
| TOTAL: | 1,792,402.49 |
| Owners Share: | 1,792,402.49 |

**L. HISTORY/ GENERAL**

Road Section No.: 001-00000

TSH Inspection

# Appendix E: Upper Tier Road Classification / Road Rationalization Criteria

# A GUIDE FOR COMPLETING COUNTY AND REGIONAL ROAD SYSTEM BY-LAWS


MINISTRY OF TRANSPORTATION AND COMMUNICATIONS

Municipal Roads Office

TRANSPORTATION PROGRAMS DIVISION

July, 1982

## CONTENTS

## FOREWORD

This guide for completing county and regional road system by-laws replaces the manual 'Guide for Completing Regional and County Road System By-laws' dated September, 1973. The revisions included in the Guide are directed towards the 'Plan Method' of formulating by-laws since the majority of county and regional road systems have now been established by this method.

The model formats included also emphasize the Plan Method which is replacing the earlier 'written description' method.

# PART I
# COUNTY AND REGIONAL ROAD SYSTEMS

## INTRODUCTION

The intention of this Manual is to assist Counties and Regional Municipalities in establishing and amending their County or Regional road systems.

Establishing and amending the system requires the approval of the Lieutenant Governor in Council.

Each County or Regional Municipality has been granted the power under the Public Transportation and Highway Improvement Act or their respective Regional Act to establish, maintain, add or remove designated roads from or to their county or regional road system.

The information presented in this Guide is applicable to regional road systems, county road systems and the designating of suburban roads. The model by-laws outlined in Parts II and III of the Guide are presented as typical formats for use by counties and regional municipalities assuming the responsibilities of their road systems. They are of standardized form resulting from many years of experience gained in the course of processing and approving by-laws.

It is hoped that adherence to the model formats will ensure that the wording used in the preparation of by-laws will be appropriate to the facts as they exist in each particular case; the wording has been chosen with care so that it may be used confidently as a formula for subsequent by-laws.

A schedule model is included in Part V of the guide which represents a composite of the Schedule to the Establishing By-law as amended by subsequent amending by-laws.

Information is also given on suburban road designations and revocations.

## COUNTY ROAD SYSTEM BY-LAWS

Each county in the Province has established a county road system under the Public Transportation and Highway Improvement Act or its predecessor, The Act for the Improvement of Public Highways. In each case the original by-law has been amended from time to time by amending by-laws which added roads to, and deleted roads from, the schedule to the original by-law. These amendments have been consolidated from time to time by consolidating by-laws which substituted a new schedule to the original by-law in place of the old, amended schedule.

The descriptions used in the original by-laws establishing a county road system are usually vague, and those in the amending by-laws, especially those prepared in the period from 1902 to about 1920, are also vague and sometimes contradictory. Further, the operative clauses in some original by-laws are sometimes in direct conflict with present-day practices of the county.

The following explanations and instructions are given to guide county officials in the orderly revision of existing by-laws, and in the development of a more appropriate method of identifying the actual county road system and the authority of the county to operate such system.

These by-laws are important legal documents bearing directly on the authority of a County Council to spend money on the county road system, and define the roads on which the county has legal responsibility for repair. Care should be taken in their drafting.

It should be remembered that the purpose of the by-laws is to reflect accurately the county road system as it exists. Whenever the by-laws do not accurately reflect the physical system, it is the by-laws which are imperfect.

Misconceptions arise from time to time because both the Public Transportation and Highway Improvement Act and the Municipal Act deal with county roads, and a proper understanding of the relationship between these two Acts will help to clear up at least some of them. The Municipal Act is the basic legislation which, among other things, defines the powers and duties of municipal corporations with respect to highways and bridges. It was in the Statutes long before the Public Transportation and Highway Improvement Act or its predecessor Acts were enacted, and under it the council of a county could assume a road by passing a by-law assented to by the council of the local municipality within which the road was situated, and thereupon the road became

a county road under the jurisdiction and control of the county council. The county council then became liable for the maintenance and repair of the road and could exercise the various powers conferred by The Municipal Act with respect to it. It could, for instance, after due notice, pass a by-law for widening, altering and diverting the road and, subject to some restrictions in certain cases, for stopping it up altogether and leasing or selling the soil and freehold thereof. It could at any time it saw fit repeal the by-law assuming the road, thereby returning it to the jurisdiction and control of the local municipal council. The power of a county council to assume a road as a county road by by-law passed under The Municipal Act still exists, but it has been superseded by a similar power conferred by the Public Transportation and Highway Improvement Act and today all county roads are part of the county road systems established under the Public Transportation and Highway Improvement Act.

The Public Transportation and Highway Improvement Act provides for the establishment of county roads systems and for the payment of Provincial subsidies on county expenditures made on such systems. The county road systems were established in the early years of the present century by by-laws passed by each county council under authority granted in The Act for The Improvement of Public Highways, later superseded by The Highway Improvement Act. Such by-laws required the approval of the Lieutenant Governor in Council. Throughout the years the county road systems have been greatly expanded by means of amending by-laws likewise approved and have become a very important part of the highway system of the Province.

A road which has been assumed as a county road under the provisions of the Public Transportation and Highway Improvement Act is as much a county road as if it were assumed by by-law passed under the Municipal Act and in general the provisions of that Act apply to it. The county council has the same duty to maintain it and keep it in repair with the added responsibility of doing so in accordance with the requirements of the Minister of Transportation and Communications in order to obtain the Provincial subsidy. The county council has power to pass the by-laws relating to the road which is authorized to pass by The Municipal Act provided such by-laws do not conflict with any provision of The Public Transportation and Highway Improvement Act.

The roads which comprise a county road system established under the Public Transportation and Highway Improvement Act are county roads whether they be in a town, a village or a township and a by-law which assumes a road as part of such a system may not do so subject to any conditions whatsoever. Such a by-law may not, for instance, assume a road and limit the county council's jurisdiction to the central portion 7 metres in width or otherwise. The fact that a county assumes a road in any municipality does not mean that the county council is obliged to undertake works on that road beyond what might be required to construct and maintain it to the recognized standard for a county road in the particular locality, having due regard for the density of traffic and other local conditions. What that standard of construction and maintenance shall be is a matter of policy to be determined by the county council subject to the requirements of the Minister of Transportation and Communications. The Public Transportation and Highway Improvement Act exempts the corporation of a county from the liability for the building, maintaining and repairing of sidewalks on any county road and recognizes the possibility of some obligation on the part of the local municipality in certain instances to assume the cost of widening the right-of-way, the construction of a wider pavement or other special construction and the maintenance and repair thereof by providing for agreements to be entered into with the approval of the Minister in such cases. This is a matter which should be thoroughly understood by the county officials and by the officials of the local municipalities, particularly those of the urban municipalities.

### Establishing By-laws

A new system can be designated by a new establishing by-law.

When the task of determining what alterations have been made to the physical system over the years becomes impossible due to the inaccuracies or vagueness of old descriptions, it is desirable to start afresh by establishing the system and adopting a new plan. In effect, the slate is wiped clean and the road system starts afresh.

A sample by-law for establishing a system and adopting a plan or road improvement and several actual descriptions are shown as Form 1.

### Amending By-laws

It will be noted that the power conferred on a county by Section 44 (5) of The Public Transportation and Highway Improvement Act, R.S.O. 1980, Chpt. 421 is the power to amend the by-law establishing the county road system. Therefore, the enacting para-

graph of any amending by-law should refer to the original by-law which established the system. For clarity it should also refer to the last consolidating by-law and subsequent amending by-laws in the following manner:

> *"The Schedule to By-law Number_____ being the original by-law establishing a county road system in the County of_____ as amended by By-law Number_____, being the last consolidating by-law establishing the said system and further amended by subsequent amending by-laws is hereby amended by adding thereto (by removing therefrom) the roads designated and described as follows:"*

Before adopting the wording of the enacting paragraph suggested above, the original by-law should be examined. Some counties first passed a by-law adopting a plan of county road improvement and later passed another by-law establishing a county road system.

These are complimentary by-laws and both are required to establish the system. Both by-laws should be referred to in the enacting paragraph somewhat as follows:

> *"The Schedule to By-law Number_____ being taken together with and supplementing By-law Number_____, the original by-law establishing a county road system, etc."*

The wording adopted should be appropriate to the facts as they exist in each particular case and should be chosen with care so that the same wording can be used confidently as a formula for all subsequent by-laws.

**Consolidating By-laws**

When the number of amending by-laws make an accurate determination of the existing county road system difficult, it is desirable to consolidate the amendments and the original schedule by passing a consolidating by-law.

It is important to note that a consolidating by-law essentially substitutes a new schedule for the previous schedule to the original by-law establishing the county road system. However, the act of consolidation may also allow for a change in the system at the same time, may it be addition to the system or deletion from it.

In many counties there have been over the years many relatively minor changes made in the physical system by the construction of diversions, and suitable amendments to the schedule to the original by-law have not always been made.

Therefore, before preparing a consolidating by-law, the existing amendments to the current schedule of the original by-law should be assembled and checked for accuracy of description, then the physical system should be examined to determine, if all the changes due to construction have been reflected in suitable changes in the schedule to the original by-law.

When these steps are completed, the necessary revision to the legal system to make it conform adequately to the physical system can be determined.

These revisions should be made by including them in the consolidating by-law, may it be addition, deletion or both to the county road system, as the case may be. In case the consolidating by-law does not change the system (i.e. no addition or deletion of road is made), this should be reflected in the text of the by-law. The consolidating by-law may be passed to repeal the existing schedule of the establishing by-law and its amendments and to substitute a new schedule in its place. This new schedule should, of course, accurately describe all the roads in the county road system. While the additions and deletions relative to the system by the consolidating by-law do not have to be listed as such in the by-law, it is advisable to list them in an accompanying letter to assist the reviewers of the by-law who review the changes.

**Written Method of Description**

Historically, the roads affected by the establishing by-law and the various amending by-laws have been described in words. Prior to 1949, almost any style of description was accepted, and this produced many problems because most descriptions were incomplete or vague. In 1949, a memorandum establishing a formula for such descriptions was sent to all counties and, since then, the Ministry has been very strict as to the style of such descriptions.

**Plan Method of Description**

To simplify the task of preparing by-laws and to allow for a much greater precision in the designation of what roads or portions of roads actually constitute the county road system the Ministry encourages the use of by-laws affecting county road systems which employ a plan method of illustrating what road or portion of road is referred to in the by-law.

Model by-laws designed for use with the plan method for the various types of by-laws discussed previously are shown as:

**Form 1 – Establishing By-law (Plan Method)**

Form 2 – Assumption By-law (Plan Method)

Form 3 – Reversion By-law (Plan Method)

Form 4 – Reversion and Assumption By-law (Plan Method)

Form 5 – Consolidation By–law including Reversion and Assumption (Plan Method)

Because of the problem of dealing with a county road system partly described in words and partly illustrated by plans, the Ministry requires that counties wishing to adopt the plan method observe the following steps.

1. Prepare plans illustrating the location of the roads to be included in the county system, generally to a scale of 1:50,000, on a standard A2 metric size. This will allow for a photographic reduction to a convenient A4 size, and such reductions can be attached to the copies of by-laws provided by the county clerk for use as evidence in courts and for other legal requirements. A separate plan, one or more, will be required for each road.

   The Ministry will supply upon request a transparency of a standard sheet. From this transparency prints may be made and these can be used for each plan required. From these, further transparencies may be made as required. It is recommended that at least two transparencies be made, one for the county clerk's file and one for the county engineer's file. White prints may be made in quantity from these transparencies.

   The plans should show the following details at a scale of 1:50,000. (When only small portions of roads are to be illustrated, the scale may be altered to allow for an adequate presentation of the necessary detail.)

   (a) The road being assumed or reverted-by a solid line.
   (b) All intersecting roads-by jurisdiction.
   (c) Streams, railroads and canals-with identifying names.
   (d) The limits of urban municipalities.
   (e) County and township boundaries.
   (f) Lots and concessions.
   (g) A north point and a scale bar.
   (h) Inserts showing the details of and approximate distances to lot lines or municipal limits or boundaries at the points of commencement and termination, and, where the road is not on a road allowance, approximate measurements to lot corners whenever the road leaves, joins or crosses a road allowance or railway right-of-way.
   (i) A key plan to a scale sufficient to locate the road with respect to The King's Highway and large urban centres.

2. Pass a by-law (Form 1) to establish the county road system and adopt a plan of county road improvement.

This will nullify the effects of past actions and also establish a plan method of description that can be maintained at a higher level of accuracy with less effort than the former written method of description allows.

It is particularly important to observe the systematic way changes to the county road system are dealt with by the plan method. Briefly, the by-law establishing the county road system (Form 1) designates as county roads all roads shown on the plans in the schedule which is attached to and forms part of the by-law. The schedule is made up of the plans of the roads forming the county road system. The active clauses of the establishing by-law deal with such things as the designation as a county road and the county road number.

### Amending By-Laws – Plan Method of Description

Where the original establishing by-law has been carefully drafted, the amendments to the county road system become a simple matter of amending the schedule of plans that is part of the establishing by-law. A road is added to the county road system by adding the plan of the road to the schedule. Similarly, a road is removed from the county road system by removing the plan of the road from the schedule of plans.

1. To add roads to the county road system requires that the plans to be added to the schedule be part of the amending by-law (Form 2) since formal identification of the plan to be added is essential.

2. To remove roads from the county road system requires that the plans to be removed from the schedule be identified only by the plan number since the plan number has already been specified in either the establishing by-law or a subsequent amending by-law. Thus the plans of roads removed from the county road system need not form part of the amending by-law (Form 3).

3. Where a change to an existing road is the subject of the amendment, the plan of the existing road is removed from the schedule and

the revised plan of the road is added to the schedule. Only the plan added to the schedule need from part of the amending by-law (Form 4).

**Identifying the Plans by Number**

Each plan of a road in the Plan Method is identified by a number of reference purposes. For reasons of consistency, the same numbering system should be used by all counties and regions for plans in the original schedule or on plans with by-laws which amend that schedule.

1. Numbering Original Plans

For definition, *"original plans"* are those in the schedule of an establishing or consolidating by-law.

The numbering of *"original plans"* is to be *"County Road Plan No. X-Y"*. The significance of the first number is that it also is the county road number. The second number is the sheet number of the total plan for the particular road. For example, suppose it takes three sheets or separate plans to show a particular road to be known as County road 22. The first sheet would be numbered:

*"County Road Plan No. 22-1"*

the second sheet

*"County Road Plan No. 22-2"*

and the third sheet

*"County Road Plan No. 22-3"*

2. Numbering Amending Plans

By definition, *"amending plans"* are those forming part of by-laws to amend the schedule of plans of the establishing or consolidating by-law by adding the plan to the said schedule thus adding the road to the road system.

The numbering of *"amending plans"* is to be:

*"County Road Plan No. X-Y-R-Z"*

The first number is the county road number.

The second number is the sheet number as described above.

The *"R"* indicates that it is a plan revising the original schedule of plans.

The last number represents the last two digits of the year the by-law was passed.

Thus, *"County Road Plan No. 22-3-R-82"* means that it is a plan of part only of County Road 22 because there are at least 2 other sheets to comprise the total plan for County Road 22 and that the particular plan was added to, and thus revised, the schedule of the latest establishing or consolidating by-law by an amending by-law passed in 1982. Also, the addition of a new county road would have a similarly numbered plan for the purpose of indicating the year the by-law passed, that the by-law amended, or revised, the schedule of the latest consolidating or establishing by-law, the number by which the road is designated and the sheet number of the total plan for the road.

**Recording Amendments**

Each amending by-law should record reference numbers of all previous amending by-laws from the date of the last consolidating or re-establishing by-law. This action provides a convenient means of maintaining a complete record of by-laws affecting the designation of county roads.

There is still a need for quick reference to these changes and the effect on the over-all system. To fill this need, we suggest the following:

A County Master Map (1:100,000 scale) attached to, or kept with, the by-law, having a colour code showing the amendments and by-law numbers approving the changes.

i.e.:

| | |
|---|---|
| Yellow-organge | Illustrating the county road system as detailed in the Establishing By-law. |
| Red | Showing roads or portions of roads removed since Establishing By-law was passed – note by-law number by which removal was made. |
| Green | Showing location or portions of roads added since the Establishing By-law was passed – note by-law number by which addition was made. |

**Preliminary Action**

When considering amendments to the County/Regional road system, it is advisable that the municipality undertake the following preliminary review prior to preparing the by-law:

1. Ensure that any additions to the road system meet at least one of the following criteria.

   (1) Connect urban centres of more than 150 persons in 200 hectares or less, to each other and to the King's Highway unless such a service is now provided by the King's Highway.

   (2) Connect the King's Highway to:

   (a) the King's Highway, or
   (b) crossings of the Provincial boundary, or
   (c) major commercial and industrial areas, or
   (d) major institutional complexes such as universities, hospitals, etc.

   (3) Provide service close to consistent major attractors or generators of heavy vehicles such as refineries, steel plants, mines, quarries, commercial gravel pits and saw mills in continuous operation, etc.

   (4) Provide service parallel to and, where justified, on crossings of major barriers to free traffic movement.

   (5) Provide service close to major resort and recreational areas.

   (6) Connect upper-tier road to:

   (a) the King's Highway or its connections under 2 above, or
   (b) crossings of the Provincial boundary, or
   (c) major commercial and industrial areas, or
   (d) major institutional complexes such as universities, hospitals, etc.

   (7) Provide service in urban areas within the cells formed by the King's Highway and its connecting links and the streets selected by the above criteria, provided that the traffic demand existing on the street considered is predominantly for through movement, as follows:

| Population Density Within Cell | Additional Service Required When Spacing of Roads is Greater Than |
|---|---|
| Less than 40 persons per hectare | 2 000 m |
| between 40 and 125 persons per hectare | 1 200 m |
| more than 125 persons per hectare | 900 m |

   (8) Provide service on those roads which are extensions of streets selected by the above criteria in urban areas, to the first intersection where the annual average daily traffic is below 400 vpd, then connect either to an upper-tier road, or to the King's Highway by the shortest route.

   (9) Provide service in rural areas within the cells formed by the King's Highway and the roads selected by the above criteria as follows:

| Population Density Within Cell | Additional Service Required When Spacing of Roads is Greater Than |
|---|---|
| Less than 1 person per $km^2$ | No additional service required |
| More than 1 person per $km^2$ | 20 km |
| More than 4 persons per $km^2$ | 15 km |

| Population Density within Cell | Additional Service Required When Spacing of Roads is Greater Than |
|---|---|
| More than 8 persons per $km^2$ | 10 km |
| More than 16 persons per $km^2$ | 6 km |

Details on the application of the criteria can be found in the Ministry's "Methods Manual – Municipal Road Systems – Needs Measurements".

2. Meet with the Ministry's District Municipal Engineer to discuss the proposed additions and deletions.

By taking these two preliminary steps, the municipality will eliminate many possible problems and will expedite the approval of the by-law.

## REGIONAL ROAD SYSTEM BY-LAWS

Each district, metropolitan or regional municipality has the power to pass by-laws adding roads to or removing roads from the road system and is required to or may pass consolidating by-laws although there are differences in the way the original road systems were established.

A model consolidating by-law (Form 6) and model by-laws to add (Form 7), to remove (Form 8), or to remove and to add (Form 9) roads to the regional road system using the plan method have been developed. The plan method for describing county road systems applies to regional road systems with necessary changes.

## SUBMITTING BY-LAWS FOR THE APPROVAL OF THE LIEUTENANT GOVERNOR IN COUNCIL

All by-laws affecting roads to be included in county or regional road systems require the approval of the Lieutenant Governor in Council. Such by-laws should be submitted to the District Engineer's office for forwarding for approval.

It is recommended that drafts of such by-laws be submitted for screening before being passed. This step avoids delays in obtaining approval of the Lieutenant Governor in Council.

# Appendix F: 10 Year Program from Performance Model

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2023 | 1 | 1 | 003-00000 | COUNTY ROAD 03 N.MONAG./SMITH | KINGS HIGHWAY 07-to-1.1 KM EAST OF KING`S HIGHWAY 7 | 1MICRO2D | $ 86,700 | 65.00 | 65.00 | 4.00 | $ 1,170,647 | $ 1,170,647 | 1.02 |
| 2023 | 1 | 1 | 003-00800 | COUNTY ROAD 03 N.MONAG./SMITH | 1.1KM EAST OF KING`S HIGHWAY 7-to-CITY OF PETERBOROUGH WEST LIMITS | 1MICRO2D | $ 204,000 | 85.00 | 85.00 | 4.00 | $ 3,601,992 | $ 3,601,992 | 2.40 |
| 2023 | 1 | 1 | 005-00000 | COUNTY ROAD 05 N.MONAG./HWY.28 | 0.1km EAST OF KINGS HIGHWAY 7-to-PETERBOROUGH CITY WEST LIMITS | 1MICRO2D | $ 175,100 | 70.00 | 70.00 | 4.00 | $ 3,128,006 | $ 3,128,006 | 2.06 |
| 2023 | 1 | 1 | 010-13370 | COUNTY ROAD 10 CAVAN | MORTON LINE-to-SOUTH LIMIT OF IDA | FDR-R2 | $ 323,335 | 65.00 | 100.00 | | $ 845,859 | $ 1,301,322 | 0.74 |
| 2023 | 1 | 1 | 010-14570 | COUNTY ROAD 10 CAVAN | SOUTH LIMIT OF IDA-to-COUNTY ROAD 09 | FDR-R2 | $ 2,158,481 | 35.00 | 100.00 | | $ 3,040,521 | $ 8,687,204 | 4.94 |
| 2023 | 1 | 1 | 015-00000 | COUNTY ROAD 15 N.MONGHAN | BREALEY DRIVE-to-SCOTTS CORNERS - KINGS HWY 7A | FDR-R2 | $ 1,223,431 | 40.00 | 100.00 | | $ 2,429,519 | $ 6,073,798 | 2.80 |
| 2023 | 1 | 1 | 036-20600 | COUNTY ROAD 36 HARVEY | COUNTY ROAD 507-to-4.55km FROM COUNTY ROAD 507 (LIMIT NEW ASPHALT) | FDR-R2 | $ 2,084,201 | 30.00 | 100.00 | | $ 2,628,856 | $ 8,762,853 | 4.77 |
| 2023 | 1 | 1 | 036-28500 | COUNTY ROAD 36 HARVEY | NOGIES CREEK-to-NORTH LIMITS OF BOBCAYGEON | FDR-R2 | $ 3,381,912 | 30.00 | 30.00 | | $ 4,265,690 | $ 4,265,690 | 7.74 |
| 2023 | 1 | 1 | 050-00000 | COUNTY ROAD 50 BELMONT | KING`S HIGHWAY 7-to-NORTHUMBERLAND COUNTY BDRY | FDR-R2 | $ 1,371,990 | 30.00 | 100.00 | | $ 1,535,493 | $ 5,118,310 | 3.14 |
| 2023 | 1 | 1 | 504-21050 | COUNTY ROAD 504 CHANDOS | ALDA | 1DST2_20 | $ 928,200 | 30.00 | 95.00 | | $ 1,662,991 | $ 5,266,138 | 4.76 |
| | | | | | | | **$ 11,937,350** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2024 | 1 | 1 | 010-19300 | COUNTY ROAD 10 CAVAN | COUNTY ROAD 9 AT MOUNT PLEASANT-to-VICTORIA COUNTY BOUNDARY | 1MICRO2D | $ 201,514 | 69.36 | 69.36 | 4.00 | $ 1,719,813 | $ 1,719,813 | 1.41 |
| 2024 | 1 | 1 | 012-08500 | COUNTY ROAD 12 SMITH | 218m EAST OF LOT 3/4, CON 5-to-THE LOOP | 1MICRO2D | $ 427,323 | 48.00 | 48.00 | 4.00 | $ 1,671,376 | $ 1,671,376 | 2.99 |
| 2024 | 1 | 1 | 018-00000 | COUNTY ROAD 18 SMITH | PETERBORO NORTH CITY LIMITS-to-COUNTY ROAD 19 | 1MICRO2D | $ 14,292 | 66.82 | 66.82 | 4.00 | $ 213,735 | $ 213,735 | 0.10 |
| 2024 | 1 | 1 | 018-00250 | COUNTY ROAD 18 SMITH | COUNTY ROAD 19-to-0.9 km NORTH OF COUNTY ROAD 19 | 1MICRO2D | $ 160,068 | 66.91 | 66.91 | 4.00 | $ 2,735,398 | $ 2,735,398 | 1.12 |
| 2024 | 1 | 1 | 018-01150 | COUNTY ROAD 18 SMITH | 0.9 km NORTH OF COUNTY ROAD 19-to-COUNTY ROAD 1 | 1MICRO2D | $ 105,759 | 66.82 | 66.82 | 4.00 | $ 1,581,640 | $ 1,581,640 | 0.74 |
| 2024 | 1 | 1 | 018-02120 | COUNTY ROAD 18 SMITH | COUNTY ROAD 1-to-BRIDGENORTH SOUTH LIMITS | 1MICRO2D | $ 451,619 | 66.82 | 66.82 | 4.00 | $ 4,580,321 | $ 4,580,321 | 3.16 |
| 2024 | 1 | 1 | 018-06640 | COUNTY ROAD 18 SMITH | COUNTY ROAD 14-to-COUNTY ROAD 20 | 1MICRO2D | $ 260,110 | 42.21 | 42.21 | 4.00 | $ 2,155,302 | $ 2,155,302 | 1.82 |
| 2024 | 1 | 1 | 018-08450 | COUNTY ROAD 18 SMITH | COUNTY ROAD 20-to-COUNTY ROAD 24 | 1MICRO2D | $ 427,323 | 66.82 | 66.82 | 4.00 | $ 4,036,442 | $ 4,036,442 | 2.99 |
| 2024 | 1 | 1 | 018-11430 | COUNTY ROAD 18 SMITH | COUNTY ROAD 24-to-COUNTY ROAD 23 | 1MICRO2D | $ 503,070 | 63.00 | 63.00 | 4.00 | $ 4,480,271 | $ 4,480,271 | 3.52 |
| 2024 | 1 | 1 | 018-14930 | COUNTY ROAD 18 SMITH | COUNTY ROAD 23-to-COUNTY ROAD 29 | 1MICRO2D | $ 110,046 | 76.83 | 76.83 | 4.00 | $ 1,195,206 | $ 1,195,206 | 0.77 |
| 2024 | 1 | 1 | 019-00000 | COUNTY ROAD 19 SMITH | COUNTY ROAD 18-to-1.1km E.TO CITY LIMITS-HYDRO LINE | 1MICRO2D | $ 197,226 | 83.00 | 83.00 | 4.00 | $ 2,172,689 | $ 2,172,689 | 1.38 |
| 2024 | 1 | 1 | 027-01000 | COUNTY ROAD 27 (ACKINSON RD.) | 1.0 km NORTH-to-COUNTY ROAD 12 | 1PR2a | $ 260,000 | 25.00 | 100.00 | | $ 183,708 | $ 734,830 | 0.40 |
| 2024 | 1 | 1 | 031-00000 | COUNTY ROAD 31 OTONABEE | COUNTY ROAD 2-to-NORTH LIMIT HIAWATHA INDIAN RESERV | 1DST2_20 | $ 678,600 | 39.14 | 95.00 | | $ 1,586,214 | $ 3,850,034 | 3.48 |
| 2024 | 1 | 1 | 031-03500 | COUNTY ROAD 31 OTONABEE | NORTH LIMIT HIAWATHA INDIAN RESERV-to-SOUTHERLY 1.8km | 1DST2_20 | $ 390,000 | 39.14 | 95.00 | | $ 911,617 | $ 2,212,663 | 2.00 |
| 2024 | 1 | 1 | 033-06400 | COUNTY ROAD 33 DOURO | COUNTY ROAD 32-to-KINGS HIGHWAY 28 | 1PR2a | $ 877,500 | 29.13 | 100.00 | | $ 590,483 | $ 2,027,061 | 1.35 |
| 2024 | 1 | 1 | 046-10700 | COUNTY ROAD 46 BELMONT/METHUEN | COUNTY ROAD 47-to-DEVIL'S 4 MILE ROAD | 1DST2_20 | $ 1,743,300 | 29.13 | 95.00 | | $ 4,412,305 | $ 14,389,599 | 8.94 |
| 2024 | 1 | 1 | 047-00000 | COUNTY ROAD 47 BELMONT/METHUEN/ | COUNTY ROAD 46-to-COUNTY ROAD 44 | 1DST2_20 | $ 625,950 | 20.00 | 95.00 | | $ 747,647 | $ 3,551,324 | 3.21 |
| 2024 | 1 | 1 | 048-08210 | COUNTY ROAD 48 BELMONT | TWP. RD. BETWEEN CON.4/5 BELMONT-to-FREEMANS CORNERS | 1DST2_20 | $ 423,150 | 43.00 | 95.00 | | $ 1,086,650 | $ 2,400,739 | 2.17 |
| 2024 | 1 | 1 | 054-00000 | COUNTY ROAD 54 (BALMER RD.) NOR | COUNTY ROAD 620-to-EASTERLY 9.1 KM (GRAVEL STARTS) | 1DST2_20 | $ 1,905,150 | 20.00 | 95.00 | | $ 2,275,549 | $ 10,808,859 | 9.77 |
| 2024 | 1 | 1 | 054-09100 | COUNTY ROAD 54 (BALMER RD.) NOR | 9.1 KM (START OF GRAVEL)-to-EASTERLY 1.7 KM (CULS-DE-SAC) | 1DST2_20 | $ 167,700 | 30.00 | 95.00 | | $ 300,456 | $ 951,445 | 0.86 |
| 2024 | 1 | 1 | 503-00000 | COUNTY ROAD 503 GALWAY | 0.2 km E JCT COUNTY ROAD 121-to-PETERBOROUGH/HALIBURTON BOUNDARY | FDR-R2 | $ 571,990 | 34.13 | 100.00 | | $ 1,367,129 | $ 4,005,652 | 2.20 |
| 2024 | 1 | 1 | 503-02200 | COUNTY ROAD 503 GALWAY | 3.9 km E KINMOUNT-CO. RD. 121-to-E JCT PETERBOROUGH/HALIBURTON BDRY | FDR-R2 | $ 907,385 | 29.13 | 100.00 | | $ 1,822,010 | $ 6,254,756 | 3.49 |
| 2024 | 1 | 1 | 001-00000 | COUNTY ROAD 1 SMITH WARD | COUNTY ROAD 18-to-2.57km WEST OF COUNTY RD 18 (MICRO LIMIT) | CIR-R2 | $ 1,349,300 | 29.90 | 100.00 | | $ 2,607,351 | $ 8,720,239 | 4.02 |
| 2024 | 1 | 1 | 010-00000 | COUNTY ROAD 10 CAVAN | PETERBOROUGH COUNTY SOUTH BRDY.-to-ZION LINE | 1DST2_20 | $ 863,850 | 25.00 | 95.00 | | $ 1,289,750 | $ 4,901,049 | 4.43 |
| 2024 | 1 | 1 | 010-04500 | COUNTY ROAD 10 CAVAN | ZION LINE-to-0.5km NORTH OF ZION LINE | 1DST2_20 | $ 204,750 | 30.00 | 95.00 | | $ 366,836 | $ 1,161,648 | 1.05 |
| | | | | | | | **$ 13,826,975** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2025 | 1 | 1 | 002-23640 | COUNTY ROAD 02 OTONABEE | KEENE WEST LIMITS-to- COUNTY ROAD 34 | 1MICRO2D | $ 50,946 | 67.38 | 67.38 | 4.00 | $ 1,405,242 | $ 1,405,242 | 0.76 |
| 2025 | 1 | 1 | 002-24500 | COUNTY RD 2 | COUNTY ROAD 34-to-KEENE EAST LIMITS | 1MICRO2D | $ 26,143 | 61.53 | 61.53 | 4.00 | $ 658,503 | $ 658,503 | 0.39 |
| 2025 | 1 | 1 | 004-17960 | COUNTY ROAD 04 DUMMER | WARSAW WEST LIMITS-to-COUNTY ROAD 38 | 1MILLO1a2 | $ 388,000 | 46.86 | 46.86 | | $ 1,247,328 | $ 1,247,328 | 0.97 |
| 2025 | 1 | 1 | 007-00000 | COUNTY ROAD 07 CAVAN | PETERBOROUGH COUNTY/MANVERS TWP.-to-PETERBOROUGH COUNTY/EMILY TWP. | FDR-R2 | $ 285,110 | 28.26 | 100.00 | | $ 656,700 | $ 2,323,779 | 1.29 |
| 2025 | 1 | 1 | 008-03080 | COUNTY ROAD 08 DOURO/DUMMER | DOURO 4TH LINE-to-COUNTY ROAD 38 | 1DST2_20 | $ 1,357,200 | 20.00 | 95.00 | | $ 1,621,067 | $ 7,700,067 | 6.96 |
| 2025 | 1 | 1 | 009-06300 | COUNTY ROAD 09 N.MONAGHAN | KINGS HIGHWAY 7-to-EASTERLY 2.05KM | 1MICRO2D | $ 136,079 | 77.22 | 77.22 | 4.00 | $ 2,823,781 | $ 2,823,781 | 2.03 |
| 2025 | 1 | 1 | 009-08700 | COUNTY ROAD 09 N.MONAGHAN | 2.05km EAST OF HIGHWAY 7-to-CITY OF PETERBOROUGH WEST | 1MICRO2D | $ 71,056 | 77.22 | 77.22 | 4.00 | $ 2,235,567 | $ 2,235,567 | 1.06 |
| 2025 | 1 | 1 | 011-00000 | COUNTY ROAD 11 N.MONAGHAN | COUNTY ROAD 28-to-LOT 6/7,CON.9 N.MONAGHAN TWP. | 1DST2_20 | $ 674,700 | 20.00 | 95.00 | | $ 805,875 | $ 3,827,907 | 3.46 |
| 2025 | 1 | 1 | 022-00000 | COUNTY ROAD 22 SMITH | N.LIMIT OF CURVE LAKE INDIAN RES.-to-COUNTY ROAD 23 | FDR-R2 | $ 979,099 | 38.26 | 100.00 | | $ 2,871,681 | $ 7,505,701 | 4.43 |
| 2025 | 1 | 1 | 034-07700 | COUNTY ROAD 34 OTONABEE | KEENE NORTH LIMITS-to-COUNTY ROAD 2 | 1MICRO2D | $ 85,133 | 67.38 | 67.38 | 4.00 | $ 2,344,540 | $ 2,344,540 | 1.27 |
| 2025 | 1 | 1 | 040-00000 | COUNTY ROAD 40 NORWOOD | KINGS HIGHWAY 7-to-NORWOOD NORTH LIMITS | 1MICRO2D | $ 55,638 | 77.22 | 77.22 | 4.00 | $ 3,350,631 | $ 3,350,631 | 0.83 |
| 2025 | 1 | 1 | 040-01300 | COUNTY ROAD 40 ASPHODEL | NORWOOD NORTH LIMITS-to-COUNTY ROAD 8 | 1MICRO2D | $ 46,924 | 82.89 | 82.89 | 4.00 | $ 1,020,359 | $ 1,020,359 | 0.70 |
| 2025 | 1 | 1 | 044-07440 | COUNTY ROAD 44 BELMONT | COUNTY ROAD 47-to-3.2km EAST OF COUNTY ROAD 6 | 1DST2_20 | $ 910,650 | 30.00 | 95.00 | | $ 1,631,548 | $ 5,166,568 | 4.67 |
| 2025 | 1 | 1 | 045-00000 | COUNTY ROAD 45 NORWOOD | HIGHWAY 7-to-S.LIMITS OF NORWOOD | 1MICRO2D | $ 71,726 | 67.38 | 67.38 | 4.00 | $ 1,969,096 | $ 1,969,096 | 1.07 |
| 2025 | 1 | 1 | 046-19600 | COUNTY ROAD 46 METHUEN | DEVIL'S 4 MILE ROAD-to-SANDY LAKE ROAD | 1DST2_20 | $ 1,634,100 | 28.26 | 95.00 | | $ 4,012,395 | $ 13,488,237 | 8.38 |
| 2025 | 1 | 1 | 046-40580 | COUNTY ROAD 46 METHUEN/CHANDOS | COUNTY ROAD 504-to-1.6km S OF COUNTY ROAD 504 | 1MICRO2D | $ 124,013 | 87.00 | 87.00 | 4.00 | $ 1,874,358 | $ 1,874,358 | 1.85 |
| 2025 | 1 | 1 | 048-01800 | COUNTY ROAD 48 BELMONT | MARY ST.,HAVELOCK-to-TWP. RD. BETWEEN CON.4/5 BELMONT(MILE OF MEMORIES RD) | 1DST2_20 | $ 1,244,100 | 34.00 | 95.00 | | $ 2,526,163 | $ 7,058,396 | 6.38 |
| 2025 | 1 | 1 | 049-00000 | COUNTY ROAD 49 HARVEY | COUNTY ROAD 36 BOBCAYGEON-to-9.1 km N OF BOBCAYGEON | FDR-R2 | $ 1,931,677 | 33.26 | 100.00 | | $ 5,340,240 | $ 16,056,044 | 8.74 |
| 2025 | 1 | 1 | 049-09100 | COUNTY ROAD 49 GALWAY | 9.1 km N BOBCAYGEON-COUNTY ROAD 36-to-S JCT COUNTY ROAD 121-UNION CREEK | FDR-R2 | $ 1,927,256 | 33.26 | 100.00 | | $ 5,328,020 | $ 16,019,303 | 8.72 |
| 2025 | 1 | 1 | 052-00000 | COUNTY ROAD 52 (JACK'S LAKE | COUNTY ROAD 504-to-JACK'S LAKE (DEAD END) | 1MICRO2D | $ 335,841 | 15.00 | 15.00 | 4.00 | $ 875,166 | $ 875,166 | 5.01 |
| 2025 | 1 | 1 | 121-00000 | COUNTY ROAD 121 GALWAY | COUNTY ROAD 49-to-KINMOUNT-S JCT COUNTY ROAD 503 | FDR-R2 | $ 1,949,358 | 42.09 | 100.00 | | $ 6,819,847 | $ 16,203,010 | 8.82 |
| 2025 | 1 | 1 | 507-14800 | COUNTY ROAD 507 CAVENDISH | BEAVER LAKE ROAD-to-BAKER DRIVE | 1MICRO2D | $ 412,260 | 25.00 | 25.00 | 4.00 | $ 1,790,510 | $ 1,790,510 | 6.15 |
| | | | | | | | **$ 14,697,009** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2026 | 1 | 1 | 004-05500 | COUNTY ROAD 04 DOURO | 100M WEST OF 8TH LINE-to-KINGS HIGHWAY 28 | 1MICRO2D | $ 236,197 | 65.40 | 65.40 | 4.00 | $ 3,642,473 | $ 3,642,473 | 3.02 |
| 2026 | 1 | 1 | 006-26780 | COUNTY ROAD 06 DUMMER/BURLE/METH | COUNTY ROAD 44-to-NEPTHON,LOT13/14,CON.10,METHUEN | FDR-R2 | $ 2,208,369 | 32.39 | 100.00 | | $ 4,069,998 | $ 12,565,600 | 6.84 |
| 2026 | 1 | 1 | 008-10280 | COUNTY ROAD 08 DUMMER | COUNTY ROAD 38-to-COTTESLOE | 1DST2_20 | $ 652,039 | 32.39 | 95.00 | | $ 1,850,540 | $ 5,427,641 | 3.11 |
| 2026 | 1 | 1 | 020-00000 | COUNTY ROAD 20 SMITH | COUNTY ROAD 18-to-1.4 km NORTH OF COUNTY ROAD 18 | 1MICRO2D | $ 122,791 | 56.00 | 56.00 | 4.00 | $ 1,023,880 | $ 1,023,880 | 1.57 |
| 2026 | 1 | 1 | 020-01350 | COUNTY ROAD 20 SMITH | 1.4 km NORTH OF COUNTY ROAD 18-to-CENTRE LINE | 1MICRO2D | $ 211,952 | 44.00 | 44.00 | 4.00 | $ 1,388,621 | $ 1,388,621 | 2.71 |
| 2026 | 1 | 1 | 020-04350 | COUNTY ROAD 20 SMITH | CENTRE LINE-to-COUNTY ROAD 23 | 1MICRO2D | $ 371,502 | 56.00 | 56.00 | 4.00 | $ 3,097,728 | $ 3,097,728 | 4.75 |
| 2026 | 1 | 1 | 020-08990 | COUNTY ROAD 20 SMITH | COUNTY ROAD 23-to-COUNTY ROAD 25 | 1MICRO2D | $ 452,842 | 65.40 | 65.40 | 4.00 | $ 5,983,149 | $ 5,983,149 | 5.79 |
| 2026 | 1 | 1 | 035-02470 | COUNTY ROAD 35 OTONABEE | LOT 16/17 AT ZION-to-KINGS HIGHWAY 7 | FDR-R2 | $ 1,972,680 | 41.04 | 100.00 | | $ 4,606,549 | $ 11,224,534 | 6.11 |
| 2026 | 1 | 1 | 036-25150 | COUNTY ROAD 36 HARVEY | 4.55km FROM COUNTY ROAD 507 (LIMIT NEW ASPHALT)-to-NOGIES CREEK | 1MICRO2D | $ 243,236 | 49.33 | 49.33 | 4.00 | $ 2,818,374 | $ 2,818,374 | 3.11 |
| 2026 | 1 | 1 | 036-28500 | COUNTY ROAD 36 HARVEY | NOGIES CREEK-to-NORTH LIMITS OF BOBCAYGEON | 1MICRO2D | $ 605,353 | 28.26 | 28.26 | 4.00 | $ 4,018,280 | $ 4,018,280 | 7.74 |
| 2026 | 1 | 1 | 038-00000 | COUNTY ROAD 38 ASPHODEL | COUNTY ROAD 2-to-LOT 10/11, ASPHODEL TWP. | 1MICRO2D | $ 238,543 | 59.64 | 59.64 | 4.00 | $ 3,341,678 | $ 3,341,678 | 3.05 |
| 2026 | 1 | 1 | 038-03030 | COUNTY ROAD 38 ASPHODEL | LOT 10/11, ASPHODEL TWP.-to-KINGS HIGHWAY 7 | 1MICRO2D | $ 217,427 | 49.33 | 49.33 | 4.00 | $ 2,519,318 | $ 2,519,318 | 2.78 |
| 2026 | 1 | 1 | 038-05930 | COUNTY ROAD 38 ASPHODEL/DUMMER | KINGS HIGHWAY 7-to-COUNTY ROAD 8 | 1DST2_20 | $ 1,272,628 | 37.40 | 95.00 | | $ 3,650,559 | $ 9,272,811 | 6.07 |
| 2026 | 1 | 1 | 046-27940 | COUNTY ROAD 46 METHUEN | SANDY LAKE ROAD-to-CENTRE OF CON.5,IN LOT 19,METHUEN | 1DST2_20 | $ 903,629 | 41.70 | 95.00 | | $ 3,045,095 | $ 6,937,268 | 4.31 |
| 2026 | 1 | 1 | 048-10810 | COUNTY ROAD 48 BELMONT | FREEMANS CORNERS-to-TWP. RD. NORTH,LOT 2O, CON.2/3 (PRESTON RD.) | 1MICRO2D | $ 415,300 | 56.00 | 56.00 | 4.00 | $ 3,462,934 | $ 3,462,934 | 5.31 |
| 2026 | 1 | 1 | 048-16160 | COUNTY ROAD 48 BELMONT | TWP. RD. NORTH,LOT 2O, CON.2/3-to-2.2km EASTERLY | 1MICRO2D | $ 188,488 | 44.00 | 44.00 | 4.00 | $ 1,234,899 | $ 1,234,899 | 2.41 |
| 2026 | 1 | 1 | 048-18360 | COUNTY ROAD 48 BELMONT | END OF SECTION 48164-to-0.3km EAST,HAMLET OF CORDOVA | 1MICRO2D | $ 18,771 | 86.15 | 86.15 | 4.00 | $ 564,701 | $ 564,701 | 0.24 |
| 2026 | 1 | 1 | 048-18660 | COUNTY ROAD 48 BELMONT | 0.3km EAST,HAMLET OF CORDOVA-to-HASTINGS COUNTY BDRY. | 1MICRO2D | $ 69,608 | 84.00 | 84.00 | 4.00 | $ 870,625 | $ 870,625 | 0.89 |
| 2026 | 1 | 1 | 504-06400 | COUNTY ROAD 504 CHANDOS | 100m WEST OF MCCOY ROAD-to-1.0 km WEST OF COUNTY ROAD 46 | 1DST2_20 | $ 631,073 | 37.43 | 95.00 | | $ 1,312,043 | $ 3,330,058 | 3.01 |
| 2026 | 1 | 1 | 504-18400 | COUNTY ROAD 504 CHANDOS | 2.4 km NORTH OF RENWICK ROAD-to-5.05 km SOUTH OF COUNTY ROAD 620 | 1SST1a | $ 112,710 | 20.00 | 20.00 | 4.00 | $ 514,735 | $ 514,735 | 2.21 |
| 2026 | 1 | 1 | 507-00000 | COUNTY ROAD 507 HARVEY | NORTH JCT COUNTY ROAD 36-to-7.8 km N OF COUNTY ROAD 36 | FDR-R2 | $ 2,460,201 | 25.00 | 100.00 | | $ 3,159,619 | $ 12,638,475 | 7.62 |
| | | | | | | | **$ 13,605,339** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2027 | 1 | 0 | 620-00000 | COUNTY ROAD 620 ASPLEY | KINGS HWY 28-to-COUNTY ROAD 620A | CRK4rds | $ 992 | 79.14 | 79.14 | 2.00 | $ 1,521,140 | $ 1,521,140 | 0.38 |
| 2027 | 1 | 0 | 029-06500 | COUNTY ROAD 29 LAKEFIELD | W.LIMITS OF LAKEFIELD-to-N.LIMITS OF LAKEFIELD | CRK4rds | $ 6,109 | 73.00 | 73.00 | 2.00 | $ 4,865,327 | $ 4,865,327 | 2.34 |
| 2027 | 1 | 0 | 029-05800 | COUNTY ROAD 29 SMITH | 2.4 km NORTH OF COUNTY ROAD 23-to-W.LIMITS OF LAKEFIELD | CRK4rds | $ 2,193 | 73.00 | 73.00 | 2.00 | $ 1,744,591 | $ 1,744,591 | 0.84 |
| 2027 | 1 | 0 | 045-07230 | COUNTY ROAD 45 HASTINGS | RIVER ROAD HASTINGS (OLD ORCHARD R-to-DIVISION ST. HASTINGS | CRK4rds | $ 1,697 | 91.36 | 91.36 | 2.00 | $ 3,138,206 | $ 3,138,206 | 0.65 |
| 2027 | 1 | 0 | 028-00000 | COUNTY ROAD 28 CAVAN | KING`S HWY 115-to-1.5km SOUTH OF HWY 115 | CRK4rds | $ 4,151 | 70.11 | 70.11 | 2.00 | $ 2,590,906 | $ 2,590,906 | 1.59 |
| 2027 | 1 | 0 | 028-07510 | COUNTY ROAD 28 CAVAN | S.LIMITS SOUTH MONAGHAN-to-N.LIMITS OF BAILIEBORO | CRK4rds | $ 5,221 | 73.40 | 73.40 | 2.00 | $ 3,411,934 | $ 3,411,934 | 2.00 |
| 2027 | 1 | 0 | 028-10540 | COUNTY ROAD 28 CAVAN | S.LIMITS OF BAILIEBORO-to-NORTHUMBERLAND COUNTY BDRY | CRK4rds | $ 2,715 | 79.84 | 79.84 | 2.00 | $ 1,929,872 | $ 1,929,872 | 1.04 |
| 2027 | 1 | 0 | 016-00000 | COUNTY ROAD 16 ENNISMORE | COUNTY ROAD 14-to-COUNTY ROAD 17 | CRK4rds | $ 7,779 | 70.11 | 70.11 | 2.00 | $ 4,382,929 | $ 4,382,929 | 2.98 |
| 2027 | 1 | 0 | 504-00500 | COUNTY ROAD 504 ANSTRUTHER | COUNTY ROAD 620A-to-ANSTRUTHER TWP RD L 34-35 | CRK4rds | $ 757 | 73.21 | 73.21 | 2.00 | $ 579,856 | $ 579,856 | 0.29 |
| 2027 | 1 | 0 | 004-02300 | COUNTY ROAD 04 DOURO/OTONABEE | UNIVERSITY ROAD-to-9TH LINE DOURO | CRK4rds | $ 4,699 | 88.77 | 88.77 | 2.00 | $ 3,153,898 | $ 3,153,898 | 1.80 |
| 2027 | 1 | 0 | 504-00000 | COUNTY ROAD 504 ANSTRUTHER | KINGS HWY 28-to-COUNTY ROAD 620A | CRK4rds | $ 1,357 | 79.02 | 79.02 | 2.00 | $ 1,122,257 | $ 1,122,257 | 0.52 |
| 2027 | 1 | 0 | 016-04100 | COUNTY ROAD 16 ENNISMORE | ENNISMORE EAST LIMITS-to-ENNISMORE NORTH LIMITS | CRK4rds | $ 1,827 | 79.14 | 79.14 | 2.00 | $ 1,520,200 | $ 1,520,200 | 0.70 |
| 2027 | 1 | 0 | 030-00000 | COUNTY ROAD 30 BELMONT | HIGHWAY 7-to-SOUTH LIMITS OF HAVELOCK | CRK4rds | $ 2,741 | 79.14 | 79.14 | 2.00 | $ 2,269,537 | $ 2,269,537 | 1.05 |
| 2027 | 1 | 0 | 620A-00000 | COUNTY ROAD 620A ASPLEY | COUNTY ROAD 504-to-COUNTY ROAD 620 | CRK4rds | $ 2,088 | 79.14 | 79.14 | 2.00 | $ 1,729,171 | $ 1,729,171 | 0.80 |
| 2027 | 1 | 0 | 034-08960 | COUNTY ROAD 34 OTONABEE | COUNTY ROAD 2 KEENE-to-0.8 km SOUTH OF COUNTY ROAD 2 | CRK4rds | $ 1,827 | 84.47 | 84.47 | 2.00 | $ 1,635,348 | $ 1,635,348 | 0.70 |
| 2027 | 1 | 0 | 037-14550 | COUNTY ROAD 37 HARVEY | ADAM & EVE ROAD-to-COUNTY ROAD 36 | CRK4rds | $ 2,349 | 91.36 | 91.36 | 2.00 | $ 2,245,694 | $ 2,245,694 | 0.90 |
| 2027 | 1 | 0 | 016-03300 | COUNTY ROAD 16 ENNISMORE | COUNTY ROAD 17-to-END OF SUBURBAN SECTION,LOT 8 (COMMUNITY CENTRE) | CRK4rds | $ 1,906 | 79.14 | 79.14 | 2.00 | $ 1,099,421 | $ 1,099,421 | 0.73 |
| 2027 | 1 | 0 | 016-05100 | COUNTY ROAD 16 ENNISMORE | ENNISMORE NORTH LIMITS-to-N.E.END OF GANNONS NARROWS CAUSEWA | CRK4rds | $ 22,241 | 73.31 | 73.31 | 2.00 | $ 11,251,437 | $ 11,251,437 | 8.52 |
| 2027 | 1 | 0 | 017-00000 | COUNTY ROAD 17 ENNISMORE | COUNTY ROAD 16-to-6.4km N.E.,TO CENTRE LOT 14 | CRK4rds | $ 16,472 | 79.14 | 79.14 | 2.00 | $ 9,173,869 | $ 9,173,869 | 6.31 |
| 2027 | 1 | 0 | 046-05900 | COUNTY ROAD 46 BELMONT | LOTS 15/16,BELMONT TWP.-to-COUNTY ROAD 47 | CRK4rds | $ 9,293 | 73.31 | 73.31 | 2.00 | $ 4,608,142 | $ 4,608,142 | 3.56 |
| 2027 | 1 | 0 | 023-00000 | COUNTY ROAD 23 SMITH | COUNTY ROAD 29-to-COUNTY ROAD 18 | CRK4rds | $ 6,474 | 73.31 | 73.31 | 2.00 | $ 3,158,247 | $ 3,158,247 | 2.48 |
| 2027 | 1 | 0 | 507-12630 | COUNTY ROAD 507 HARVEY | MISSISSAUGA DAM ROAD-to-FIRE ROUTE 160 | CRK4rds | $ 13,105 | 73.31 | 73.31 | 2.00 | $ 6,235,259 | $ 6,235,259 | 5.02 |
| 2027 | 1 | 0 | 039-00000 | COUNTY ROAD 39 (BENSFORT ROAD) O | COUNTY ROAD 2 OTONABEE WARD-to-S. LIMITS OF PETERBOROUGH | CRK4rds | $ 15,924 | 79.14 | 79.14 | 2.00 | $ 8,152,979 | $ 8,152,979 | 6.10 |
| 2027 | 1 | 0 | 004-04000 | COUNTY ROAD 04 DOURO | 9TH LINE DOURO-to-100M WEST OF 8TH LINE | CRK4rds | $ 3,994 | 91.36 | 91.36 | 2.00 | $ 2,577,859 | $ 2,577,859 | 1.53 |
| 2027 | 1 | 0 | 012-00600 | COUNTY ROAD 12 SMITH | LOT 12,CON 1/2,SMITH TWP.-to-LOTS 6/7,CON 1/2,SMITH TWP. | CRK4rds | $ 3,837 | 91.36 | 91.36 | 2.00 | $ 2,419,238 | $ 2,419,238 | 1.47 |
| 2027 | 1 | 0 | 037-13350 | COUNTY ROAD 37 HARVEY | MELODY BAY ROAD-to-ADAM & EVE ROAD | CRK4rds | $ 3,133 | 91.36 | 91.36 | 2.00 | $ 1,834,002 | $ 1,834,002 | 1.20 |
| 2027 | 1 | 0 | 040-02100 | COUNTY ROAD 40 DUMMER | COUNTY ROAD 8-to-LOTS 14/15, CENTRE DUMMER | CRK4rds | $ 22,737 | 91.36 | 91.36 | 2.00 | $ 13,311,799 | $ 13,311,799 | 8.71 |
| 2027 | 1 | 0 | 048-00000 | COUNTY ROAD 48 HAVELOCK | CONCESSION ST. HAVELOCK CO. RD.46-to-QUEBEC ST. HAVELOCK | FDR-U2 | $ 338,513 | 48.31 | 100.00 | | $ 1,199,905 | $ 2,483,761 | 0.47 |
| 2027 | 1 | 0 | 018-05600 | COUNTY ROAD 18 SMITH | BRIDGENORTH SOUTH LIMITS-to-COUNTY ROAD 14 | CIR-U2 | $ 1,066,371 | 29.60 | 100.00 | | $ 1,137,716 | $ 3,843,634 | 1.37 |
| 2027 | 1 | 0 | 004-18830 | COUNTY ROAD 04 DUMMER | COUNTY ROAD 38-to-WARSAW NORTH LIMITS | 1MICRO2D | $ 63,852 | 75.27 | 75.27 | 4.00 | $ 2,158,555 | $ 2,158,555 | 1.05 |
| 2027 | 1 | 1 | 002-00000 | COUNTY ROAD 2 S.MONAGHAN WARD | COUNTY ROAD 28 - BAILEBORO-to-580m EAST OF COUNTY ROAD 28 | 1MILLO1a2 | $ 138,373 | 57.75 | 57.75 | | $ 871,608 | $ 871,608 | 0.55 |
| 2027 | 1 | 1 | 002-17660 | COUNTY ROAD 02 OTONABEE | COUNTY ROAD 35, CON 11/12-to-COUNTY ROAD 31 | 1MICRO2D | $ 125,069 | 79.14 | 79.14 | 4.00 | $ 1,953,088 | $ 1,953,088 | 1.37 |
| 2027 | 1 | 1 | 002-19000 | COUNTY ROAD 02 OTONABEE | COUNTY ROAD 31-to-KEENE WEST LIMITS | 1MICRO2D | $ 433,635 | 79.14 | 79.14 | 4.00 | $ 6,771,655 | $ 6,771,655 | 4.75 |
| 2027 | 1 | 1 | 002-33700 | COUNTY ROAD 02 ASPHODEL | OTONABEE \ ASPHODEL BOUNDARY-to- COUNTY ROAD 38 | 1MICRO2D | $ 152,457 | 57.00 | 57.00 | 4.00 | $ 1,970,718 | $ 1,970,718 | 1.67 |
| 2027 | 1 | 1 | 002-35050 | COUNTY ROAD 02 ASPHODEL | COUNTY ROAD 38-to- VILLAGE OF HASTINGS WEST LIMITS | 1MICRO2D | $ 676,470 | 57.00 | 57.00 | 4.00 | $ 8,533,243 | $ 8,533,243 | 7.41 |
| 2027 | 1 | 1 | 004-19330 | COUNTY ROAD 04 DUMMER | WARSAW NORTH LIMITS-to-COUNTY ROAD 6 | 1MICRO2D | $ 400,770 | 53.33 | 53.33 | 4.00 | $ 2,726,451 | $ 2,726,451 | 4.39 |
| 2027 | 1 | 1 | 006-14700 | COUNTY ROAD 06 DUMMER | HALL'S GLEN, CON 3/4-to-CON.5/6,DUMMER TWP. | 1MICRO2D | $ 327,737 | 63.42 | 63.42 | 4.00 | $ 4,182,614 | $ 4,182,614 | 3.59 |
| 2027 | 1 | 1 | 006-18400 | COUNTY ROAD 06 DUMMER | CON.5/6,DUMMER TWP.-to-COUNTY ROAD 40 | 1MICRO2D | $ 393,466 | 73.31 | 73.31 | 4.00 | $ 5,596,153 | $ 5,596,153 | 4.31 |
| 2027 | 1 | 1 | 008-00000 | COUNTY ROAD 08 DOURO | COUNTY ROAD 4-to-KINGS HIGHWAY 28 | 1PR2a | $ 203,750 | 43.95 | 100.00 | | $ 298,870 | $ 680,023 | 0.41 |
| 2027 | 1 | 1 | 010-05000 | COUNTY ROAD 10 CAVAN | 0.5km NORTH OF ZION LINE-to-COUNTY ROAD 21 | 1MILLO1a2 | $ 123,277 | 73.31 | 73.31 | | $ 616,315 | $ 616,315 | 0.49 |
| 2027 | 1 | 1 | 010-10400 | COUNTY ROAD 10 CAVAN | KINGS HIGHWAY 115-to-KINGS HIGHWAY 7A | 1MICRO2D | $ 105,898 | 79.14 | 79.14 | 4.00 | $ 1,430,870 | $ 1,430,870 | 1.16 |
| 2027 | 1 | 1 | 010-12000 | COUNTY ROAD 10 CAVAN | KINGS HIGHWAY 7A-to-MORTON LINE | 1MICRO2D | $ 124,156 | 73.31 | 73.31 | 4.00 | $ 1,753,296 | $ 1,753,296 | 1.36 |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2027 | 1 | 1 | 020-14760 | COUNTY ROAD 20 SMITH | COUNTY ROAD 25-to-0.35 m NORTH OF COUNTY ROAD 25 | 1DST2_20 | $ 54,256 | 59.00 | 95.00 | | $ 226,740 | $ 365,090 | 0.33 |
| 2027 | 1 | 1 | 021-00000 | COUNTY ROAD 21 CAVAN/MANVERS | KING`S HWY 115-to-CON. 4/5 CAVAN TOWNSHIP | 1MICRO2D | $ 15,520 | 40.17 | 40.17 | 4.00 | $ 108,388 | $ 108,388 | 0.17 |
| 2027 | 1 | 1 | 021-00200 | COUNTY ROAD 21 CAVAN | CON. 4/5 LOT 1,CAVAN-to-MILLBROOK WEST LIMITS AT QUEEN STR MILLBROOK WEST LIMITS AT CAVAN ST.-to-MILLBROOK PEN. | 1MICRO2D | $ 513,058 | 33.80 | 33.80 | 4.00 | $ 2,212,151 | $ 2,212,151 | 5.62 |
| 2027 | 1 | 1 | 021-06400 | COUNTY ROAD 21 CAVAN | ENTRANCE | 1MICRO2D | $ 76,685 | 79.14 | 79.14 | 4.00 | $ 2,991,911 | $ 2,991,911 | 0.84 |
| 2027 | 1 | 1 | 021-07220 | COUNTY ROAD 21 CAVAN | UNION STREET-to-CAVAN STREET | 1MICRO2D | $ 34,691 | 79.14 | 79.14 | 4.00 | $ 1,331,615 | $ 1,331,615 | 0.38 |
| 2027 | 1 | 1 | 021-07660 | COUNTY ROAD 21 MILLBROOK/CAVAN | UNION STREET-to-COUNTY ROAD 10 NORTH | 1MICRO2D | $ 20,997 | 79.14 | 79.14 | 4.00 | $ 547,430 | $ 547,430 | 0.23 |
| 2027 | 1 | 1 | 021-07960 | COUNTY ROAD 21 MILLBOOK/CAVAN | COUNTY ROAD 10 NORTH-to-MILLBROOK EAST LIMITS | 1MICRO2D | $ 62,078 | 57.75 | 57.75 | 4.00 | $ 1,125,096 | $ 1,125,096 | 0.68 |
| 2027 | 1 | 1 | 021-14360 | COUNTY ROAD 21 S. MONAGHAN | COUNTY ROAD 28-to-WALLACE POINT BRIDGE | 1MICRO2D | $ 361,514 | 73.31 | 73.31 | 4.00 | $ 4,732,116 | $ 4,732,116 | 3.96 |
| 2027 | 1 | 1 | 025-00000 | COUNTY ROAD 25 SMITH | COUNTY ROAD 18-to-9TH LINE SMITH | 1DST2_20 | $ 248,261 | 42.00 | 95.00 | | $ 738,564 | $ 1,670,561 | 1.51 |
| 2027 | 1 | 1 | 025-03200 | COUNTY ROAD 25 SMITH | 9TH LINE SMITH-to-TWP. ROAD - KATCHIWANO GOLF CLUB | 1DST2_20 | $ 572,151 | 42.00 | 95.00 | | $ 1,702,120 | $ 3,850,034 | 3.48 |
| 2027 | 1 | 1 | 025-05000 | COUNTY ROAD 25 SMITH | TWP. ROAD KATCHIWANO GOLF CLUB-to-MILLER ROAD | 1DST2_20 | $ 266,346 | 53.33 | 95.00 | | $ 1,006,116 | $ 1,792,257 | 1.62 |
| 2027 | 1 | 1 | 025-06600 | COUNTY ROAD 25 SMITH | MILLER ROAD-to-COUNTY ROAD 20 | 1DST2_20 | $ 314,025 | 46.00 | 95.00 | | $ 1,023,182 | $ 2,113,094 | 1.91 |
| 2027 | 1 | 1 | 036-07400 | COUNTY ROAD 36 HARVEY | DEER BAY REACH ROAD-to-INTERS. CO.RD.23 AND CO.RD.36 | FDR-R2 | $ 2,220,000 | 36.52 | 100.00 | | $ 3,663,026 | $ 10,030,192 | 5.92 |
| 2027 | 1 | 1 | 044-00000 | COUNTY ROAD 44 BELMONT | COUNTY ROAD 46-to-DRAINS PIT ENTRANCE | 1MICRO2D | $ 149,718 | 73.21 | 73.21 | 4.00 | $ 1,896,179 | $ 1,896,179 | 1.64 |
| 2027 | 1 | 1 | 046-33140 | COUNTY ROAD 46 METHUEN | CENTRE OF CON.5,IN LOT 19,METHUEN-to-LOT26, 5.6km SOUTH OF COUNTY RD 50 | 1DST2_20 | $ 861,514 | 30.00 | 95.00 | | $ 1,830,688 | $ 5,797,177 | 5.24 |
| 2027 | 1 | 1 | 507-20940 | COUNTY ROAD 507 CAVENDISH | BAKER DRIVE-to-SALMON LAKE ROAD | 1SST1a | $ 367,200 | 59.00 | 59.00 | 4.00 | $ 4,947,049 | $ 4,947,049 | 7.20 |
| 2027 | 1 | 1 | 507-28180 | COUNTY ROAD 507 CAVENDISH | SALMON LAKE ROAD-to-PETERBOROUGH/HALIBURTON BDRY | 1SST1a | $ 154,020 | 68.00 | 68.00 | 4.00 | $ 2,391,540 | $ 2,391,540 | 3.02 |
| 2027 | 1 | 1 | 620-01110 | COUNTY ROAD 620 CHANDOS | 200 m NORTH OF MAX WILSON ROAD-to-COUNTY ROAD 54 | 1DST2_20 | $ 452,131 | 40.17 | 95.00 | | $ 1,832,206 | $ 4,333,073 | 2.75 |
| 2027 | 1 | 1 | 620-03510 | COUNTY ROAD 620 CHANDOS | CLYDESDALE ROAD-to-200 m NORTH OF MAX WILSON ROAD | 1DST2_20 | $ 411,028 | 36.52 | 95.00 | | $ 1,514,295 | $ 3,939,157 | 2.50 |
| 2027 | 1 | 1 | 620-06410 | COUNTY ROAD 620 CHANDOS | W JCT CLYDESDALE RD-to- 12.1 km W OF E JCT COUNTY ROAD504 | 1DST2_20 | $ 323,890 | 40.60 | 95.00 | | $ 1,332,134 | $ 3,117,062 | 1.97 |
| 2027 | 1 | 1 | 620-08310 | COUNTY ROAD 620 CHANDOS | 1.8 km EAST OF VIC TANNER ROAD-to-CLYDESDALE ROAD | 1DST2_20 | $ 291,008 | 40.17 | 95.00 | | $ 1,184,350 | $ 2,800,928 | 1.77 |
| 2027 | 1 | 1 | 620-12610 | COUNTY ROAD 620 CHANDOS | VIC TANNER ROAD-to-1.8 km EAST OF VIC TANNER ROAD | 1DST2_20 | $ 687,239 | 40.17 | 95.00 | | $ 2,796,940 | $ 6,614,621 | 4.18 |
| 2027 | 1 | 1 | 620-14410 | COUNTY ROAD 620 CHANDOS | E JCT CLYDESDALE ROAD-to- 1.6 km W OF E JCT COUNTY ROAD 504 | 1DST2_20 | $ 721,765 | 32.60 | 95.00 | | $ 2,391,853 | $ 6,970,122 | 4.39 |
| 2027 | 1 | 1 | 620-18810 | COUNTY ROAD 620 CHANDOS | 1.6 km W OF E JCT COUNTY ROAD 504-to- E JCT COUNTY ROAD 504 | 1DST2_20 | $ 254,837 | 36.52 | 95.00 | | $ 874,202 | $ 2,274,075 | 1.55 |
| | | | | | | | **$ 14,275,344** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2028 | 1 | 0 | 015-00000 | COUNTY ROAD 15 N.MONGHAN | BREALEY DRIVE-to-SCOTTS CORNERS - KINGS HWY 7A | CRK4rds | $ 7,309 | 95.74 | 95.74 | 2.00 | $ 5,815,054 | $ 5,815,054 | 2.80 |
| 2028 | 1 | 0 | 036-20600 | COUNTY ROAD 36 HARVEY | COUNTY ROAD 507-to-4.55km FROM COUNTY ROAD 507 (LIMIT NEW ASPHALT) | CRK4rds | $ 12,452 | 94.47 | 94.47 | 2.00 | $ 8,278,267 | $ 8,278,267 | 4.77 |
| 2028 | 1 | 0 | 010-13370 | COUNTY ROAD 10 CAVAN | MORTON LINE-to-SOUTH LIMIT OF IDA | CRK4rds | $ 1,932 | 94.47 | 94.47 | 2.00 | $ 1,229,359 | $ 1,229,359 | 0.74 |
| 2028 | 1 | 0 | 010-14570 | COUNTY ROAD 10 CAVAN | SOUTH LIMIT OF IDA-to-COUNTY ROAD 09 | CRK4rds | $ 12,896 | 94.47 | 94.47 | 2.00 | $ 8,206,802 | $ 8,206,802 | 4.94 |
| 2028 | 1 | 0 | 050-00000 | COUNTY ROAD 50 BELMONT | KING`S HIGHWAY 7-to-NORTHUMBERLAND COUNTY BDRY | CRK4rds | $ 8,197 | 94.47 | 94.47 | 2.00 | $ 4,835,267 | $ 4,835,267 | 3.14 |
| 2028 | 1 | 0 | 042-00000 | COUNTY ROAD 42 ASPHODEL | COUNTY ROAD 45-to-ASPHODEL/SEYMOUR TWP. BDRY | FDR-R2 | $ 2,699,820 | 28.00 | 100.00 | | $ 2,649,063 | $ 9,460,941 | 5.15 |
| 2028 | 1 | 0 | 042-05120 | COUNTY ROAD 42 BELMONT/SEYMOUR | ASPHODEL/SEYMOUR TWP. BDRY.-to-COUNTY ROAD 30 | FDR-R2 | $ 1,619,892 | 28.00 | 100.00 | | $ 1,589,438 | $ 5,676,565 | 3.09 |
| 2028 | 1 | 0 | 504-16000 | COUNTY ROAD 504 CHANDOS | RENWICK ROAD-to-2.4 km NORTH OF RENWICK ROAD | 1DST2_10 | $ 524,070 | 40.00 | 95.00 | | $ 945,622 | $ 2,245,853 | 2.03 |
| 2028 | 1 | 0 | 014-01440 | COUNTY ROAD 14 ENNISMORE | COUNTY ROAD 16-to-PETERBOROUGH/VICTORIA COUNTY BDRY. | FDR-R2 | $ 2,857,091 | 30.65 | 100.00 | | $ 3,068,698 | $ 10,012,064 | 5.45 |
| 2028 | 1 | 0 | 004-17960 | COUNTY ROAD 04 DUMMER | WARSAW WEST LIMITS-to-COUNTY ROAD 38 | FDR-U2 | $ 624,589 | 43.95 | 100.00 | | $ 1,169,869 | $ 2,661,818 | 0.97 |
| 2028 | 1 | 0 | 037-00000 | COUNTY ROAD 37 HARVEY | COUNTY ROAD 16-to-FLYNN'S ROAD | FDR-R2 | $ 3,098,240 | 30.65 | 100.00 | | $ 3,288,910 | $ 10,730,539 | 5.91 |
| 2028 | 1 | 0 | 046-00000 | COUNTY ROAD 46 HAVELOCK | KINGS HIGHWAY 7-to-HAVELOCK NORTH LIMITS | 1MILLO1a2 | $ 935,733 | 71.34 | 88.34 | | $ 8,266,727 | $ 10,236,651 | 2.28 |
| 2028 | 1 | 0 | 004-08800 | COUNTY ROAD 04 DOURO | KINGS HIGHWAY 28-to-ROAD BETWEEN CON.3/4,DOURO TWP. | FDR-R2 | $ 2,238,491 | 35.65 | 100.00 | | $ 2,796,498 | $ 7,844,315 | 4.27 |
| 2028 | 1 | 0 | 507-07800 | COUNTY ROAD 507 HARVEY | FIRE ROUTE 160-to-BEAVER LAKE ROAD | FDR-R2 | $ 1,142,836 | 30.65 | 100.00 | | $ 1,108,222 | $ 3,615,732 | 2.18 |
| 2028 | 1 | 0 | 024-00000 | COUNTY ROAD 24 SMITH | CITY OF PETERBOROUGH NORTH LIMITS-to-TWP. RD. BETWEEN CON.3/4 SMITH TWP | FDR-R2 | $ 361,723 | 42.49 | 100.00 | | $ 538,596 | $ 1,267,582 | 0.69 |
| 2028 | 1 | 0 | 002-12860 | COUNTY ROAD 02 S.MONAG./OTONABEE | BENSFORT BRIDGE-to-HYWOOD DRIVE | FDR-R2 | $ 387,935 | 55.87 | 100.00 | | $ 759,517 | $ 1,359,436 | 0.74 |
| 2028 | 1 | 0 | 023-17760 | COUNTY ROAD 23 SMITH | BUCKHORN SOUTH LIMITS-to-SOUTH JCT COUNTY ROAD 36 | 1MICRO2D | $ 88,276 | 79.84 | 79.84 | 4.00 | $ 2,385,963 | $ 2,385,963 | 1.04 |
| | | | | | | | **$ 16,621,482** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2029 | 1 | 0 | 001-00000 | COUNTY ROAD 1 SMITH WARD | COUNTY ROAD 18-to-2.57km WEST OF COUNTY RD 18 (MICRO LIMIT) | CRK4rds | $ 10,494 | 95.74 | 95.74 | 2.00 | $ 8,348,757 | $ 8,348,757 | 4.02 |
| 2029 | 1 | 0 | 027-01000 | COUNTY ROAD 27 (ACKINSON RD.) | 1.0 km NORTH-to-COUNTY ROAD 12 | CRK4rds | $ 1,044 | 94.47 | 94.47 | 2.00 | $ 694,194 | $ 694,194 | 0.40 |
| 2029 | 1 | 0 | 503-00000 | COUNTY ROAD 503 GALWAY | 0.2 km E JCT COUNTY ROAD 121-to-PETERBOROUGH/HALIBURTON BOUNDARY | CRK4rds | $ 5,743 | 94.47 | 94.47 | 2.00 | $ 3,784,139 | $ 3,784,139 | 2.20 |
| 2029 | 1 | 0 | 503-02200 | COUNTY ROAD 503 GALWAY | 3.9 km E KINMOUNT-CO. RD. 121-to-E JCT PETERBOROUGH/HALIBURTON BDRY | CRK4rds | $ 9,111 | 94.47 | 94.47 | 2.00 | $ 5,908,868 | $ 5,908,868 | 3.49 |
| 2029 | 1 | 0 | 033-06400 | COUNTY ROAD 33 DOURO | COUNTY ROAD 32-to-KINGS HIGHWAY 28 | CRK4rds | $ 3,524 | 94.47 | 94.47 | 2.00 | $ 1,914,965 | $ 1,914,965 | 1.35 |
| 2029 | 1 | 0 | 018-00250 | COUNTY ROAD 18 SMITH | COUNTY ROAD 19-to-0.9 km NORTH OF COUNTY ROAD 19 | 1ROL12 | $ 258,933 | 66.82 | 83.82 | | $ 2,731,719 | $ 3,426,708 | 1.12 |
| 2029 | 1 | 0 | 046-00000 | COUNTY ROAD 46 HAVELOCK | KINGS HIGHWAY 7-to-HAVELOCK NORTH LIMITS | CRK4rds | $ 5,952 | 88.34 | 88.34 | 2.00 | $ 10,236,651 | $ 10,236,651 | 2.28 |
| 2029 | 1 | 0 | 021-24160 | COUNTY ROAD 21 OTONABEE | STEWART HALL LOT17, CON 15/16-to-CITY OF PETERBOROUGH SOUTH LIMITS | FDR-R2 | $ 2,574,003 | 38.43 | 100.00 | | $ 3,466,403 | $ 9,020,043 | 4.91 |
| 2029 | 1 | 0 | 034-00000 | COUNTY ROAD 34 OTONABEE | KINGS HIGHWAY 7-to-KEENE NORTH LIMITS | FDR-R2 | $ 3,884,595 | 38.43 | 100.00 | | $ 5,231,373 | $ 13,612,733 | 7.41 |
| 2029 | 1 | 0 | 021-18260 | COUNTY ROAD 21 OTONABEE | WALLACE POINT BRIDGE-to-STEWART HALL LOT 17,CON 15/16 | FDR-R2 | $ 2,117,917 | 38.40 | 100.00 | | $ 2,806,840 | $ 7,309,478 | 4.04 |
| 2029 | 1 | 0 | 504-03500 | COUNTY ROAD 504 CHANDOS | WHITMORE ROAD-to-100m WEST OF MCCOY ROAD | 1DST2_10 | $ 817,405 | 48.00 | 95.00 | | $ 1,671,376 | $ 3,307,931 | 2.99 |
| 2029 | 1 | 0 | 009-00000 | COUNTY ROAD 09 CAVAN | COUNTY ROAD 10-to-BEST ROAD | FDR-U2 | $ 783,071 | 53.98 | 100.00 | | $ 1,776,599 | $ 3,291,217 | 1.19 |
| 2029 | 1 | 0 | 002-00000 | COUNTY ROAD 2 S.MONAGHAN WARD | COUNTY ROAD 28 - BAILEBORO-to-580m EAST OF COUNTY ROAD 28 | FDR-U2 | $ 354,149 | 55.87 | 100.00 | | $ 843,234 | $ 1,509,278 | 0.55 |
| 2029 | 1 | 0 | 006-00000 | COUNTY ROAD 06 DOURO | KINGS HIGHWAY 28-to-DOURO 1st LINE | FDR-R2 | $ 2,726,032 | 45.40 | 100.00 | | $ 4,336,969 | $ 9,552,795 | 5.20 |
| 2029 | 1 | 0 | 002-00580 | COUNTY ROAD 02 S.MONAGHAN WARD | 580m East of Hwy 28-to-LOTS 12/13 (FISHER'S CORNERS) | FDR-R2 | $ 3,465,206 | 45.40 | 100.00 | | $ 5,405,831 | $ 11,907,117 | 6.61 |
| | | | | | | | **$ 17,017,179** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2030 | 1 | 0 | 049-00000 | COUNTY ROAD 49 HARVEY | COUNTY ROAD 36 BOBCAYGEON-to-9.1 km N OF BOBCAYGEON | CRK4rds | $ 22,816 | 94.47 | 94.47 | 2.00 | $ 15,168,145 | $ 15,168,145 | 8.74 |
| 2030 | 1 | 0 | 049-09100 | COUNTY ROAD 49 GALWAY | 9.1 km N BOBCAYGEON-COUNTY ROAD 36-to-S JCT COUNTY ROAD 121-UNION CREEK | CRK4rds | $ 22,764 | 94.47 | 94.47 | 2.00 | $ 15,133,436 | $ 15,133,436 | 8.72 |
| 2030 | 1 | 0 | 121-00000 | COUNTY ROAD 121 GALWAY | COUNTY ROAD 49-to-KINMOUNT-S JCT COUNTY ROAD 503 | CRK4rds | $ 23,025 | 94.47 | 94.47 | 2.00 | $ 15,306,984 | $ 15,306,984 | 8.82 |
| 2030 | 1 | 0 | 007-00000 | COUNTY ROAD 07 CAVAN | PETERBOROUGH COUNTY/MANVERS TWP.-to-PETERBOROUGH COUNTY/EMILY TWP. | CRK4rds | $ 3,368 | 94.47 | 94.47 | 2.00 | $ 2,195,274 | $ 2,195,274 | 1.29 |
| 2030 | 1 | 0 | 022-00000 | COUNTY ROAD 22 SMITH | N.LIMIT OF CURVE LAKE INDIAN RES.-to-COUNTY ROAD 23 | CRK4rds | $ 11,565 | 94.47 | 94.47 | 2.00 | $ 7,090,636 | $ 7,090,636 | 4.43 |
| 2030 | 1 | 0 | 504-00500 | COUNTY ROAD 504 ANSTRUTHER | COUNTY ROAD 620A-to-ANSTRUTHER TWP RD L 34-35 | 1ROL12 | $ 37,873 | 71.18 | 88.18 | | $ 563,778 | $ 698,425 | 0.29 |
| 2030 | 1 | 0 | 029-05800 | COUNTY ROAD 29 SMITH | 2.4 km NORTH OF COUNTY ROAD 23-to-W.LIMITS OF LAKEFIELD | 1ROL12 | $ 140,832 | 69.91 | 86.91 | | $ 1,670,744 | $ 2,077,019 | 0.84 |
| 2030 | 1 | 0 | 029-06500 | COUNTY ROAD 29 LAKEFIELD | W.LIMITS OF LAKEFIELD-to-N.LIMITS OF LAKEFIELD | 1ROL12 | $ 398,513 | 69.91 | 86.91 | | $ 4,659,384 | $ 5,792,405 | 2.34 |
| 2030 | 1 | 0 | 002-14160 | COUNTY ROAD 02 OTONABEE | HYWOOD DRIVE-to-COUNTY ROAD 35, CON 11/12 | FDR-R2 | $ 1,677,558 | 43.95 | 100.00 | | $ 2,483,256 | $ 5,650,184 | 3.20 |
| 2030 | 1 | 0 | 044-12740 | COUNTY ROAD 44 METHUEN/DUMMER | 3.2 km EAST OF COUNTY ROAD 6-to-COUNTY ROAD 6 | 1DST2_20 | $ 1,174,849 | 46.00 | 95.00 | | $ 1,939,224 | $ 4,004,920 | 3.62 |
| 2030 | 1 | 0 | 002-24500 | COUNTY RD 2 | COUNTY ROAD 34-to-KEENE EAST LIMITS | FDR-U2 | $ 251,124 | 59.64 | 100.00 | | $ 638,276 | $ 1,070,215 | 0.39 |
| 2030 | 1 | 0 | 002-24800 | COUNTY ROAD 02 OTONABEE | KEENE EAST LIMITS-to- OTONABEE \ ASPHODEL BOUNDARY | FDR-R2 | $ 4,712,889 | 52.09 | 100.00 | | $ 8,836,856 | $ 16,964,592 | 8.99 |
| 2030 | 1 | 0 | 034-09760 | COUNTY ROAD 34 OTONABEE | 0.8km SOUTH OF COUNTY ROAD 2-to-ENT. TO PROV. PARK IN CON. 7 | 1DST2_10 | $ 1,048,521 | 38.29 | 95.00 | | $ 1,230,711 | $ 3,053,475 | 2.76 |
| 2030 | 1 | 0 | 002-09820 | COUNTY ROAD 02 S. MONAGHAN WARD | CON.2/3,AT BENSFORT-to-0.8 KM SOUTH OF BENSFORT BRIDGE | FDR-R2 | $ 1,950,161 | 52.09 | 100.00 | | $ 3,559,790 | $ 6,833,923 | 3.72 |
| 2030 | 1 | 0 | 021-08560 | COUNTY ROAD 21 CAVAN | MILLBROOK EAST LIMITS-to-COUNTY ROAD 28 | FDR-R2 | $ 2,998,635 | 52.09 | 100.00 | | $ 5,473,656 | $ 10,508,075 | 5.72 |
| 2030 | 1 | 0 | 035-00000 | COUNTY ROAD 35 OTONABEE | COUNTY ROAD 2-to-ROAD BETWEEN LOT 16/17, ZION | FDR-R2 | $ 1,289,623 | 52.09 | 100.00 | | $ 2,363,203 | $ 4,536,770 | 2.46 |
| 2030 | 1 | 0 | 504-12900 | COUNTY ROAD 504 CHANDOS | LASWADE RD-CHANDOS TWP-IN C-2-to- CHANDOS TWP RD L 21 C 4 | 1DST2_20 | $ 1,355,004 | 46.00 | 95.00 | | $ 2,110,647 | $ 4,358,946 | 3.94 |
| 2030 | 1 | 0 | 010-06100 | COUNTY ROAD 10 CAVAN | COUNTY ROAD 21 AT MILLBROOK-to-0.8 km NORTHERLY | CIR-U2 | $ 716,341 | 51.20 | 100.00 | | $ 1,173,352 | $ 2,291,704 | 0.81 |
| 2030 | 1 | 0 | 620-00000 | COUNTY ROAD 620 ASPLEY | KINGS HWY 28-to-COUNTY ROAD 620A | 1MICRO2D | $ 23,109 | 77.22 | 77.22 | 4.00 | $ 1,484,236 | $ 1,484,236 | 0.38 |
| 2030 | 1 | 0 | 028-07110 | COUNTY ROAD 28 CAVAN | N.LIMITS OF SOUTH MONAGHAN-to-S.LIMITS OF SOUTH MONAGHAN | CIR-U2 | $ 371,129 | 51.20 | 100.00 | | $ 487,106 | $ 951,379 | 0.33 |
| 2030 | 1 | 0 | 620A-00000 | COUNTY ROAD 620A ASPLEY | COUNTY ROAD 504-to-COUNTY ROAD 620 | 1MICRO2D | $ 48,649 | 77.22 | 77.22 | 4.00 | $ 1,687,220 | $ 1,687,220 | 0.80 |
| | | | | | | | **$ 18,278,348** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | COUNTY ROAD 06 | | | | | | | | | |
| 2031 | 1 | 0 | 006-26780 | DUMMER/BURLE/METH | COUNTY ROAD 44-to-NEPTHON,LOT13/14,CON.10,METHUEN | CRK4rds | $ 17,856 | 94.47 | 94.47 | 2.00 | $ 11,870,722 | $ 11,870,722 | 6.84 |
| 2031 | 1 | 0 | 035-02470 | COUNTY ROAD 35 OTONABEE | LOT 16/17 AT ZION-to-KINGS HIGHWAY 7 | CRK4rds | $ 15,950 | 94.47 | 94.47 | 2.00 | $ 10,603,817 | $ 10,603,817 | 6.11 |
| 2031 | 1 | 0 | 029-06500 | COUNTY ROAD 29 LAKEFIELD | W.LIMITS OF LAKEFIELD-to-N.LIMITS OF LAKEFIELD | CRK4rds | $ 6,109 | 86.91 | 86.91 | 2.00 | $ 5,792,405 | $ 5,792,405 | 2.34 |
| 2031 | 1 | 0 | 029-05800 | COUNTY ROAD 29 SMITH | 2.4 km NORTH OF COUNTY ROAD 23-to-W.LIMITS OF LAKEFIELD | CRK4rds | $ 2,193 | 86.91 | 86.91 | 2.00 | $ 2,077,019 | $ 2,077,019 | 0.84 |
| 2031 | 1 | 0 | 507-00000 | COUNTY ROAD 507 HARVEY | NORTH JCT COUNTY ROAD 36-to-7.8 km N OF COUNTY ROAD 36 | CRK4rds | $ 19,892 | 94.47 | 94.47 | 2.00 | $ 11,939,567 | $ 11,939,567 | 7.62 |
| 2031 | 1 | 0 | 040-00000 | COUNTY ROAD 40 NORWOOD | KINGS HIGHWAY 7-to-NORWOOD NORTH LIMITS | 1MILLO1a2 | $ 340,640 | 73.31 | 90.31 | | $ 3,180,973 | $ 3,918,615 | 0.83 |
| 2031 | 1 | 0 | 036-25150 | COUNTY ROAD 36 HARVEY | 4.55km FROM COUNTY ROAD 507 (LIMIT NEW ASPHALT)-to-NOGIES CREEK | FDR-R2 | $ 1,630,377 | 48.31 | 100.00 | | $ 2,760,098 | $ 5,713,306 | 3.11 |
| 2031 | 1 | 0 | 038-03030 | COUNTY ROAD 38 ASPHODEL | LOT 10/11, ASPHODEL TWP.-to-KINGS HIGHWAY 7 | FDR-R2 | $ 1,457,379 | 48.31 | 100.00 | | $ 2,467,226 | $ 5,107,071 | 2.78 |
| 2031 | 1 | 0 | 045-01030 | COUNTY ROAD 45 ASPHODEL | S.LIMITS OF NORWOOD-to-RIVER ROAD HASTINGS (OLD ORCHARD | FDR-R2 | $ 3,313,177 | 50.20 | 100.00 | | $ 5,828,381 | $ 11,610,320 | 6.32 |
| 2031 | 1 | 0 | 504-00800 | COUNTY ROAD 504 ANSTRUTHER | ANSTRUTHER TWP RD L 34-35-to-2.0 km W OF CHANDOS T.RD L 5-6 | 1DST2_20 | $ 1,602,619 | 44.00 | 95.00 | | $ 2,387,813 | $ 5,155,505 | 4.66 |
| 2031 | 1 | 0 | 020-01350 | COUNTY ROAD 20 SMITH | 1.4 km NORTH OF COUNTY ROAD 18-to-CENTRE LINE | 1DST2_20 | $ 984,477 | 42.00 | 95.00 | | $ 1,325,502 | $ 2,998,158 | 2.71 |
| 2031 | 1 | 0 | 018-11430 | COUNTY ROAD 18 SMITH | COUNTY ROAD 24-to-COUNTY ROAD 23 | CIR-R2 | $ 2,062,052 | 54.00 | 100.00 | | $ 3,840,232 | $ 7,111,541 | 3.52 |
| 2031 | 1 | 0 | 045-00000 | COUNTY ROAD 45 NORWOOD | HIGHWAY 7-to-S.LIMITS OF NORWOOD | FDR-U2 | $ 679,905 | 63.42 | 100.00 | | $ 1,853,370 | $ 2,922,374 | 1.07 |
| 2031 | 1 | 0 | 002-23640 | COUNTY ROAD 02 OTONABEE | KEENE WEST LIMITS-to- COUNTY ROAD 34 | FDR-U2 | $ 489,369 | 63.42 | 100.00 | | $ 1,322,655 | $ 2,085,548 | 0.76 |
| 2031 | 1 | 0 | 034-07700 | COUNTY ROAD 34 OTONABEE | KEENE NORTH LIMITS-to-COUNTY ROAD 2 | FDR-U2 | $ 814,171 | 63.42 | 100.00 | | $ 2,206,748 | $ 3,479,578 | 1.27 |
| | | | | COUNTY ROAD 05 | 0.1km EAST OF KINGS HIGHWAY 7-to-PETERBOROUGH CITY WEST | | | | | | | | |
| 2031 | 1 | 0 | 005-00000 | N.MONAG./HWY.28 | LIMITS | CIR-R2 | $ 1,273,987 | 57.00 | 100.00 | | $ 2,547,091 | $ 4,468,580 | 2.06 |
| 2031 | 1 | 0 | 009-04000 | COUNTY ROAD 09 CAVAN | 3.2KM EAST OF BEST ROAD-to-KINGS HIGHWAY 7 | FDR-R2 | $ 1,053,716 | 55.87 | 100.00 | | $ 2,063,013 | $ 3,692,523 | 2.01 |
| 2031 | 1 | 0 | 018-02120 | COUNTY ROAD 18 SMITH | COUNTY ROAD 1-to-BRIDGENORTH SOUTH LIMITS | CIR-R2 | $ 1,954,271 | 57.00 | 100.00 | | $ 3,907,188 | $ 6,854,715 | 3.16 |
| 2031 | 1 | 0 | 037-11300 | COUNTY ROAD 37 HARVEY | 1.1km WEST OF MELODY BAY ROAD-to-SHAWS ROAD | 1DST2_20 | $ 823,718 | 44.00 | 95.00 | | $ 1,081,177 | $ 2,334,360 | 2.11 |
| | | | | COUNTY ROAD 54 (BALMER RD.) | | | | | | | | | |
| 2031 | 1 | 0 | 054-09100 | NOR | 9.1 KM (START OF GRAVEL)-to-EASTERLY 1.7 KM (CULS-DE-SAC) | 1SST1a_10 | $ 96,036 | 78.00 | 90.00 | | $ 781,186 | $ 901,369 | 0.86 |
| 2031 | 1 | 0 | 003-00000 | COUNTY ROAD 03 N.MONAG./SMITH | KINGS HIGHWAY 07-to-1.1 KM EAST OF KING`S HIGHWAY 7 | FDR-R2 | $ 534,722 | 57.75 | 100.00 | | $ 1,040,075 | $ 1,800,996 | 1.02 |
| 2031 | 1 | 0 | 045-07230 | COUNTY ROAD 45 HASTINGS | RIVER ROAD HASTINGS (OLD ORCHARD R-to-DIVISION ST. HASTINGS | 1MICRO2D | $ 49,731 | 88.20 | 88.20 | 4.00 | $ 3,029,660 | $ 3,029,660 | 0.65 |
| 2031 | 1 | 0 | 504-00500 | COUNTY ROAD 504 ANSTRUTHER | COUNTY ROAD 620A-to-ANSTRUTHER TWP RD L 34-35 | 1MICRO2D | $ 17,636 | 88.18 | 88.18 | 4.00 | $ 698,425 | $ 698,425 | 0.29 |
| | | | | | | | **$ 19,239,983** | | | | | | |

# County of Peterborough

## 10 Year Performance Model by Best ROI with Committed Projects (20220825)

| Year | Fund | Proj | Asset ID | Street Name | Description | Imp. Type | Cost | Start Cond | End Cond | Yrs Hold | Start Value | End Value | Length (km) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2032 | 1 | 0 | 048-00000 | COUNTY ROAD 48 HAVELOCK | CONCESSION ST. HAVELOCK CO. RD.46-to-QUEBEC ST. HAVELOCK | CRK4rds | $ 1,227 | 94.47 | 94.47 | 2.00 | $ 2,346,409 | $ 2,346,409 | 0.47 |
| 2032 | 1 | 0 | 018-05600 | COUNTY ROAD 18 SMITH | BRIDGENORTH SOUTH LIMITS-to-COUNTY ROAD 14 | CRK4rds | $ 3,576 | 95.74 | 95.74 | 2.00 | $ 3,679,895 | $ 3,679,895 | 1.37 |
| 2032 | 1 | 0 | 036-07400 | COUNTY ROAD 36 HARVEY | DEER BAY REACH ROAD-to-INTERS. CO.RD.23 AND CO.RD.36 | CRK4rds | $ 15,454 | 94.47 | 94.47 | 2.00 | $ 9,475,522 | $ 9,475,522 | 5.92 |
| 2032 | 1 | 0 | 008-00000 | COUNTY ROAD 08 DOURO | COUNTY ROAD 4-to-KINGS HIGHWAY 28 | CRK4rds | $ 1,070 | 94.47 | 94.47 | 2.00 | $ 642,418 | $ 642,418 | 0.41 |
| 2032 | 1 | 0 | 040-00000 | COUNTY ROAD 40 NORWOOD | KINGS HIGHWAY 7-to-NORWOOD NORTH LIMITS | CRK4rds | $ 2,167 | 90.31 | 90.31 | 2.00 | $ 3,918,615 | $ 3,918,615 | 0.83 |
| 2032 | 1 | 0 | 504-00000 | COUNTY ROAD 504 ANSTRUTHER COUNTY ROAD 46 | KINGS HWY 28-to-COUNTY ROAD 620A | 1ROL12 | $ 67,910 | 73.21 | 90.21 | | $ 1,039,742 | $ 1,281,180 | 0.52 |
| 2032 | 1 | 0 | 046-10700 | BELMONT/METHUEN COUNTY ROAD 54 (BALMER RD.) | COUNTY ROAD 47-to-DEVIL'S 4 MILE ROAD | 1SST1a_10 | $ 1,369,920 | 75.00 | 90.00 | | $ 11,360,210 | $ 13,632,251 | 8.94 |
| 2032 | 1 | 0 | 054-00000 | NOR | COUNTY ROAD 620-to-EASTERLY 9.1 KM (GRAVEL STARTS) | 1SST1a_10 | $ 1,091,011 | 75.00 | 90.00 | | $ 8,533,310 | $ 10,239,971 | 9.77 |
| 2032 | 1 | 0 | 021-07960 | COUNTY ROAD 21 MILLBOOK/CAVAN COUNTY ROAD 47 | COUNTY ROAD 10 NORTH-to-MILLBROOK EAST LIMITS | FDR-U2 | $ 491,686 | 55.87 | 100.00 | | $ 1,088,469 | $ 1,948,218 | 0.68 |
| 2032 | 1 | 0 | 047-00000 | BELMONT/METHUEN/ | COUNTY ROAD 46-to-COUNTY ROAD 44 | 1SST1a_10 | $ 402,934 | 75.00 | 90.00 | | $ 2,803,677 | $ 3,364,412 | 3.21 |
| 2032 | 1 | 0 | 504-21050 | COUNTY ROAD 504 CHANDOS | 5.05 km N.E. OF CHANDOS T.L21-C4-to- E JCT SEC CO.RD.620 GLEN ALDA | 1SST1a_10 | $ 696,423 | 71.00 | 90.00 | | $ 3,935,745 | $ 4,988,973 | 4.76 |
| 2032 | 1 | 0 | 037-10200 | COUNTY ROAD 37 HARVEY | MELODY BAY ROAD-to-1.1km WEST OF MELODY BAY ROAD | 1SST1a_10 | $ 336,917 | 71.00 | 90.00 | | $ 1,868,652 | $ 2,368,714 | 2.26 |
| 2032 | 1 | 0 | 002-33700 | COUNTY ROAD 02 ASPHODEL | OTONABEE \ ASPHODEL BOUNDARY-to- COUNTY ROAD 38 | CIR-R2 | $ 978,303 | 54.00 | 100.00 | | $ 1,866,996 | $ 3,457,400 | 1.67 |
| 2032 | 1 | 0 | 002-35050 | COUNTY ROAD 02 ASPHODEL | COUNTY ROAD 38-to- VILLAGE OF HASTINGS WEST LIMITS | CIR-R2 | $ 4,340,853 | 54.00 | 100.00 | | $ 8,084,125 | $ 14,970,601 | 7.41 |
| 2032 | 1 | 0 | 018-08450 | COUNTY ROAD 18 SMITH | COUNTY ROAD 20-to-COUNTY ROAD 24 | CIR-R2 | $ 1,751,572 | 54.00 | 100.00 | | $ 3,262,015 | $ 6,040,769 | 2.99 |
| 2032 | 1 | 0 | 008-00430 | COUNTY ROAD 08 DOURO | KINGS HIGHWAY 28-to-DOURO 4TH LINE | FDR-R2 | $ 1,389,228 | 53.98 | 100.00 | | $ 2,576,819 | $ 4,773,655 | 2.65 |
| 2032 | 1 | 0 | 012-02000 | COUNTY ROAD 12 SMITH | LILY LAKE ROAD-to-COUNTY ROAD 1 | FDR-R2 | $ 1,499,317 | 53.98 | 100.00 | | $ 2,781,020 | $ 5,151,945 | 2.86 |
| 2032 | 1 | 0 | 026-00000 | COUNTY ROAD 26 EMILY | KINGS HIGHWAY 7 AT FOWLERS CORNERS-to-CON.5/6 EMILY TWP.VICTORIA CO. | FDR-R2 | $ 1,798,132 | 53.98 | 100.00 | | $ 3,335,279 | $ 6,178,731 | 3.43 |
| 2032 | 1 | 0 | 038-00000 | COUNTY ROAD 38 ASPHODEL | COUNTY ROAD 2-to-LOT 10/11, ASPHODEL TWP. | FDR-R2 | $ 1,598,922 | 55.87 | 100.00 | | $ 3,130,442 | $ 5,603,082 | 3.05 |
| 2032 | 1 | 0 | 031-03500 | COUNTY ROAD 31 OTONABEE | NORTH LIMIT HIAWATHA INDIAN RESERV-to-SOUTHERLY 1.8km | 1SST1a_10 | $ 292,615 | 75.00 | 90.00 | | $ 1,746,839 | $ 2,096,207 | 2.00 |
| 2032 | 1 | 0 | 018-00000 | COUNTY ROAD 18 SMITH | PETERBORO NORTH CITY LIMITS-to-COUNTY ROAD 19 | CIR-R2 | $ 108,179 | 54.00 | 100.00 | | $ 172,728 | $ 319,867 | 0.10 |
| | | | | | | | **$ 18,237,416** | | | | | | |

# Appendix G: Inventory Manual References

## TABLE F-1 ROAD DESIGN STANDARDS

### RURAL ROAD STANDARDS

| | | 50-199 AADT 200 | 200-399 AADT 300 | 400-999 AADT 400 | 1000-1999 AADT 500 | 2000-2999 AADT 600 | 3000-3999 AADT 700 | 4000+ AADT 800 | 4 lanes & Exp 4LN,EXP |
|---|---|---|---|---|---|---|---|---|---|
| Shw | Surface Width (m) | 6.0 | 6.0 | 6.5 | 6.5 | 7.0 | 7.0 | 7.5 | 15.0 |
| DDP | Shoulder Width (m) | 1.5 | 1.5 | 1.5 | 2.5 | 2.5 | 3.0 | 3.0 | 3.0 |
| DA | Hot Mix (mm) | | *16 | 50 | 50 | 100 | 100 | 100 | 100 |
| DB | Granular A (mm) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| | **Southern Ontario** | | | | | | | | |
| DB | *Granular B (mm)* | | | | | | | | |
| | BS | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |
| | RW, REC,NC | 300 | 300 | 450 | 450 | 450 | 450 | 450 | 450 |
| | **Northern Ontario** | | | | | | | | |
| DB | *Granular B (mm)* | | | | | | | | |
| | BS | 250 | 250 | 250 | 250 | 250 | 250 | 250 | 250 |
| | RW, REC,NC | 400 | 400 | 550 | 550 | 550 | 550 | 550 | 550 |
| | **Concrete Surface** | | | | | | | | |
| DC | Concrete (mm) | 150 | 150 | 150 | 225 | 225 | 225 | 225 | 225 |
| DB | Granular B (mm) | 150 | 150 | 150 | 150 | 150 | 150 | 150 | 150 |

* Double Surface Treatment (DST) assumed to equal 16 mm of Hot Mix

**Note: Class 100 rural roads are eligible for maintenance subsidy only.**

### SEMI-URBAN ROAD STANDARDS

| | | Local Roads | | Collector Roads | | Arterials |
|---|---|---|---|---|---|---|
| | | Residential LR | Comm/Ind LCI | Residential CR | Comm/Ind CCI | All Lanes ART |
| | Lane Width (m) | 3.0 | 3.25 | 3.25 | 3.75 | 3.75 |
| Shw | Shoulder Width (m) | 1.5 | 1.5 | 2.5 | 2.5 | 3.0 |
| DDP | Hot Mix (mm) | 50 | 50 | 50 | 100 | 100 |
| DA | Granular A (mm) | 150 | 150 | 150 | 150 | 150 |
| | **Southern Ontario** | | | | | |
| DB | *Granular B (mm)* | | | | | |
| | BS | 150 | 150 | 150 | 150 | 150 |
| | RW, REC | 250 | 300 | 300 | 450 | 450 |
| | **Northern Ontario** | | | | | |
| DB | *Granular B (mm)* | | | | | |
| | BS | 250 | 250 | 250 | 250 | 250 |
| | RW, REC | 350 | 400 | 400 | 550 | 550 |
| | **Concrete Surface** | | | | | |
| DC | Concrete (mm) | 150 | 150 | 225 | 225 | 225 |
| DB | Granular B (mm) | 150 | 150 | 150 | 150 | 150 |

### URBAN ROAD STANDARDS

| | | Local Roads | | Collector Roads | | Arterials | Expressways |
|---|---|---|---|---|---|---|---|
| | | Residential LR | Comm/Ind LCI | Residential CR | Comm/Ind CCI | All Lanes ART | All Lanes EXP |
| | Through Lane Width (m) | 3.0 | 3.25 | 3.25 | 3.75 | 3.75 | 3.75 |
| | Parking Lane Width (m) | 2.5 | 2.5 | 2.5 | 2.5 | 3.0 | 3.0 |
| | Curb Offset each side (m) | .5 | .5 | .5 | .5 | .5 | .5 |
| | **Granular Base** | | | | | | |
| DDP | Hot Mix (mm) | 100 | 100 | 100 | 150 | 150 | 150 |
| DA | Granular A (mm) | 150 | 150 | 150 | 150 | 150 | 150 |
| DB | Granular B (mm) | | | | | | |
| | Southern Ontario | 300 | 300 | 300 | 300 | 450 | 450 |
| | Northern Ontario | 400 | 400 | 400 | 400 | 550 | 550 |
| | **Concrete Base** | | | | | | |
| DDP | Hot Mix (mm) | 50 | 50 | 50 | 50 | 100 | 100 |
| DC | Concrete (mm) | 150 | 150 | 200 | 200 | 200 | 200 |
| DB | Granular B (mm) | 150 | 150 | 150 | 150 | 150 | 200 |
| | **Concrete Surface** | | | | | | |
| DC | Concrete (mm) | 150 | 150 | 250 | 250 | 250 | 250 |
| DB | Granular B (mm) | 150 | 150 | 150 | 150 | 150 | 150 |

Note: Bench Mark Costs will not exceed the design standards specified in the above tables

*Feb 1, 1991*

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TABLE 93R - MINIMUM TOLERABLE SURFACE WIDTH - RURAL (metres)

| | EXISTING CLASS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 4LN | EXP |
| ROADWAY WIDTH | 5.0 | 5.5 | 5.5 | 6.0 | 6.0 | 6.0 | 6.5 | 6.5 | 13.0 | 3.5/lane |

TABLE 93SU - MINIMUM TOLERABLE SURFACE WIDTH - SEMI-URBAN and URBAN (metres)

| | SEMI-URBAN | | URBAN | |
|---|---|---|---|---|
| FUNCTIONAL CLASSIFICATION | 2 Way (2W,2M) | 1 Way (1W,1M) | 2 Way (2W,2M) | 1 Way (1W,1M) |
| 2-lane Local Residential | 5.0 | 5.0 | 5.5 | 5.5 |
| 2-lane Local Comm. & Ind. | 5.5 | 5.5 | 6.0 | 6.0 |
| 2-lane Collector Residential | 5.5 | 5.5 | 6.0 | 6.0 |
| 2-lane Collector Comm. & Ind. | 6.0 | 6.0 | 6.5 | 6.5 |
| 2-lane Arterial | 6.0 | 6.0 | 6.5 | 6.5 |
| 3-lane Local Comm. & Ind. | 9.0 | 8.7 | 9.0 | 8.7 |
| 3-lane Collector Residential | 9.0 | 8.7 | 9.0 | 8.7 |
| 3-lane Collector Comm. & Ind. | 9.0 | 8.7 | 9.0 | 8.7 |
| 3-lane Arterial | 9.0 | 9.0 | 9.5 | 9.5 |
| 4-lane Collector Residential | 11.0 | 11.0 | 11.5 | 11.5 |
| 4-lane Collector Comm. & Ind. | 12.0 | 12.0 | 12.5 | 12.5 |
| 4-lane Arterial | 12.0 | 12.0 | 12.5 | 12.5 |
| 5-lane Arterial | 15.0 | 15.0 | 15.5 | 15.5 |
| 6-lane Arterial | 18.0 | 18.0 | 18.5 | 18.5 |
| 7-lane Arterial | 21.5 | 21.5 | 22.0 | 22.0 |
| 8-lane Arterial | 24.5 | 24.5 | 25.0 | 25.0 |
| 9-lane Arterial | 27.5 | 27.5 | 28.0 | 28.0 |
| Expressway | — | — | 3.5/ln | 3.5/ln |

Peterborough County

# Appendix 2

## Structure Appendices

4 ROADS MANAGEMENT SERVICES

# Asset Classes and Deterioration Curves for Structures

## Asset Classes

The structure asset classes that have been developed are very simple, hence the limited classifications by the more basic material types used in bridge and culvert construction. The resulting models are very simple also and do not necessarily reflect the complexity of individual structures. Their purpose is to develop life cycle costs for structure assets for the purpose of overall budget planning. The most current Ontario Structure Inspection Manual (OSIM) structure inspections, if conducted thoroughly by experienced practitioners, will provide definitive recommendations for any immediate action that is required, and order-of-magnitude guidance for more substantive rehabilitation or replacement work requiring further in-depth analysis and engineering. OSIM inspection reports are not intended to provide detailed instructions for the rehabilitation or replacement of any bridge or culvert, nor should they be used for this purpose.

In order to utilize the Best Practice and Performance Modeling modules of WorkTech Asset Manager Foundation (WT), assets must be defined by an asset class. Tables 1 and 2, identify the bridge and culvert structure asset classes that have been developed for use in WT by 4 Roads Management Services Inc.

**Table 1: Bridge Asset Classes**

| Asset Class | Subtype | Material | Roadside Envt | AADT Low | AADT High |
|---|---|---|---|---|---|
| SCB | All | C - Cast In Place or Pre-Cast | All | 1 | 100,000 |
| SSB | All | S - Steel | All | 1 | 100,000 |
| SWB | All | T - Timber/Wood | All | 1 | 100,000 |

**Table 2: Culvert Asset Classes**

| Asset Class | Subtype | Material | Roadside Envt | AADT Low | AADT High |
|---|---|---|---|---|---|
| SCC | All | CPR - Cast in Place or Pre-Cast | All | 1 | 100,000 |
| SSC | All | CST - Corr. Steel | All | 1 | 100,000 |

Bridges in particular, and culverts to a lesser extent, have a large number of construction types, material combinations for substructure, superstructure and wearing surfaces. (The different components of the structures are generally referred to in OSIM as *elements*.) Creating specific models for each potential permutation would result in numerous deterioration curves that may prove too onerous for the purpose for which this model was developed.

From the Ministry of Transportation of Ontario (MTO) Engineering Standards Branch 2009;

> *The Ontario Structure Inspection Manual (OSIM) contains over 15 Element Groups and over 40 elements. Each bridge typically has at least 20 elements, and usually much more. Each element is inspected in accordance with OSIM and the quantities in each of four Condition States are recorded.*

4 Roads developed these simple deterioration curves and asset classes to expedite the development of best practices and demonstrate the longer term effects of varying funding levels and the overall performance of the structures inventory over time.

## Deterioration Curves

In Ontario, there are/were two methodologies that are typically used to evaluate bridge and culvert structures; the Ontario Structural Inspection Manual (OSIM) and Municipal Bridge Appraisal Manual (MBADES). Structure inspections are regulated through Ontario Regulation 104/97, Standards for Bridges (O.Reg 104/97), which requires inspections be conducted once every 2 calendar years and in accordance with the Ontario Structure Inspection Manual.

From the ratings obtained during the evaluations, a Bridge Condition Index (BCI) may be calculated. From the Ministry of Transportation of Ontario (MTO) Engineering Standards Branch 2009;

> *The Bridge Condition Index (BCI) was developed as a means of combining the inspection information into a single value. This number, the BCI value, gives an indication of the overall condition of the bridge.*
>
> *The BCI is calculated using asset management principals based on the remaining economic worth of the bridge. It is based on the premise that a bridge starts at a new condition and deteriorates to a lower condition with time. It uses actual inspection data from the various bridge elements and as the elements deteriorate they have a lower economic value. Essentially, the BCI is a weighted average of all elements (since all elements are not of equal value to the bridge) and all Condition States (since each condition state represents a certain degree of loss of value of the element). The BCI begins at 100 when the bridge is in new condition and theoretically becomes 0 as all elements become fully in Poor condition. Practically, it is impossible for the BCI to fall to 0 since the entire bridge does not become poor before rehabilitation work is performed.*
>
> *The BCI is based on the current value and replacement value of all elements in a bridge. The current value of the element is determined based on the depreciated value of the portions of the element that are in each of the four Condition States (Excellent, Good, Fair, Poor).*

BCI ratings interpretation, from the MTO website:

> *Good - BCI Range 70 -100 For a bridge with a BCI greater than 70, maintenance work is not usually required within the next five years.*
>
> *Fair - BCI Range 60 -70 For a bridge with a BCI between 60 and 70 the maintenance work is usually scheduled within the next five years. This is the ideal time to schedule major bridge repairs from an economic perspective.*
>
> *Poor - BCI Less than 60 - For a bridge with a BCI rating of less than 60, maintenance work is usually scheduled within approximately one year.*

**Table 2: BCI Correlations**

| Time of Need | BCI | Time of Need Description | Condition Description |
|---|---|---|---|
| NOW | 1-60 | Now Needs –Reconstruction / Major Rehabilitation/ Safety Improvements | Poor to Very Poor to Failed |
| 1 to 5 | 60-70 | 1 to 5 year Needs – /more extensive Rehabilitation | Fair / Passable |
| 6 to 10 | 70-85 | 6 to 10 Year Needs – Patch, Pave Waterproof / Minor Rehabilitation | Good |
| ADEQ | 86-100 | Adequate – Maintenance and Preservation | Satisfactory/ Good/ Excellent |

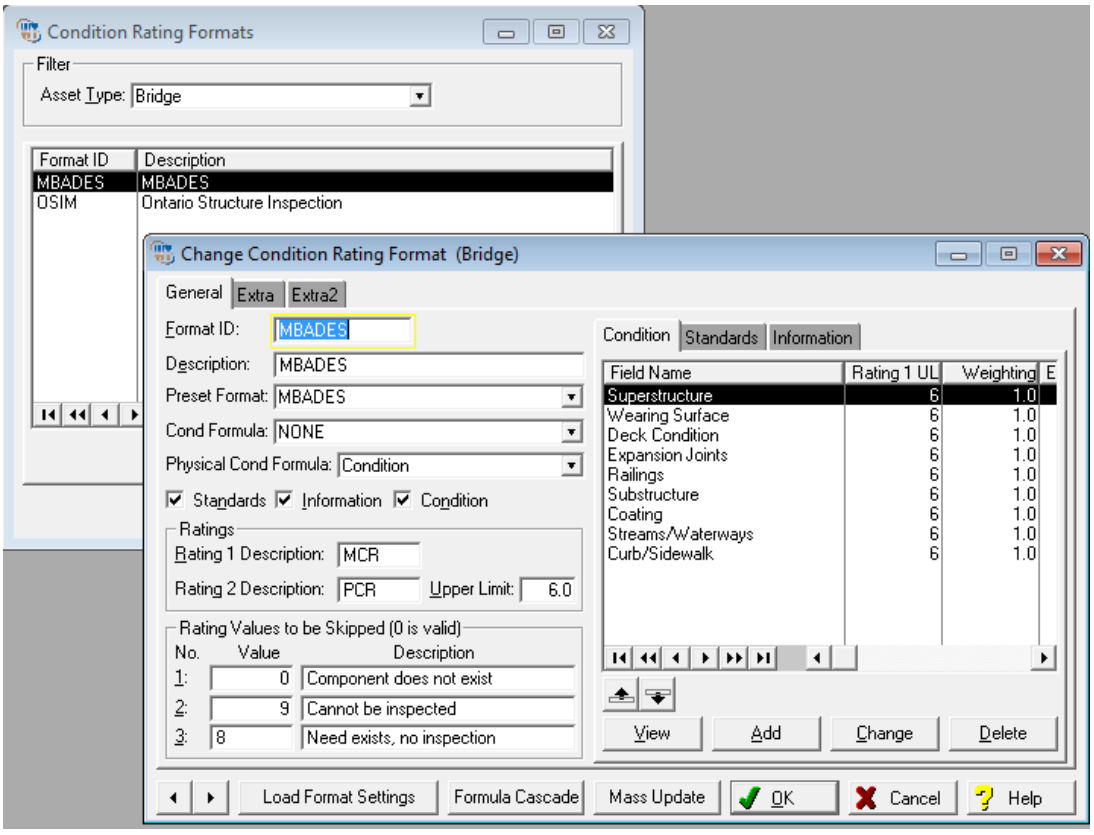
To be clear, the BCI provides a general indication of overall condition based on a measure of residual value. The improvement recommendations and the BCI may driven by a limited number of elements. A low BCI may not necessarily indicate replacement is required. Conversely, a high BCI may not necessarily indicate that a structure is safe; most major bridge failures and collapses are related to the failure of a single critical element and many bridges with a relatively high BCI have experienced catastrophic failure. This underscores the importance of having experienced bridge engineers review and vet OSIM reports and subsequent prioritization lists.

In WorkTech, on the analysis tab, when 'no change' is selected, if an asset is selected that has an identified improvement type, that improvement will be used for the project in the year that it is selected. In the later years, presumably after all current deficiencies have been corrected the model will revert to the assigned asset class for deterioration and project selection based on estimated condition.

A 'committed project' may also be inserted into the model where an improvement recommendation and costing have been provided through the OSIM inspection.

All deterioration curves relate to the 'Physical Condition' data field in WorkTech. For the structures inventory, the BCI calculated by the consulting firm that performed the bridge inspection has to be imported to the Condition1 and Ph Condition (Physical Condition) data fields. The BCI is then used as the 'Physical Condition' for modeling purposes.

**Figure 1: Sample Rating Format – MBADES (WorkTech 6 Screen Capture)**




Please note, the deterioration curves are the same for each asset class by material type regardless of roadside environment. The curves and intervention / treatment points vary by material type.

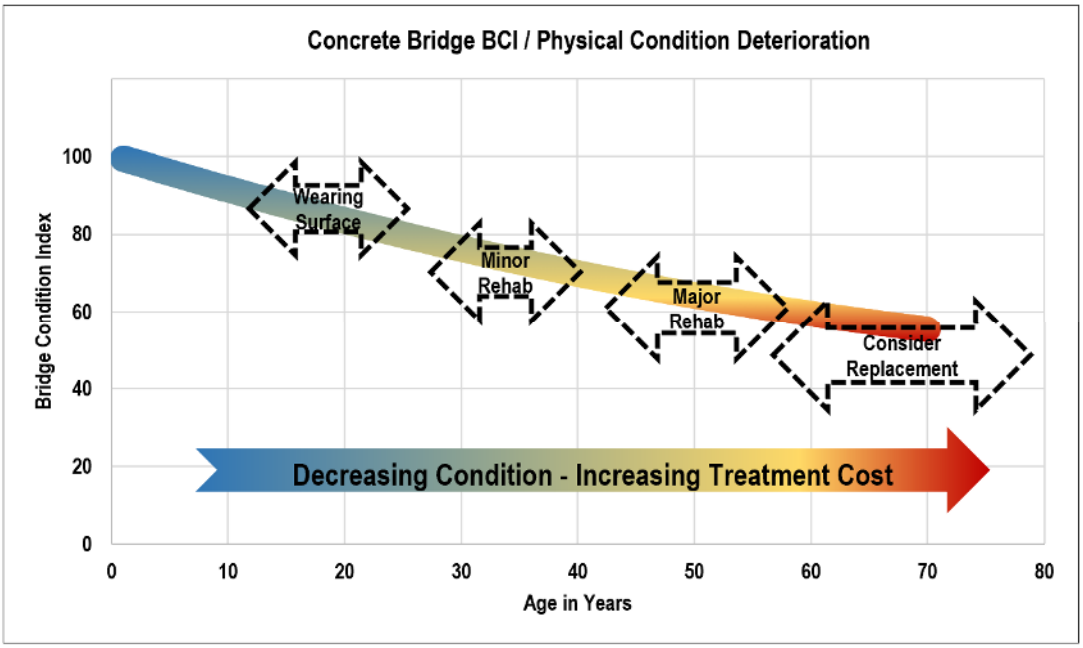
The Condition Rating Format also has to be selected and set up. WorkTech is pre-configured for both MBADES and OSIM. Select the appropriate format. Figure 1 provides a screen capture form WorkTech 6 of the MBADES rating system.

## Improvement Types- Effect on the Asset

In the OSIM and MBADES Manuals there are over 150 improvement types for bridges and culverts. In order to simplify the model process, the consultant recommendations are reviewed and reduced to a simple improvement type using the costs calculated by the consultant. For the purposes of the longer term model, averaging of the typical costs that may be incurred with each of the simplified improvement types has been used.

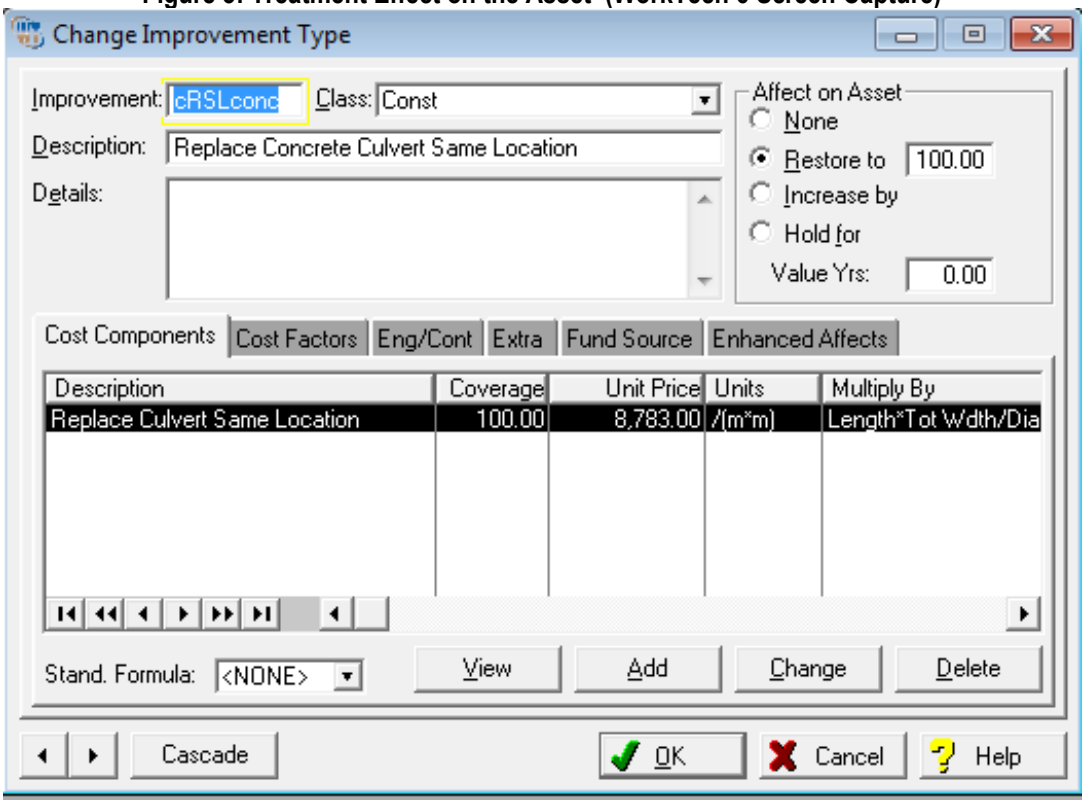
Figure 2 illustrates in general terms the timing and condition for improvements for a concrete structure. Other material types would be similar in terms of the treatments and relative condition where they occur, however the rate of deterioration and timing would differ.

**Figure 2: Concrete Structure -BCI versus Improvement Selection**




Critical to the development of the model is the effect of the treatment on the asset. The effect on the asset may be expressed as 'None', 'Restore to', 'Increase by' or 'Hold' as shown on the following screen capture from WorkTech Asset Manager Foundation. Figure 3 is a screen capture of the WT6 entry of affect on the asset.

**Figure 3: Treatment Effect on the Asset (WorkTech 6 Screen Capture)**




The usual expectation is that a treatment will increase the condition of the structure asset. The following graphic illustrates that perception.

**Figure 4: Anticipated Structure Performance with Improvements -Perception**

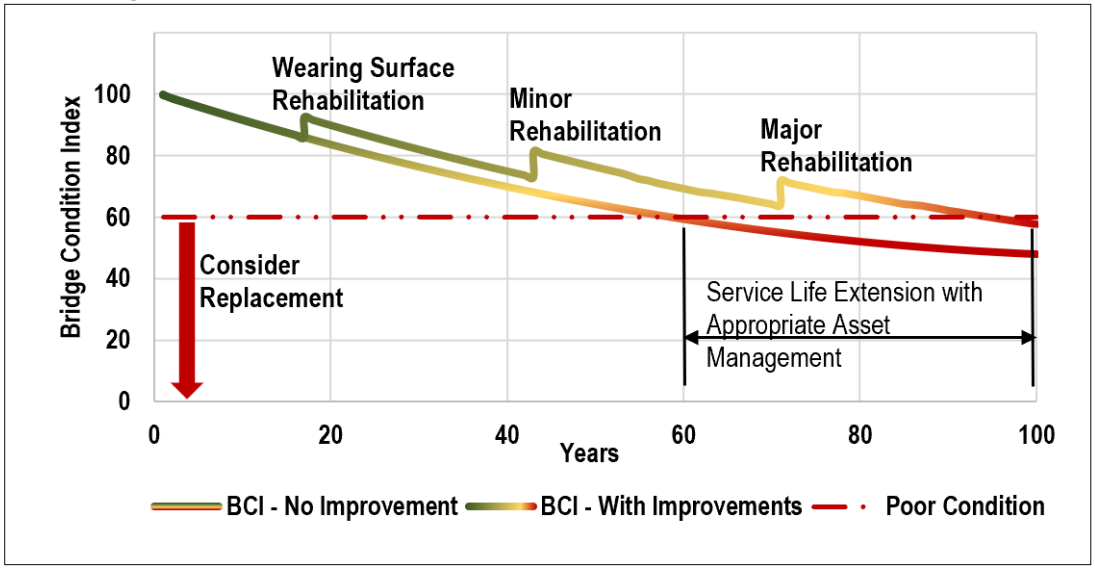
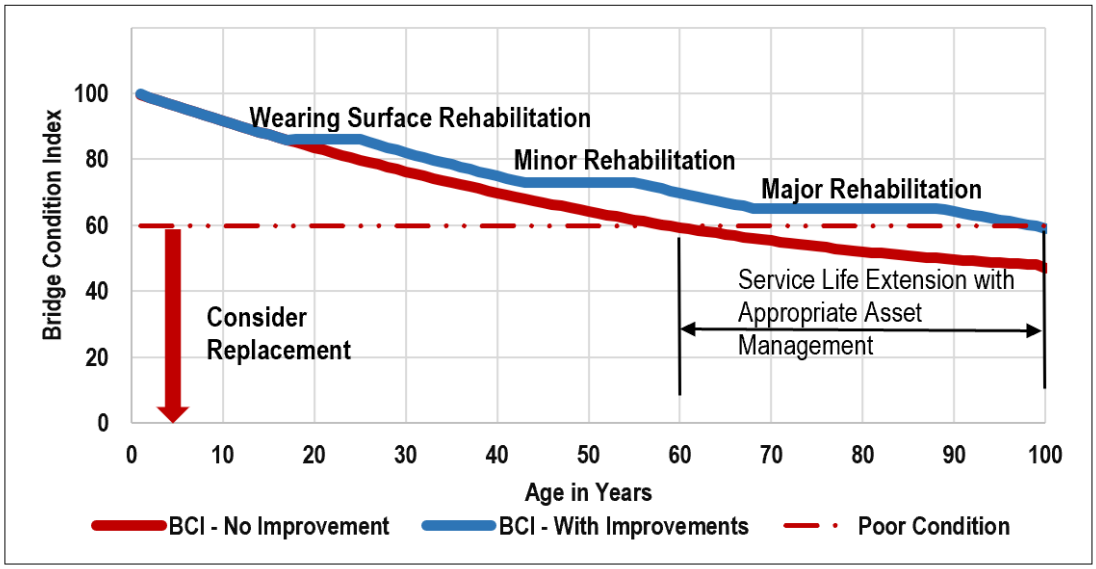


**Figure 5: Performance Model – Effect of Treatment on Asset – Software Set-up**




The general perception/ expectation is that an improvement to an asset will improve the condition, as reflected in the BCI. The software has limitations; however, these can be mitigated through careful modeling by experienced practitioners. For example, increasing the condition (BCI) of the asset for a wearing surface rehabilitation would be followed by a subsequent gradual deterioration of the BCI to the point where the condition would reach a trigger point where a minor rehabilitation would be required again by the software, in essence a perpetual cycle of minor rehabilitations. This does not bear a resemblance of what would actually be required over the life cycle of the structure.

Secondly, from an OSIM inspection perspective, the age of an element, or the length of time that it has been exposed to the environment, limits the increase to the condition/rating that may be applied, as OSIM requires that elements be degraded from Excellent to Good over time, even in the absence of obvious material defects.

For structures, the 'Restore to' and 'Increase By' options were not used for most treatments for the above noted reason. In order to make the software produce a work plan and treatment selection as shown in Figure 4, then the affect on the asset became a 'Hold' instead of an increased condition. The net effect to the perceived life cycle is then met, as the selected treatments result in a modelled extension of the total life of the asset that is consistent with the actual physical extension that would be encountered in practice. Figure 5 illustrates how this has been accomplished. By 'holding' the condition of the asset for an appropriate period of time, then appropriate treatments will be selected at a representative condition/timeline, and the total modeled extension of service life will be roughly equal to the actual extension that would be experienced (from 60 years to 100 years in the above example).

The effect that a treatment has on an asset is critical to the analysis. Inaccurate determination of the effect of a treatment on an asset will produce an inaccurate – and indefensible- result. Figure 5 is a comparison of the deterioration of a concrete bridge without any treatment applied versus a concrete bridge that has appropriate treatment at the optimal condition, illustrating the method that the 'Hold' effect on asset which produces the same effect and lifecycle as shown in Figure 4.

Figure 6 combines the perception/expectation and the modeling graphics, illustrating the message that the right treatment at the right time extends the asset service life.

**Figure 6: Effect on BCI - Perception Vs Model**

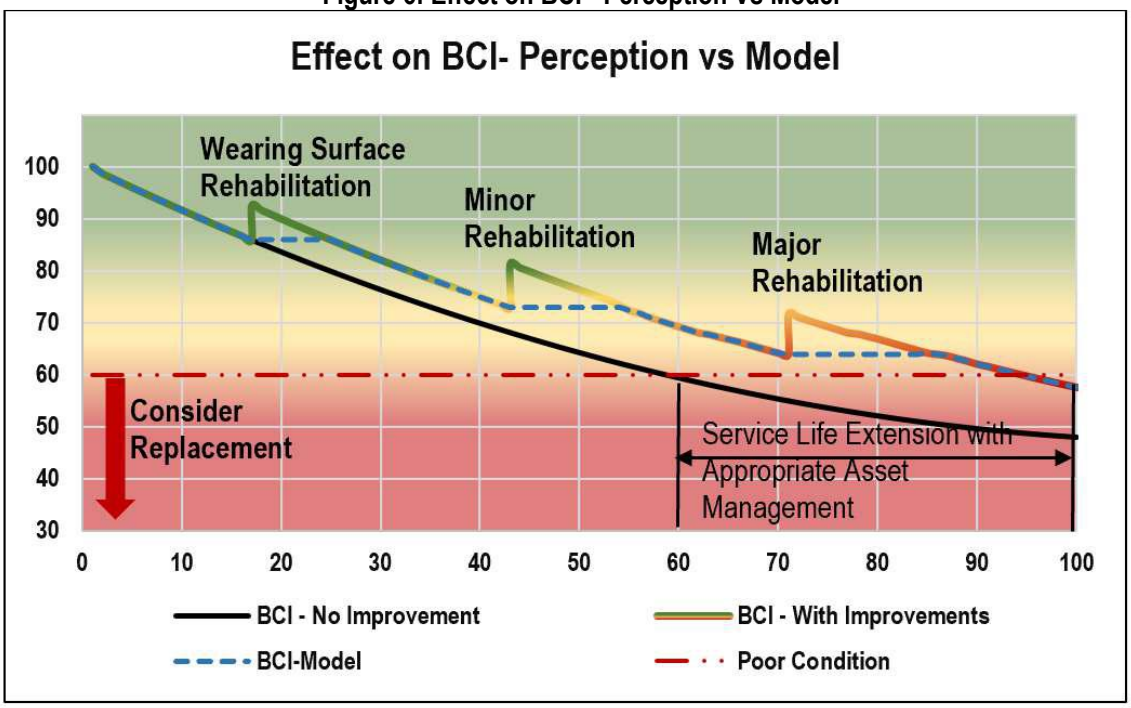



Table 3 identifies a number of improvement types and further identifies the effect that they have on a bridge asset. A similar approach may be taken with other assets.

**Table 3: Improvement Types and Effect on the Asset**

| Code | Description | Effect on the Asset |
|---|---|---|
| NBIR | No Bridge Improvement Required | None |
| WSR | Wearing Surface Rehabilitation | Hold for 8 Years |
| MinBRH | Minor Bridge Rehabilitation | Hold for 12 Years |
| MBRH | Major Bridge Rehabilitation | Hold for 20 Years |
| RSL | Replace bridge - same location | Restore to BCI = 100 |

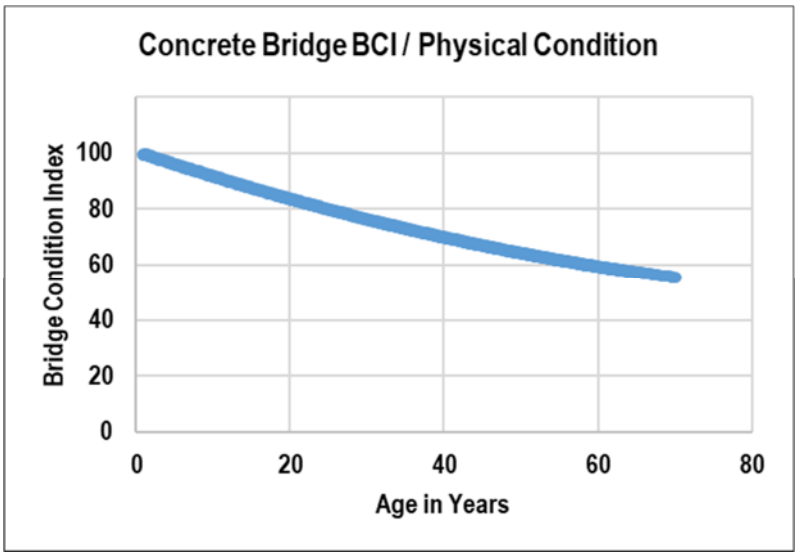
## Structure Deterioration Curves by Material Type

The following pages includes tables and graphs indicating the anticipated performance of structures the condition triggers for treatments. The deterioration curves by asset class used in concert with the table indicating the treatment effect on the asset, and the agency's unit costs, will produce a performance model that demonstrates the effect on the system at various budget levels and produce a program based on input parameters.

## Concrete Bridges- All Roadsides,

**Table 4: Concrete Bridge Structure Deterioration and Treatments**

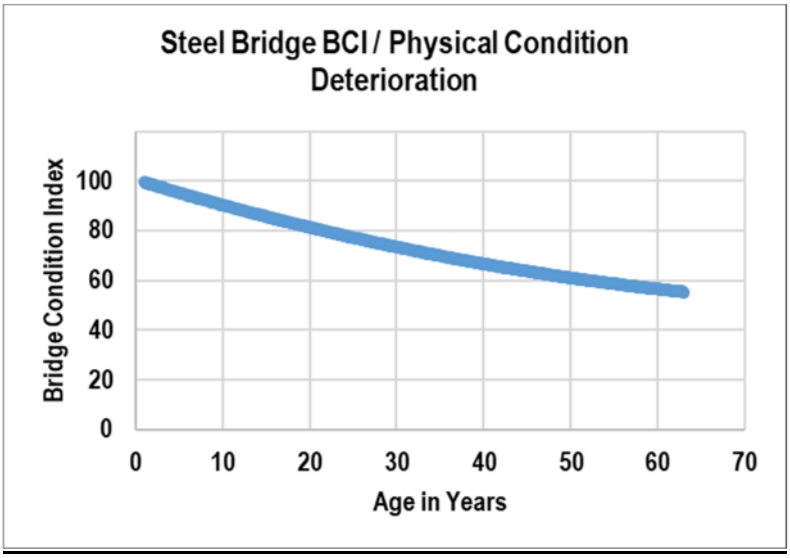
| Concrete Bridge, Concrete Deck and Asphalt Wearing Surface | | | | |
|---|---|---|---|---|
| Year | BCI / Physical Condition | Condition Description | Improvement | Description |
| 1 | 100 | Excellent | NBIR | No Bridge Improvement Required |
| 17 | 85 | Good | WSR | Wearing Surface Rehabilitation |
| 35 | 73 | Good | MinBRH | Minor Bridge Rehabilitation |
| 50 | 65 | Fair | MBRH | Major Bridge Rehabilitation |
| 70 | 55 | Poor | RSL | Replace bridge - same location |



## Steel Bridges, All Roadsides-

**Table 5: Steel Structure Deterioration and Treatments**

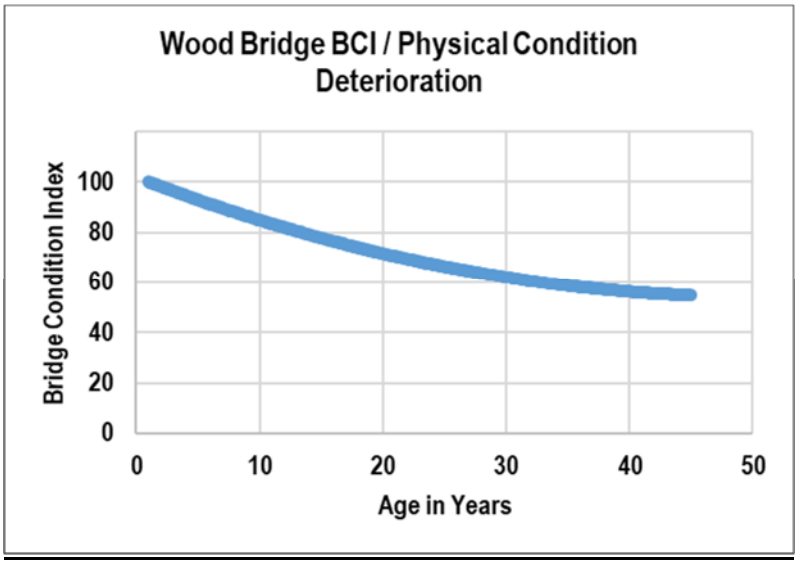
| Steel Bridge -Concrete Deck with Asphalt Wearing Surface | | | | |
|---|---|---|---|---|
| Age | BCI / Physical Condition | Condition Description | Improvement | Improvement |
| 1 | 100 | Excellent | NBIR | No Bridge Improvement Required |
| 15 | 85 | Good | WSR | Wearing Surface Rehabilitation |
| 30 | 73 | Good | MinBRH | Minor Bridge Rehabilitation |
| 45 | 65 | Fair | MBRH | Major Bridge Rehabilitation |
| 63 | 55 | Poor | RSL | Replace bridge - same location |



## Timber Bridges All Roadsides

**Table 6: Wood Structure Deterioration and Treatments**

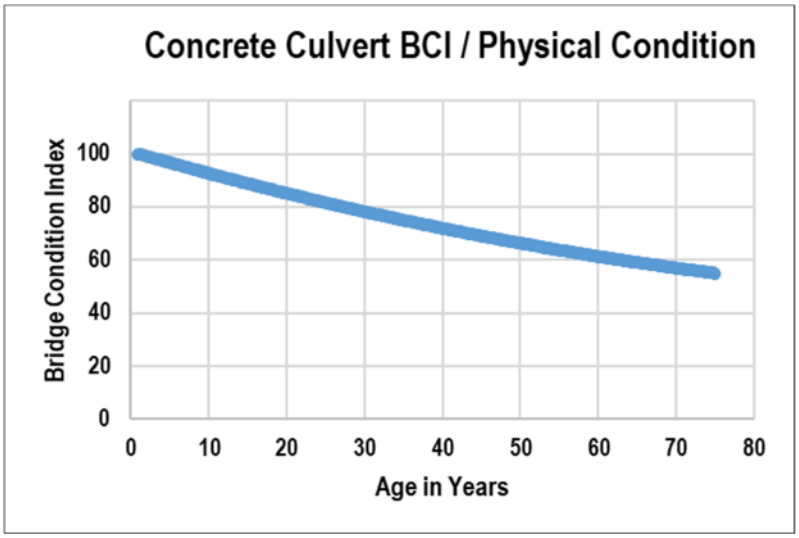
| Wood - Bridge - Wood Deck and Wearing Surface | | | | |
|---|---|---|---|---|
| Age | BCI / Physical Condition | Condition Description | Improvement | Improvement |
| 1 | 100 | Excellent | NBIR | No Bridge Improvement Required |
| 10 | 85 | Good | WSR | Wearing Surface Rehabilitation |
| 22 | 70 | Good | MinBRH | Deck Replacement |
| 32 | 60 | Fair | MBRH | Major Bridge Rehabilitation |
| 45 | 55 | Poor | RSL | Replace bridge - same location |



## Concrete Culverts All Roadsides

**Table 7: Concrete Culvert Deterioration and Treatments**

| Concrete Culvert | | | | |
|---|---|---|---|---|
| Age | BCI / Physical Condition | Condition Description | Improvement | Improvement Description |
| 1 | 100 | Excellent | NCIR | No Culvert Improvement Required |
| 35 | 75 | Good | cREHAB | Culvert Rehabilitation |
| 75 | 55 | Poor | cRSLconc | Replace Concrete Culvert Same Location |



## Steel Culverts, All Roadsides

**Table 8: Steel Culverts Deterioration and Treatments**

| Steel Culvert | | | | |
|---|---|---|---|---|
| Age | BCI / Physical Condition | Condition Description | Improvement | Improvement Description |
| 1 | 100 | Excellent | NCIR | No Culvert Improvement Required |
| 75 | 55 | Poor | cRSLsteel | Replace Steel Culvert Same Location |

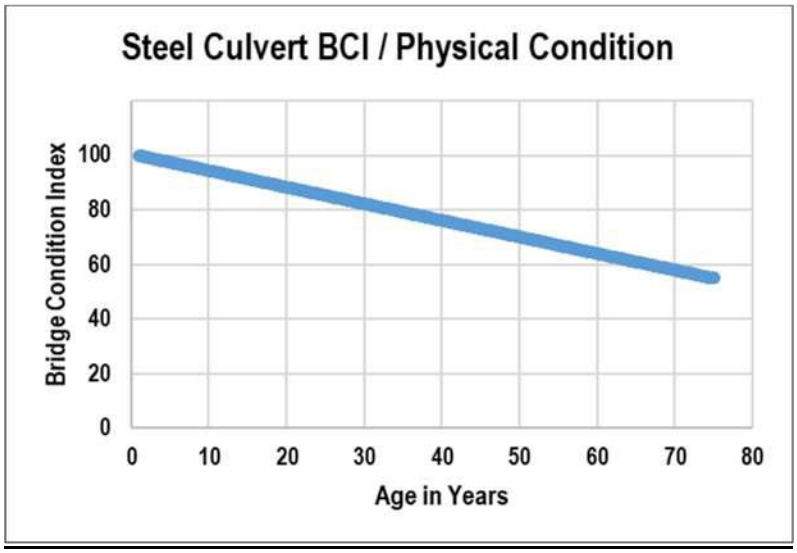


**Figure 7 Sample Performance Model Output**


**Table 9: Acronym Definitions**

| Acronym | Description |
|---|---|
| RSL | Replace Same Location |
| WSR | Wearing Surface Rehabilitation |
| CDR | Complete Deck Replacement |
| MBRH | Major Bridge Rehabilitation |

# Appendix 3

## Transportation Master Plan Projects

**APPENDIX C**
**TABLE C-1**

**COUNTY OF PETERBOROUGH**
**CALCULATION OF SERVICE LEVELS**
**SERVICES RELATED TO A HIGHWAY**

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|---|---|---|---|---|
| Historical Population | 84,560 | 85,156 | 85,759 | 86,369 | 86,985 | 87,301 | 87,676 | 88,107 | 88,596 | 89,145 |
| Historical Employment | 11,563 | 11,927 | 12,303 | 12,690 | 13,090 | 13,095 | 13,103 | 13,113 | 13,126 | 13,139 |
| Historical Population + Employment | 96,123 | 97,083 | 98,062 | 99,059 | 100,075 | 100,396 | 100,779 | 101,220 | 101,722 | 102,284 |

**INVENTORY SUMMARY ($000)**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Buildings | $9,312.0 | $9,312.0 | $9,312.0 | $9,312.0 | $9,312.0 | $9,312.0 | $9,312.0 | $9,312.0 | $9,312.0 | $9,312.0 |
| Land | $11,579.2 | $11,579.2 | $11,579.2 | $11,579.2 | $11,579.2 | $11,579.2 | $11,579.2 | $11,579.2 | $11,579.2 | $11,579.2 |
| Roads | $744,784.0 | $744,784.0 | $744,784.0 | $744,784.0 | $744,784.0 | $744,784.0 | $744,784.0 | $744,784.0 | $744,784.0 | $744,784.0 |
| Bridges & Culverts | $220,336.0 | $224,876.0 | $225,876.0 | $226,876.0 | $227,876.0 | $230,056.0 | $231,056.0 | $232,056.0 | $233,056.0 | $234,056.0 |
| Vehicles | $10,422.0 | $10,487.0 | $11,025.0 | $10,507.5 | $11,062.5 | $10,945.5 | $11,133.0 | $11,113.0 | $11,796.5 | $11,784.0 |
| Furniture & Equipment | $111.1 | $111.1 | $158.9 | $158.9 | $158.9 | $158.9 | $158.9 | $158.9 | $158.9 | $158.9 |
| **Total ($000)** | **$996,544.3** | **$1,001,149.3** | **$1,002,735.1** | **$1,003,217.6** | **$1,004,772.6** | **$1,006,835.6** | **$1,008,023.1** | **$1,009,003.1** | **$1,010,686.6** | **$1,011,674.1** |

**SERVICE LEVEL ($/pop+empl)**

| | | | | | | | | | | | **Average Service Level** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Buildings | $96.88 | $95.92 | $94.96 | $94.00 | $93.05 | $92.75 | $92.40 | $92.00 | $91.54 | $91.04 | $93.45 |
| Land | $120.46 | $119.27 | $118.08 | $116.89 | $115.71 | $115.34 | $114.90 | $114.40 | $113.83 | $113.21 | $116.21 |
| Roads | $7,748.24 | $7,671.62 | $7,595.03 | $7,518.59 | $7,442.26 | $7,418.46 | $7,390.27 | $7,358.07 | $7,321.76 | $7,281.51 | $7,474.58 |
| Bridges & Culverts | $2,292.23 | $2,316.33 | $2,303.40 | $2,290.31 | $2,277.05 | $2,291.49 | $2,292.70 | $2,292.59 | $2,291.11 | $2,288.29 | $2,293.55 |
| Vehicles | $108.42 | $108.02 | $112.43 | $106.07 | $110.54 | $109.02 | $110.47 | $109.79 | $115.97 | $115.21 | $110.59 |
| Furniture & Equipment | $1.16 | $1.14 | $1.62 | $1.60 | $1.59 | $1.58 | $1.58 | $1.57 | $1.56 | $1.55 | $1.50 |
| **Total ($/pop+empl)** | **$10,367.39** | **$10,312.30** | **$10,225.52** | **$10,127.48** | **$10,040.20** | **$10,028.64** | **$10,002.31** | **$9,968.42** | **$9,935.77** | **$9,890.80** | **$10,089.88** |

**COUNTY OF PETERBOROUGH**
**CALCULATION OF MAXIMUM ALLOWABLE**
**SERVICES RELATED TO A HIGHWAY**

| | |
|---|---|
| **30-Year Funding Envelope Calculation** | |
| 10-Year Average Service Level 2012-2021 | $10,089.9 |
| Net Population & Employment Growth 2022-2051 | 26,335 |
| **Net Maximum Allowable Funding Envelope** | $265,720,890 |

**APPENDIX C**
**TABLE C-2**

**COUNTY OF PETERBOROUGH**
**DEVELOPMENT-RELATED CAPITAL PROGRAM**
**SERVICES RELATED TO A HIGHWAY**

| Project Description | Gross Project Cost | Grants/ Subsidies/Other Recoveries | Net Municipal Cost | Ineligible Costs Replacement & BTE Shares | Ineligible Costs Replacement & BTE Shares | Total DC Eligible Costs | DC Eligible Costs Prior Growth | DC Eligible Costs 2022-2051 | DC Eligible Costs Other Dev. Related |
|---|---|---|---|---|---|---|---|---|---|
| **1.0 SERVICES RELATED TO A HIGHWAY** | | | | | | | | | |
| **1.1 Buildings, Land & Furnishings** | | | | | | | | | |
| 1.1.1 Douro Depot Expansion (3,000 sq.ft) | $ 660,000 | $ - | $ 660,000 | 0% | $ - | $ 660,000 | $ - | $ 660,000 | $ - |
| 1.1.2 Centreline Depot - Feasibility Study | $ 80,000 | $ - | $ 80,000 | 0% | $ - | $ 80,000 | $ 80,000 | $ - | $ - |
| 1.1.3 Centreline Depot - Expansion (3,000 sq.ft) | $ 825,000 | $ - | $ 825,000 | 0% | $ - | $ 825,000 | $ - | $ 825,000 | $ - |
| 1.1.4 Salt Shed - Expand Capacity | $ 156,000 | $ - | $ 156,000 | 0% | $ - | $ 156,000 | $ 156,000 | $ - | $ - |
| 1.1.5 Provision for Additional Engineering Space | $ 1,000,000 | $ - | $ 1,000,000 | 0% | $ - | $ 1,000,000 | $ - | $ 1,000,000 | $ - |
| Subtotal Buildings, Land & Furnishings | $ 2,721,000 | $ - | $ 2,721,000 | | $ - | $ 2,721,000 | $ 236,000 | $ 2,485,000 | $ - |
| **1.2 Vehicles & Equipment** | | | | | | | | | |
| 1.2.1 Single Axle Dump Truck | $ 150,000 | $ - | $ 150,000 | 0% | $ - | $ 150,000 | $ 150,000 | $ - | $ - |
| 1.2.2 Pick-up 3/4 tonne | $ 48,000 | $ - | $ 48,000 | 0% | $ - | $ 48,000 | $ 48,000 | $ - | $ - |
| 1.2.3 Pick-up 3/4 tonne | $ 48,000 | $ - | $ 48,000 | 0% | $ - | $ 48,000 | $ 48,000 | $ - | $ - |
| 1.2.4 Provision for New Vehicles | $ 750,000 | $ - | $ 750,000 | 0% | $ - | $ 750,000 | $ - | $ 750,000 | $ - |
| Subtotal Vehicles & Equipment | $ 996,000 | $ - | $ 996,000 | | $ - | $ 996,000 | $ 246,000 | $ 750,000 | $ - |
| **1.3 Studies** | | | | | | | | | |
| 1.3.1 Active Transportation Master Plan (remaining share) | $ 55,000 | $ - | $ 55,000 | 0% | $ - | $ 55,000 | $ 55,000 | $ - | $ - |
| 1.3.2 Lakefield Network Study | $ 100,000 | $ - | $ 100,000 | 0% | $ - | $ 100,000 | $ - | $ 100,000 | $ - |
| 1.3.3 County Road 10 Railway Crossing Study | $ 75,000 | $ - | $ 75,000 | 50% | $ 37,500 | $ 37,500 | $ - | $ 37,500 | $ - |
| 1.3.4 Transportation Master Plan (including supporting studies) | $ 450,000 | $ - | $ 450,000 | 0% | $ - | $ 450,000 | $ - | $ 450,000 | $ - |
| 1.3.5 Provision for Additional Studies (TMP, ATMP, Other Studies to 2051) | $ 3,500,000 | $ - | $ 3,500,000 | 0% | $ - | $ 3,500,000 | $ - | $ 3,500,000 | $ - |
| Subtotal Studies | $ 4,180,000 | $ - | $ 4,180,000 | | $ 37,500 | $ 4,142,500 | $ 55,000 | $ 4,087,500 | $ - |
| **1.4 Intersection Improvements** | | | | | | | | | |
| 1.4.1 CR 01 (Lindsay Road) and CR 12 (Fifes Bay Road) | $ 425,000 | $ - | $ 425,000 | 25% | $ 106,250 | $ 318,750 | $ - | $ 318,750 | $ - |
| 1.4.2 CR 02 and CR 28 | $ 275,000 | $ - | $ 275,000 | 25% | $ 68,750 | $ 206,250 | $ - | $ 206,250 | $ - |
| 1.4.3 CR 12 (Lily Lake Road/Fifes Bay Road) and CR 27 (Ackison Road) | $ 625,000 | $ 100,000 | $ 525,000 | 25% | $ 131,250 | $ 393,750 | $ - | $ 393,750 | $ - |
| 1.4.4 CR 18 and CR 19 (Line Road 3)/Line Road 3 | $ 100,000 | $ - | $ 100,000 | 25% | $ 25,000 | $ 75,000 | $ - | $ 75,000 | $ - |
| 1.4.5 CR 18 (8th Line) and CR 23 (Buckhorn Road) | $ 450,000 | $ - | $ 450,000 | 25% | $ 112,500 | $ 337,500 | $ - | $ 337,500 | $ - |
| 1.4.6 CR 18 (8th Line) and CR 24 (Centre Line) | $ 350,000 | $ - | $ 350,000 | 25% | $ 87,500 | $ 262,500 | $ - | $ 262,500 | $ - |
| 1.4.7 CR 18 (8th Line) and CR 25 (Youngs Point Road) | $ 250,000 | $ - | $ 250,000 | 25% | $ 62,500 | $ 187,500 | $ - | $ 187,500 | $ - |
| 1.4.8 CR 22 (Curve Lake Road) and CR 23 (Buckhorn Road) | $ 2,750,000 | $ - | $ 2,750,000 | 25% | $ 687,500 | $ 2,062,500 | $ - | $ 2,062,500 | $ - |
| 1.4.9 CR 23 (Buckhorn Road) and CR 29 (Lakefield Road) | $ 350,000 | $ - | $ 350,000 | 25% | $ 87,500 | $ 262,500 | $ - | $ 262,500 | $ - |
| 1.4.10 CR 23 (Buckhorn Road) and CR 36 | $ 180,000 | $ - | $ 180,000 | 25% | $ 45,000 | $ 135,000 | $ - | $ 135,000 | $ - |
| 1.4.11 CR 28 and Third Line/Zion Line | $ 175,000 | $ - | $ 175,000 | 25% | $ 43,750 | $ 131,250 | $ - | $ 131,250 | $ - |
| 1.4.12 CR 28 and Larmer Line | $ 75,000 | $ - | $ 75,000 | 25% | $ 18,750 | $ 56,250 | $ - | $ 56,250 | $ - |
| 1.4.13 Allowance for Unspecified Locations | $ 250,000 | $ - | $ 250,000 | 25% | $ 62,500 | $ 187,500 | $ - | $ 187,500 | $ - |
| 1.4.14 Allowance for Unspecified Locations | $ 250,000 | $ - | $ 250,000 | 25% | $ 62,500 | $ 187,500 | $ - | $ 187,500 | $ - |
| 1.4.15 Allowance for Unspecified Locations | $ 250,000 | $ - | $ 250,000 | 25% | $ 62,500 | $ 187,500 | $ - | $ 187,500 | $ - |
| Subtotal Intersection Improvements | $ 6,755,000 | $ 100,000 | $ 6,655,000 | | $ 1,663,750 | $ 4,991,250 | $ - | $ 4,991,250 | $ - |

**APPENDIX C**
**TABLE C-2**

**COUNTY OF PETERBOROUGH**
**DEVELOPMENT-RELATED CAPITAL PROGRAM**
**SERVICES RELATED TO A HIGHWAY**

| Project Description | Gross Project Cost | Grants/ Subsidies/Other Recoveries | Net Municipal Cost | Ineligible Costs Replacement & BTE Shares | Ineligible Costs Replacement & BTE Shares | Total DC Eligible Costs | DC Eligible Costs Prior Growth | DC Eligible Costs 2022-2051 | DC Eligible Costs Other Dev. Related |
|---|---|---|---|---|---|---|---|---|---|
| **1.0 SERVICES RELATED TO A HIGHWAY** | | | | | | | | | |
| **1.5 Roadway Upgrades/Capacity Expansion** | | | | | | | | | |
| 1.5.1 CR 04 (Warsaw Road) - Television Road to CR 41 (University Road) | $ 7,680,000 | $ - | $ 7,680,000 | 5% | $ 384,000 | $ 7,296,000 | $ 80,000 | $ 7,216,000 | $ - |
| 1.5.2 CR 10 - County Rd 21 (King Street) to Fallis Line - (Millbrook) - NEW | $ 9,800,000 | $ - | $ 9,800,000 | 10% | $ 980,000 | $ 8,820,000 | $ 80,000 | $ 8,740,000 | $ - |
| 1.5.3 CR 10 - Fallis Line to Highway 115 | $ 11,207,000 | $ - | $ 11,207,000 | 10% | $ 1,120,700 | $ 10,086,300 | $ 80,000 | $ 10,006,300 | $ - |
| 1.5.4 CR 12 (Lily Lake Road) - CR 27 (Ackison Road) to City of Peterborough Limit | $ 6,560,000 | $ - | $ 6,560,000 | 10% | $ 656,000 | $ 5,904,000 | $ 80,000 | $ 5,824,000 | $ - |
| 1.5.5 CR 18 (Chemong Road) - City of Peterborough Limit to 0.6 km N. of CR 19 (Line Road 3) | $ 2,197,000 | $ - | $ 2,197,000 | 10% | $ 219,700 | $ 1,977,300 | $ 80,000 | $ 1,897,300 | $ - |
| 1.5.6 CR 18 (Chemong Road) - 1 km N. of CR 19 (Line Road 3) to CR 1 (Lindsay Road) | $ 1,896,000 | $ - | $ 1,896,000 | 10% | $ 189,600 | $ 1,706,400 | $ 80,000 | $ 1,626,400 | $ - |
| 1.5.7 CR 18 (Chemong Road) - CR 1 (Lindsay Road) to Bridgenorth | $ 6,600,000 | $ - | $ 6,600,000 | 10% | $ 660,000 | $ 5,940,000 | $ 80,000 | $ 5,860,000 | $ - |
| 1.5.8 CR 18 (Ward Street) - South Limit of Bridgenorth to CR 14 (Bridge Road) | $ 17,460,000 | $ - | $ 17,460,000 | 25% | $ 4,365,000 | $ 13,095,000 | $ 80,000 | $ 13,015,000 | $ - |
| 1.5.9 CR 28 - From Highway 7- 115 to Fraserville - NEW | $ 9,300,000 | $ - | $ 9,300,000 | 10% | $ 930,000 | $ 8,370,000 | $ 80,000 | $ 8,290,000 | $ - |
| 1.5.10 CR 29 (Lakefield Road) - City of Peterborough Limit to 7th Line | $ 14,760,000 | $ - | $ 14,760,000 | 10% | $ 1,476,000 | $ 13,284,000 | $ 80,000 | $ 13,204,000 | $ - |
| 1.5.11 CR 29 (Lakefield Road/Water Street) - Lakefield Second Crossing | $ 25,800,000 | $ - | $ 25,800,000 | 0% | $ - | $ 25,800,000 | $ 80,000 | $ 25,720,000 | $ - |
| 1.5.12 CR 48 (George Street) - CR 48 (Ontario Street) to Mill Lane (County's share) | $ 5,864,000 | $ - | $ 5,864,000 | 50% | $ 2,932,000 | $ 2,932,000 | $ 80,000 | $ 2,852,000 | $ - |
| Subtotal Roadway Upgrades/Capacity Expansion | $ 119,124,000 | $ - | $ 119,124,000 | | $ 13,913,000 | $ 105,211,000 | $ 960,000 | $ 104,251,000 | $ - |
| **1.6 James A. Gifford Causeway** | | | | | | | | | |
| 1.6.1 CR 14 (Yankee Line/Bridge Road) and CR 16 (Robinson Road) | $ 480,000 | $ - | $ 480,000 | 25% | $ 120,000 | $ 360,000 | $ 31,570 | $ 328,430 | $ - |
| 1.6.2 CR 14 (Bridge Road) and CR 18 (Ward Street) | $ 2,160,000 | $ - | $ 2,160,000 | 25% | $ 540,000 | $ 1,620,000 | | $ 1,620,000 | $ - |
| 1.6.3 CR 14 (Yankee Line/Bridge Road) - CR 16 (Robinson Road) to CR 18 (Ward Street) (Remaining work 2023) | $ 900,000 | $ - | $ 900,000 | 10% | $ 90,000 | $ 810,000 | $ - | $ 810,000 | $ - |
| Subtotal James A. Gifford Causeway | $ 3,540,000 | $ - | $ 3,540,000 | | $ 750,000 | $ 2,790,000 | $ 31,570 | $ 2,758,430 | $ - |
| **1.7 Other Infrastructure & Committed Projects** | | | | | | | | | |
| 1.7.1 Allowance for Cycling Facilities (Paved Shoulders and Multi-Use Trails) - Various Locations on County Roads | $ 1,000,000 | $ - | $ 1,000,000 | 75% | $ 750,000 | $ 250,000 | $ - | $ 250,000 | $ - |
| 1.7.2 Allowance for Cycling Facilities (Paved Shoulders and Multi-Use Trails) - Various Locations on County Roads | $ 1,000,000 | $ - | $ 1,000,000 | 75% | $ 750,000 | $ 250,000 | $ - | $ 250,000 | $ - |
| 1.7.3 Allowance for Cycling Facilities (Paved Shoulders and Multi-Use Trails) - Various Locations on County Roads | $ 1,000,000 | $ - | $ 1,000,000 | 75% | $ 750,000 | $ 250,000 | $ - | $ 250,000 | $ - |
| 1.7.4 Allowance for Drainage and Stormwater Management - Various Locations on County Roads | $ 250,000 | $ - | $ 250,000 | 75% | $ 187,500 | $ 62,500 | $ - | $ 62,500 | $ - |
| 1.7.5 Allowance for Drainage and Stormwater Management - Various Locations on County Roads | $ 250,000 | $ - | $ 250,000 | 75% | $ 187,500 | $ 62,500 | $ - | $ 62,500 | $ - |
| 1.7.6 Allowance for Drainage and Stormwater Management - Various Locations on County Roads | $ 250,000 | $ - | $ 250,000 | 75% | $ 187,500 | $ 62,500 | $ - | $ 62,500 | $ - |
| 1.7.7 County Committed Projects | $ 1,900,000 | $ - | $ 1,900,000 | 0% | $ - | $ 1,900,000 | $ 1,900,000 | $ - | $ - |
| Subtotal Other Infrastructure & Committed Projects | $ 5,650,000 | $ - | $ 5,650,000 | | $ 2,812,500 | $ 2,837,500 | $ 1,900,000 | $ 937,500 | $ - |
| **TOTAL SERVICES RELATED TO A HIGHWAY** | **$ 142,966,000** | **$ 100,000** | **$ 142,866,000** | | **$ 19,176,750** | **$ 123,689,250** | **$ 3,428,570** | **$ 120,260,680** | **$ - ** |

| | | |
|---|---|---|
| **Residential Development Charge Calculation** | | |
| Residential Share of 2022 - 2051 DC Eligible Costs | 74% | $88,992,904 |
| 30-Year Population Growth in New Units | | 24,152 |
| Development Charge Per Capita | | **$3,684.69** |
| **Non-Residential Development Charge Calculation** | | |
| Non-Residential Share of 2022 - 2051 DC Eligible Costs | 26% | $31,267,777 |
| 30-Year Growth in Square Metres | | 826,578 |
| Development Charge Per Square Metre | | **$37.83** |

| | |
|---|---|
| 2022 - 2051 Net Funding Envelope | $265,720,890 |
| Uncommitted Reserve Fund Balance | |
| Balance as at December 31, 2021 | $3,428,570 |

# Appendix 4

## Financing Strategy Details

| Asset | Average over 10 years | Total 10 years | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Roads -Recommended 10 year Program | $15,773,643 | $157,736,425 | $11,937,350 | $13,826,975 | $14,697,009 | $13,605,339 | $14,275,344 | $16,621,482 | $17,017,179 | $18,278,348 | $19,239,983 | $18,237,416 |
| Bridges and Culverts (Recommended 10 Year program from Wills) | $4,899,034 | $48,990,340 | $4,258,900 | $4,047,460 | $4,119,670 | $4,828,320 | $4,726,480 | $4,214,870 | $6,817,030 | $4,365,900 | $4,076,600 | $7,535,110 |
| Facilies (average annual estimate from 2018 AMP) | $756,632 | $7,566,320 | $756,632 | $756,632 | $756,632 | $756,632 | $756,632 | $756,632 | $756,632 | $756,632 | $756,632 | $756,632 |
| Total Requirements ($2022) | $21,429,309 | $214,293,085 | $16,952,882 | $18,631,067 | $19,573,311 | $19,190,291 | $19,758,456 | $21,592,984 | $24,590,841 | $23,400,880 | $24,073,215 | $26,529,158 |
| Levy (Preservation 2022) | $9,719,254 | $97,192,540 | $9,719,254 | $9,719,254 | $9,719,254 | $9,719,254 | $9,719,254 | $9,719,254 | $9,719,254 | $9,719,254 | $9,719,254 | $9,719,254 |
| 2.5% Infrastructure Levy | $1,339,365 | $13,393,655 | $1,195,501 | $1,225,389 | $1,256,023 | $1,287,424 | $1,319,609 | $1,352,600 | $1,386,415 | $1,421,075 | $1,456,602 | $1,493,017 |
| Gas Tax | $ 1,769,166 | $17,691,660 | $1,769,166 | $1,769,166 | $1,769,166 | $1,769,166 | $1,769,166 | $1,769,166 | $1,769,166 | $1,769,166 | $1,769,166 | $1,769,166 |
| OCIF Funding (unknown) | $ 400,000 | $4,000,000 | $400,000 | $400,000 | $400,000 | $400,000 | $400,000 | $400,000 | $400,000 | $400,000 | $400,000 | $400,000 |
| Total Funding Available ($2022) | $13,227,785 | $132,277,855 | $13,083,921 | $13,113,809 | $13,144,443 | $13,175,844 | $13,208,029 | $13,241,020 | $13,274,835 | $13,309,495 | $13,345,022 | $13,381,437 |
| Funding Gap ($2022) | $8,201,523 | $82,015,230 | $3,868,961 | $5,517,258 | $6,428,868 | $6,014,447 | $6,550,427 | $8,351,964 | $11,316,006 | $10,091,385 | $10,728,193 | $13,147,721 |
| Funding Gap % ($2022) | 62% | 62% | 30% | 42% | 49% | 46% | 50% | 63% | 85% | 76% | 80% | 98% |
| Assumed Inflation Rate (Construction index) | 0.00% | | 5.88% | 3.32% | 2.13% | 2.01% | 2.39% | 2.41% | 2.41% | 2.41% | 2.41% | 2.41% |
| Total Requirements (Adjusted for Inflation) | $25,614,504 | $256,145,041 | $17,951,232 | $20,382,476 | $21,869,399 | $21,872,273 | $23,057,863 | $25,805,415 | $30,097,408 | $29,331,187 | $30,902,215 | $34,875,573 |
| Funding Gap (Adjusted For inflation - Assumes no additional funding) | $12,386,719 | $123,867,187 | $4,867,311 | $7,268,668 | $8,724,956 | $8,696,429 | $9,849,834 | $12,564,396 | $16,822,573 | $16,021,692 | $17,557,194 | $21,494,136 |
| Cumulative Levy impact ($2022 = 47,820,042) | 25.90% | 259.03% | 10.17% | 13.78% | 15.82% | 15.37% | 17.41% | 21.77% | 27.84% | 24.77% | 27.48% | 32.85% |
| Cost per household (2022) | $221.36 | $2,213.64 | $104.43 | $148.91 | $173.52 | $162.33 | $176.80 | $225.42 | $305.43 | $272.37 | $289.56 | $354.86 |
| Cost per household (Assumes inflation) | $334.32 | $3,343.24 | $131.37 | $196.19 | $235.49 | $234.72 | $265.85 | $339.12 | $454.05 | $432.43 | $473.88 | $580.14 |
| Levy ($2022 ) with 2.5% Infrastructure Levy | $54,913,984 | $549,139,841 | $49,015,543 | $50,240,932 | $51,496,955 | $52,784,379 | $54,103,988 | $55,456,588 | $56,843,003 | $58,264,078 | $59,720,680 | $61,213,697 |

| | Scenario analysis | | | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program | | Average over 10 years | Total 10 years | | | | | | | | | | |
| Option A1: 10 Year Plan | Total Requirements ($2022) | $21,429,309 | $214,293,085 | $16,952,882 | $18,631,067 | $19,573,311 | $19,190,291 | $19,758,456 | $21,592,984 | $24,590,841 | $23,400,880 | $24,073,215 | $26,529,158 |
| | Funding Gap ($2022) | $8,201,523 | $82,015,230 | $3,868,961 | $5,517,258 | $6,428,868 | $6,014,447 | $6,550,427 | $8,351,964 | $11,316,006 | $10,091,385 | $10,728,193 | $13,147,721 |
| | %age increase from prior year | 10.51% | 171.51% | 8.09% | 10.67% | 11.24% | 9.45% | 9.40% | 10.96% | 13.38% | 10.53% | 10.12% | 11.27% |
| | $ per household annual | $221.36 | $2,213.64 | $104.43 | $148.91 | $173.52 | $162.33 | $176.80 | $225.42 | $305.43 | $272.37 | $289.56 | $354.86 |
| | $ per household annual with inflation | $334.32 | $3,343.24 | $131.37 | $196.19 | $235.49 | $234.72 | $265.85 | $339.12 | $454.05 | $432.43 | $473.88 | $580.14 |
| | Condition Roads 2032 | 64.98 | 71.37 | 54 | 57.24 | 61.58 | 63.46 | 65.73 | 67.42 | 68.64 | 69.73 | 70.59 | 71.37 |
| | Condition Structures 2032 | 70.12 | 69.79 | 70.69 | 70.18 | 70.04 | 70.07 | 70.01 | 70.36 | 70.16 | 70 | 69.89 | 69.79 |
| | Option 2: Short Term Sustainability | | | | | | | | | | | | |
| Option A2: Short Term Sustainability | Total Requirements | $19,710,732 | $197,107,320 | $19,710,732 | $19,710,732 | $19,710,732 | $19,710,732 | $19,710,732 | $19,710,732 | $19,710,732 | $19,710,732 | $19,710,732 | $19,710,732 |
| | Funding Gap ($2022) | $6,482,947 | $64,829,465 | $6,626,811 | $6,596,923 | $6,566,289 | $6,534,888 | $6,502,703 | $6,469,712 | $6,435,897 | $6,401,237 | $6,365,710 | $6,329,295 |
| | %age increase from prior year | 8.97% | 135.57% | 13.86% | 12.12% | 10.76% | 9.67% | 8.77% | 8.02% | 7.39% | 6.84% | 6.37% | 5.95% |
| | $ per household annual | $174.98 | $1,749.78 | $178.86 | $178.05 | $177.23 | $176.38 | $175.51 | $174.62 | $173.71 | $172.77 | $171.81 | $170.83 |
| | $ per household annual with inflation | $273.22 | $2,732.22 | $210.12 | $228.02 | $239.58 | $250.67 | $264.28 | $278.37 | $292.78 | $307.56 | $322.67 | $338.15 |
| | Condition Roads 2032 | 64.98 | 69.59 | 59.33 | 61.24 | 62.32 | 63.41 | 64.64 | 65.85 | 66.8 | 67.78 | 68.82 | 69.59 |
| | Condition Structures 2032 | 70.12 | 69.79 | 70.69 | 70.18 | 70.04 | 70.07 | 70.01 | 70.36 | 70.16 | 70 | 69.89 | 69.79 |
| Option A3: Long Term Sustainability | Total Requirements | $30,410,732 | $304,107,320 | $30,410,732 | $30,410,732 | $30,410,732 | $30,410,732 | $30,410,732 | $30,410,732 | $30,410,732 | $30,410,732 | $30,410,732 | $30,410,732 |
| | Funding Gap ($2022) | $17,182,947 | $171,829,465 | $17,326,811 | $17,296,923 | $17,266,289 | $17,234,888 | $17,202,703 | $17,169,712 | $17,135,897 | $17,101,237 | $17,065,710 | $17,029,295 |
| | %age increase from prior year | 16.76% | 359.33% | 36.23% | 26.55% | 20.94% | 17.29% | 14.71% | 12.80% | 11.32% | 10.15% | 9.20% | 8.40% |
| | $ per household annual | $463.78 | $4,637.77 | $467.66 | $466.85 | $466.03 | $465.18 | $464.31 | $463.42 | $462.51 | $461.57 | $460.61 | $459.63 |
| | $ per household annual with inflation | $615.35 | $6,153.52 | $515.89 | $543.94 | $562.23 | $579.80 | $601.27 | $623.50 | $646.22 | $669.53 | $693.37 | $717.77 |
| | Condition Roads2032 | 72.70 | 79.97 | 61.62 | 64.88 | 67.85 | 70.36 | 72.89 | 75.16 | 76.96 | 78.37 | 78.89 | 79.97 |
| | Condition Structures 2032 | 70.12 | 69.79 | 70.69 | 70.18 | 70.04 | 70.07 | 70.01 | 70.36 | 70.16 | 70 | 69.89 | 69.79 |

| LEVY DEBT SCENARIOS | Scenario analysis | | | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Program | | Average over 10 years | Total 10 years | | | | | | | | | | |
| Option B1: Levy Increase at 2% annually for infrastructure, Debt issuance for remainder | Tax Levy (2%) | $1,123,720 | $11,237,197 | $956,401 | $1,003,220 | $1,034,658 | $1,067,602 | $1,100,589 | $1,134,890 | $1,172,259 | $1,214,314 | $1,255,382 | $1,297,883 |
| | Total Debt issued | $7,077,803 | $70,778,033 | $2,912,560 | $4,514,039 | $5,394,210 | $4,946,845 | $5,449,837 | $7,217,074 | $10,143,748 | $8,877,071 | $9,472,811 | $11,849,838 |
| | Debt payments (P&I) (levy requirement) | $2,087,737 | $20,877,366 | $189,047 | $488,734 | $848,476 | $1,177,479 | $1,539,941 | $2,021,452 | $2,700,417 | $3,290,704 | $3,918,110 | $4,703,006 |
| | Total Levy (2% levy + debt) | $58,125,440 | $581,254,404 | $50,160,991 | $51,732,885 | $53,380,088 | $55,029,460 | $56,744,518 | $58,612,930 | $60,715,678 | $62,769,095 | $64,894,172 | $67,214,587 |
| | %age increase from prior year | 5.82% | 148.01% | 2.40% | 3.04% | 3.75% | 4.36% | 5.00% | 5.83% | 6.98% | 7.93% | 8.88% | 10.05% |
| | $ per household annual | $86.68 | $866.79 | $30.92 | $40.27 | $50.83 | $60.60 | $71.27 | $85.19 | $104.53 | $121.59 | $139.64 | $161.97 |
| | Condition Roads 2032 | 64.98 | 71.37 | 54 | 57.24 | 61.58 | 63.46 | 65.73 | 67.42 | 68.64 | 69.73 | 70.59 | 71.37 |
| | Condition Structures 2032 | 70.12 | 69.79 | 70.69 | 70.18 | 70.04 | 70.07 | 70.01 | 70.36 | 70.16 | 70 | 69.89 | 69.79 |
| | Interest Cost for 25 years | $4,966,664 | $49,666,637 | $2,043,813 | $3,167,609 | $3,785,246 | $3,471,320 | $3,824,281 | $5,064,393 | $7,118,110 | $6,229,253 | $6,647,298 | $8,315,314 |
| | Prinicipal for 25 years | $7,077,803 | $70,778,033 | $2,912,560 | $4,514,039 | $5,394,210 | $4,946,845 | $5,449,837 | $7,217,074 | $10,143,748 | $8,877,071 | $9,472,811 | $11,849,838 |
| | Total | $12,044,467 | $120,444,671 | $4,956,373 | $7,681,647 | $9,179,456 | $8,418,165 | $9,274,118 | $12,281,467 | $17,261,858 | $15,106,325 | $16,120,109 | $20,165,152 |
| Option B2: Debt inssuance for entire Program for 10 years, put 3% levy increase into reserve to finance future program | Tax Levy (3%) before Debt Payments | $1,712,070 | $17,120,695 | $1,434,601 | $1,521,405 | $1,572,038 | $1,624,366 | $1,676,840 | $1,731,380 | $1,790,649 | $1,857,128 | $1,922,362 | $1,989,926 |
| | Total Debt issued | $8,201,523 | $82,015,230 | $3,868,961 | $5,517,258 | $6,428,868 | $6,014,447 | $6,550,427 | $8,351,964 | $11,316,006 | $10,091,385 | $10,728,193 | $13,147,721 |
| | Debt payments (P&I) (levy requirement) | $2,539,567 | $25,395,670 | $263,360 | $638,920 | $1,076,533 | $1,485,936 | $1,931,824 | $2,500,342 | $3,270,623 | $3,957,543 | $4,687,811 | $5,582,777 |
| | Total Levy (3% levy + debt) | $59,165,621 | $591,656,206 | $50,713,504 | $52,401,257 | $54,145,526 | $55,894,681 | $57,712,653 | $59,688,310 | $61,904,275 | $64,078,749 | $66,330,854 | $68,786,399 |
| | %age levy increase from prior year | 7.98% | 171.51% | 6.05% | 4.41% | 5.27% | 6.04% | 6.84% | 7.82% | 9.13% | 10.23% | 11.35% | 12.68% |
| | $ per household annual | $114.75 | $1,147.54 | $45.83 | $58.31 | $71.49 | $83.95 | $97.40 | $114.22 | $136.61 | $156.94 | $178.41 | $204.39 |
| | Condition Roads | 64.98 | 71.37 | 54 | 57.24 | 61.58 | 63.46 | 65.73 | 67.42 | 68.64 | 69.73 | 70.59 | 71.37 |
| | Condition Structures | 70.12 | 69.79 | 70.69 | 70.18 | 70.04 | 70.07 | 70.01 | 70.36 | 70.16 | 70 | 69.89 | 69.79 |
| Option B3: Debt inssuance for entire Program for 10 years no other levy increases | Tax Levy (0%) | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 | $0 |
| | Total Debt issued | $8,201,523 | $82,015,230 | $3,868,961 | $5,517,258 | $6,428,868 | $6,014,447 | $6,550,427 | $8,351,964 | $11,316,006 | $10,091,385 | $10,728,193 | $13,147,721 |
| | Debt payments (P&I) (levy requirement) | $2,539,567 | $25,395,670 | $263,360 | $638,920 | $1,076,533 | $1,485,936 | $1,931,824 | $2,500,342 | $3,270,623 | $3,957,543 | $4,687,811 | $5,582,777 |
| | Total Levy | $56,960,429 | $569,604,294 | $48,083,402 | $48,722,322 | $49,798,855 | $51,284,791 | $53,216,615 | $55,716,958 | $58,987,580 | $62,945,124 | $67,632,935 | $73,215,712 |
| | %age increase from prior year | 4.38% | 171.51% | 0.55% | 1.33% | 2.21% | 2.98% | 3.77% | 4.70% | 5.87% | 6.71% | 7.45% | 8.25% |
| | $ per household annual | $68.54 | $685.44 | $7.11 | $17.24 | $29.06 | $40.11 | $52.14 | $67.49 | $88.28 | $106.82 | $126.53 | $150.68 |
| | Condition Roads | 64.98 | 71.37 | 54 | 57.24 | 61.58 | 63.46 | 65.73 | 67.42 | 68.64 | 69.73 | 70.59 | 71.37 |
| | Condition Structures | 70.12 | 69.79 | 70.69 | 70.18 | 70.04 | 70.07 | 70.01 | 70.36 | 70.16 | 70 | 69.89 | 69.79 |
| | Interest Cost for 25 years | $5,755,205 | $57,552,047 | $2,714,942 | $3,871,592 | $4,511,290 | $4,220,481 | $4,596,591 | $5,860,773 | $7,940,712 | $7,081,366 | $7,528,229 | $9,226,070 |
| | Prinicipal for 25 years | $8,201,523 | $82,015,230 | $3,868,961 | $5,517,258 | $6,428,868 | $6,014,447 | $6,550,427 | $8,351,964 | $11,316,006 | $10,091,385 | $10,728,193 | $13,147,721 |
| | Total | $13,956,728 | $139,567,278 | $6,583,903 | $9,388,851 | $10,940,158 | $10,234,928 | $11,147,017 | $14,212,737 | $19,256,718 | $17,172,751 | $18,256,423 | $22,373,791 |

**A - Schedule of Projects**

| Project Description | Strategic Objectives | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 |
|---|---|---|---|---|---|---|---|---|---|---|
| Linear Assets Forecast | Improved essential infrastructure-financial sustainability | $ 13,986,150 | $ 9,922,300 | $ 14,064,350 | $ 13,929,425 | $ 15,423,950 | $ 17,235,240 | $ 16,902,275 | $ 18,452,065 | $ 20,853,960 |
| Engineered Structures Forecast | Improved essential infrastructure-financial sustainability | $ 5,464,942 | $ 4,693,442 | $ 4,371,442 | $ 5,315,442 | $ 5,624,777 | $ 4,654,242 | $ 5,502,962 | $ 5,005,242 | $ 5,306,942 |
| Transportation Plan Forecast | Improved essential infrastructure-financial sustainability | $ 397,614 | $ 2,897,614 | $ 270,000 | $ 570,000 | $ 320,000 | $ 770,000 | $ 770,000 | $ 1,070,000 | $ 320,000 |
| Contributions to reserve | Contribution to Public Works Capital Reserve | $ 522,143 | -$ 266,506 | -$ 141,303 | $ 75,643 | -$ 119,045 | -$ 16,649 | $ 895,576 | $ 1,007,186 | $ 553,862 |
| | Contribution to OCIF Reserve Fund | | | | | | | | | |
| | Contribution to Public Works Facilities Reserve (1-03-2500-3100) | $ 23,376 | $ 23,960 | | | | | | | |
| | **Total annual project costs** | **$ 20,394,225** | **$ 17,270,810** | **$ 18,564,489** | **$ 19,890,510** | **$ 21,249,682** | **$ 22,642,833** | **$ 24,070,813** | **$ 25,534,493** | **$ 27,034,764** |
| **PW Project Funding Sources** | **Funding Source** | | | | | | | | | |
| | Levy | $ 13,362,597 | $ 14,624,723 | $ 15,918,402 | $ 17,244,423 | $ 18,603,595 | $ 19,996,746 | $ 21,424,726 | $ 22,888,406 | $ 24,388,677 |
| | Federal Gas Tax Funds | $ 1,846,087 | $ 1,846,087 | $ 1,846,087 | $ 1,846,087 | $ 1,846,087 | $ 1,846,087 | $ 1,846,087 | $ 1,846,087 | $ 1,846,087 |
| | OCIF | | | | | | | | | |
| | Other funding initiatives (Including Debt financing) | $ 3,576,263 | | | | | | | | |
| | Development Charges | $ 800,000 | $ 800,000 | $ 800,000 | $ 800,000 | $ 800,000 | $ 800,000 | $ 800,000 | $ 800,000 | $ 800,000 |
| | Contributions from project reserves | $ 732,488 | | | | | | | | |
| | Cross Culvert Program Levy (from operating budget) | | | | | | | | | |
| | Carried over through reserve | | | | | | | | | |
| | **Total Annual Project based funding** | **$ 20,317,434** | **$ 17,270,810** | **$ 18,564,489** | **$ 19,890,510** | **$ 21,249,682** | **$ 22,642,833** | **$ 24,070,813** | **$ 25,534,493** | **$ 27,034,764** |
| | *Unfunded amount* | *$ 76,791* | *$ -* | *$ -* | *$ -* | *$ -* | *$ -* | *$ -* | *$ -* | *$ -* |
| | Annual Levy increase in dollars (2.5% of general County levy) | $ 1,231,343 | $ 1,262,126 | $ 1,293,679 | $ 1,326,021 | $ 1,359,172 | $ 1,393,151 | $ 1,427,980 | $ 1,463,679 | $ 1,500,271 |
| | Annual levy Increase as a percentage of PW Levy | 10.15% | 9.45% | 8.85% | 8.33% | 7.88% | 7.49% | 7.14% | 6.83% | 6.55% |
| | Approved Levy | | | | | | | | | |
| **PW Combined Roads & Bridges Re** | **PW Combined Roads & Bridges Reserve Continuity Schedule** | | | | | | | | | |
| | Opening Balance | $ 6,254,996 | $ 6,044,651 | $ 5,778,144 | $ 5,636,842 | $ 5,712,485 | $ 5,593,440 | $ 5,576,792 | $ 6,472,368 | $ 7,479,554 |
| | Contributions to Infrastructure Reserve | $ 522,143 | -$ 266,506 | -$ 141,303 | $ 75,643 | -$ 119,045 | -$ 16,649 | $ 895,576 | $ 1,007,186 | $ 553,862 |
| | Contributions from Reserve | $ 732,488 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $ - |
| | Estimated Project Planning Reserve Closing Balance | $ 6,044,651 | $ 5,778,144 | $ 5,636,842 | $ 5,712,485 | $ 5,593,440 | $ 5,576,792 | $ 6,472,368 | $ 7,479,554 | $ 8,033,416 |

Recommended Reserve Strategy Option 1

| Recommended Split | | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Roads LT Reserve | Opening Balance | $ 4,741,438 | $ 5,697,838 | $ 6,678,149 | $ 7,682,968 | $ 8,712,907 | $ 9,768,595 | $ 10,850,674 | $ 11,959,806 | $ 13,096,666 | $ 14,261,948 |
| | Annual Levy increase in dollars (2.5% of general County levy) | $ 1,195,501 | $ 1,225,389 | $ 1,256,023 | $ 1,287,424 | $ 1,319,609 | $ 1,352,600 | $ 1,386,415 | $ 1,421,075 | $ 1,456,602 | $ 1,456,602 |
| | OCIF | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 |
| | An additional annual Levy Increase to fund gap (2% of general levy) | $ 956,401 | $ 980,311 | $ 1,004,819 | $ 1,029,939 | $ 1,055,688 | $ 1,082,080 | $ 1,109,132 | $ 1,136,860 | $ 1,165,282 | $ 1,194,414 |
| | Estimated Transfers in | $ 2,551,902 | $ 2,605,699 | $ 2,660,842 | $ 2,717,363 | $ 2,775,297 | $ 2,834,679 | $ 2,895,546 | $ 2,957,935 | $ 3,021,883 | $ 3,051,016 |
| | Transfers out for program | -$ 1,595,501 | -$ 1,625,389 | -$ 1,656,023 | -$ 1,687,424 | -$ 1,719,609 | -$ 1,752,600 | -$ 1,786,415 | -$ 1,821,075 | -$ 1,856,602 | -$ 1,856,602 |
| | Ending Balance | $ 5,697,838 | $ 6,678,149 | $ 7,682,968 | $ 8,712,907 | $ 9,768,595 | $ 10,850,674 | $ 11,959,806 | $ 13,096,666 | $ 14,261,948 | $ 15,456,361 |
| | | | | | | | | | | | |
| Structures LT Reserve | Opening Balance | $ 1,025,233 | $ 1,503,433 | $ 1,993,589 | $ 2,495,998 | $ 3,010,968 | $ 3,538,812 | $ 4,079,851 | $ 4,634,417 | $ 5,202,847 | $ 5,785,488 |
| | Federal Gas Tax Contributions | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 |
| | An additional annual Levy Increase to fund gap (1% of general levy) | $ 478,200 | $ 490,155 | $ 502,409 | $ 514,970 | $ 527,844 | $ 541,040 | $ 554,566 | $ 568,430 | $ 582,641 | $ 597,207 |
| | Estimated Transfers in | $ 2,247,200 | $ 2,259,155 | $ 2,271,409 | $ 2,283,970 | $ 2,296,844 | $ 2,310,040 | $ 2,323,566 | $ 2,337,430 | $ 2,351,641 | $ 2,366,207 |
| | Transfers out for program | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 | -$ 1,769,000 |
| | Ending Balance | $ 1,503,433 | $ 1,993,589 | $ 2,495,998 | $ 3,010,968 | $ 3,538,812 | $ 4,079,851 | $ 4,634,417 | $ 5,202,847 | $ 5,785,488 | $ 6,382,695 |
| | | | | | | | | | | | |
| Transportation Master Plan | Opening Balance | $ 488,325 | $ 478,200 | $ 1,115,402 | $ 1,768,535 | $ 2,437,995 | $ 3,124,192 | $ 3,827,544 | $ 4,548,479 | $ 5,287,438 | $ 6,044,871 |
| | From project reserve | $ 732,488 | | | | | | | | | |
| | Assessment Growth estimated at 1.3% per year | $ 478,200 | $ 637,202 | $ 653,132 | $ 669,460 | $ 686,197 | $ 703,352 | $ 720,936 | $ 738,959 | $ 757,433 | $ 776,369 |
| | Estimated Transfers in | $ 1,210,688 | $ 637,202 | $ 653,132 | $ 669,460 | $ 686,197 | $ 703,352 | $ 720,936 | $ 738,959 | $ 757,433 | $ 776,369 |
| | Transfers out for program | -$ 1,220,813 | | | | | | | | | |
| | Ending Balance | $ 478,200 | $ 1,115,402 | $ 1,768,535 | $ 2,437,995 | $ 3,124,192 | $ 3,827,544 | $ 4,548,479 | $ 5,287,438 | $ 6,044,871 | $ 6,821,240 |
| Total ending Balances (3 reserves) | | $ 7,679,472 | $ 9,787,141 | $ 11,947,501 | $ 14,161,870 | $ 16,431,598 | $ 18,758,070 | $ 21,142,703 | $ 23,586,952 | $ 26,092,307 | $ 28,660,297 |

Reserve option 2

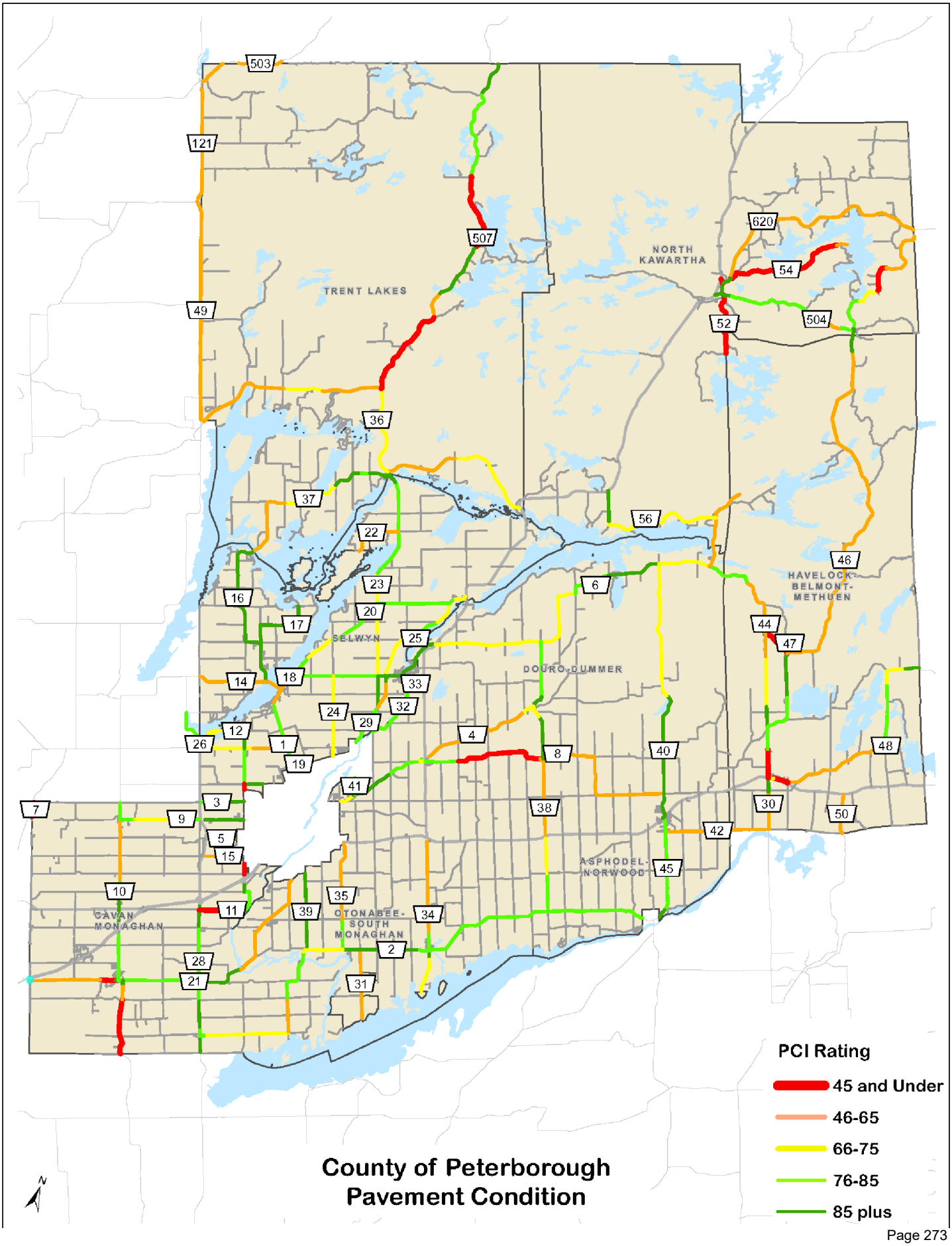
| Recommended Split | | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Roads LT Reserve | Opening Balance | $ 5,942,736 | $ 7,538,237 | $ 10,705,663 | $ 15,128,514 | $ 20,838,177 | $ 27,866,821 | $ 36,247,421 | $ 46,013,776 | $ 57,200,530 | $ 69,843,193 |
| | Annual Levy increase in dollars (2.5% of general County levy - accumulated) | $ 1,195,501 | $ 2,420,890 | $ 3,676,913 | $ 4,964,337 | $ 6,283,946 | $ 7,636,546 | $ 9,022,961 | $ 10,444,036 | $ 11,900,638 | $ 13,393,655 |
| | OCIF | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 | $ 400,000 |
| | An additional annual Levy Increase to fund gap (2% of general levy) | $ - | $ 346,536 | $ 345,938 | $ 345,326 | $ 344,698 | $ 344,054 | $ 343,394 | $ 342,718 | $ 342,025 | $ 341,314 |
| | Estimated Transfers in | $ 1,595,501 | $ 3,167,426 | $ 4,422,851 | $ 5,709,663 | $ 7,028,644 | $ 8,380,600 | $ 9,766,355 | $ 11,186,754 | $ 12,642,663 | $ 14,134,969 |
| | | | | | | | | | | | |
| | Ending Balance | $ 7,538,237 | $ 10,705,663 | $ 15,128,514 | $ 20,838,177 | $ 27,866,821 | $ 36,247,421 | $ 46,013,776 | $ 57,200,530 | $ 69,843,193 | $ 83,978,162 |
| Structures LT Reserve | Opening Balance | $ 1,152,250 | $ 2,921,250 | $ 4,863,518 | $ 6,805,487 | $ 8,747,150 | $ 10,688,499 | $ 12,629,526 | $ 14,570,223 | $ 16,510,582 | $ 18,450,594 |
| | Federal Gas Tax Contributions | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 | $ 1,769,000 |
| | An additional annual Levy Increase to fund gap (1% of general levy) | $ - | $ 173,268 | $ 172,969 | $ 172,663 | $ 172,349 | $ 172,027 | $ 171,697 | $ 171,359 | $ 171,012 | $ 170,657 |
| | Estimated Transfers in | $ 1,769,000 | $ 1,942,268 | $ 1,941,969 | $ 1,941,663 | $ 1,941,349 | $ 1,941,027 | $ 1,940,697 | $ 1,940,359 | $ 1,940,012 | $ 1,939,657 |
| | | | | | | | | | | | |
| | Ending Balance | $ 2,921,250 | $ 4,863,518 | $ 6,805,487 | $ 8,747,150 | $ 10,688,499 | $ 12,629,526 | $ 14,570,223 | $ 16,510,582 | $ 18,450,594 | $ 20,390,251 |
| | | | | | | | | | | | |
| Transportation Master Plan | Opening Balance | $ - | $ - | $ 225,249 | $ 450,109 | $ 674,570 | $ 898,624 | $ 1,122,259 | $ 1,345,465 | $ 1,568,232 | $ 1,790,548 |
| | From project reserve | $ 478,200 | | | | | | | | | |
| | Assessment Growth estimated at 1.3% per year | $ - | $ 225,249 | $ 224,860 | $ 224,462 | $ 224,054 | $ 223,635 | $ 223,206 | $ 222,767 | $ 222,316 | $ 221,854 |
| | Estimated Transfers in | $ 478,200 | $ 225,249 | $ 224,860 | $ 224,462 | $ 224,054 | $ 223,635 | $ 223,206 | $ 222,767 | $ 222,316 | $ 221,854 |
| | Transfers out for program | -$ 478,200 | | | | | | | | | |
| | Ending Balance | $ - | $ 225,249 | $ 450,109 | $ 674,570 | $ 898,624 | $ 1,122,259 | $ 1,345,465 | $ 1,568,232 | $ 1,790,548 | $ 2,012,402 |
| Total ending Balances (3 reserves) | | $ 10,459,486 | $ 15,794,429 | $ 22,384,110 | $ 30,259,897 | $ 39,453,944 | $ 49,999,206 | $ 61,929,464 | $ 75,279,344 | $ 90,084,335 | $ 106,380,816 |
| Levy Impact Reserve Option 2 | | $ 1,195,501 | $ 2,594,158 | $ 3,849,882 | $ 5,137,000 | $ 6,456,295 | $ 7,808,573 | $ 9,194,658 | $ 10,615,395 | $ 12,071,650 | $ 13,564,312 |
| Levy Total | | $ 50,211,044 | $ 52,805,202 | $ 56,655,084 | $ 61,792,084 | $ 68,248,379 | $ 76,056,952 | $ 85,251,610 | $ 95,867,005 | $ 107,938,656 | $ 121,502,968 |
| %age Change | | 2.4% | 5.2% | 7.3% | 9.1% | 10.4% | 11.4% | 12.1% | 12.5% | 12.6% | 12.6% |

| | RATES | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 4.7% | | 5.0% | | 5.7% | | 7.0% | | Total Sum of Total Payment | Total Sum of Interest Amount |
| YEAR | Sum of Total Payment | Sum of Interest Amount | Sum of Total Payment | Sum of Interest Amount | Sum of Total Payment | Sum of Interest Amount | Sum of Total Payment | Sum of Interest Amount | | |
| 2023 | $ 6,240 | $ 4,270 | $ 6,430 | $ 4,544 | $ 6,887 | $ 5,185 | $ 7,775 | $ 6,376 | $ 27,332 | $ 20,376 |
| 2024 | $ 6,807 | $ 4,559 | $ 7,015 | $ 4,857 | $ 7,513 | $ 5,552 | $ 8,481 | $ 6,850 | $ 29,817 | $ 21,819 |
| 2025 | $ 6,807 | $ 4,451 | $ 7,015 | $ 4,746 | $ 7,513 | $ 5,438 | $ 8,481 | $ 6,733 | $ 29,817 | $ 21,368 |
| 2026 | $ 6,807 | $ 4,338 | $ 7,015 | $ 4,630 | $ 7,513 | $ 5,316 | $ 8,481 | $ 6,606 | $ 29,817 | $ 20,891 |
| 2027 | $ 6,807 | $ 4,220 | $ 7,015 | $ 4,508 | $ 7,513 | $ 5,188 | $ 8,481 | $ 6,471 | $ 29,817 | $ 20,386 |
| 2028 | $ 6,807 | $ 4,096 | $ 7,015 | $ 4,380 | $ 7,513 | $ 5,051 | $ 8,481 | $ 6,325 | $ 29,817 | $ 19,852 |
| 2029 | $ 6,807 | $ 3,965 | $ 7,015 | $ 4,245 | $ 7,513 | $ 4,907 | $ 8,481 | $ 6,169 | $ 29,817 | $ 19,287 |
| 2030 | $ 6,807 | $ 3,829 | $ 7,015 | $ 4,103 | $ 7,513 | $ 4,755 | $ 8,481 | $ 6,002 | $ 29,817 | $ 18,689 |
| 2031 | $ 6,807 | $ 3,686 | $ 7,015 | $ 3,954 | $ 7,513 | $ 4,594 | $ 8,481 | $ 5,823 | $ 29,817 | $ 18,057 |
| 2032 | $ 6,807 | $ 3,536 | $ 7,015 | $ 3,798 | $ 7,513 | $ 4,423 | $ 8,481 | $ 5,631 | $ 29,817 | $ 17,387 |
| 2033 | $ 6,807 | $ 3,379 | $ 7,015 | $ 3,633 | $ 7,513 | $ 4,242 | $ 8,481 | $ 5,425 | $ 29,817 | $ 16,679 |
| 2034 | $ 6,807 | $ 3,214 | $ 7,015 | $ 3,460 | $ 7,513 | $ 4,051 | $ 8,481 | $ 5,204 | $ 29,817 | $ 15,929 |
| 2035 | $ 6,807 | $ 3,042 | $ 7,015 | $ 3,278 | $ 7,513 | $ 3,848 | $ 8,481 | $ 4,967 | $ 29,817 | $ 15,135 |
| 2036 | $ 6,807 | $ 2,861 | $ 7,015 | $ 3,087 | $ 7,513 | $ 3,633 | $ 8,481 | $ 4,713 | $ 29,817 | $ 14,294 |
| 2037 | $ 6,807 | $ 2,671 | $ 7,015 | $ 2,886 | $ 7,513 | $ 3,406 | $ 8,481 | $ 4,440 | $ 29,817 | $ 13,404 |
| 2038 | $ 6,807 | $ 2,473 | $ 7,015 | $ 2,675 | $ 7,513 | $ 3,166 | $ 8,481 | $ 4,148 | $ 29,817 | $ 12,462 |
| 2039 | $ 6,807 | $ 2,265 | $ 7,015 | $ 2,453 | $ 7,513 | $ 2,912 | $ 8,481 | $ 3,835 | $ 29,817 | $ 11,464 |
| 2040 | $ 6,807 | $ 2,046 | $ 7,015 | $ 2,219 | $ 7,513 | $ 2,643 | $ 8,481 | $ 3,499 | $ 29,817 | $ 10,408 |
| 2041 | $ 6,807 | $ 1,818 | $ 7,015 | $ 1,974 | $ 7,513 | $ 2,358 | $ 8,481 | $ 3,139 | $ 29,817 | $ 9,288 |
| 2042 | $ 6,807 | $ 1,578 | $ 7,015 | $ 1,716 | $ 7,513 | $ 2,056 | $ 8,481 | $ 2,753 | $ 29,817 | $ 8,103 |
| 2043 | $ 6,807 | $ 1,327 | $ 7,015 | $ 1,445 | $ 7,513 | $ 1,737 | $ 8,481 | $ 2,339 | $ 29,817 | $ 6,847 |
| 2044 | $ 6,807 | $ 1,064 | $ 7,015 | $ 1,160 | $ 7,513 | $ 1,399 | $ 8,481 | $ 1,895 | $ 29,817 | $ 5,517 |
| 2045 | $ 6,807 | $ 788 | $ 7,015 | $ 861 | $ 7,513 | $ 1,041 | $ 8,481 | $ 1,418 | $ 29,817 | $ 4,108 |
| 2046 | $ 6,807 | $ 499 | $ 7,015 | $ 546 | $ 7,513 | $ 662 | $ 8,481 | $ 908 | $ 29,817 | $ 2,615 |
| 2047 | $ 6,807 | $ 196 | $ 7,015 | $ 215 | $ 7,513 | $ 261 | $ 8,481 | $ 360 | $ 29,817 | $ 1,032 |
| 2048 | $ 565 | $ 2 | $ 585 | $ 2 | $ 625 | $ 3 | $ 706 | $ 4 | $ 2,480 | $ 12 |
| Grand Total | $ 170,172 | $ 70,172 | $ 175,377 | $ 75,377 | $ 187,826 | $ 87,826 | $ 212,033 | $ 112,033 | $ 745,409 | $ 345,409 |

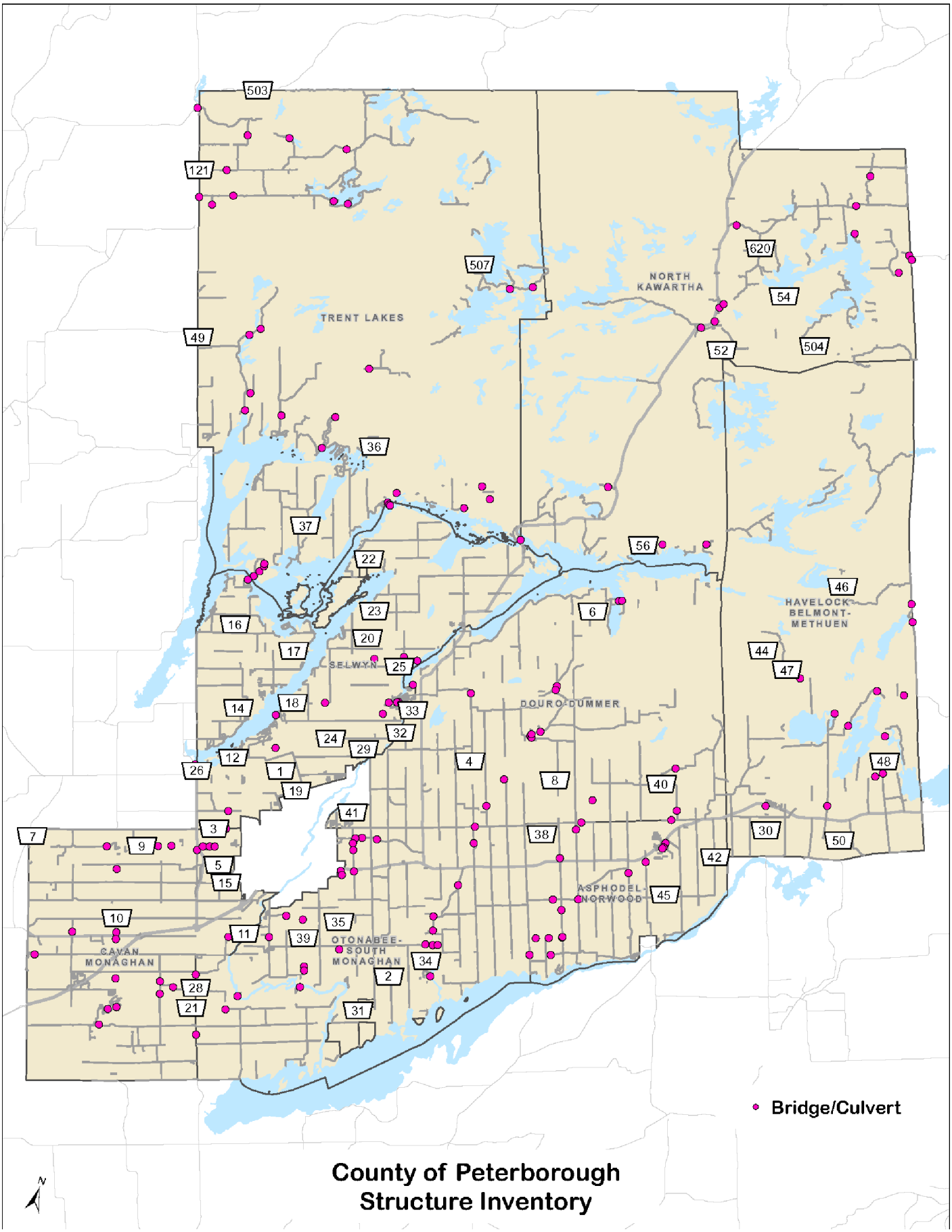
# Appendix 5

## Maps

# Map of County Roads Pavement Condition 2021



# Map of County Structure Inventory 2021



# Appendix 6

## Asset Management Planning Regulation O.Reg 588/17

# Infrastructure for Jobs and Prosperity Act, 2015

## ONTARIO REGULATION 588/17
## ASSET MANAGEMENT PLANNING FOR MUNICIPAL INFRASTRUCTURE

**Consolidation Period:** From March 15, 2021 to the e-Laws currency date.

Las amendment: 193/21.

Legislative History: 193/21.

***This is the English version of a bilingual regulation.***

**CONTENTS**



### INTERPRETATION AND APPLICATION

**Definitions**

**1.** (1) In this Regulation,

"asset category" means a category of municipal infrastructure assets that is,

(a) an aggregate of assets described in each of clauses (a) to (e) of the definition of core municipal infrastructure asset, or

(b) composed of any other aggregate of municipal infrastructure assets that provide the same type of service; ("catégorie de biens")

"core municipal infrastructure asset" means any municipal infrastructure asset that is a,

(a) water asset that relates to the collection, production, treatment, storage, supply or distribution of water,

(b) wastewater asset that relates to the collection, transmission, treatment or disposal of wastewater, including any wastewater asset that from time to time manages stormwater,

(c) stormwater management asset that relates to the collection, transmission, treatment, retention, infiltration, control or disposal of stormwater,

(d) road, or

(e) bridge or culvert; ("bien d'infrastructure municipale essentiel")

"ecological functions" has the same meaning as in Ontario Regulation 140/02 (Oak Ridges Moraine Conservation Plan) made under the *Oak Ridges Moraine Conservation Act, 2001*; ("fonctions écologiques")

"green infrastructure asset" means an infrastructure asset consisting of natural or human-made elements that provide ecological and hydrological functions and processes and includes natural heritage features and systems, parklands, stormwater

management systems, street trees, urban forests, natural channels, permeable surfaces and green roofs; ("bien d'infrastructure verte")

"hydrological functions" has the same meaning as in Ontario Regulation 140/02; ("fonctions hydrologiques")

"joint municipal water board" means a joint board established in accordance with a transfer order made under the *Municipal Water and Sewage Transfer Act, 1997*; ("conseil mixte de gestion municipale des eaux")

"lifecycle activities" means activities undertaken with respect to a municipal infrastructure asset over its service life, including constructing, maintaining, renewing, operating and decommissioning, and all engineering and design work associated with those activities; ("activités relatives au cycle de vie")

"municipal infrastructure asset" means an infrastructure asset, including a green infrastructure asset, directly owned by a municipality or included on the consolidated financial statements of a municipality, but does not include an infrastructure asset that is managed by a joint municipal water board; ("bien d'infrastructure municipale")

"municipality" has the same meaning as in the *Municipal Act, 2001*; ("municipalité")

"operating costs" means the aggregate of costs, including energy costs, of operating a municipal infrastructure asset over its service life; ("frais d'exploitation")

"service life" means the total period during which a municipal infrastructure asset is in use or is available to be used; ("durée de vie")

"significant operating costs" means, where the operating costs with respect to all municipal infrastructure assets within an asset category are in excess of a threshold amount set by the municipality, the total amount of those operating costs. ("frais d'exploitation importants")

(2) In Tables 1 and 2,

"connection-days" means the number of properties connected to a municipal system that are affected by a service issue, multiplied by the number of days on which those properties are affected by the service issue. ("jours-branchements")

(3) In Table 4,

"arterial roads" means Class 1 and Class 2 highways as determined under the Table to section 1 of Ontario Regulation 239/02 (Minimum Maintenance Standards for Municipal Highways) made under the *Municipal Act, 2001*; ("artères")

"collector roads" means Class 3 and Class 4 highways as determined under the Table to section 1 of Ontario Regulation 239/02; ("routes collectrices")

"lane-kilometre" means a kilometre-long segment of roadway that is a single lane in width; ("kilomètre de voie")

"local roads" means Class 5 and Class 6 highways as determined under the Table to section 1 of Ontario Regulation 239/02. ("routes locales")

(4) In Table 5,

"Ontario Structure Inspection Manual" means the Ontario Structure Inspection Manual (OSIM), published by the Ministry of Transportation and dated October 2000 (revised November 2003 and April 2008) and available on a Government of Ontario website; ("manuel d'inspection des structures de l'Ontario")

"structural culvert" has the meaning set out for "culvert (structural)" in the Ontario Structure Inspection Manual. ("ponceau structurel")

**Application**

**2.** For the purposes of section 6 of the Act, every municipality is prescribed as a broader public sector entity to which that section applies.

## STRATEGIC ASSET MANAGEMENT POLICIES

**Strategic asset management policy**

**3.** (1) Every municipality shall prepare a strategic asset management policy that includes the following:

1. Any of the municipality's goals, policies or plans that are supported by its asset management plan.
2. The process by which the asset management plan is to be considered in the development of the municipality's budget or of any long-term financial plans of the municipality that take into account municipal infrastructure assets.
3. The municipality's approach to continuous improvement and adoption of appropriate practices regarding asset management planning.
4. The principles to be followed by the municipality in its asset management planning, which must include the principles set out in section 3 of the Act.

5. The municipality's commitment to consider, as part of its asset management planning,
    i. the actions that may be required to address the vulnerabilities that may be caused by climate change to the municipality's infrastructure assets, in respect of such matters as,
        A. operations, such as increased maintenance schedules,
        B. levels of service, and
        C. lifecycle management,
    ii. the anticipated costs that could arise from the vulnerabilities described in subparagraph i,
    iii. adaptation opportunities that may be undertaken to manage the vulnerabilities described in subparagraph i,
    iv. mitigation approaches to climate change, such as greenhouse gas emission reduction goals and targets, and
    v. disaster planning and contingency funding.
6. A process to ensure that the municipality's asset management planning is aligned with any of the following financial plans:
    i. Financial plans related to the municipality's water assets including any financial plans prepared under the *Safe Drinking Water Act, 2002*.
    ii. Financial plans related to the municipality's wastewater assets.
7. A process to ensure that the municipality's asset management planning is aligned with Ontario's land-use planning framework, including any relevant policy statements issued under subsection 3 (1) of the *Planning Act*, any provincial plans as defined in the *Planning Act* and the municipality's official plan.
8. An explanation of the capitalization thresholds used to determine which assets are to be included in the municipality's asset management plan and how the thresholds compare to those in the municipality's tangible capital asset policy, if it has one.
9. The municipality's commitment to coordinate planning for asset management, where municipal infrastructure assets connect or are interrelated with those of its upper-tier municipality, neighbouring municipalities or jointly-owned municipal bodies.
10. The persons responsible for the municipality's asset management planning, including the executive lead.
11. An explanation of the municipal council's involvement in the municipality's asset management planning.
12. The municipality's commitment to provide opportunities for municipal residents and other interested parties to provide input into the municipality's asset management planning.

(2) For the purposes of this section,

"capitalization threshold" is the value of a municipal infrastructure asset at or above which a municipality will capitalize the value of it and below which it will expense the value of it. ("seuil de capitalisation")

**Update of asset management policy**

**4.** Every municipality shall prepare its first strategic asset management policy by July 1, 2019 and shall review and, if necessary, update it at least every five years.

## ASSET MANAGEMENT PLANS

**Asset management plans, current levels of service**

**5.** (1) Every municipality shall prepare an asset management plan in respect of its core municipal infrastructure assets on or before July 1, 2022, and in respect of all of its other municipal infrastructure assets on or before July 1, 2024. O. Reg. 193/21, s. 1.

(2) A municipality's asset management plan must include the following:

1. For each asset category, the current levels of service being provided, determined in accordance with the following qualitative descriptions and technical metrics and based on data from at most the two calendar years prior to the year in which all information required under this section is included in the asset management plan:
    i. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 1, 2, 3, 4 or 5, as the case may be.
    ii. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.

2. The current performance of each asset category, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency, and based on data from at most two calendar years prior to the year in which all information required under this section is included in the asset management plan.
3. For each asset category,
    i. a summary of the assets in the category,
    ii. the replacement cost of the assets in the category,
    iii. the average age of the assets in the category, determined by assessing the average age of the components of the assets,
    iv. the information available on the condition of the assets in the category, and
    v. a description of the municipality's approach to assessing the condition of the assets in the category, based on recognized and generally accepted good engineering practices where appropriate.
4. For each asset category, the lifecycle activities that would need to be undertaken to maintain the current levels of service as described in paragraph 1 for each of the 10 years following the year for which the current levels of service under paragraph 1 are determined and the costs of providing those activities based on an assessment of the following:
    i. The full lifecycle of the assets.
    ii. The options for which lifecycle activities could potentially be undertaken to maintain the current levels of service.
    iii. The risks associated with the options referred to in subparagraph ii.
    iv. The lifecycle activities referred to in subparagraph ii that can be undertaken for the lowest cost to maintain the current levels of service.
5. For municipalities with a population of less than 25,000, as reported by Statistics Canada in the most recent official census, the following:
    i. A description of assumptions regarding future changes in population or economic activity.
    ii. How the assumptions referred to in subparagraph i relate to the information required by paragraph 4.
6. For municipalities with a population of 25,000 or more, as reported by Statistics Canada in the most recent official census, the following:
    i. With respect to municipalities in the Greater Golden Horseshoe growth plan area, if the population and employment forecasts for the municipality are set out in Schedule 3 or 7 to the 2017 Growth Plan, those forecasts.
    ii. With respect to lower-tier municipalities in the Greater Golden Horseshoe growth plan area, if the population and employment forecasts for the municipality are not set out in Schedule 7 to the 2017 Growth Plan, the portion of the forecasts allocated to the lower-tier municipality in the official plan of the upper-tier municipality of which it is a part.
    iii. With respect to upper-tier municipalities or single-tier municipalities outside of the Greater Golden Horseshoe growth plan area, the population and employment forecasts for the municipality that are set out in its official plan.
    iv. With respect to lower-tier municipalities outside of the Greater Golden Horseshoe growth plan area, the population and employment forecasts for the lower-tier municipality that are set out in the official plan of the upper-tier municipality of which it is a part.
    v. If, with respect to any municipality referred to in subparagraph iii or iv, the population and employment forecasts for the municipality cannot be determined as set out in those subparagraphs, a description of assumptions regarding future changes in population or economic activity.
    vi. For each of the 10 years following the year for which the current levels of service under paragraph 1 are determined, the estimated capital expenditures and significant operating costs related to the lifecycle activities required to maintain the current levels of service in order to accommodate projected increases in demand caused by growth, including estimated capital expenditures and significant operating costs related to new construction or to upgrading of existing municipal infrastructure assets. O. Reg. 588/17, s. 5 (2).

(3) Every asset management plan must indicate how all background information and reports upon which the information required by paragraph 3 of subsection (2) is based will be made available to the public. O. Reg. 588/17, s. 5 (3).

(4) In this section,

"2017 Growth Plan" means the Growth Plan for the Greater Golden Horseshoe, 2017 that was approved under subsection 7 (6) of the *Places to Grow Act, 2005* on May 16, 2017 and came into effect on July 1, 2017; ("Plan de croissance de 2017")

"Greater Golden Horseshoe growth plan area" means the area designated by section 2 of Ontario Regulation 416/05 (Growth Plan Areas) made under the *Places to Grow Act, 2005*. ("zone de croissance planifiée de la région élargie du Golden Horseshoe") O. Reg. 588/17, s. 5 (4).

**Asset management plans, proposed levels of service**

**6.** (1) Subject to subsection (2), on or before July 1, 2025, every asset management plan prepared under section 5 must include the following additional information:

1. For each asset category, the levels of service that the municipality proposes to provide for each of the 10 years following the year in which all information required under section 5 and this section is included in the asset management plan, determined in accordance with the following qualitative descriptions and technical metrics:
    i. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 1, 2, 3, 4 or 5, as the case may be.
    ii. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.
2. An explanation of why the proposed levels of service under paragraph 1 are appropriate for the municipality, based on an assessment of the following:
    i. The options for the proposed levels of service and the risks associated with those options to the long term sustainability of the municipality.
    ii. How the proposed levels of service differ from the current levels of service set out under paragraph 1 of subsection 5 (2).
    iii. Whether the proposed levels of service are achievable.
    iv. The municipality's ability to afford the proposed levels of service.
3. The proposed performance of each asset category for each year of the 10-year period referred to in paragraph 1, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency.
4. A lifecycle management and financial strategy that sets out the following information with respect to the assets in each asset category for the 10-year period referred to in paragraph 1:
    i. An identification of the lifecycle activities that would need to be undertaken to provide the proposed levels of service described in paragraph 1, based on an assessment of the following:
        A. The full lifecycle of the assets.
        B. The options for which lifecycle activities could potentially be undertaken to achieve the proposed levels of service.
        C. The risks associated with the options referred to in sub-subparagraph B.
        D. The lifecycle activities referred to in sub-subparagraph B that can be undertaken for the lowest cost to achieve the proposed levels of service.
    ii. An estimate of the annual costs for each of the 10 years of undertaking the lifecycle activities identified in subparagraph i, separated into capital expenditures and significant operating costs.
    iii. An identification of the annual funding projected to be available to undertake lifecycle activities and an explanation of the options examined by the municipality to maximize the funding projected to be available.
    iv. If, based on the funding projected to be available, the municipality identifies a funding shortfall for the lifecycle activities identified in subparagraph i,
        A. an identification of the lifecycle activities, whether set out in subparagraph i or otherwise, that the municipality will undertake, and
        B. if applicable, an explanation of how the municipality will manage the risks associated with not undertaking any of the lifecycle activities identified in subparagraph i.
5. For municipalities with a population of less than 25,000, as reported by Statistics Canada in the most recent official census, a discussion of how the assumptions regarding future changes in population and economic activity, set out in subparagraph 5 i of subsection 5 (2), informed the preparation of the lifecycle management and financial strategy referred to in paragraph 4 of this subsection.
6. For municipalities with a population of 25,000 or more, as reported by Statistics Canada in the most recent official census,

i. the estimated capital expenditures and significant operating costs to achieve the proposed levels of service as described in paragraph 1 in order to accommodate projected increases in demand caused by population and employment growth, as set out in the forecasts or assumptions referred to in paragraph 6 of subsection 5 (2), including estimated capital expenditures and significant operating costs related to new construction or to upgrading of existing municipal infrastructure assets,

ii. the funding projected to be available, by source, as a result of increased population and economic activity, and

iii. an overview of the risks associated with implementation of the asset management plan and any actions that would be proposed in response to those risks.

7. An explanation of any other key assumptions underlying the plan that have not previously been explained. O. Reg. 588/17, s. 6 (1); O. Reg. 193/21, s. 2 (1).

(2) With respect to an asset management plan prepared under section 5 on or before July 1, 2022, if the additional information required under this section is not included before July 1, 2024, the municipality shall, before including the additional information, update the current levels of service set out under paragraph 1 of subsection 5 (2) and the current performance measures set out under paragraph 2 of subsection 5 (2) based on data from the two most recent calendar years. O. Reg. 193/21, s. 2 (2).

**Update of asset management plans**

**7.** (1) Every municipality shall review and update its asset management plan at least five years after the year in which the plan is completed under section 6 and at least every five years thereafter.

(2) The updated asset management plan must comply with the requirements set out under paragraphs 1, 2 and 3 and subparagraphs 5 i and 6 i, ii, iii, iv and v of subsection 5 (2), subsection 5 (3) and paragraphs 1 to 7 of subsection 6 (1).

**Endorsement and approval required**

**8.** Every asset management plan prepared under section 5 or 6, or updated under section 7, must be,

(a) endorsed by the executive lead of the municipality; and

(b) approved by a resolution passed by the municipal council.

**Annual review of asset management planning progress**

**9.** (1) Every municipal council shall conduct an annual review of its asset management progress on or before July 1 in each year, starting the year after the municipality's asset management plan is completed under section 6.

(2) The annual review must address,

(a) the municipality's progress in implementing its asset management plan;

(b) any factors impeding the municipality's ability to implement its asset management plan; and

(c) a strategy to address the factors described in clause (b).

**Public availability**

**10.** Every municipality shall post its current strategic asset management policy and asset management plan on a website that is available to the public, and shall provide a copy of the policy and plan to any person who requests it.

TABLE 1

WATER ASSETS

| Column 1<br>Service attribute | Column 2<br>Community levels of service (qualitative descriptions) | Column 3<br>Technical levels of service (technical metrics) |
|---|---|---|
| Scope | 1. Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal water system.<br>2. Description, which may include maps, of the user groups or areas of the municipality that have fire flow. | 1. Percentage of properties connected to the municipal water system.<br>2. Percentage of properties where fire flow is available. |
| Reliability | Description of boil water advisories and service interruptions. | 1. The number of connection-days per year where a boil water advisory notice is in place compared to the total number of properties connected to the municipal water system.<br>2. The number of connection-days per year due to water main breaks compared to the total number of properties connected to the municipal water system. |

TABLE 2

WASTEWATER ASSETS

| Column 1<br>Service attribute | Column 2<br>Community levels of service (qualitative descriptions) | Column 3<br>Technical levels of service (technical metrics) |
|---|---|---|
| Scope | Description, which may include maps, of the user groups or areas of the municipality that are connected to the municipal wastewater system. | Percentage of properties connected to the municipal wastewater system. |
| Reliability | 1. Description of how combined sewers in the municipal wastewater system are designed with overflow structures in place which allow overflow during storm events to prevent backups into homes.<br>2. Description of the frequency and volume of overflows in combined sewers in the municipal wastewater system that occur in habitable areas or beaches.<br>3. Description of how stormwater can get into sanitary sewers in the municipal wastewater system, causing sewage to overflow into streets or backup into homes.<br>4. Description of how sanitary sewers in the municipal wastewater system are designed to be resilient to avoid events described in paragraph 3.<br>5. Description of the effluent that is discharged from sewage treatment plants in the municipal wastewater system. | 1. The number of events per year where combined sewer flow in the municipal wastewater system exceeds system capacity compared to the total number of properties connected to the municipal wastewater system.<br>2. The number of connection-days per year due to wastewater backups compared to the total number of properties connected to the municipal wastewater system.<br>3. The number of effluent violations per year due to wastewater discharge compared to the total number of properties connected to the municipal wastewater system. |

TABLE 3

STORMWATER MANAGEMENT ASSETS

| Column 1<br>Service attribute | Column 2<br>Community levels of service (qualitative descriptions) | Column 3<br>Technical levels of service (technical metrics) |
|---|---|---|
| Scope | Description, which may include maps, of the user groups or areas of the municipality that are protected from flooding, including the extent of the protection provided by the municipal stormwater management system. | 1. Percentage of properties in municipality resilient to a 100-year storm.<br>2. Percentage of the municipal stormwater management system resilient to a 5-year storm. |

TABLE 4

ROADS

| Column 1<br>Service attribute | Column 2<br>Community levels of service (qualitative descriptions) | Column 3<br>Technical levels of service (technical metrics) |
|---|---|---|
| Scope | Description, which may include maps, of the road network in the municipality and its level of connectivity. | Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality. |
| Quality | Description or images that illustrate the different levels of road class pavement condition. | 1. For paved roads in the municipality, the average pavement condition index value.<br>2. For unpaved roads in the municipality, the average surface condition (e.g. excellent, good, fair or poor). |

TABLE 5

BRIDGES AND CULVERTS

| Column 1<br>Service attribute | Column 2<br>Community levels of service (qualitative descriptions) | Column 3<br>Technical levels of service (technical metrics) |
|---|---|---|
| Scope | Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists). | Percentage of bridges in the municipality with loading or dimensional restrictions. |
| Quality | 1. Description or images of the condition of bridges and how this would affect use of the bridges.<br>2. Description or images of the condition of culverts and how this would affect use of the culverts. | 1. For bridges in the municipality, the average bridge condition index value.<br>2. For structural culverts in the municipality, the average bridge condition index value. |

**11.** OMITTED (PROVIDES FOR COMING INTO FORCE OF PROVISIONS OF THIS REGULATION).