FINAL

AECOM

City of Sault Ste. Marie Asset Management Plan Roads and Bridges

August 4th, 2022

Delivering a better world

Statement of Qualifications and Limitations

The attached Report (the “Report”) has been prepared by AECOM Canada Ltd. (“AECOM”) for the benefit of the Client (“Client”) in accordance with the agreement between AECOM and Client, including the scope of work detailed therein (the “Agreement”).

The information, data, recommendations and conclusions contained in the Report (collectively, the “Information”):

- is subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the “Limitations”);
- represents AECOM’s professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to AECOM which has not been independently verified;
- has not been updated since the date of issuance of the Report and its accuracy is limited to the time period and circumstances in which it was collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- was prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time..

AECOM shall be entitled to rely upon the accuracy and completeness of information that was provided to it and has no obligation to update such information. AECOM accepts no responsibility for any events or circumstances that may have occurred since the date on which the Report was prepared and, in the case of subsurface, environmental or geotechnical conditions, is not responsible for any variability in such conditions, geographically or over time.

AECOM agrees that the Report represents its professional judgement as described above and that the Information has been prepared for the specific purpose and use described in the Report and the Agreement, but AECOM makes no other representations, or any guarantees or warranties whatsoever, whether express or implied, with respect to the Report, the Information or any part thereof.

Without in any way limiting the generality of the foregoing, any estimates or opinions regarding probable construction costs or construction schedule provided by AECOM represent AECOM’s professional judgement in light of its experience and the knowledge and information available to it at the time of preparation. Since AECOM has no control over market or economic conditions, prices for construction labour, equipment or materials or bidding procedures, AECOM, its directors, officers and employees are not able to, nor do they, make any representations, warranties or guarantees whatsoever, whether express or implied, with respect to such estimates or opinions, or their variance from actual construction costs or schedules, and accept no responsibility for any loss or damage arising therefrom or in any way related thereto. Persons relying on such estimates or opinions do so at their own risk.

Except (1) as agreed to in writing by AECOM and Client; (2) as required by-law; or (3) to the extent used by governmental reviewing agencies for the purpose of obtaining permits or approvals, the Report and the Information may be used and relied upon only by Client.

AECOM accepts no responsibility, and denies any liability whatsoever, to parties other than Client who may obtain access to the Report or the Information for any injury, loss or damage suffered by such parties arising from their use of, reliance upon, or decisions or actions based on the Report or any of the Information (“improper use of the Report”), except to the extent those parties have obtained the prior written consent of AECOM to use and rely upon the Report and the Information. Any injury, loss or damages arising from improper use of the Report shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report and any use of the Report is subject to the terms hereof.

AECOM: 2015-04-13

Quality information

Prepared by

Donghui Lu, Ph.D., IAM Cert., Asset Management Consultant

Checked by

Shawn Lapain, P.Eng., Senior Pavement Engineer

Checked by

Khalid Kaddoura, Ph.D., P.Eng., PMP, Senior Asset Management Engineer

Checked by

Nikita Bhalla, MEL, E.I.T., Asset Management Consultant

Verified by

Jeff Atherton, AVP, Project Advisor

Approved by

Chris Lombard, MBA P.Eng., Asset Management Leader, Americas Water

Revision History

Revision	Revision date	Details	Authorized	Name	Position
Draft V0	June 30th, 2022	Draft Report – Roads and Bridges AM Plan		Chris Lombard	Project Manager
Final	August 4th, 2022	Final Report – Roads and Bridges AM Plan		Chris Lombard	Project Manager

Distribution List

# Hard Copies	PDF Required	Association / Company Name
0	1	Catherine Taddo, P.Eng., Manager, Development and Environmental Engineering, Public Works and Engineering Services, City of Sault Ste. Marie

Prepared for:

Catherine Taddo, P. Eng.
Manager, Development and Environmental Engineering
Public Works and Engineering Services

City of Sault Ste. Marie
99 Foster Drive, Sault Ste. Marie, ON P6A 5X6

Prepared by:

AECOM, 523 Wellington Street East
Sault Ste. Marie, Ontario Canada P6A 2M4

T 705.942.2612 F 705.942.3642

Table of Contents

1. Introduction 1
   - 1.1 Background 1
   - 1.2 Scope and Objectives 1
   - 1.3 Asset Management Provincial Requirements 2
2. State of Infrastructure 3
   - 2.1 Asset Hierarchy 3
   - 2.2 Current State of the Assets 4
   - 2.2.1 Asset Inventory 4
   - 2.2.2 Traffic Volume Impact 5
   - 2.2.3 Current Replacement Value 5
   - 2.2.4 Asset Age and Remaining Service Life 6
   - 2.2.5 Pavement Condition Assessment 7
   - 2.2.6 Bridges and Culverts Condition Summary 9
   - 2.3 Asset Data Gap Analysis 10
   - 2.3.1 Data Gap Observations 10
   - 2.3.2 Data Confidence 10
   - 2.3.3 Data Management Practice 11
   - 2.3.3.1 Current Data Management State 13
   - 2.3.3.2 Future Data Management State 13
3. Level of Service 14
   - 3.1 Purpose 14
   - 3.2 Objectives 14
   - 3.3 Stakeholders Identification 15
   - 3.4 O. Reg. 588/17 Levels of Service Metrics 15
   - 3.5 Levels of Service Performance Targets 19
   - 3.6 Future Demand Drivers 19
4. Asset Management Strategies 21
   - 4.1 Current Asset Management Strategies 22
   - 4.2 Road Lifecycle Management Model 25
   - 4.2.1 Road Pavement Lifecycle Intervention Strategy 25
   - 4.2.2 Capital Work Prioritization Strategy 26
   - 4.3 Bridge Lifecycle Management 26
5. Funding Need Analysis 28
   - 5.1 Road Capital Reinvestment Scenario Analysis 28
   - 5.1.1 Worst First Scenario 28
   - 5.1.2 Cost Effective Scenario 30
   - 5.1.3 Benchmarking for Roads Capital Reinvestment Needs 31
   - 5.2 Bridges Capital Reinvestment Need 32
   - 5.3 Full Funding Need Profile 32
6. Implementation Plan and Continuous Improvement 34

Appendix A - Roads MS Excel Inventory 38
Appendix B - Bridges and Culverts MS Excel Inventory 39

Appendix C - Road Condition Distribution by Functional Class 40

Figures

Figure 2-1: City of Sault Ste. Marie Roads, and Bridges and Culverts Asset Hierarchy 3
Figure 2-2: City's Pavement Surface Type by Lane kilometre 4
Figure 2-3: Current Traffic Volume Distribution by Functional Class 5
Figure 2-4: Weighted Average Age and Remaining Service Life 7
Figure 2-5: Roads Condition Summary 8
Figure 2-6: Roads Condition Distribution by Lane Kilometres 8
Figure 2-7: Roads Condition Distribution Weighted by Replacement Value 9
Figure 2-8: Bridges & Culverts Condition Summary 9
Figure 2-9: Bridges and Culverts Condition Distribution Details 10
Figure 2-10: Asset Information Lifecycle 11
Figure 3-1: City of Sault Ste. Marie Roads Connectivity Map and Condition Distribution 18
Figure 3-2: Bridges and Culverts Condition Images 19
Figure 4-1: Lifecycle Cost Accumulation Over Asset Life 21
Figure 4-2: Sample of Pavement Deterioration Curves and Intervention Approaches 25
Figure 4-3: Pavement Lifecycle Management Decision Tree 27
Figure 5-1: Roads 10-Year Reinvestment Needs - Worst First Scenario 28
Figure 5-2: Roads 10-Year Prioritized Work Plan by Lane Kilometre – Worst First Scenario 29
Figure 5-3: Roads 10-Year Reinvestment Needs – Cost Effective Scenario 30
Figure 5-4: Roads 10-Year Prioritized Work Plan by Lane Kilometre – Cost Effective Scenario 31
Figure 5-5: Bridges & Culverts 10-Year Reinvestment Need 32
Figure 5-6: Roads, Bridges and Culverts Full Funding Need Profile 33
Figure A-1: Arterial Roads Condition Distribution 40
Figure A-2: Collector Roads Condition Distribution 41
Figure A-3: Local Roads Condition Distribution 42
Figure A-4: Rural Roads Condition Distribution 43

Tables

Table 1-1: In-Scope Roads, Bridges and Culverts 2
Table 1-2: O. Reg. 588/17: AM Planning for Municipal Infrastructure 2
Table 2-1: Roads Asset Inventory 4
Table 2-2: Bridges and Culverts Asset Inventory 5
Table 2-3: Roads and Bridges Current Replacement Value Summary 6
Table 2-4: Condition Grading Scale 7
Table 2-5: Observations on Asset Data Completeness 10
Table 2-6: Data Confidence Grading Scale 11
Table 2-7: High-Level Asset Data Confidence Grades 11
Table 3-1: The City's Overarching Themes and Objectives 14
Table 3-2: O. Reg. 588/17 Levels of Service Metrics (Roads) 16
Table 3-3: O. Reg. 588/17 Levels of Service Metrics (Bridges and Culverts) 16
Table 4-1: Lifecycle Management Strategies for Roads and Bridges 23
Table 4-2: Pavement Lifecyle Intervention Strategy and Criteria 26
Table 5-1: Roads 10-Year Total and Annual Average Reinvestment Need for Worst First Scenario 29
Table 5-2: Level of Service Achievements from Worst First Scenario 29
Table 5-3: Roads 10-Year Total and Annual Average Reinvestment Need for Cost Effective Scenario 30
Table 5-4: Level of Service Achievements from Cost Effective Scenario 31
Table 5-5: Capital Reinvestment Benchmarking 32

List of Abbreviations

Abbreviation	Description
AADT	Average Annual Daily Traffic
AM	Asset Management
AMP	Asset Management Plan
BCI	Bridge Condition Index
CHBDC	Canadian Highway Bridge Design Code
CIBI	Canadian Infrastructure Benchmarking Initiative
CMMS	Computerized Maintenance Management System
ESL	Estimated Service Life
FIPPA	Freedom of Information and Protection of Privacy Act
GIS	Geographic Information System
LoS	Level of Service
MFIPPA	Municipal Freedom of Information and Protection of Privacy Act
MTO	Ministry of Transportation Ontario
N/A	Not applicable
O&M	Operations and Maintenance
O. Reg.	Ontario Regulation
OSIM	Ontario Structure Inspection Manual
PCI	Pavement Condition Index
PCR	Pavement Condition Rating
PN	Priority Number
PGN	Priority Guide Number
RCR	Ride Comfort Rating
RMS	Road Management System
RSL	Remaining Service Life
SSMIC	Sault Ste. Marie Innovation Centre

1. Introduction

AECOM Canada Ltd. (AECOM) was retained by The City of Sault Ste. Marie (the "City") to develop an asset management plan to comply with the first phase of the Ontario Regulation 588/17 (O. Reg. 588/17) requirements in respect to its core municipal infrastructure assets. The scope of work for this investigation is outlined in AECOM's proposal dated June 9th, 2021 and subsequent project correspondence.

1.1 Background

Sault Ste. Marie is a city located on the St. Mary's River, North of the United States of America, bordering on two of the Great Lakes with an estimated population of 73,368 (2016). The City provides a wide range of public services to their constituents with the expectation from the public that these services are expected to function efficiently at a certain level of service. The provision of these services requires the management of the physical assets to meet desired service levels, manage risks, and to provide long term financial sustainability. These assets include, but aren't limited to roads, bridges, sidewalks, wastewater assets, stormwater management assets, landfill, fleets, buildings, and parks.

In accordance with the terms of reference for this assignment, it is understood that the City is proceeding with an asset management plan to comply with the first phase of the regulatory requirements in respect to its core municipal infrastructure assets, in accordance with O. Reg. 588/17, by July 1, 2022. The core assets to be included in the scope, as defined by the regulation, include the City's wastewater assets, stormwater management assets, roads, and bridges and culverts.

1.2 Scope and Objectives

In 2015, the City's first Asset Management Plan (AMP) was published. In 2019, by City Council approval, the Strategic Asset Management (AM) Policy came into effect.

Organizations that implement good AM practices will benefit from improved business and financial performance, effective investment decisions, and better risk management. Stakeholders can expect lower total asset lifecycle costs, higher asset performance, and confidence in sustained future performance.

The objective of this AMP is to capture the core infrastructure assets and deliver a financial and technical roadmap for the management of the City's roads, bridges and culverts, wastewater assets, and stormwater assets. The intent of this plan is to provide the means for the City to maximize value from its assets, at the lowest overall expense while, at the same time, maintaining the desired service levels for its residents. Furthermore, the objective of this AMP is to align with the guidelines laid out in the City's Strategic AM Policy and Section 5 of O. Reg. 588/17.

As management of each core asset is not a consistent process due to maintenance and construction requirements, we have grouped the core assets as follows:

1. Roads, and Bridges and Culverts.
2. Stormwater Management Assets.
3. Wastewater Assets.

This AMP has been developed for the City's Roads & Bridges, as shown in **Table 1-1.** Wastewater, and Stormwater AMPs are presented under separate reports.

Table 1-1: In-Scope Roads, Bridges and Culverts

Asset Category	Sub-Assets
Roads	Arterial, Collector, Local, and Rural Roads.
Bridges and Culverts (>3m)	Vehicular Bridges, and Pedestrian Bridges.

The following elements are included within the scope of this AMP:

- Asset hierarchy, a summary of the asset inventory, including the replacement cost of the assets, the average age of the assets, pavement field condition assessment, and data gaps analysis (**Sections 2**).
- The City's level of service objectives, stakeholder identification, current levels of service (LoS) have been determined in accordance with the qualitative descriptions and technical metrics outlined in O. Reg. 588/17, and future demand drivers (**Section 3**).
- Asset lifecycle management strategies, lifecycle management decision trees and work prioritization model, and funding needs to maintain current LoS, minimize associated asset risks, and to optimize costs over the whole lifecycle of the asset (**Section 4** and **Section 5**).

1.3 Asset Management Provincial Requirements

O. Reg. 588/17 came into effect in 2018 and stipulates specific AM requirements to be in place within Ontario municipalities by certain key dates (**Table 1-2**). The development of this AMP addresses the July 1st, 2022 requirement and is one of the steps to guide the City towards meeting the July 1st, 2024 deadline.

Table 1-2: O. Reg. 588/17: AM Planning for Municipal Infrastructure

Description: A regulation made under the Infrastructure for Jobs and Prosperity Act, 2015, stating that every municipality shall prepare and update a Strategic AM Policy, and that every municipality shall prepare an AM Plan for its core infrastructure assets by July 1, 2022, and an AM Plan for all other infrastructure assets by July 1, 2024. The regulation outlines several requirements that each AM Plan must follow, such as including current and proposed level of service. Core municipal infrastructure assets include water, wastewater, stormwater, road, and bridge assets.	
Deadline Date	**Regulatory Requirement**
July 1st, 2019	All municipalities are required to prepare their first Strategic AM Policy.
July 1st, 2022	All municipalities are required to have an AM Plan for its entire core municipal infrastructure (i.e., water, wastewater, stormwater, roads, and bridges & culverts).
July 1st, 2024	All municipalities are required to have an AM Plan for infrastructure assets not included under their core assets.
July 1st, 2025	All AM Plans must include information about the level of service that the municipality proposes to provide, the activities required to meet those level of service, and a strategy to fund activities.

2. State of Infrastructure

Understanding the basic physical state of the complex systems that support an owner's network are key to proper asset management, safe use of said infrastructure and effective delivery of service to the public. If the current condition is not known, it poses a serious problem in determining how to maintain an effective service life. As part of AECOM's mandate, a review of available roads, bridges and culverts was completed. The following sections present the results of the assessment and the current state of these assets.

2.1 Asset Hierarchy

Roads are categorized by functional class including arterial roads, collector roads, local roads, and rural roads. Bridges and culverts are divided by vehicular bridges and pedestrian bridges. The in-scope culverts are structural culverts that have a span of 3 meters or more as defined in the Ontario Structure Inspection Manual (OSIM).

Approximately 36% (25 centreline kilometres) of the arterial roads are designated as Ministry of Transportation Provincial Connecting Link roads, which move provincial traffic through the City. There also exists a connection to the United States (US) Interstate System at the International Bridge to Michigan in the downtown core. The City continues to apply for annual funding to assist with the cost of moving provincial traffic within the municipal boundaries. The usual MTO Connecting Link grant is the lesser of 90% of the project cost or $3 M, if the annual application is successful. **Figure 2-1** below presents the asset hierarchy for roads and bridges.

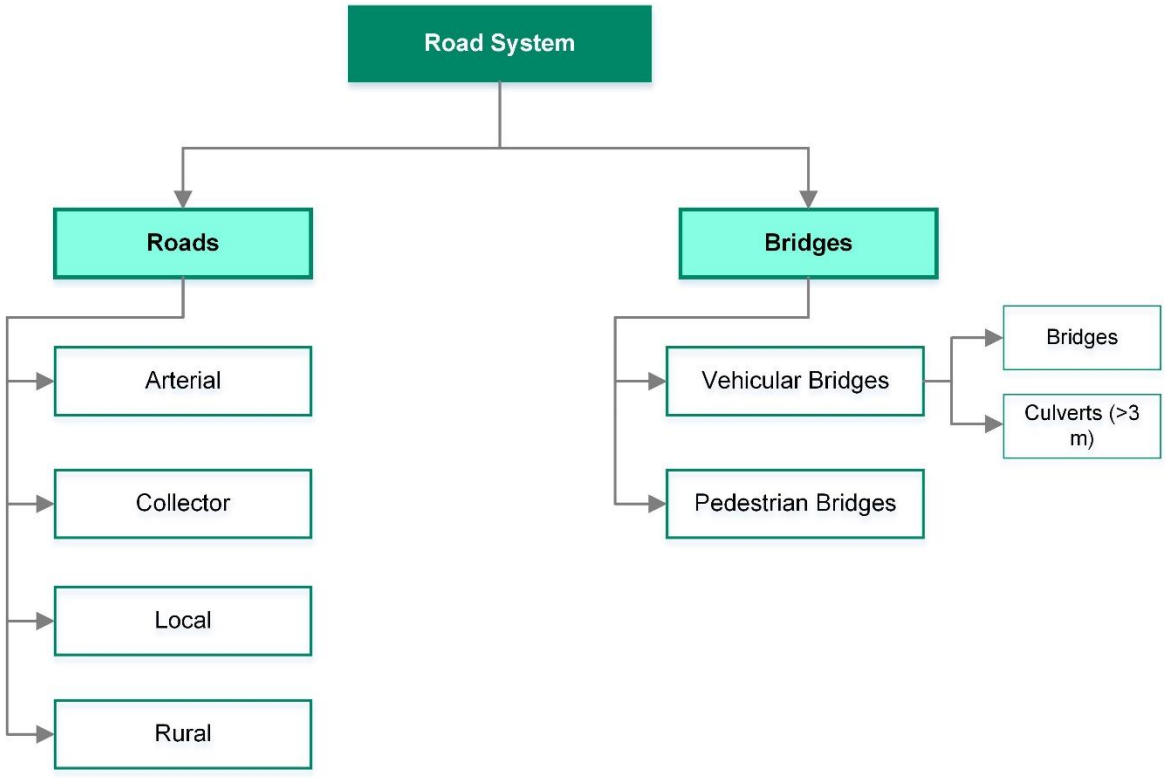


Figure 2-1: City of Sault Ste. Marie Roads, and Bridges and Culverts Asset Hierarchy

2.2 Current State of the Assets

2.2.1 Asset Inventory

The roads quantity is summarized by "*centreline kilometre"* and *"lane kilometre"*. Centreline kilometre refers to the linear distance of the road section measured at the center of the road from its starting point to its end point, while lane kilometre is used to measure the total length and lane count of a given road.

The City currently owns and maintains 531 centreline kilometres of roads, totalling 1,184 lane kilometres. Local roads account for approximately half of the road network. **Table 2-1** present the summary for the road inventory.

Table 2-1: Roads Asset Inventory

Asset Group	Asset Category	Quantity 1 (Centreline km)	Quantity 2 (Lane km)
Roads	Arterial Roads	73	244
	Collector Roads	73	166
	Local Roads	267	537
	Rural Roads	119	238
	Total	**531**	**1,184**

Please refer to **Appendix A** for the complete roads inventory.

Figure 2-2 summarizes the pavement surface types within the City limits. Approximately 98% of the road network is predominantly constructed as high class and low-class bituminous pavement (flexible / surface treatment) with 1.5% constructed as a gravel roadway, and the remaining 1% as rigid / composite pavement.

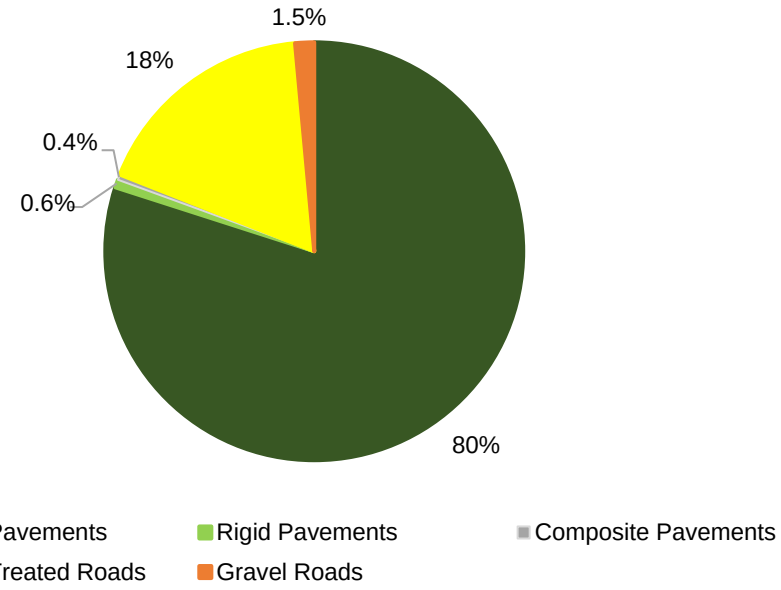


Figure 2-2: City's Pavement Surface Type by Lane kilometre

Table 2-2 summarizes the bridges and culverts inventory. The City has a total of forty-nine bridges and structural culverts including thirty-six vehicular bridges and thirteen pedestrian bridges. Pedestrian Bridges are structures supporting pedestrian movement. Refer to **Appendix B** for complete bridges and culverts inventory including a structural level inventory and an element level inventory.

Table 2-2: Bridges and Culverts Asset Inventory

Asset Group	Asset Category		Quantity	Unit
Bridges and Culverts	Vehicular Bridges	Bridges	24	Ea.
		Culverts (> 3m)	12	Ea.
	Pedestrian Bridges		13	Ea.
	Total		**49**	Ea.

2.2.2 Traffic Volume Impact

Average Annual Daily Traffic (AADT) is generally the representation of the average traffic loads experienced by a roadway daily, over the course of a year. This information is very important in assessing the current structural support capabilities of a roadway, asking the question if the subject road can support current traffic but also will a road be able to support future traffic growth.

Available traffic information was provided to AECOM by the City. This traffic data was used as one of the metrics to determine the current service level of the roadway asset, pavement lifecycle strategy, as traffic loads have a significant impact on the deterioration rate and service life of the pavements. **Figure 2-3** present the traffic distribution for each road functional class.

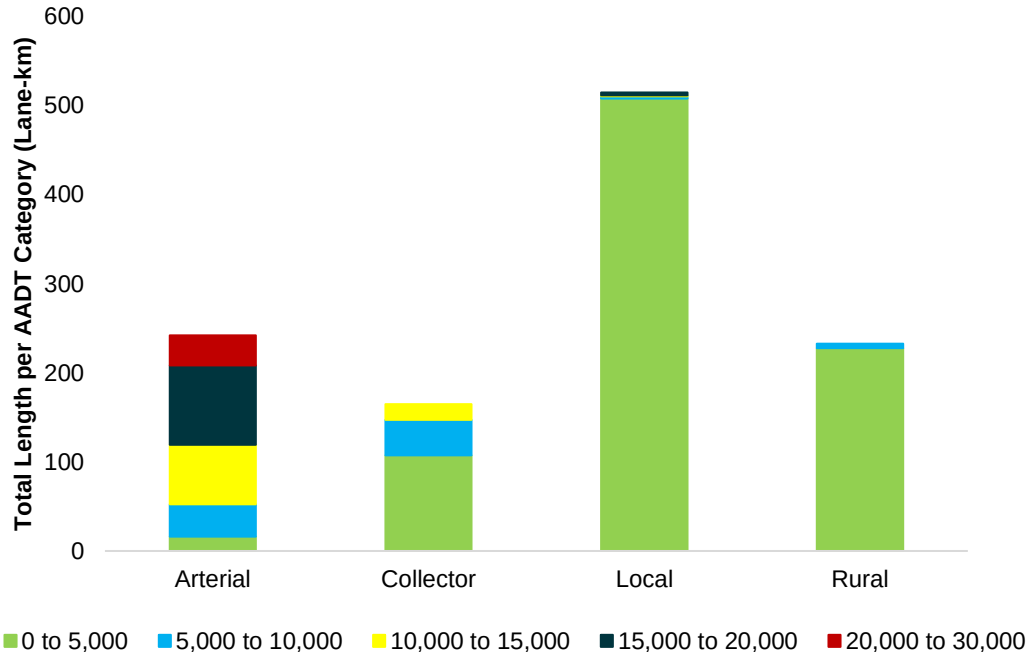


Figure 2-3: Current Traffic Volume Distribution by Functional Class

2.2.3 Current Replacement Value

Replacement value for roads was estimated using 2022 road construction costs that includes pavement removal and reinstatement. The estimate includes a contingency cost to address specific road related ancillary items such as curbs. The total cost does not include replacement costs for underground pipes, adjacent sidewalks, and other peripheral items.

The replacement value for bridges and culverts was estimated based on unit cost per deck areas from 2016 MTO Parametric Estimating Guide, with a project markup of 45% applied to account for the cost to remove existing structure, engineering costs, contingencies, and mobility.

The total estimated value of the City's roads, and bridges and culverts is $730 Million. **Table 2-3** summarizes replacement values for roads and bridges. The total estimated replacement value of the City's roads is approximately $649 Million. Local roads account for the majority value of the network value. The current replacement value for the City's bridges and culverts is estimated at $82 Million.

Table 2-3: Roads and Bridges Current Replacement Value Summary

Asset Group	Asset Category	Unit Replacement Cost ($ / Unit)	Total Replacement Value (2022)
Roads	Arterial Roads	$1,264,000 - $2,857,000 / Centreline-km	$144,042,000
	Collector Roads	$487,000 - $2,857,000 / Centreline-km	$101,410,000
	Local Roads	$440,000 - $2,374,000 / Centreline-km	$299,031,000
	Rural Roads	$440,000 - $1,264,000 / Centreline-km	$104,281,000
Bridges & Culverts	Vehicular Bridges	$5,700 - $ 9,300 / m^2	$69,199,000
	Pedestrian Bridges	$5,700 - $ 9,300 / m^2	$12,351,000
		Roads Sub-Total	**$648,764,000**
		Bridges & Culverts Sub-Total	**$81,550,000**
		Total	**$730,314,000**

2.2.4 Asset Age and Remaining Service Life

In practice, various assets will deteriorate at different rates and not necessarily linearly over time. However, it is pivotal to keep in mind the level of effort required to predict failure compared with the asset value. More sophisticated deterioration modelling may be warranted for very high value assets, whilst the cost of deterioration modeling for low-value assets may very well exceed the replacement cost of the asset. The actual service life can vary significantly from the estimated service life (ESL). The latter is defined as the period over which an asset is available for use and able to provide the required LoS at an acceptable risk and serviceability (i.e., without unforeseen costs of disruption for maintenance and repair). In some instances, a variation in expected vs. actual service life is evident due to the following factors:

- **Operating conditions and demands:** Some assets are operated intermittently or even infrequently or are being operated at a lower demand than its designed capacity. Thus, the actual operating "age" of the asset is reduced.
- **Environment:** Some assets are exposed to very aggressive environmental conditions (e.g., corrosive chemicals), while other assets are in relatively benign conditions; thus, the deterioration of assets is affected differently.
- **Maintenance:** Assets are maintained through refurbishment or replacement of components, which prolongs the service life of the asset.
- **Technological Obsolescence:** Some assets can theoretically be maintained indefinitely, although considerations such as cost to maintain the asset, its energy efficiency, and the cost to upgrade to an updated technology that would result in cost savings are likely to render this approach uneconomical.

As built construction information is currently not available for analyzing the age and remaining service life (RSL) for roads. Collecting construction date / rehabilitation date information will better represent the state of the roads assets and help inform future pavement AM decisions.

Figure 2-4 shows the average age weighted by replacement value as a proportion of the average useful life for bridges & culverts. Currently, the City's vehicular bridges are approximately more than 70% through the asset's expected service life, while pedestrian bridges are about 35% through the asset's expected service life.

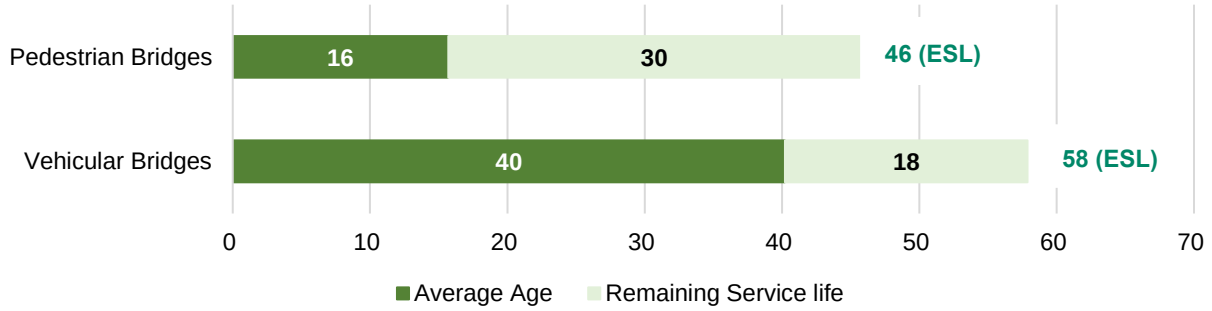


Figure 2-4: Weighted Average Age and Remaining Service Life

2.2.5 Pavement Condition Assessment

A visual field condition survey of the City's road network was performed in Summer 2021. The condition survey was completed in accordance with the Ministry of Transportation Ontario (MTO) guidelines including the "Manual for Condition Rating of Flexible Pavements (SP-024)", "Manual for the Condition Rating of Surface-Treated Pavements (SP-021)", and "Manual for Condition Rating of Gravel Surface Roads (SP-025)".

High resolution videos were collected for the full length of each road section in both directions of travel by driving a vehicle with two mounted cameras. The pavement condition index (PCI) was calculated by integrating Ride Comfort Rating (RCR) and Pavement Condition Rating (PCR) following the MTO guidelines and MTO Pavement Design and Rehabilitation Manual.

The PCI score (0 - worst to 100 - best) was used as an indicator for the pavement's condition. The PCI thresholds for different surface types for the condition states were adopted from the condition rating approach from MTO condition rating guidelines. **Table 2-4** shows the condition grading scale for different pavement surface types.

Table 2-4: Condition Grading Scale

Pavement Condition Rating	Flexible and Rigid Pavements		Surface Treated and Gravel Pavements	
	PCI Minimum	PCI Maximum	PCI Minimum	PCI Maximum
Very Poor	0	19	0	19
Poor	20	39	20	39
Fair	40	64	40	59
Good	65	89	60	79
Very Good	90	100	80	100

Results of AECOM's assessment indicate that in general, the City's road network is overall in Fair condition. Forty-one percent (41%) of the road network is currently in Good to Very Good Condition, which are likely not requiring rehabilitation interventions within the next 10 years. Roads in Poor to Very Poor condition (22%) may require attention in the short-term as they approach and pass the acceptable level of service criteria, especially for road sections carrying high traffic volumes and with high criticality. **Figure 2-5** presents the summary of current road network condition.

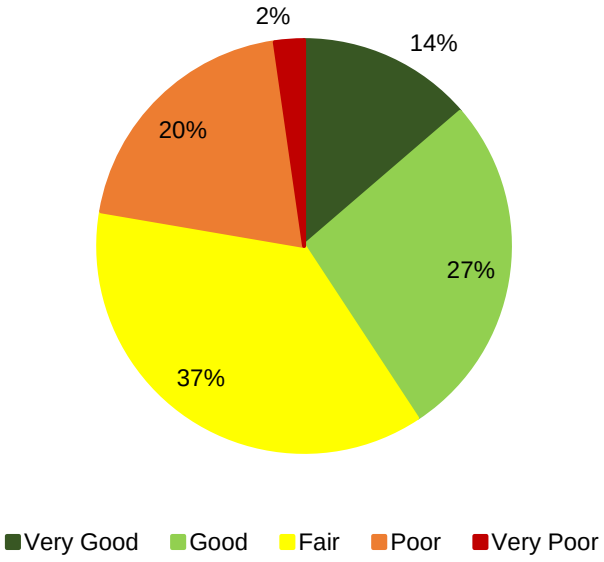


Figure 2-5: Roads Condition Summary

Figure 2-6 and **Figure 2-7** show the road condition distribution by lane kilometre and condition as a percentage of replacement value. Arterial roads are primarily in Very Good to Good condition with no sections in Very Poor condition. The City made great efforts in keeping this functional class at a relatively high level of condition among all the functional classes. Collector roads are overall in Fair to Good condition. Local roads and rural roads are overall in Fair condition.

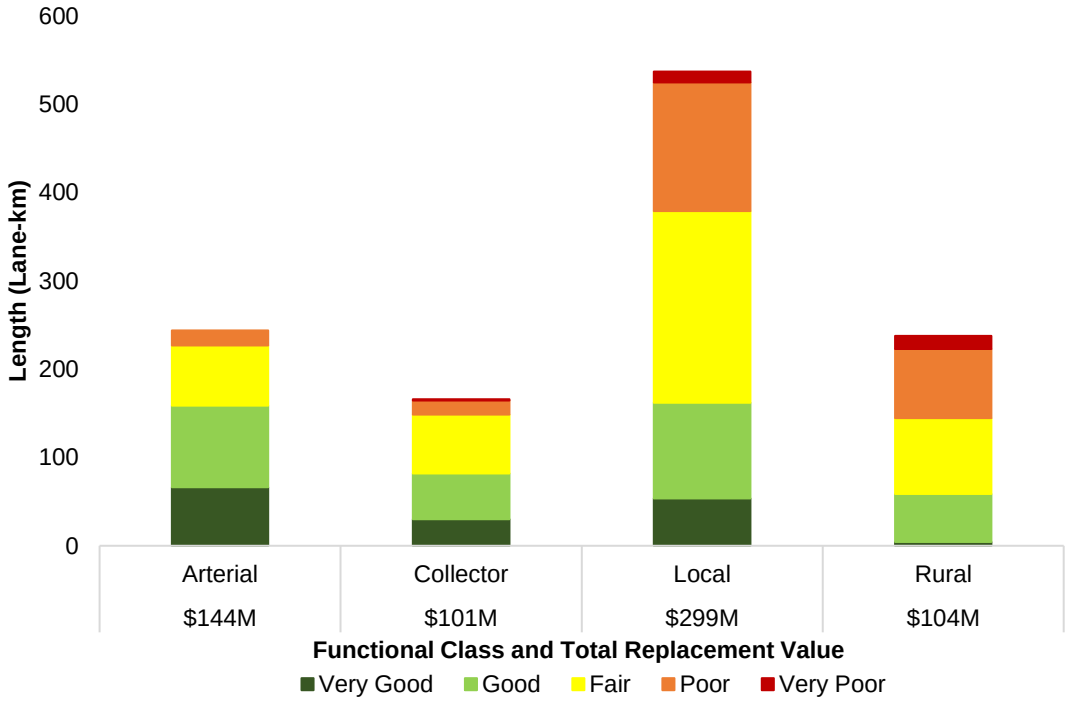


Figure 2-6: Roads Condition Distribution by Lane Kilometres

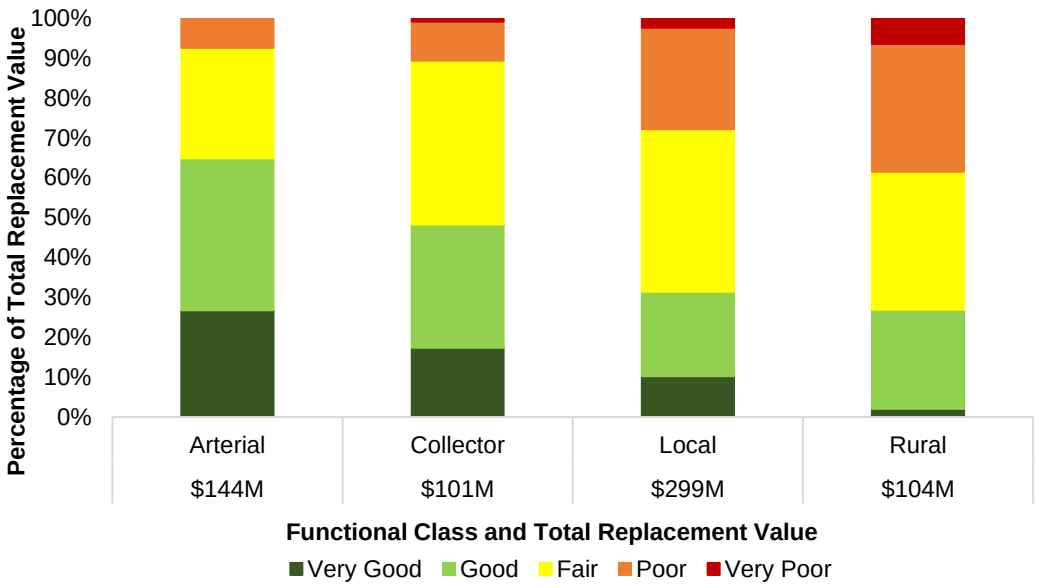


Figure 2-7: Roads Condition Distribution Weighted by Replacement Value

2.2.6 Bridges and Culverts Condition Summary

It is understood that the City retains a consultant every two years to perform a network level inspection of the bridges and culverts within the City limits. The objective of this inspection is to identify structural issues and concerns following the Ontario Structure Inspection Manual (OSIM) which is in compliance with O. Reg. 104/97. Inspection results are documented and prioritized 10-year capital needs are identified in the consultant report. The most recent inspections were completed in 2020, which provides an overall condition of each bridge and culverts (>3m in diameter), through the bridge condition index (BCI). BCI ranges from 0 to 100 where 100 represents a new structure with no deficiency. To have a consistent condition rating system across the City's asset groups, the bridge conditions are divided into five classes by BCI ranges: Very Good (80-100), Good (60-80), Fair (40-60), Poor (20-40), and Very Poor (0-20).

Figure 2-8 shows a summary of the City's bridges and culverts. Approximately, 83% of the bridges and culverts are in Good to Very Good condition with the remaining 17 percent in fair condition. Currently, there are no bridges or culverts in Poor to Very Poor condition.

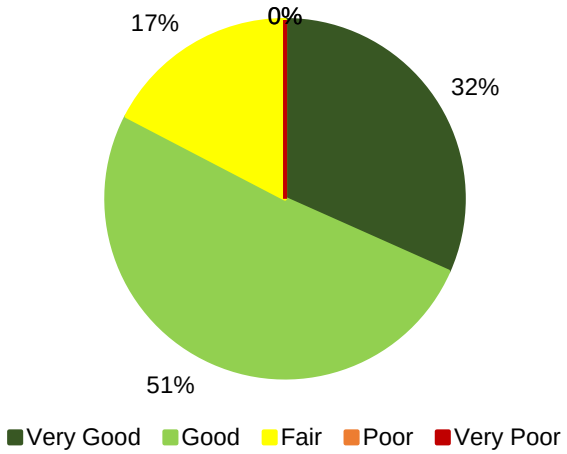


Figure 2-8: Bridges & Culverts Condition Summary

The detailed condition profile for bridges and culverts is shown in **Figure 2-9**. Both Vehicular Bridges and Pedestrian Bridges are predominantly in a Good or Very Good condition.

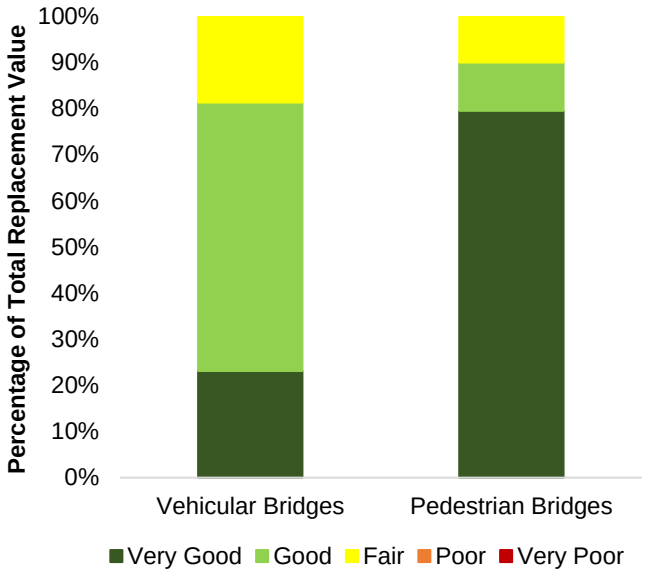


Figure 2-9: Bridges and Culverts Condition Distribution Details

2.3 Asset Data Gap Analysis

This section summarizes the current state of the City's asset data by assessing the quality of the asset inventory. To determine the overall confidence in the current asset data, identify existing data gaps, as well as to gather insight into the City's data management practices, AECOM facilitated a virtual State of Infrastructure and Data Gap Analysis Workshop on December 3rd, 2021 with key staff across the in-scope assets. An online Data Management Gap Assessment Survey was also distributed to the AM Working Group to elicit further insights on the City's current and desired future state, as well as key challenges, regarding the City's overall data management.

2.3.1 Data Gap Observations

Table 2-5 provides a summary of observed data gaps in the compiled roads, and bridges and culverts inventory across key data attributes that help to make informed decisions over the asset lifecycle for this AM plan.

Table 2-5: Observations on Asset Data Completeness

Asset Group	Inventory Completeness (%)						
	Asset ID	Street Name / Location	Install Date	Inspection Date	Condition	Expected Service Life	Replacement Cost
Roads	100%	100%	0%	100%	100%	100%	0%*
Bridges & Culverts	100%	100%	100%	100%	100%	0%*	0%*

* The gap is filled during the development of this AM plan.

2.3.2 Data Confidence

The quality of asset data is critical for effective AM, accurate financial forecasts, and informed decision-making. For this reason, it is important to know what the reliability of the information is for the State of Infrastructure analysis of the roads and bridges. **Table 2-6** provides a description for the data confidence grades used to classify the reliability of the asset data used in this data gap analysis. Through consultation with City staff during the Data Gap and State of Infrastructure Workshop, the asset attribute data for the roads, and bridges and culverts were assigned the grades outlined in **Table 2-7**.

Table 2-6: Data Confidence Grading Scale

Confidence Grades	Description
A - Highly reliable	Data is based on sound records, procedures, investigations and analysis, documented properly and agreed as the best method of assessment. Dataset is complete and estimated to be accurate ± 2%
B - Reliable	Data is based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example some of the data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation. Dataset is complete and estimated to be accurate ± 10%
C - Uncertain	Data is based on sound records, procedures, investigations and analysis which is incomplete or unsupported, or extrapolated from a limited sample for which grade A or B data are available. Dataset is substantially complete but up to 50% is extrapolated data and accuracy estimated ± 25%
D - Very Uncertain	Data is based on unconfirmed verbal reports and/or cursory inspections and analysis. Dataset may not be fully complete, and most data is estimated or extrapolated. Accuracy ± 40%
E - Unknown	None or very little data held.

Table 2-7: High-Level Asset Data Confidence Grades

Asset Category	Data Confidence Average Grade		
	Inventory	Age	Condition
Roads	A	--	A
Bridges and Culverts	A	A	A

2.3.3 Data Management Practice

The asset data lifecycle is a sequence of stages that data goes through from its initial creation (i.e., data capture and entry) to its eventual archival and/or deletion at the end of its useful life[1]. A clear definition and understanding of the organization's process for acquiring, storing, utilizing, assessing, improving, archiving, and deleting data (see **Figure 2-10**) will ensure good data management practices and help to sustain levels of data quality required to support AM activities.

Figure 2-10: Asset Information Lifecycle

[1] TechTarget Network, Definition: Data Life Cycle, 2020.

The seven key stages of the asset data lifecycle are described in more detail below:

1. **Acquiring New Data**: The majority of new asset data arises from asset creation, refurbishment and overhaul activities. New data may also come by way of inheritance or transfers from other business units, organizations, or third parties. As such, it is important to have clearly defined processes in place not only to add or update asset data, but to migrate and merge data from other sources.
2. **Storing Data**: The way asset data is stored is an important consideration for overall data quality. Having a planned approach to data storage will inevitably reduce the likelihood of duplication and inconsistencies across datasets within the organization. Depending on the needs of the organization, this stage may involve procuring a new software to adequately house the data, along with a data backup and recovery plan to ensure that the necessary data protection and privacy standards are met.
3. **Utilizing / Analysing Data**: This aspect of the asset information lifecycle is where users encounter the data to support data-driven activities within the organization. Data can be viewed, processed, edited, and published to allow users to access the data outside the organization. Critical data that has been modified should be fully traceable to maintain the integrity of the data. As such, it is important to communicate to the users why asset data is so important, and how it is used to inform decisions within the organization.
4. **Assessing Data**: Assessing the data quality helps to determine the level of confidence in the information and ensures that decision-makers are making informed decisions based on the quality of data available to them. Moreover, it is important to fully understand the availability and quality of the asset data before issuing information publicly. Some of the results of data degradation, due to improper or lack of assessment, may include:
    - Poor asset performance due to lack of information and understanding of asset behaviour.
    - Non-compliance with statutory regulations or safety requirements.
    - Safety incidents due to risks not being identified or reported.
    - Asset failure due to gaps in maintenance planning.
5. **Improving Data**: Improving data quality involves establishing clear targets which are intended to be communicated widely across the organization. It is imperative that the organization understand the costs, benefits, and risks associated with any data improvements since the cost of the improvement may outweigh the overall benefit. It is also important to note that *more* data does not necessarily mean *better* data. It is very possible to collect data that does not add value to the organization. As such, it is critical that the organization aligns its data improvement targets with its AM objectives and considers the data-driven decisions staff need to make at the operational and strategic level, to ensure that the *right* data is being improved upon.
6. **Archiving Data**: Archiving data is the process of storing data that is no longer active or required but is able to be retrieved in case it is needed again. Data that is archived is stored in a location where no usage or maintenance occurs. It is recommended that a data archive strategy exists within an organization in order to lay out the data archival requirements, which considers the following:
    - What data should be archived and why?
    - Are there any legal obligations for retaining data records?
    - How long should data records be retained?
    - What is the risk associated with not being able to retrieve data records?
    - Who should be able to access archived data records?
    - What is the expected timeframe to retrieve archived data records?

    Clearly communicating these requirements across the organization is key to ensuring staff are educated on why records are being archived, how they can access archived data records, and for how long archived data records can still be accessed.
7. **Deleting Data:** The deletion of data is the final component of the asset information lifecycle. Typically, within organizations there is a resistance to permanently delete data, otherwise known as data “squirrelling”, due to

the overall capacity of storing data increasing and the cost decreasing. However, within the organization's data archive strategy, a retention period should be specified to indicate when data should be deleted, along with any processes to follow, such as obtaining prior authorization.

2.3.3.1 Current Data Management State

The City's roads, bridges, and culverts asset data is currently stored in a Geographical Information System (GIS), Road Management System (RMS), Excel spreadsheets, reports, and as-built drawings. The City's roads and bridges data is more robust compared to other core service areas.

Currently, the City utilizes an RMS to store field assessment results for roads. The system was greatly enhanced by GIS integration and maintained by the GIS/Asset Management Technician in the Engineering Department. The RMS data can be linked to GIS with unique road segment IDs.

The bridges and culverts condition data is biennially updated based on OSIM inspection findings. The consolidated inventory for bridges & culverts includes a structural level and element level inventories along with a recommended 10-year capital plan.

The City is following the mandate in records retention procedures for municipalities as per the Freedom of Information and Protection of Privacy Act ("FIPPA") and the Municipal Freedom of Information and Protection of Privacy Act ("MFIPPA").

2.3.3.2 Future Data Management State

The City will develop and implement a software strategy that helps streamline data management following this AMP. Eventually, the City anticipates having a clear and efficient data management process and comprehensive asset inventory to support their asset management decision-making. The implementation plan for data improvement is presented in **Section 6**.

3. Level of Service

3.1 Purpose

Level of Service (LoS) supports every aspect of the overall AM System. The objective of establishing clearly defined service levels is to help the City meet stakeholder values, achieve its strategic goals, make informed decisions, and implement effective asset lifecycle activities.

Documenting LoS is a proven practice that will enable the City to:

- Link corporate strategic objectives to customer expectations and technical operations.
- Balance customer needs and expectations while evaluating the effectiveness of operations and whether the right LoS is being provided at the right cost.
- Transition from an “Asset Stewardship” approach that focuses on making decisions based on maintaining assets in an acceptable condition to a “Serviceability” approach that is geared towards making decisions based on balancing the costs, risks, and goals for the LoS being provided by the City’s assets.
- Communicate the physical nature of infrastructure that the City owns and is financially responsible for while promoting the use of LoS to enable effective consultation with stakeholders regarding alternative funding options according to desired LoS outcomes.
- Make recommendations on strategies that the City can take now to minimize future renewal costs while ensuring that adequate LoS can be delivered without burdening future generations.
- Assess internal (e.g., program changes) and external (e.g., climate change) factors that have the potential to impact the City’s ability to deliver services and how these factors may impact the LoS being provided.
- Implement a corporate continuous improvement program to further optimize AM across all service areas.

The O. Reg. 588/17 requires that all AMPs include the current Levels of Service (LOS) being provided, determined in accordance with the qualitative descriptions and technical metrics provided (see **Section 1.3**).

3.2 Objectives

Defining LoS objectives is important for drawing a line of sight between the City’s corporate objectives and the tangible asset performance outcomes. To do so, the LoS objectives must take into consideration stakeholder interests to develop asset performance measures that aim to meet the needs and expectations of the community. By doing this, the City will ensure that their assets are striving towards optimal performance, not only operationally, but economically, socially, and sustainably as well.

Every stakeholder has certain interests in the service being provided and in general. The City’s corporate objective is to lift up the community and build pride, and attract people (visitors, employers and employees). The City’s Comprehensive Background Report[2] for the New Official Plan outlined the overarching themes that reflect the City’s value, as shown in **Table 3-1**. Each overarching theme is also assigned a corporate service objective.

The development of level of service targets should be aligned with these corporate objectives which will be addressed in the next iteration of the AMP.

Table 3-1: The City’s Overarching Themes and Objectives

Overarching Themes	Corporate Objective
Healthy Community	Supports healthy living, active transportation, access to passive and active recreation, social interaction and the creation of spaces that are comfortable, safe and accessible for all ages and abilities (the “8 to 80 Cities” concept).

[2] City of Sault Ste Marie. 2021. Comprehensive Background Report.

Overarching Themes	Corporate Objective
Environmental Sustainability	Supports energy conservation and efficiency, improved air quality, reduced greenhouse gas emissions and climate change adaptation.
Integrated Mobility	Supports accessibility and choice of a diversity of transportation modes.
Sense of Place	Fosters a welcoming place for all that establishes connection and provides a memorable experience to visitors.
Sustainable Growth	Stimulates reinvigoration of neighbourhoods to provide a complete range of housing, services, employment and recreation.
Economic Resiliency	Supports the growth and diversification of the city's economy.
Social Equity	Contributes to creating a welcoming and inclusive community, focusing on the removal of systemic barriers so that everyone has access to an acceptable standard of living and can fully participate in all aspects of community life.
Cultural Vitality	Celebrates the Sault's history, diverse communities and natural and cultural heritage, with the Downtown as the Sault's core destination for arts and culture.

3.3 Stakeholders Identification

A stakeholder is any person or organization that can affect, be affected by, or perceive themselves to be affected by a decision or an activity. Stakeholder analysis is the process of understanding stakeholder needs, expectations, and perceptions relative to the stakeholder's level-of-interest and level-of-influence over the organization. The organization typically engages with their stakeholders to:

- Establish which activities or services matter most to them.
- Understand their risk appetite and risk threshold.
- Understand their willingness to pay for services.

Stakeholders can take many forms and may be internal (i.e., staff, Council) or external (i.e., the public, regulatory agencies, suppliers, neighbouring municipalities, etc.) to the organization. The following groups were identified as key stakeholders for roads, bridges and culverts at the LoS workshops. This is not intended to be an exhaustive list; however, the following groups provide a good starting point for the City to move forward to the next stage.

- Council.
- Residents.
- Regulatory Agencies (i.e., Ministry of Transportation Ontario (MTO) and Fisheries and Oceans Canada (DFO).
- Neighbouring Municipalities or Downstream Municipalities (i.e., First Nations, the international bridge connected to the US).
- Environmental groups (i.e., active transportation related groups).
- Developers.
- Contractors and suppliers.
- Other city departments (i.e., fire & police service, planning department, and stormwater).

3.4 O. Reg. 588/17 Levels of Service Metrics

Based on currently understanding, O. Reg. 588/17 requires legislated community levels of service for core assets. Community levels of service use qualitative descriptions to describe the scope or quality of service delivered by an asset category. O. Reg. 588/17 also requires legislated technical levels of service for core assets. Technical levels of service use metrics to measure the scope or quality of service being delivered by an asset category.

Table 3-2 and **Table 3-3** present summaries of the City's roads, and bridges and culverts service level for O. Reg. 588/17 Metrics. References are provided to show where O. Reg. 588/17 requirement has been attained.

Figure 3-1 presents a key map of the existing road condition. **Figure 3-2** presents a tabular breakdown of the bridge and culvert condition assessment metrics.

Table 3-2: O. Reg. 588/17 Levels of Service Metrics (Roads)

O. Reg 588/17 LoS Performance Measure	Unit	Community or Technical LoS	Current LoS Performance (2021)
Description, which may include maps, of the road network in the municipality and its level of connectivity.	Map	Community	• Road network connectivity map and condition distribution (Refer to **Figure 3-1**).
Description or images that illustrate the different levels of road class pavement condition.	%	Technical	• Roads condition distribution maps for different functional classes (Refer to **Appendix C** for arterial, collector, local, and rural road condition distribution maps).
Number of lane kilometres of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.	#	Community	• Arterial: 0.63 Lane-km / km^2 • Collector: 0.64 Lane-km / km^2 • Local: 2.32 Lane-km / km^2 • Rural: 1.04 Lane-km / km^2
For paved roads in the municipality, the average pavement condition index value.	#	Technical	• Average PCI for Paved Roads is 59 − Average PCI for Arterial: 70 − Average PCI for Collector: 64 − Average PCI for Local: 55 − Average PCI for Rural: 47 These average PCI is weighted by replacement value.
For unpaved roads in the municipality, the average surface condition (e.g., excellent, good, fair or poor).	Text	Technical	• Fair condition.

Table 3-3: O. Reg. 588/17 Levels of Service Metrics (Bridges and Culverts)

O. Reg. 588/17 LoS Performance Measure	Unit	Community or Technical LoS	Current LoS Performance (2021)
Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Text / Map	Community	• The City's bridges and culverts have been designed in accordance with the standard and requirements of the Canadian Highway Bridge Design Code (CHBDC) at the time of construction. The bridges have been designed to carry heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, and cyclists.
% of bridges in the municipality with loading or dimensional restrictions.	%	Technical	• Two of the 49 bridges (i.e., 4% of bridges at the City) have loading or dimensional restrictions, as follows: − 19 - Town Line Road, 0.5km south of Base Line, over Big Carp River, 10t load limit; and − P8 - Fort Creek Hub Trail, approximately 625 m south of Third Line, 1000 lb (Point Load)
Description or images of the condition of bridges and how this would affect use of the bridges.	Text	Community	• The City undertakes rehabilitation / replacement works according to OSIM recommended priorities. • Refer to **Figure 3-2** for images of the condition of bridges.
Description or images of the condition of culverts and how this would affect use of the culverts.	Text / Image	Community	• The City undertakes rehabilitation / replacement works according to OSIM recommended priorities. • Refer to **Figure 3-2** for images of the condition of several culverts.

O. Reg. 588/17 LoS Performance Measure	Unit	Community or Technical LoS	Current LoS Performance (2021)
For bridges in the municipality, the average bridge condition index value.	#	Technical	• Average BCI for bridges is 72
For structural culverts in the municipality, the average bridge condition index value.	#	Technical	• Average BCI for culverts is 72

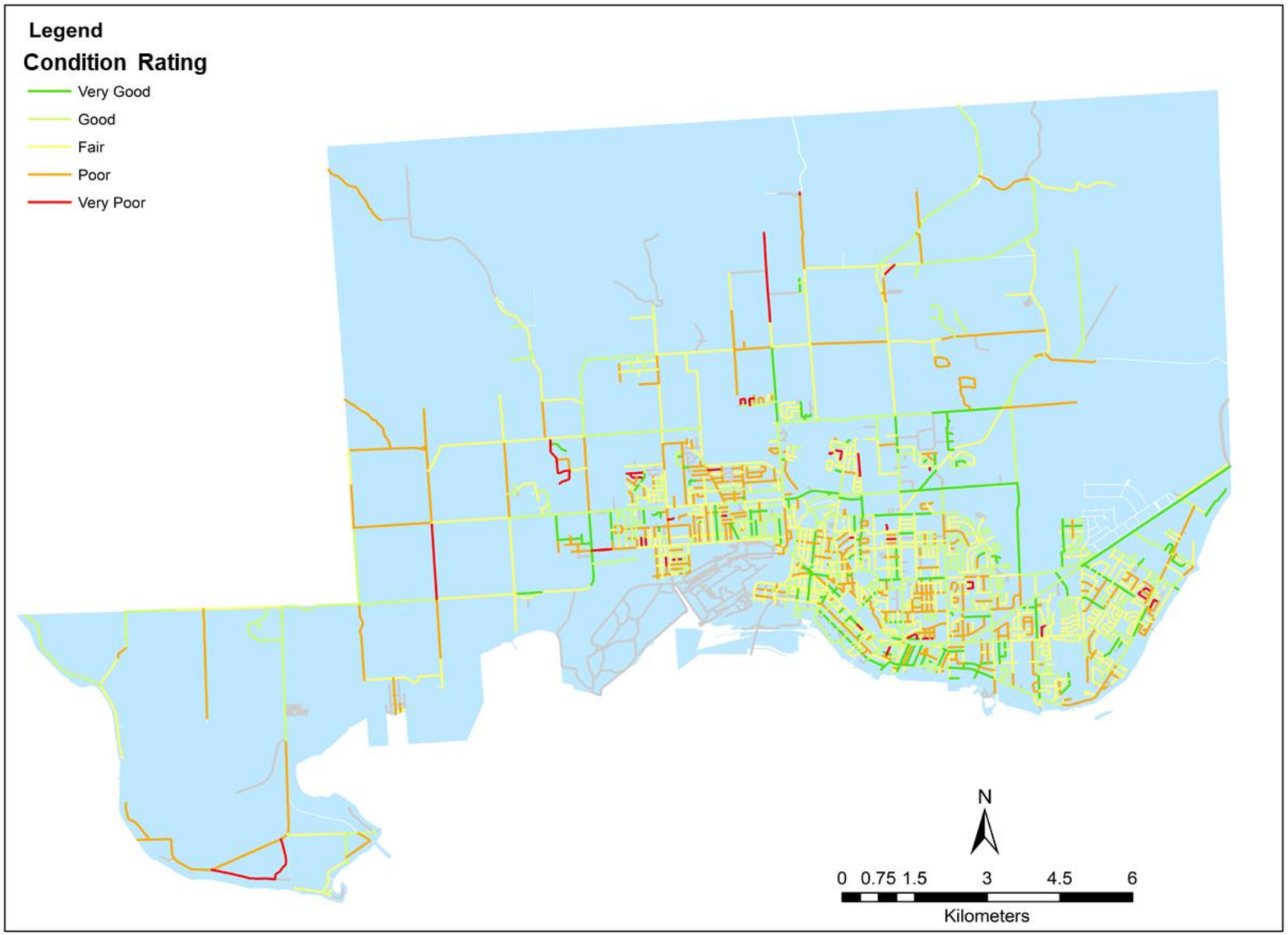


Figure 3-1: City of Sault Ste. Marie Roads Connectivity Map and Condition Distribution

	Bridges	Culverts
Condition Ratings Bridge Condition Index (BCI)	**Images of the condition of bridges and how this would affect use of the bridges.**	**Images of the condition of culverts and how this would affect use of the culverts.**
Very Good BCI Range 80-100	Bridge No. 14 BCI - 96 	Bridge No. 10 BCI - 88 
Good BCI Range 60-79	Bridge No. 1 BCI - 72 	Bridge No. 22 BCI - 66 
Fair BCI Range 40-59	Bridge No. 3 BCI - 52 	Bridge No. 41 BCI - 50 
Poor BCI Range 20-39	N/A	N/A
Very Poor BCI Range 0-19	N/A	N/A

Figure 3-2: Bridges and Culverts Condition Images

3.5 Levels of Service Performance Targets

Establishing LoS targets is an important part of continual improvement and performance management. Without performance targets, it is difficult to ascertain whether goals are being met, or the extent of the gap if they are not. Incorporating targets into the City's LoS Framework helps to ensure that targets are reasonable, aligned with customer expectations, and evaluated on an objective basis by considering cost-benefit trade-offs.

One of the key challenges in setting infrastructure performance targets in a municipal environment is that they can often become biased and/or politically motivated. Therefore, it is important to review LoS targets with internal and external stakeholders, especially the customers who will be impacted the most by changes in service delivery. An important aspect of evaluating LoS targets is determining how the user is willing to pay for the service. Regulatory requirements are an exception; however, they only provide the minimum service standard. Cost is still an important parameter to consider when assessing the merits of service improvements. To deal with the financial realities, it is necessary to:

- Calculate how much the service costs based on current LoS.
- Determine the cost associated with varying the LoS.
- Assess the customers' willingness to pay.

It is important that any targets set be realistic and achievable. Therefore, it is not advisable that the City sets any firm targets until their current performance has been fully assessed. O. Reg. 588/17 requires AMPs to include proposed levels of service and a formalized financial strategy by July 1, 2025.

3.6 Future Demand Drivers

Demand management is a critical component of managing the desired LoS in a sustainable manner, now and into the future. Understanding demand drivers enables the City to proactively develop effective, long-term strategies that are suitable for the City's unique political, environmental, social and technological landscape.

A summary of factors identified from the LoS workshop that would impact roads, and bridges and culverts service levels include, but are not limited to, the following:

- Staff availability.
- Funding level.
- Contractor availability.
- Succession Management.
- Supply Chains.
- Climate Change.

On November 2, 2021, the City of Sault Ste. Marie's Planning Division released the Comprehensive Background Report for updating the Official Plan[3]. The City's Official Plan guides the local decision-making on land use, development and public infrastructure over the next 20 years. The City's population is expected to roughly reach to 80,000 (by 2031), and 83,300 people by 2036. Employment is projected to grow by about 6,000 jobs, from approximately 31,000 jobs in 2016 to 36,900 jobs in 2036.

In 2015, the City updated the Transportation Master Plan for advancing the implementation of the various transportation improvements while considering the current and future conditions of the community. The City estimates that residential, industrial / commercial and retail development will occur in various areas of the City within the next 20 years. This new development will be spurred by the increase in population and by shifts and reallocation of the existing City residents. The master plan also includes traffic forecasts for the City's road network. AECOM recommends the City obtains a digital format of the future travel demand AADT information from the master plan, and include the traffic data in the roads inventory to help better inform roads asset management plan.

When additional assets to accommodate this population and employment growth are introduced to the City's portfolio, additional human resources, training and funding are required to maintain and operate, and renew or replace those assets. O. Reg. 588/17 requires municipalities by July 1, 2025, to estimate capital expenditures and significant operating costs to achieve the proposed LoS and accommodate projected increases in demand caused by population and employment growth. This includes the estimated capital expenditures and significant operating costs related to new construction and / or to upgrade existing municipal infrastructure assets. The City will have to address these aspects during the later phases of the AM regulatory compliance process and before the July 1, 2025 deadline.

[3] City of Sault Ste Marie. 1996. Official Plan

4. Asset Management Strategies

Asset lifecycle management focuses on the specific activities that should be undertaken during all phases of the asset lifecycle. Considering entire asset lifecycles can ensure that the City makes sound decisions that consider present and future service delivery needs.

The overarching goal of lifecycle management is to maximize the long-term benefits and services that our assets deliver while minimizing the associated costs and risks in the long run. Every asset has a lifecycle cost, which is the total cost of all the activities undertaken throughout its service life. Part of the purpose of the asset management planning process is to fully understand and predict the long-range financial requirements for the City's infrastructure to facilitate planning and resource management in the most cost-effective manner possible. **Figure 4-1** illustrates how costs typically accumulate over an asset's life. It is worth noting that the accumulation of the ongoing operations and maintenance, renewal & replacement and disposal costs is many multiples of the initial acquisition costs. As such, it is important to fully understand the entire lifecycle costs before proceeding with asset acquisition.

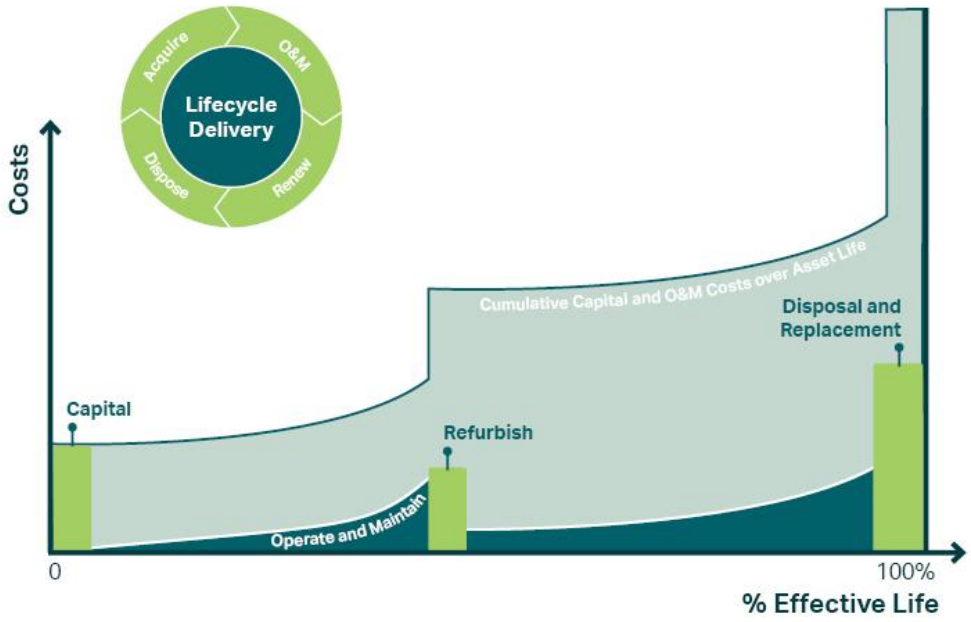


Figure 4-1: Lifecycle Cost Accumulation Over Asset Life

Asset lifecycle management strategies are typically organized into the following categories.

1. **Asset Acquisition / Procurement / Construction**: Acquisition includes expansion activities and upgrading activities to extend services to previously unserved areas or expand services to meet growth demands and to meet functional requirements. When acquiring new assets, the City should evaluate credible alternative design solutions that consider how the asset is to be managed at each of its lifecycle stages. Asset management and full lifecycle considerations for the acquisition of new assets include, but are not limited to the following:

   - The asset's operability and maintainability.
   - Availability and management of detours.
   - Staff skill and availability to manage the asset.
   - The manner of the asset's eventual disposal.

2. **Asset Operations and Maintenance (O&M)**: As new infrastructure is commissioned, the City accepts the responsibility of operating and maintaining the infrastructure according to O&M standards to ensure that the infrastructure is safe and reliable. Operations staff provide the day-to-day support required to operate the roads, bridges and culverts. Maintenance expenses include periodic preventive maintenance to ensure that the infrastructure can provide reliable service throughout the life of the asset and corrective maintenance that is required to repair defective assets as and when needed. Inadequate funding for O&M will have an adverse impact on the lifespan of assets. The number of O&M resources required in any period is a function of the current inventory of infrastructure and total O&M needs required for each asset. As the inventory of infrastructure grows, total O&M requirements will also grow.

3. **Renewal and Replacement:** The third portion of full lifecycle costing relates to the renewal and replacement of roads, and bridges and culverts that have deteriorated to the point where they no longer provide the required service. Renewal or rehabilitation cost is sometimes incurred during the life of an asset where an investment is made to improve the condition and / or functionality of the asset e.g., resurfacing of a road section. Reconstruction activities are expected to occur once an asset has reached the end of its useful life and rehabilitation is no longer an option.

4. **Decommissioning and Disposal:** There will inevitably come a point in time when an asset must be removed from service and, depending on the type of asset, there may be significant costs associated with its decommissioning and disposal. Factors that may influence the decision to remove an asset from service include changes to legislation that cause the asset to be in non-compliance, the inability of the asset to cope with increased service levels, technology advances that render the asset obsolete, the cost of retaining the asset is greater than the benefit gained, the current risk associated with the asset's failure is not tolerable, assets that have a negative impact on service delivery, the environment (e.g., roads which have persistent erosion problems, often located in areas of extremely erodible soils), or assets which can no longer be used for the purpose originally intended (e.g., roads and bridges constructed for temporary access such as designated temporary roads).

   Normally, major costs that may be incurred during disposal and decommissioning derive from the environmental impact of the disposal and, if required, the rehabilitation and decontamination of land. However, some cost savings may be achieved through the residual value of the asset or by exploring alternative uses for the asset. In all cases, it is important to consider disposal and decommissioning as the strategy employed has the potential to attract significant stakeholder attention. For that reason, the costs and risks associated with disposal and decommissioning should be equally considered in the City's capital investment decision-making process.

4.1 Current Asset Management Strategies

The asset management strategies that are currently employed by the City to manage the roads, and bridges and culverts throughout their lifecycle is summarized in **Table 4-1**.

Table 4-1: Lifecycle Management Strategies for Roads and Bridges

Asset Group	Lifecycle Activity	Description of Activities Practiced by the City	Benefit or Risk Associated with the Activities
Roads and Bridges	**Acquisition**	**Roads and Bridges** • Assumption of subdivisions, commercial and industrial extensions, local improvements, etc. • Council approved specific initiatives. • New roads through transportation planning.	• Extend services to previously unserved areas or expand services to accommodate asset enhancements. • Adequate planning and implementation of infrastructure projects help to manage existing and potential growth pressures and address other demand factors.
	Operations and Maintenance	**Roads O&M** • Road patrols. • Timely debris removal. • Annual retro-reflectivity assessment of signs and corrective action. • Bike lane summer maintenance. • Pavement paint markings. • Potholes repairs. • Pavement cracks. • Road illumination and visibility. • Street sweeping. • Curb and edge repairs. • Vegetation control. • Dust control. • Drainage improvement. • Traffic control signal systems.	• Ensure assets are operated and maintained in compliance with O. Reg. 239/02 – Minimum Maintenance Standards, which provides municipalities with a defense against liability from actions arising with regard to levels of care on roads and bridges. These standards set a minimum level of care for how roads are operated and maintained.
		Winter Control • Winter control standby. • Ice and snow removal. • Bike lane winter maintenance. • Sand and salt purchase and application. • Snow plowing. • Snow fencing. • Winter equipment fueling.	
		Bridges and Culverts O&M • Bridge cleaning. • Animal/pest control. • Asphalt surface repair. • Vegetation and debris removal.	• Ensure assets are operated and maintained in compliance with O. Reg. 239/02 – Minimum Maintenance Standards and O. Reg. 104/97: Standards for Bridges and amendments: O. Reg. 160/02, O. Reg. 278/06, and O. Reg. 472/10 – OSIM

Asset Group	Lifecycle Activity	Description of Activities Practiced by the City	Benefit or Risk Associated with the Activities
		• Concrete sealing. • Painting steel structures. • Works for drainage system.	
	Renewal and Replacement	**Roads** • Reconstruction and resurfacing of roads to address critical needs. • Coordination of road reconstruction work with utility replacement.	• Renewal and reconstruction of roads with critical needs in a timely manner reduce the safety risk, avoid premature asset failure, and achieve cost effectiveness. • Coordination of road reconstruction with sewer works optimally manages a range of assets within a road right-of-way leading to reduced cost and limited disruption to businesses and residents.
		Bridges and Culverts • Reconstruction and rehabilitation of bridges and culverts is determined based on the biennial OSIM inspection results.	• The prioritized capital plans from the biennial OSIM inspections aim to address structural deficiencies and ensure safe service.
	Disposal	**Roads, Bridges and Culverts** • Stop-up and close the road and bridges.	• Ensure assets are disposed of in compliance with waste regulations in Ontario if applicable.
	Non-Infrastructure	**Roads and Bridges** • Regular road condition assessment. • Biennial bridge condition assessment program. • Road Management System (RMS). • Transportation Master Plans and Official Plan.	• Condition assessment programs help to identify and record asset conditions for a prioritized capital programs. • RMS is used to report the condition of roads, and inform the coordination of the roads' capital work with adjacent utilities. • Transportation Master Plans and Official Plan include strategic planning / budgeting and project prioritization to inform long-term decision making.

4.2 Road Lifecycle Management Model

Condition assessment information for pavement is one of the important indicators that helps determine the reliability and serviceability of assets in their lifecycle. **Figure 4-2** illustrates the typical deterioration curves for pavements with and without rehabilitation interventions, and the near optimum pavement intervention strategies for the various condition states. For example, the design life for most asphalt pavements is 15 - 20 years and its expected operational life can be extended significantly even to 50 – 60 years if treated with proper approach at the proper time window.

Regarding the general intervention strategies, when pavement is in Very Good to Good condition, the intervention approach could be maintenance and preservation. If a pavement is in Fair condition, the recommended intervention is typically rehabilitation such as resurfacing. As pavements approach the Poor and Very Poor condition, structural enhancement and reconstruction is most likely warranted.

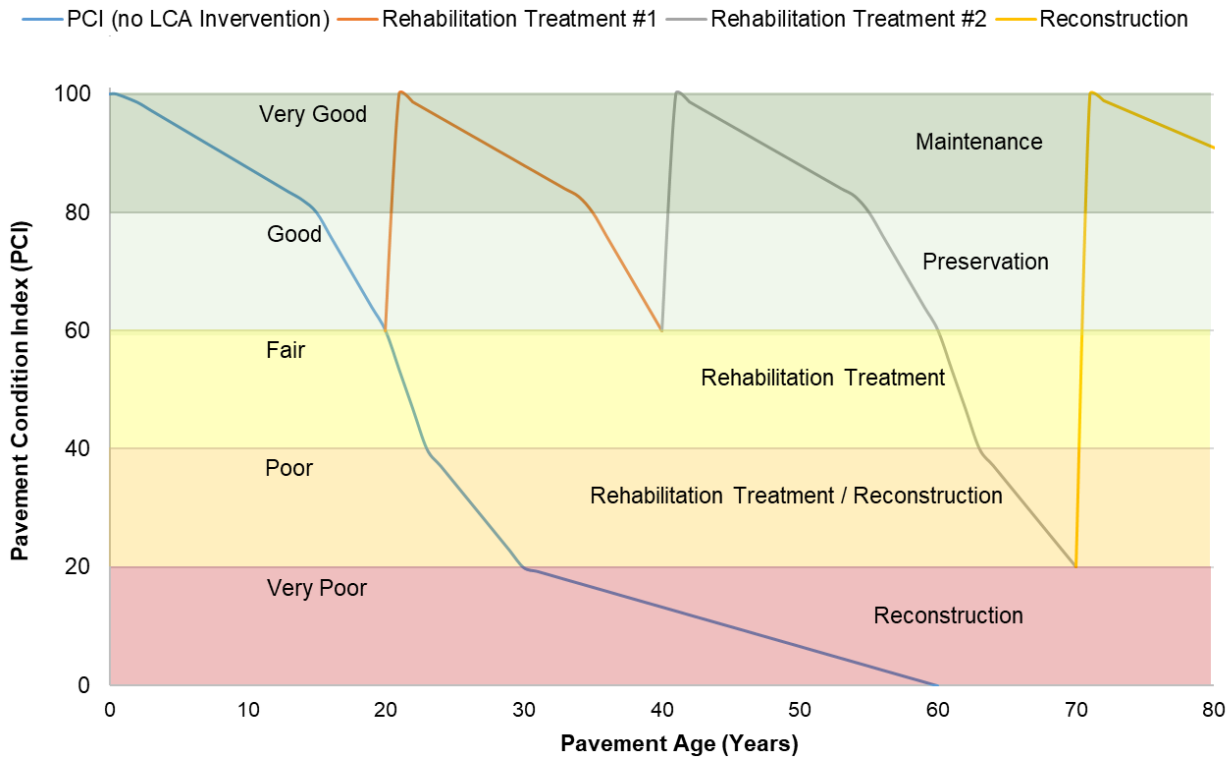


Figure 4-2: Sample of Pavement Deterioration Curves and Intervention Approaches

The proposed lifecycle management strategy for this AMP includes a pavement lifecycle interventions decision tree and a work prioritization model, which will be described in details in **Section 4.2.1** and **Section 4.2.2**, respectively.

4.2.1 Road Pavement Lifecycle Intervention Strategy

Intervention strategies for each road segment within the City's network were determined based on its condition state, which is one of the important indicators for the roads service level. Based on the current condition state, work categories are assigned to each road segment. Each work category / intervention approach includes several options of pavement treatment techniques, which the City could choose from when it comes to actual implementation. **Table 4-2** presents the pavement lifecycle intervention options and criteria.

Figure 4-3 presents the detailed pavement lifecycle decision tree and the potential treatment options. For this AMP, the capital pavement treatment approach for preservation, rehabilitation, rehabilitation / reconstruction, and reconstruction include rout and seal, variable depth resurfacing, and reconstruction with high level estimates of unit treatment cost per kilometre assigned to these treatments.

The intervention approaches for road sections that are determined to be in the treatment category of maintenance and preservation should be updated every two years based on the next condition assessment results. It is recommended that all roads should be re-prioritized when updated condition observations, updated traffic demand, and treatment costs are available.

Table 4-2: Pavement Lifecyle Intervention Strategy and Criteria

Treatment Category	Description	Pavement Condition State Criteria
Maintenance	Routine maintenance that typically consists of relatively inexpensive treatment to immediately address specific problems such as localized potholes that may affect rideability. Refer to **Table 4-1** for the City's roads O&M activities.	Very Good
Preservation	Pavement preservations are proactive activities, consisting of regularly scheduled treatments to preserve or hold the pavement condition. Conducting pavement preservation mitigates the need for invasive corrective action leading to reduced lifecycle costs, and extended service life.	Good
Rehabilitation	Rehabilitation interventions are used for pavement with acceptable structural condition. It involves actions to restore pavement surface condition and extend the service life.	Fair
Rehabilitation / Reconstruction	Rehabilitation / Reconstruction involves structural and rideability enhancements that renew the service life and improve both operational condition and functional condition (load carrying capacity) of pavement structures.	Poor
Reconstruction	Reconstruction is the activity applied when the roadway has reached the end of it's expected service life and the above categories will not effectively restore the structural and rideability levels to provide sufficient functionality.	Very Poor

4.2.2 Capital Work Prioritization Strategy

The work prioritization and capital planning scenarios (highlighted by green dashed line) in **Figure 4-3** illustrates the logic to used to prioritize capital reinvestment work with defined funding level. The road capital reinvestment needs determined by the intervention decision tree (upper section highlighted by blue dashed line in **Figure 4-3**) for each pavement segment is an input for the work prioritization model. Two prioritization approaches were developed based on the general guidelines from the MTO inventory manual:

- **Worst first scenario:** pavement intervention activities are prioritized by priority number (PN), which is a function of pavement PCI and AADT, i.e., in this scenario, the driving factors for determining which segment should be a top priority are PCI and current AADT.
- **Cost effective scenario**: pavement intervention activities are prioritized by priority guide number (PGN), which is a function of pavement PCI, future AADT, and intervention / treatment costs.

All actions for the first year of the analysis are ranked according to priority scores, and needs are funded in this order until the budget constraint is reached for that year. Funded needs become actions for that year, but all unfunded needs are rolled over into the needs for the next year. This approach can be used to prioritize work considering various budget levels.

AECOM developed an MS Excel Road Lifecycle Model to implement the scenario analysis for any desired funding levels and visualize year-over-year required reinvestment activities & spending for each road segment for a 10-year period. The level of service section in the financial dashboard compares the current levels of service and the level of service achievements from various scenarios, in terms of the condition distribution across the City's road functional classes. Refer to **Section 5.1** for roads scenario analysis results.

4.3 Bridge Lifecycle Management

The City undertakes rehabilitation / replacement works according to OSIM recommended capital priorities.

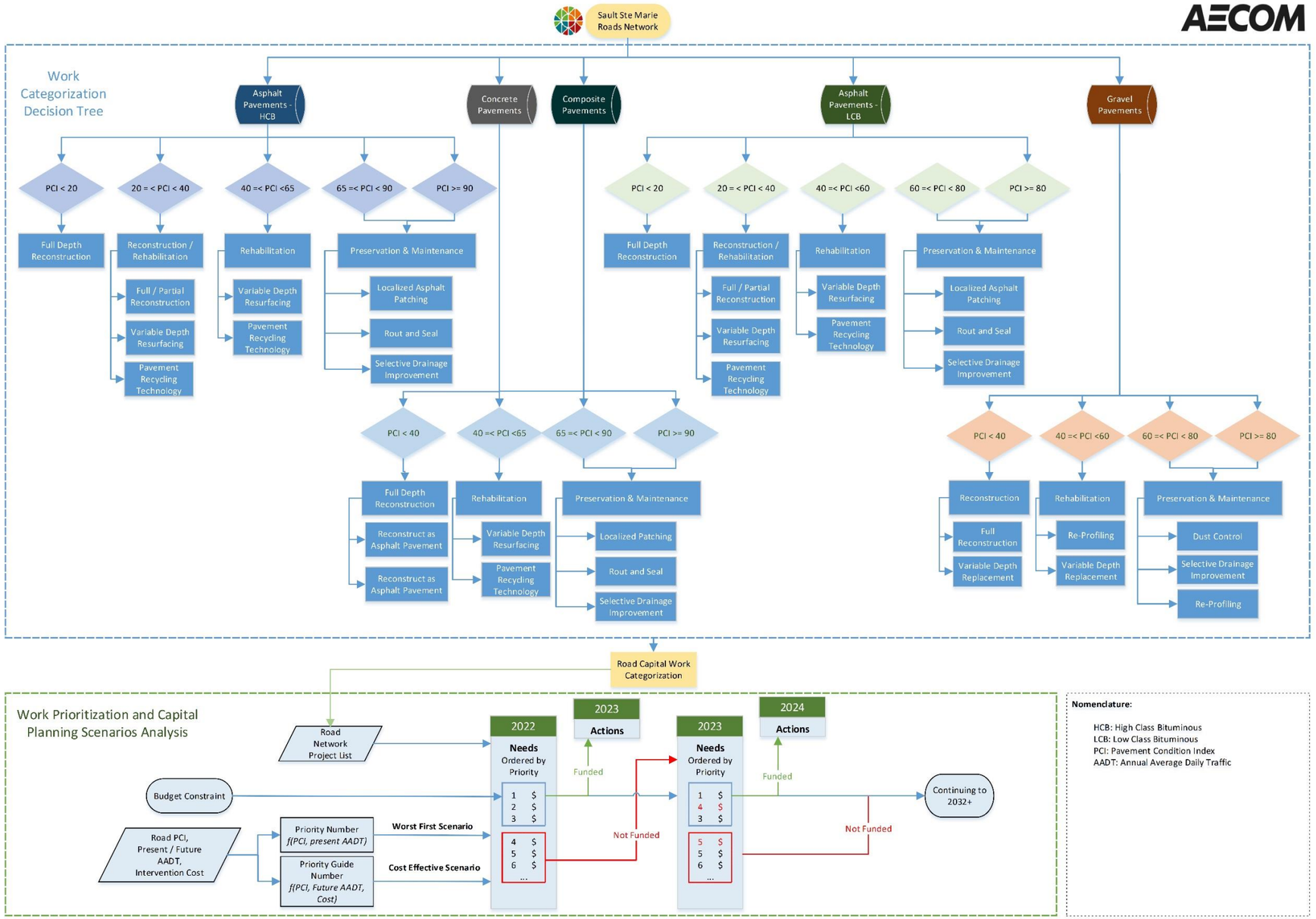


Figure 4-3: Pavement Lifecycle Management Decision Tree

5. Funding Need Analysis

5.1 Road Capital Reinvestment Scenario Analysis

Based on feedback from the City, it is understood that the forecasted annual average roads capital budget is approximately $10 Million. This budget level was used to perform scenario analysis for capital reinvestment planning. The lifecycle analysis was implemented in the Roads Lifecycle Model, developed by AECOM. A financial dashboard was developed to present the lifecycle modeling results.

It is worth noting that the work categorizations were based on visual surface condition assessment which does not represent the subsurface condition. In addition, the roads capital reinvestment costs do not include underground utility replacement costs, which are already covered in the wastewater AM plan and stormwater AM plan. Project cost and rehabilitation / reconstruction design should be further refined in advance of the actual implementation by conducting geotechnical investigations.

5.1.1 Worst First Scenario

The average annual reinvestment cost for the City's roads is $11.2 Million over the next 10 years in inflated dollar values based on the $10 Million capital budget scenario. This is equivalent to a total of approximately $112 Million over the next 10-year period, as presented in **Figure 5-1**.

The reinvestment budget allocation from the worst first scenario for each treatment category is illustrated in **Figure 5-1**. Reconstruction, reconstruction / rehabilitation (reconstruct / rehab), and rehabilitation (rehab) work were prioritized with reconstruct / rehab work accounting for the largest component throughout the next 10 years. A small amount of work was prioritized for preservation treatments in this worst first prioritization approach as the preservation treatments are assigned to roads in good condition.

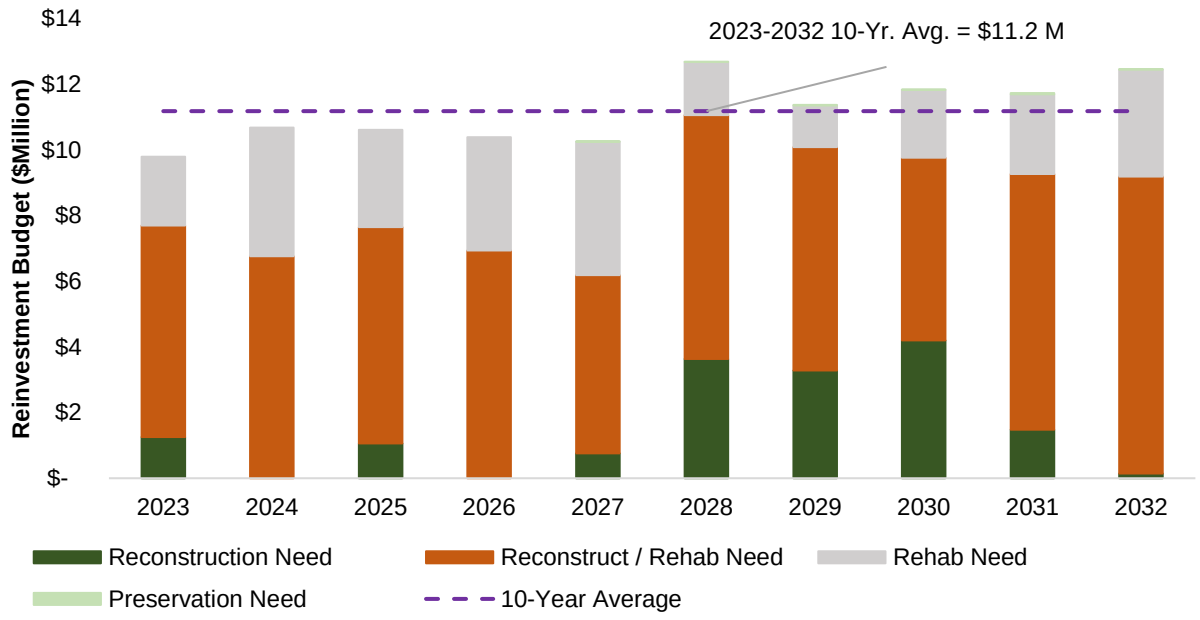


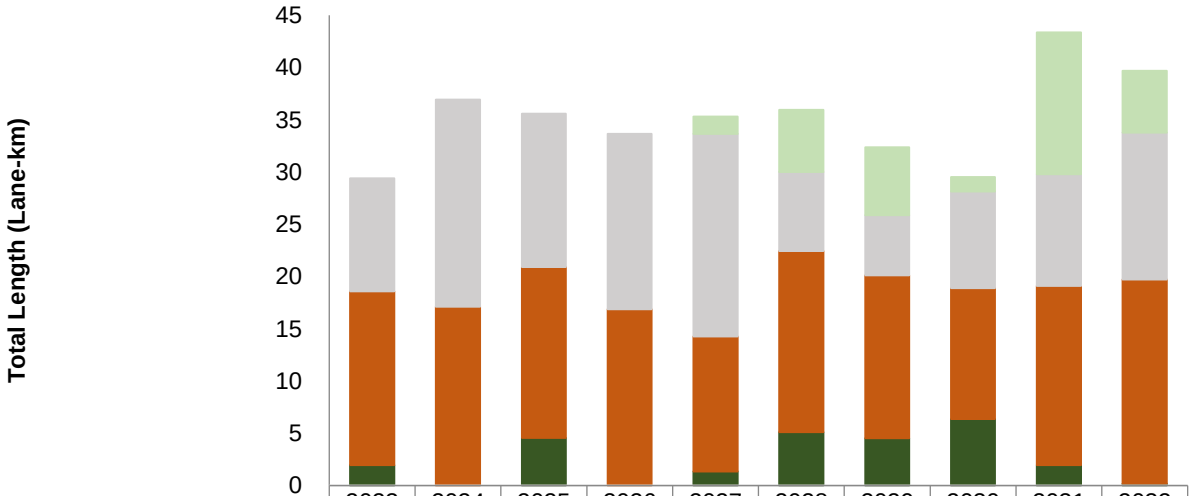
Figure 5-1: Roads 10-Year Reinvestment Needs - Worst First Scenario

The summary of reinvestment funding needs for reconstruction, reconstruction / rehabilitation, rehabilitation, and preservation under worst first scenario are presented in **Table 5-1** in inflated dollar values.

Table 5-1: Roads 10-Year Total and Annual Average Reinvestment Need for Worst First Scenario

	Reconstruction	Reconstruction / Rehabilitation	Rehabilitation	Preservation	Total
Annual Average	$1,581,000	$6,873,000	$2,710,000	$11,000	**$11,175,000**
10-Year Total	$15,810,000	$68,730,000	$27,100,000	$110,000	**$111,750,000**

The length in lane kilometre addressed by the $10 Million budget worst first scenario is presented in **Figure 5-2**. Approximately 30 to 40 lane kilometres of roads are assigned with capital reinvestment work each year under this scenario. Road segments in need of reconstruction / rehabilitation appears to be prioritized the most ($6.9 Million annually) to improve the service level considering their high traffic demand.



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Preservation Need	0	0	0	0	2	6	6	1	14	6
Rehab Need	11	20	15	17	19	8	6	9	11	14
Reconstruct / Rehab Need	17	17	16	17	13	17	16	13	17	20
Reconstruction Need	2	0	5	0	1	5	5	6	2	0
Total Length in Lane-Km	29	37	36	34	35	36	32	30	43	40

Figure 5-2: Roads 10-Year Prioritized Work Plan by Lane Kilometre – Worst First Scenario

Table 5-2 shows the service achievements for the $10 Million budget worst first scenario from the perspective of percentage of Poor to Very Poor condition roads addressed.

Based on the methodology and decision tree, all arterials currently in Poor condition and collectors in Poor to Very Poor condition will be addressed and will therefore, be restored to a Very Good surface condition under the $10 Million budget. Over 99% of Very Poor local and rural roads were addressed and approximately 0.02% of local roads remain in Very Poor condition by lane kilometre.

It should be noted that these outcomes reflect a high-level estimation of transition of road condition, as pavement age was not available to inform where the pavements currently are in their lifecycle. It is recommended to update the road condition scores within a maximum of five years and update the analysis to better inform the renewal needs.

Table 5-2: Level of Service Achievements from Worst First Scenario

% Lane Kilometre	Outcome
NA*	of Arterials that are in Very Poor Condition have been addressed
100%	of Arterials that are in Poor Condition have been addressed
100%	of Collectors that are in Very Poor Condition have been addressed
100%	of Collectors that are in Poor Condition have been addressed

% Lane Kilometre	Outcome
100%	of Locals that are in Very Poor Condition have been addressed
88%	of Locals that are in Poor Condition have been addressed
99%	of Rurals that are in Very Poor Condition have been addressed
87%	of Rurals that are in Poor Condition have been addressed

* Currently 0% of the City's Arterial roads are in Very Poor Condition

5.1.2 Cost Effective Scenario

The reinvestment budget allocation from the cost-effective scenario for each treatment category is presented in **Figure 5-3**. The detailed reinvestment needs for reconstruction, reconstruction / rehabilitation, rehabilitation, and preservation under the cost-effective scenario are presented in **Table 5-3** in inflated dollar values.

Annual average prioritized reconstruction needs for the cost-effective scenario is approximately $0.4 Million compared to the worst first scenario where the reconstruction need is $1.6 Million per year. A significant amount of rehabilitation work is prioritized ($5.8 Million annually) compared to the $2.7 Million annually from the worst first scenario.

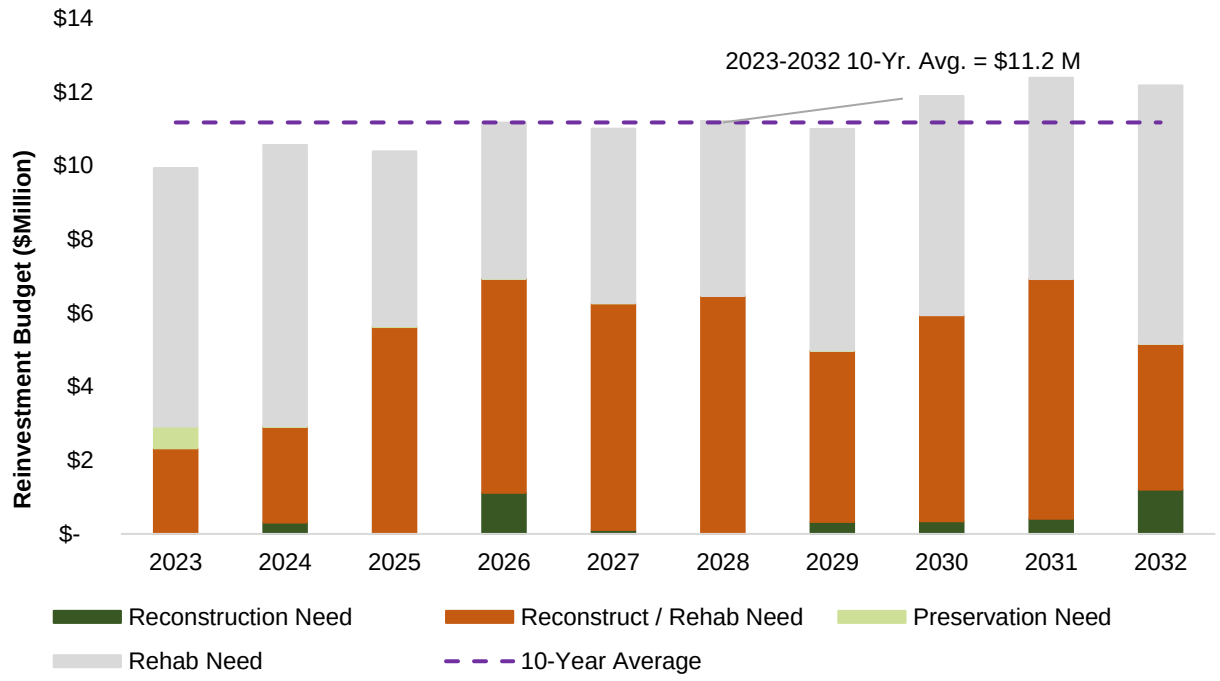
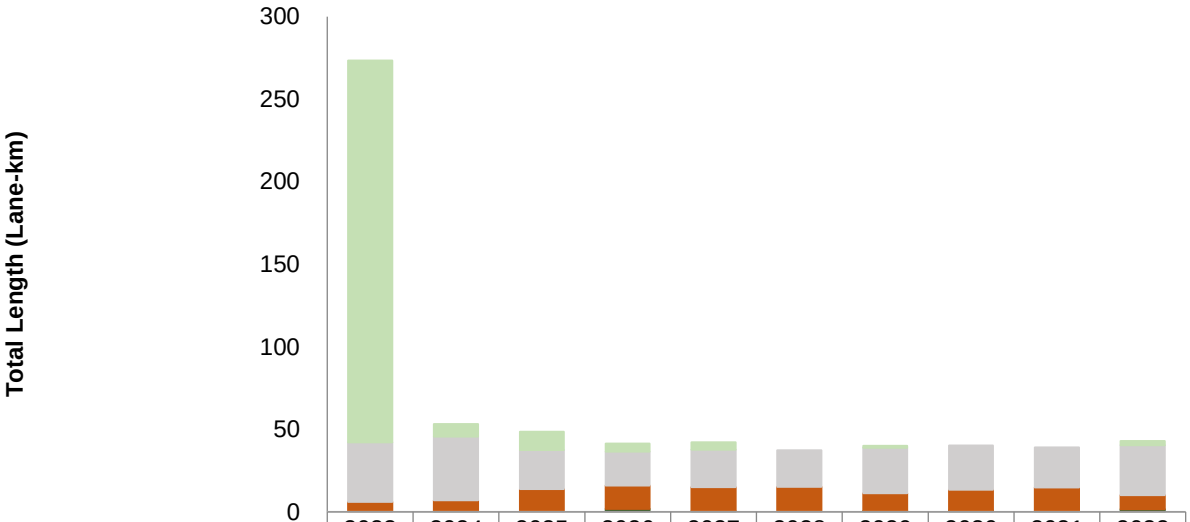


Figure 5-3: Roads 10-Year Reinvestment Needs – Cost Effective Scenario

Table 5-3: Roads 10-Year Total and Annual Average Reinvestment Need for Cost Effective Scenario

	Reconstruction Need	Reconstruct / Rehab Need	Rehab Need	Preservation Need	Total
Annual Average	$381,000	$4,966,000	$5,757,000	$68,000	**$11,172,000**
10-Year Total	$3,810,000	$49,660,000	$57,570,000	$680,000	**$111,720,000**

The annual average total length of roads addressed under the $10 Million budget from the cost-effective scenario is approximately 66 lane kilometres (**Figure 5-4**), which is almost double the length compared to the result (35 lane-km) from the worst first scenario. A larger number of roads by lane kilometre are assigned with preservation treatments with a total of $0.7 Million allocated in the next 10 years under the cost-effective scenario. Roads that need preservation and rehabilitation appears to be prioritized the most considering their higher return on investment in this scenario. The preservation activities will prevent further deterioration of the roads and extend the asset-life.



	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Preservation Need	231	8	11	5	5	0	1	0	0	3
Rehab Need	36	39	24	21	23	22	28	27	24	30
Reconstruct / Rehab Need	6	7	14	14	15	15	11	13	14	9
Reconstruction Need	0	0	0	2	0	0	1	1	1	2
Total Length in Lane-Km	273	53	48	41	42	37	40	40	39	43

Figure 5-4: Roads 10-Year Prioritized Work Plan by Lane Kilometre – Cost Effective Scenario

Table 5-4 shows the service achievements using the cost-effective scenario while constraining the budget by $10 Million. Similar to the worst first scenario, all arterials currently in Poor condition and collectors in Poor to Very Poor condition were addressed and will be recategorized to a Very Good surface condition. Approximately 99% of Very Poor local roads and 94% of rural roads are addressed, and only approximately 2.3% of local roads and 5.6% rural roads by lane kilometre remain untreated in Very Poor condition.

Table 5-4: Level of Service Achievements from Cost Effective Scenario

% Lane Km	Outcome
NA*	of Arterials that are in Very Poor Condition have been addressed
100%	of Arterials that are in Poor Condition have been addressed
100%	of Collectors that are in Very Poor Condition have been addressed
100%	of Collectors that are in Poor Condition have been addressed
99%	of Locals that are in Very Poor Condition have been addressed
87%	of Locals that are in Poor Condition have been addressed
94%	of Rurals that are in Very Poor Condition have been addressed
70%	of Rurals that are in Poor Condition have been addressed

* Currently 0% of the City's Arterial roads is Very Poor Condition

5.1.3 Benchmarking for Roads Capital Reinvestment Needs

AECOM's Canadian Infrastructure Benchmarking Initiative (CIBI, see https://www.nationalbenchmarking.com/) is a partnership of over 50 Canadian municipalities, stretching from coast-to-coast, that annually collects and reports on water, wastewater, stormwater, and transportation LoS across operational, financial, environmental, and social "bottom lines". The findings from the CIBI serve as key inputs into establishing what constitutes industry best practice for asset

management activities across Canadian municipalities. Capital reinvestment rates for roads from CIBI were reviewed and analyzed to provide the City with context and useful comparable information to make informed decisions

Table 5-5 shows the capital reinvestment benchmarking results. The City's forecasted capital reinvestment budget for roads is between the 25th percentile and 75th percentile indicating this capital reinvestment level is on par with 50% of the Canadian benchmarking municipalities' current roads capital reinvestment practice.

Table 5-5: Capital Reinvestment Benchmarking

Asset Category	Capital Reinvestment Cost	Proposed Reinvestment Rate	CIBI Capital Reinvestment Rate Benchmarking Median	CIBI Capital Reinvestment Rate Benchmarking 25th percentile to 75th percentile
Roads	$10,000,000	1.54%	1.12%	0.91% - 1.63%

5.2 Bridges Capital Reinvestment Need

The capital reinvestment need for bridges & culverts was based on the City's 2020 OSIM inspection capital recommendations. The recommended capital cost was presented in inflated dollar values. The average annual reinvestment cost for the City's bridges & culverts is projected to be approximately $0.3 Million over the next 10 years in inflated dollar values. This is equivalent to a total of approximately $3.2 Million over the next 10-year period, as presented in **Figure 5-5**.

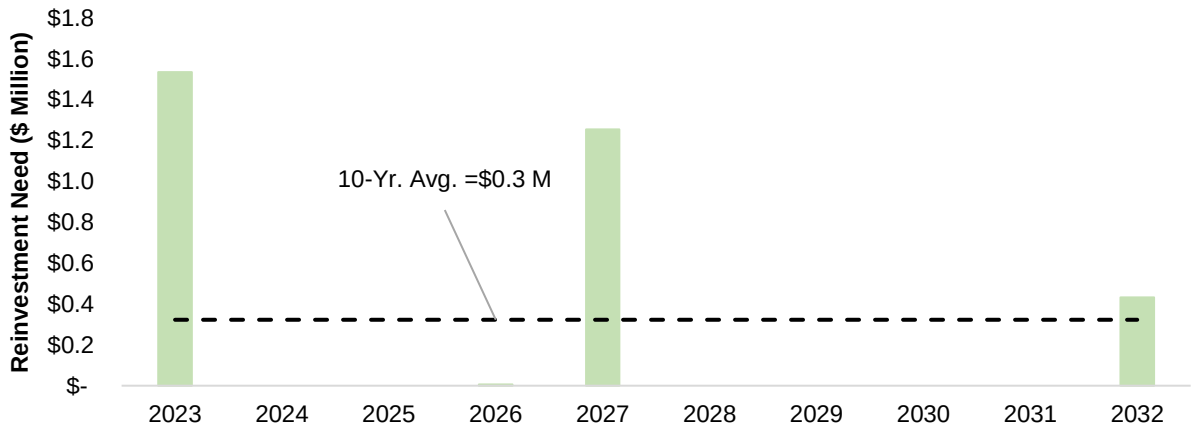


Figure 5-5: Bridges & Culverts 10-Year Reinvestment Need

5.3 Full Funding Need Profile

Figure 5-6 shows a full picture of the City's roads, bridges and culverts funding needs forecast over the next 10 years, which provides the City the full funding requirements to perform effective financial planning activities. The total annual capital reinvestment cost for roads and bridges has been overlaid with the City's annual average roadway O&M budget (on average is $3.3 Million annually), and the annual average winter control budget (on average is $6.8 Million annually).

The City's roads and bridges full funding requirement increases to approximately $230 Million over the next 10 years with the addition of roadway O&M and winter control funding requirements, equivalent to $23 Million per year in inflated dollar value.

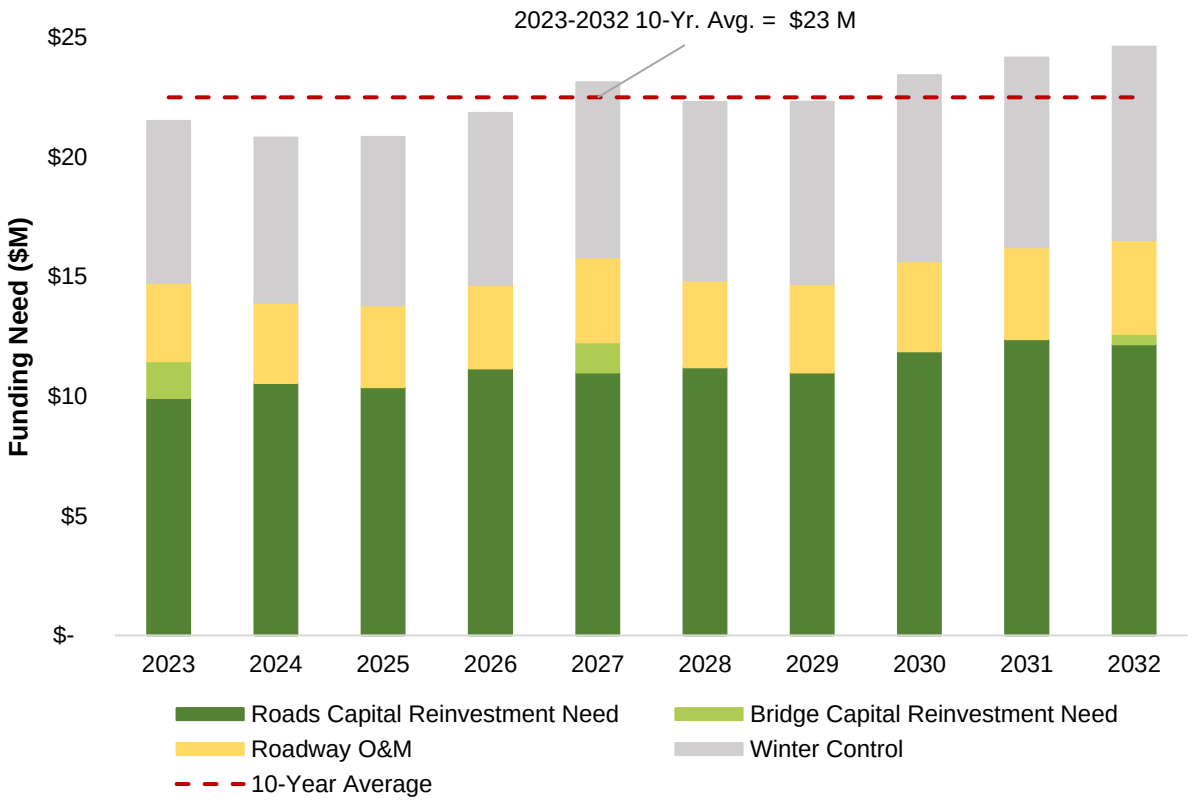


Figure 5-6: Roads, Bridges and Culverts Full Funding Need Profile

6. Implementation Plan and Continuous Improvement

Continuous improvement to management of owner assets is an important component of any AM program and is achieved through the implementation of recommended improvement initiatives which support sustainable service delivery.

Based on the results of AECOM's analysis, a suite of improvement initiatives has been identified for the next phase of AM planning for the City's roads, bridges and culverts, as outlined below:

- **Recommendation 1: Refine asset data and fill data gaps to make more informed and defensible decisions.**

  Continue to collect data and fill gaps in the GIS inventory as identified in **Section 2.3** to have a more accurate representation of the current state of the roads and bridges. It is recommended that the City continues to merge asset data from various drawings, spreadsheets, and other databases through the process of digitizing, transforming, or georeferencing assets to capture the whole inventory.

  - Continue to update dynamic inventory attributes including condition rating, traffic counts / studies, maintenance and rehabilitation activities, road classification from minimum maintenance standards, etc. by using the unique road asset ID.
  - Collect construction and rehabilitation date information to assist in projecting future pavement deterioration, which is one of the important components for informing pavement asset management planning.
  - Integrate future travel demand AADT into the road inventory. In the 2015 Transportation Master Plan, the projected AADT is in PDF format and should be digitized to help better inform roads asset management plans.

- **Recommendation 2: Develop a Data Governance Framework to provide a holistic and consistent approach to the City's roads and bridges data management practices**.

  A Data Governance Framework includes developing an Asset Information and Data Standards Strategy to clearly define what asset data exists, who is accountable for managing it, methods of data collection, and safeguarding data quality. The successful deployment of a Data Governance Framework aims to achieve the following benefits:

  - Enhanced data integrity to support reliable analysis.
  - Improved data management workflows and processes.
  - Improved AM reporting.
  - Clearly defined data management roles & responsibilities.

- **Recommendation 3: Review business process for asset acquisition and design workflow diagrams to formally document AM processes.**

  An opportunity exists for the City to continually reevaluate its business practices, including data management, to promote information sharing between roles, departments, and systems. The development of process maps is an excellent resource for visualizing the flow of information and formalizing procedures.

- **Recommendation 4: Create a data management plan for storing, reporting, and analyzing multiple years of pavement condition data**.

  Condition assessment is one of the primary steps utilized prior to performing maintenance, rehabilitation, or reconstruction activities. Road condition assessment will also allow the City to develop and refine pavement deterioration models that fit the local circumstances to:

- Better forecast rehabilitation and reconstruction needs.
- Avoid infrastructure failures and the resulting economic, social, and environmental costs.
- Leverage cost-effective methods to extend the life of assets before the asset becomes too deteriorated and must be replaced.

- **Recommendation 5: Refine the Levels of Service Framework.**

  Considering the LoS deadline of July 1st, 2025, stipulated within the O. Reg. 588/17 regulations, the steps to refining the LoS framework and quantifying the gaps between existing and target service levels can include:

  - Collecting asset performance data for key performance indicators (KPIs) that are not currently being tracked, including associated costs.
  - Reviewing the LoS performance measures on an annual basis and updating asset performance data as required.
  - Analyzing and monitoring asset performance data to determine trends and to establish annual performance benchmarks.
  - Engaging in a discussion with key stakeholders to establish service level targets and identify associated costs to meet those targets.
  - Once LoS targets have been decided upon, the City should develop strategies on how to meet service level targets considering its existing operating environment (i.e., staff availability, current funding, resources, etc.).
  - Developing a Customer Consultation Plan to engage the public and other stakeholders on the LoS framework and to better understand customers' willingness to pay for enhanced LoS.
  - Documenting information workflows, and clearly defining roles and responsibilities in the LoS continual improvement planning process. A component of collecting LoS performance data is ensuring that the right processes are in place to enable efficient LoS reporting. It is recommended that the City review its existing business process and identify opportunities to support cross-functional teamwork. This includes developing process maps and documenting clear roles and responsibilities so that key staff understand their role in data collection, recording, analysing, and monitoring.

- **Recommendation 6: Develop a Risk Assessment Framework and use risk scores to drive financial needs forecasting.**

  The use of a risk-based approach to inform financial needs provides a clear direction in maintenance, rehabilitation, and replacement work in terms of balancing priorities. It also provides transparency to the public and other stakeholders to demonstrate that decisions are made in an impartial and consistent manner, without unreasonable bias, and in accordance with agreed upon policy and priorities.

- **Recommendation 7: Implement a Computerized Maintenance Management System (CMMS) / Work Management System.**

  Implementation of a CMMS will ensure managing and tracking asset operations and maintenance on a consistent basis across all asset classes. The City will conduct an AM Software Strategy following the completion of this AM plan to identify future system requirements that may include enhancing existing software, adding-on, or replacing.

- **Recommendation 8: Acquire a Decision Support System (DSS) to prioritize and coordinate road capital planning with wastewater sewers and stormwater sewers capital planning.**

  Implementation of a DSS tool to coordinate utilities with roads programs allows to manage a range of assets within any road right-of-way to optimally coordinate leading to reduced cost and limited disruption to businesses and residents. DSS will also help prioritization and optimization of capital plans. The City will conduct an AM Software Strategy following the completion of this AM plan to identify future system requirements that may include enhancing existing software, adding-on, or replacing.

- **Recommendation 9: Refine the lifecycle model and update the model periodically as new information becomes available.**

The roads lifecycle model is based on a wide range of data inputs, currently available information, and a number of assumptions, and is therefore at best a high-level estimate of future needs.

- In light of the annual capital and O&M investments outlined in **Section 4.2**, the estimated funding requirement for capital reinvestment, O&M, and winter control is on average of $23 Million per year over the next 10 years.
- Review financial modeling assumptions on replacement values and update the financial model with latest information as it becomes available (e.g., updated traffic information).
- When there is a new iteration of pavement asset condition information, it is recommended the City to use the updated pavement condition in the model and refresh the capital reinvestment forecast to better inform asset reinvestment needs.

- **Recommendation 10: Continue to monitor growth needs and integrate growth related roads, bridges and culverts funding needs into the financial forecast and update the roads and bridges AM Plan as appropriate.**

  As referenced in **Section 3.6**, the City's roadway system is expected to grow in line with an increase in the City's population. AECOM recommends that the City:

  - Performs traffic study every five years.
  - Includes growth-related capital needs as part of the capital budgeting.
  - Coordinates AM planning and development planning processes to ensure that the infrastructure systems that are built to serve new growth can be sustained over the long term.
  - Ensures that the roads and bridges asset inventory is kept current at all times as new assets are added and existing assets are refurbished or retired.

- **Recommendation 11: Continue to find ways to improve AM initiatives across the City by maintaining a high level of AM awareness through training, AM buy-in, communication, and knowledge sharing.**

  ISO 55010[4] identifies that the financial and non-financial functions of AM within organizations are generally inadequately aligned. The lack of alignment between financial and non-financial functions can be attributed to silos in an organization, including reporting structures, functional / operational business processes, and related technical data. Financial and non-financial alignment needs to work both "vertically" and "horizontally", as follows:

  - Vertical Alignment: financial and non-financial asset-related directives by management are informed by accurate upward information flows, effectively implemented across the appropriate levels of the organization.
  - Horizontal alignment: financial and non-financial information that flows between departments conducting functions such as operations, engineering, maintenance, financial accounting, and management, etc. should use the same terminology and refer to the assets identified in the same way.

- **Recommendation 12: Develop a Knowledge Retention Strategy to document staff AM knowledge and experience for succession planning purposes.**

  Communicate AM improvement initiatives and enhance AM awareness through internal communication.

- **Recommendation 13: Develop a Change Management & Communications Plan.**

  AM buy-in and support are needed from all levels of the City to ensure that AM standards, practices, and tools are properly adopted and incorporated into day-to-day work activities. A successful Change Management & Communications Plan will depend on the following factors:

  - AM buy-in from Council, senior management, staff, and departments.
  - AM objectives are realistic and achievable.

[4] International Organization for Standardization (2019): ISO 55010 - Asset management — Guidance on the alignment of financial and non-financial functions in asset management

- AM improvement initiatives are appropriately resourced.
- A network of AM champions is developed and empowered across the City.

Appendix A - Roads MS Excel Inventory

The City's roads inventory is presented as a separate MS Excel file.

Appendix B - Bridges and Culverts MS Excel Inventory

The City's bridges and culverts inventory is presented as a separate MS Excel file.

Appendix C - Road Condition Distribution by Functional Class

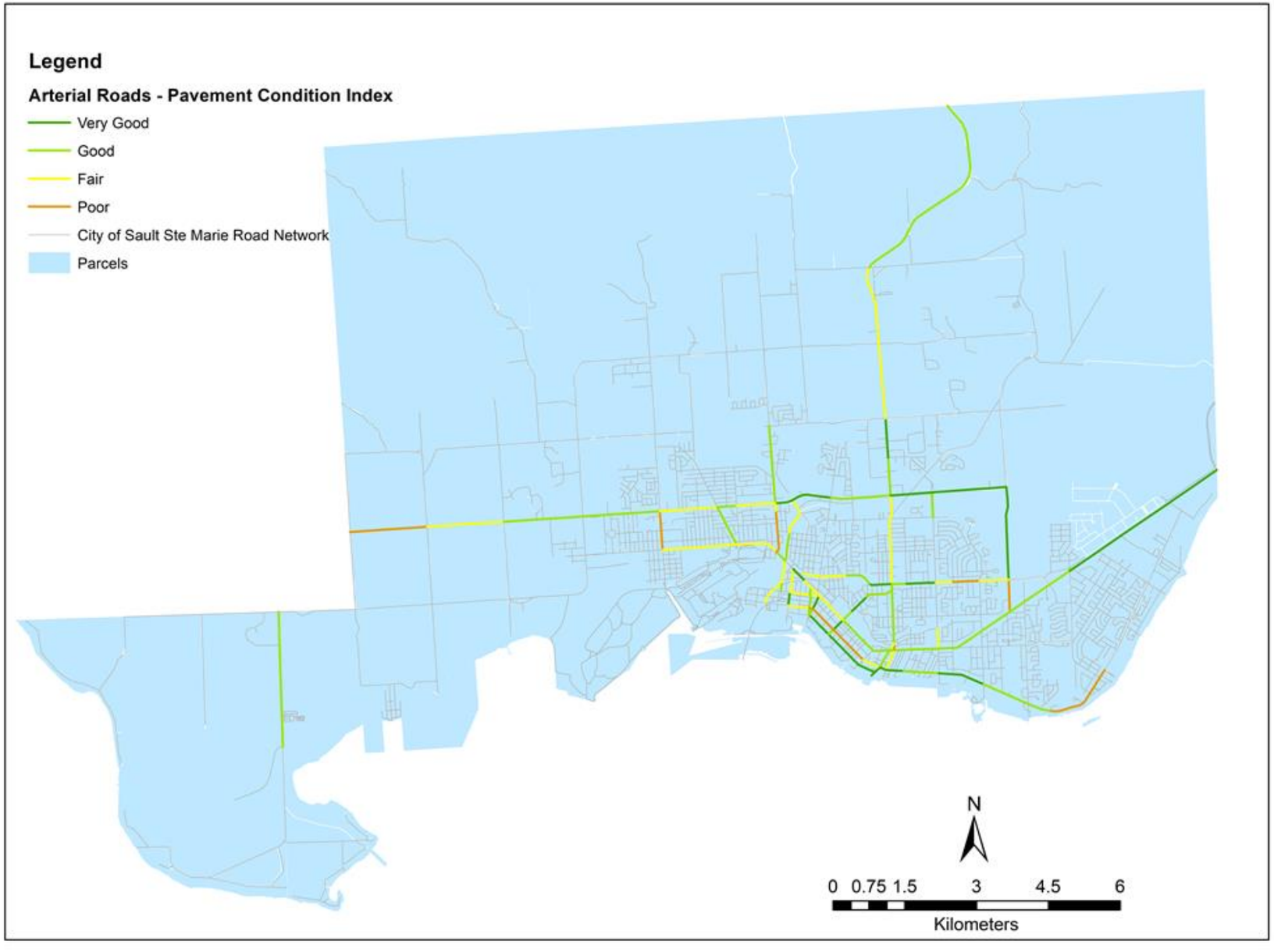


Figure A-1: Arterial Roads Condition Distribution

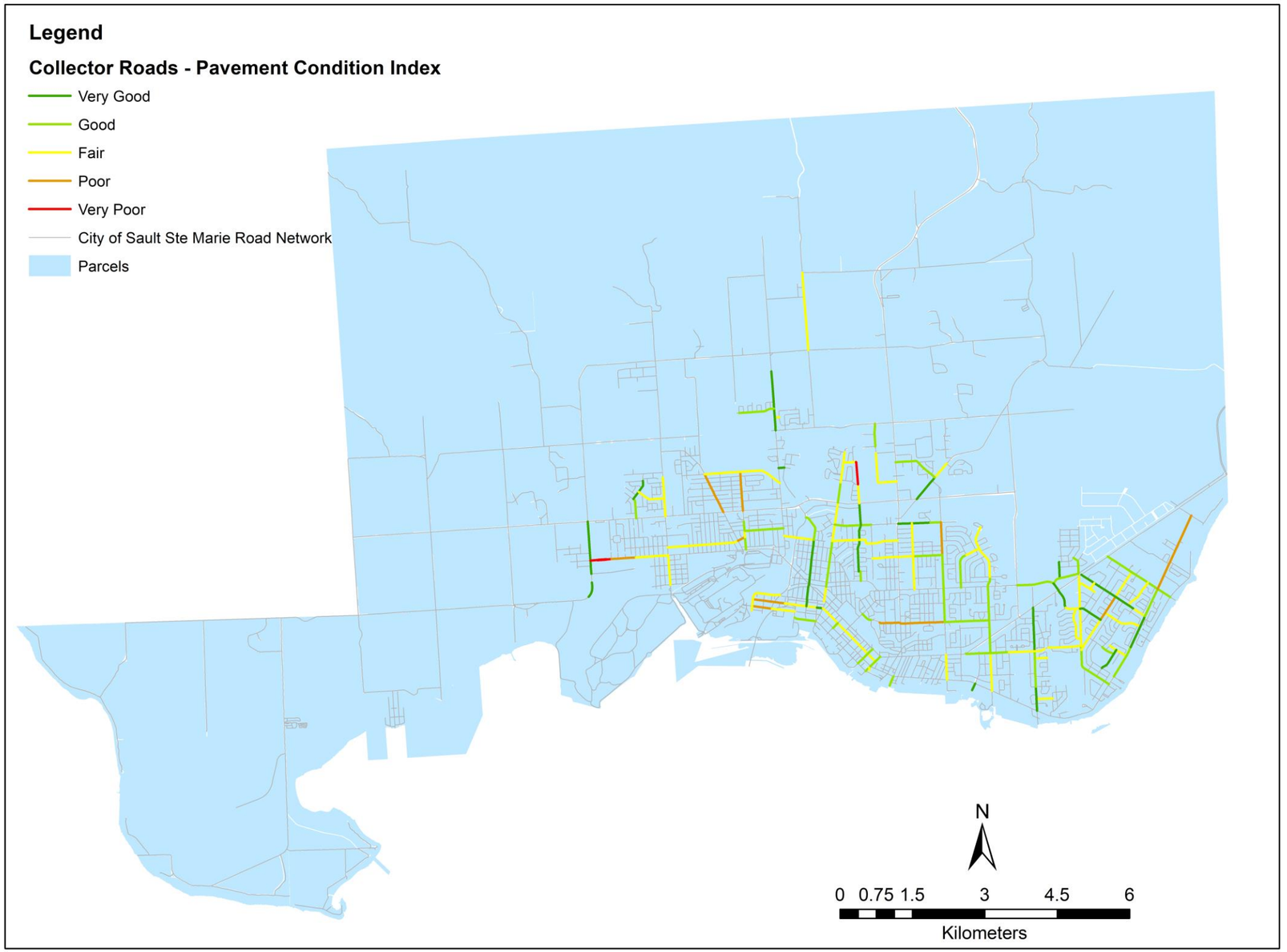


Figure A-2: Collector Roads Condition Distribution

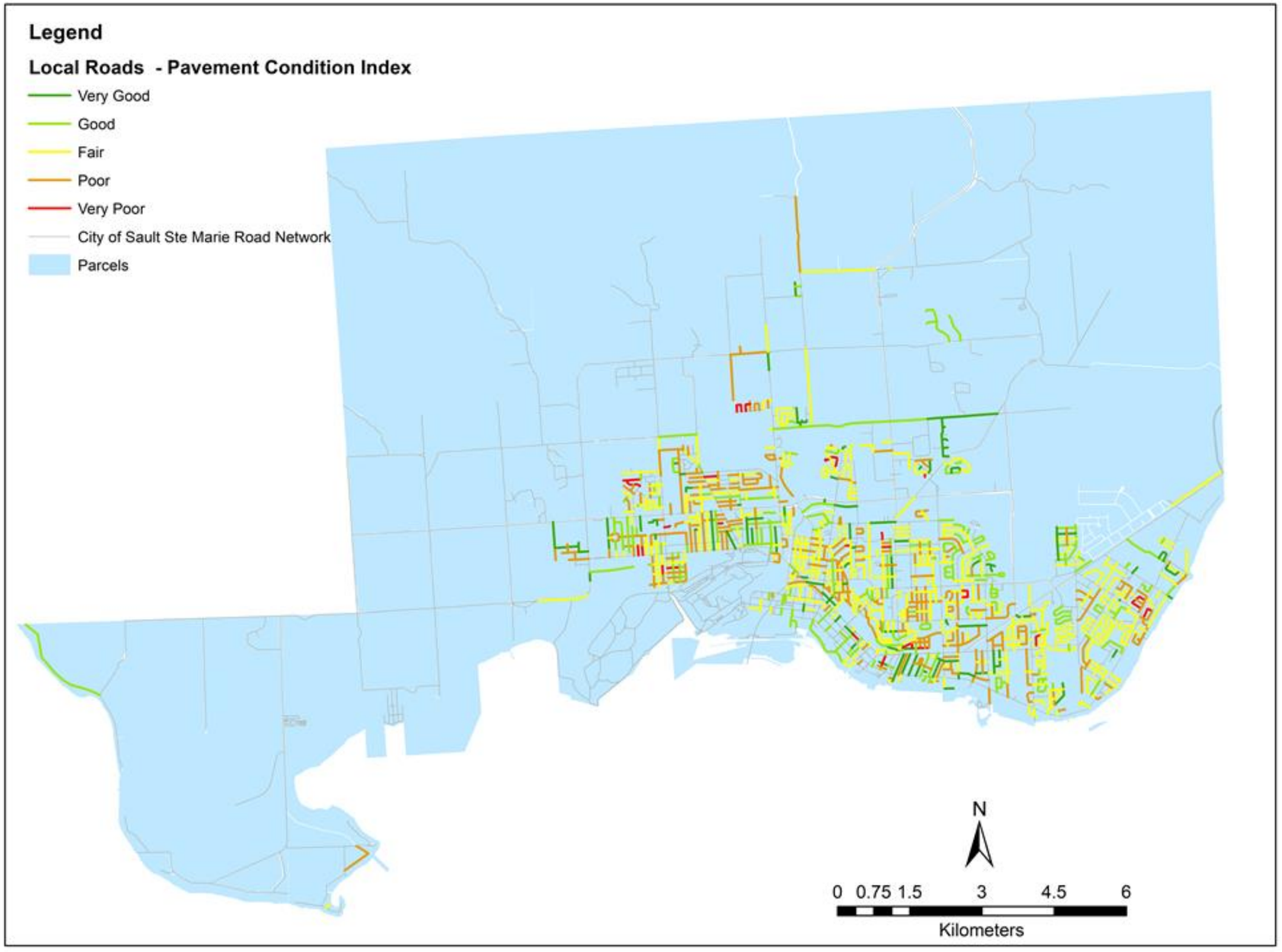


Figure A-3: Local Roads Condition Distribution

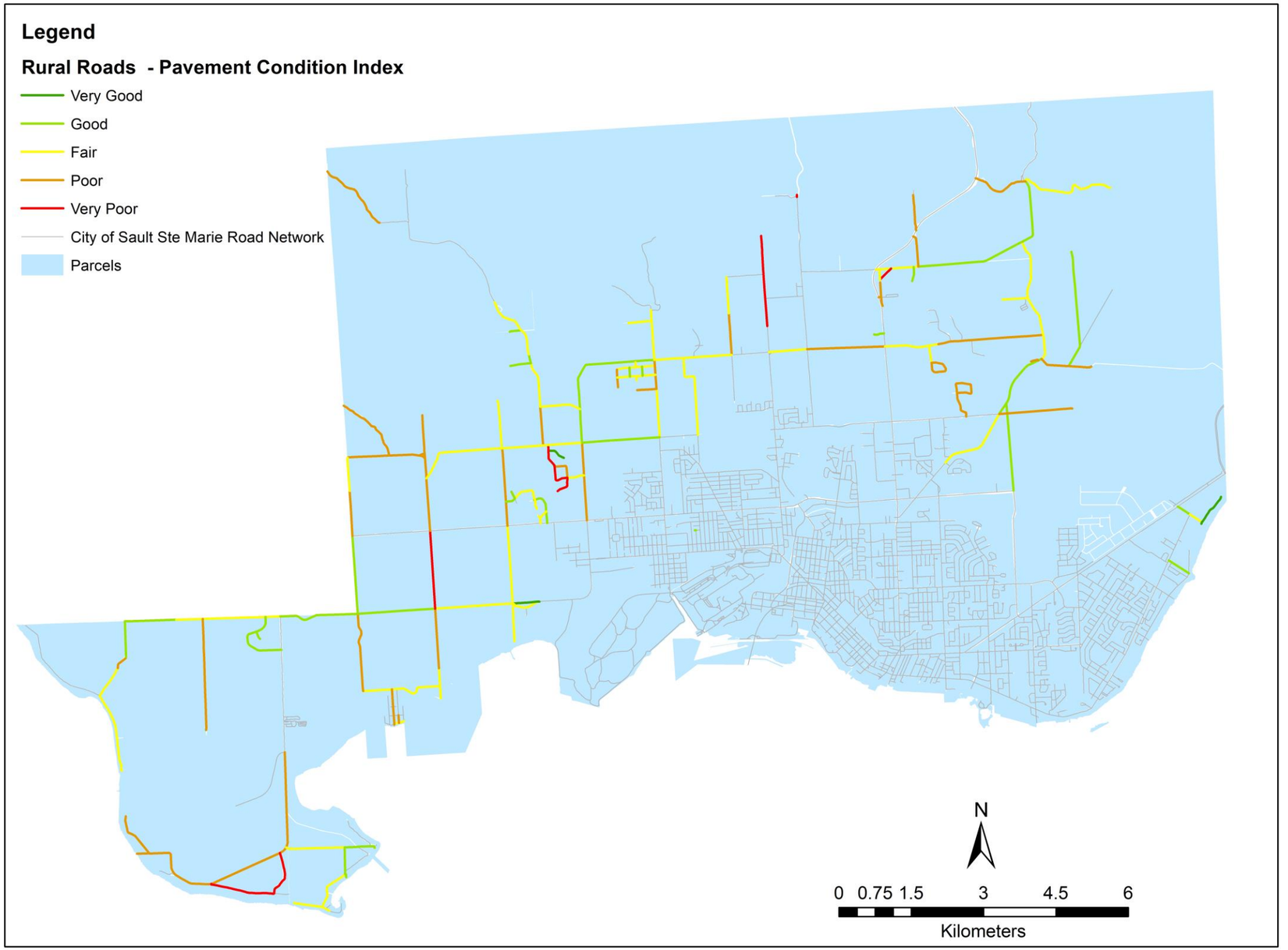


Figure A-4: Rural Roads Condition Distribution

aecom.com