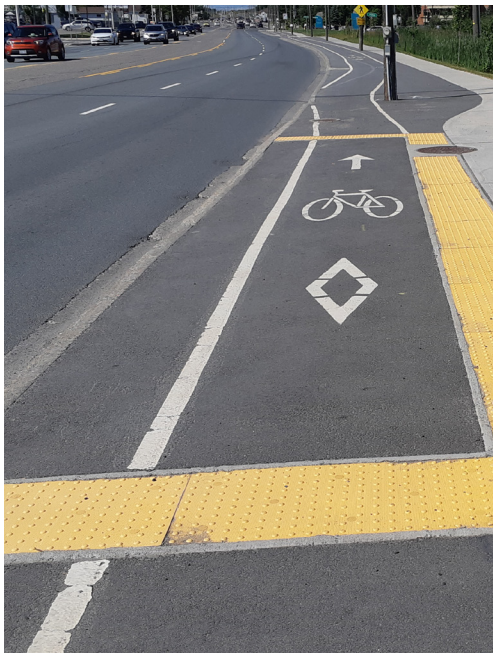
AECOM

Roads and Transportation Asset Management Plan

City of Greater Sudbury

Project number: 60718357
February, 2026







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Abbreviations

Abbreviations	Description
A/C	Asphalt over Concrete
AASHTO	American Association of State Highway and Transportation Officials
AMO	Association of Municipalities of Ontario
AMP	Asset Management Plan
AODA	Accessibility for Ontarians with Disabilities Act
AT	Active Transportation
CCBF	Canada Community-Building Fund
CEEO	Community Energy and Emissions Plan
CEPA	Canadian Environmental Protection Act
CIR	Cold In-place Recycling
CIREAM	Cold In-place Recycled Asphalt Expanded Asphalt Mix
CoF	Consequence of Failure
CON	Concrete
CPTF	Canada Public Transit Fund
DC	Development Charge
EAMP	Enterprise Asset Management Plan
ESL	Estimated Service Life
FAQ	Frequently Asked Question
G/S	Gravel, Stone
GCI	Gravel Road Index
HCB	High Class Bituminous
HMA	Hot Mix Asphalt
ICI	Industrial, Commercial & Institution
ICIP	Investing in Canada Infrastructure Program
ICP	Infrastructure Capital Planning
IRI	International Roughness Index
KPI	Key Performance Indicator
LCB	Low Class Bituminous
LOS	Levels of Service
MBNCan	Municipal Benchmarking Network Canada
MUP	Multi-use paths
NEI	Neighbourhood Equity Index
NRBCPI	Non-Residential Building Construction Price Index
NSTC	Non-Structural Cracking

Abbreviations	Description
O&M	Operations and Maintenance
O. Reg.	Ontario Regulation
OCI	Overall Condition Index
OCIF	Ontario Community Infrastructure Fund
PCI	Pavement Condition Index
PMS	Pavement Management Software
PSI	Potential for Safety Improvement
RCP	Representative Concentration Pathway
RSL	Remaining Service Life
RTAMP	Roads and Transportation Asset Management Plan
RUFF	Roughness
RUT	Rutting
SCI	Sidewalk Condition Index
SME	Subject Matter Expert
STCK	Structural Cracking
TMP	Transportation Master Plan
WMA	Warm Mix Asphalt

Executive Summary

The City of Greater Sudbury (the "City") retained AECOM Canada ULC (AECOM) to update its Roads and Transportation Asset Management Plan (RTAMP) to comply with Ontario Regulation 588/17 . The purpose of this RTAMP is to define current and proposed levels of service (LoS), quantify lifecycle activities and associated costs, assess risks, and propose funding strategies to support sustainable decision-making for the City's road, sidewalk, and bike lane infrastructure.

State of Infrastructure

The City owns and operates approximately 3,675 lane-km of roads, 406 km of sidewalks[1], and 244 lane-km of bike lanes. The total replacement value of these assets is estimated at $7.39 billion in 2024 dollars, with roads accounting for the majority. **Table E-1** summarizes the asset inventory and replacement values.

Table E-1: Asset Inventory and Replacement Value

Asset Type	Centreline Length (km)	Lane Length (km)	Replacement Value ($ Million)
Roads	1,744	3,675	$7,271.8
Sidewalks	406	-	$112.4
Bike Lanes	141	244	$8.6
Total	**-**	**-**	**$7,392.8**

Condition assessments indicate that approximately 45% of paved roads are in Good to Very Good condition, while 27% are in Poor or Very Poor condition. Arterial roads perform the best, with 75% in Good or better condition. Sidewalks are generally in Good condition, and most bike lanes – being recently installed – are in Very Good condition. **Figure E-1** illustrates the condition distribution of paved roads by lane length and replacement cost.

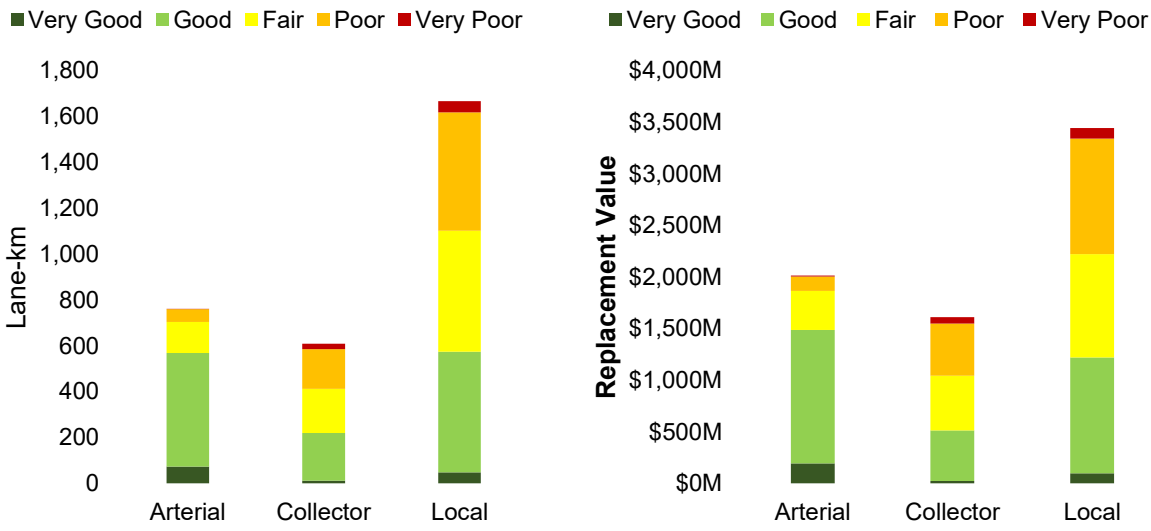


Figure E-1: Roads Condition Distribution by Lane Length (Left) and Replacement Cost (Right)

Levels of Service

To comply with the requirements of Ontario Regulation 588/17, the RTAMP establishes a proposed LoS framework that includes Community LoS and Technical LoS. The framework has been developed to reflect include information

[1] Applied Research Associates, Inc., City of Greater Sudbury ISD21-186, Sidewalk Data Collection and Asset Management, January 31, 2023.

about the LoS that the municipality proposes to provide, the lifecycle activities and associated costs needed to achieve those LoS, and the risk of failing to meet the proposed LoS.

Table E-2 lists the LoS measures used to assess and track the performance of roads, sidewalks, and bike lanes.

Table E-2: Proposed LoS Framework

LoS #	Service Area	LoS Measure	Unit of Measure	LoS Category
1	Roads	Description, including Maps of the road network in the municipality and its level of connectivity	Maps	Community LoS
2	Roads	# of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality	#	Asset (Technical) LoS
3	Roads	Road summer maintenance cost per lane km	$	Asset (Technical) LoS
4	Roads	Description, or images that illustrate the different levels of road class pavement condition	Images	Community LoS
5	Roads	Pavement Condition Index (PCI) and pavement condition category: Paved Network	0-100; categorical rating	Asset (Technical) LoS
6	Roads	PCI and pavement condition category: Arterial	0-100; categorical rating	Asset (Technical) LoS
7	Roads	PCI and pavement condition category: Collector	0-100; categorical rating	Asset (Technical) LoS
8	Roads	PCI and pavement condition category: Local	0-100; categorical rating	Asset (Technical) LoS
9	Roads	Gravel Condition Index (GCI); condition category	0-100; categorical rating	Asset (Technical) LoS
10	Roads	Roads Condition Assessment Frequency	Once every # years	Asset (Technical) LoS
11	Roads	% of roads in fair (PCI>55) or better condition based on asset replacement value	%	Asset (Technical) LoS
12	Sidewalks	Sidewalk operating rate ($ spent on O&M / Total Replacement Value)	%	Asset (Technical) LoS
13	Bike Lanes	% of Cycling Infrastructure (implemented versus planned)	%	Asset (Technical) LoS

Lifecycle Management Strategy

The RTAMP outlines lifecycle management strategies across four key phases: acquisition, operation and maintenance, renewal/rehabilitation, and disposal. Acquisition planning ensures that new assets meet growth, safety, and connectivity goals while aligning with broader municipal infrastructure initiatives. Operation and maintenance activities focus on cost-effective, routine work such as surface patching, crack sealing, and sidewalk repairs to preserve asset condition and prevent normal deterioration. Renewal and rehabilitation strategies are informed by pavement management software modeling, pavement condition data, and usage levels to optimize interventions such as overlays and rehabilitations. Disposal planning addresses assets reaching end-of-life and is aligned with asset retirement obligations and financial reporting standards.

Lifecycle decisions can be coordinated across departments, guided by risk and cost considerations, and informed by broader objectives such as climate adaptation and the City's Community Energy and Emissions Plan (CEEP).

Financial Strategy

The financial strategy outlines the City's historical spending trends, future budget forecasts, and funding requirements to maintain service levels for road, sidewalk, and bike lane infrastructure. Historically, capital reinvestment in roads ranges between $17.6 million and $53.3 million annually, with a five-year average of $25 million. Investments in sidewalks and bike lanes were relatively limited and often embedded within broader road reconstruction projects. The

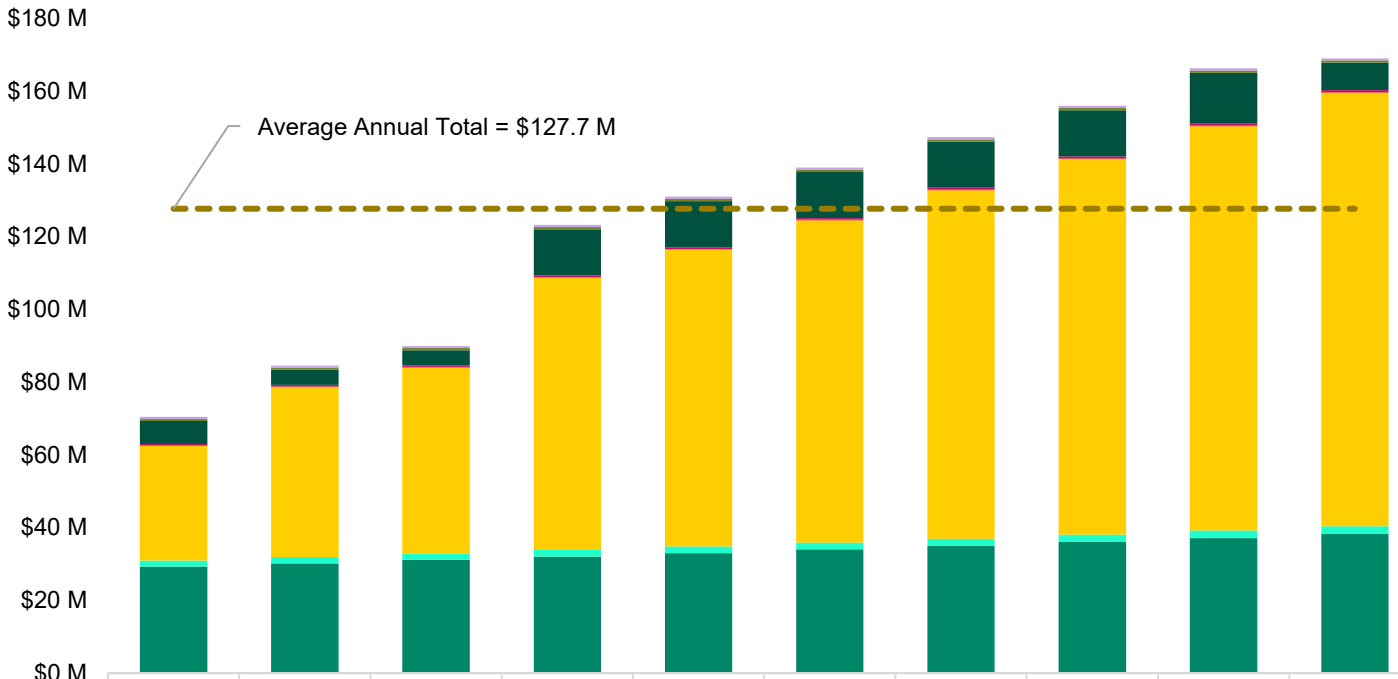
City's operating budget for roads has averaged $27.1 million annually (2020–2024), with sidewalk and bike lane operations funded as part of general maintenance activities.

To assess future needs, the RTAMP examined various budget scenarios. Scenario 1 (Current Budget) reflects a 10-year road renewal investment of $322 million and results in a projected network PCI decline from 56 to 44. In contrast, Scenario 5 (Maintain Current Condition) requires $1.05 billion over 10 years to stabilize conditions, and Scenario 6 (Improve by 10%) would require $1.5 billion. Scenario 4 (Incremental Budget Option B), at $804 million, represents a balanced investment path, stabilizing PCI at 51–52 while prioritizing arterials, which is the proposed scenario. **Table E-3** summarizes the projected 2034 PCI by scenario.

Table E-3: Summary of Road Condition Rating and PCI (in Parenthesis) by 2034

Scenario	Budget	Network	Arterial	Collector	Local
S#1 - Current Budget	$32M/yr	Fair (44)	Good (58)	Fair (42)	Poor (38)
S#2 - Maintain Arterial & Delay Others	$65M/yr	Fair (47)	Good (69)	Fair (40)	Fair (41)
S#3 - Incremental Budget Option A	$81M/yr	Fair (52)	Good (64)	Fair (46)	Fair (48)
S#4 - Incremental Budget Option B	$81M/yr	Fair (51)	Good (67)	Fair (45)	Fair (46)
S#5 - Maintain Current Condition	$105M/yr	Good (56)	Good (68)	Fair (52)	Fair (52)
S#6 - Maintain Current Condition+10%	$150M/yr	Good (61)	Good (76)	Good (56)	Good (56)
S#7 - Maintain Current Condition-10%	$66M/yr	Fair (50)	Good (61)	Fair (46)	Fair (47)

In addition, sidewalk and bike lane reinvestment needs are estimated at $4.77 million and $1.56 million, respectively, over 10 years. The City's full funding need, encompassing capital reinvestment, new capital, and O&M, is approximately $128 million annually, as illustrated in **Figure E-2**.



	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
New Capital - Sidewalks	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M
New Capital - Bike Lanes	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M	$0.6 M
New Capital - Roads	$6.3 M	$4.1 M	$4.1 M	$12.7 M	$12.7 M	$12.7 M	$12.7 M	$12.7 M	$14.0 M	$7.5 M
Capital Reinvestment - Sidewalks	$0.4 M	$0.4 M	$0.4 M	$0.5 M	$0.5 M	$0.5 M	$0.5 M	$0.5 M	$0.5 M	$0.5 M
Capital Reinvestment - Bike Lanes	$0.1 M	$0.1 M	$0.1 M	$0.1 M	$0.2 M	$0.2 M	$0.2 M	$0.2 M	$0.2 M	$0.2 M
Capital Reinvestment - Roads	$31.5 M	$46.8 M	$51.2 M	$74.9 M	$81.6 M	$88.6 M	$95.8 M	$103.3 M	$111.1 M	$119.2 M
O&M - Sidewalks	$1.6 M	$1.7 M	$1.7 M	$1.8 M	$1.8 M	$1.9 M	$1.9 M	$2.0 M	$2.1 M	$2.1 M
O&M - Roads	$29.3 M	$30.2 M	$31.1 M	$32.1 M	$33.0 M	$34.0 M	$35.0 M	$36.1 M	$37.2 M	$38.3 M
Annual Average	$127.7 M	$127.7 M	$127.7 M	$127.7 M	$127.7 M	$127.7 M	$127.7 M	$127.7 M	$127.7 M	$127.7 M

Figure E-2: Full Funding Profile for Roads, Bike Lanes, and Sidewalks

To address this gap, a 1.5% dedicated infrastructure levy is proposed, while the continuity to explore a mix of funding sources is also recommended, including federal and provincial grants, development charges, debt financing, and reserve funds.

The City also recognizes the need to proactively manage financial risk and service level trade-offs. Strategies such as asset rationalization, adjusting service standards, and converting select roads to lower surface types are considered to reduce long-term costs. Where appropriate, holding treatments like asphalt patching are used to extend pavement life under constrained budgets.

In addition to funding measures, the City continues to make effort on exploring a range of non-financial strategies to improve cost-efficiency and delivery. These include project bundling, phasing large capital works, coordinated infrastructure planning, multi-year budgeting, and enhanced procurement timing. The City also emphasizes communication with stakeholders and Councillors to support transparent decision-making and build long-term support for sustainable asset management.

Implementation Plan and Continuous Improvement

Continuous improvement is a core component of a successful asset management program. It is supported through the implementation of targeted initiatives that enhance data quality, optimize decision-making, and improve long-term service delivery. **Table E-4** outlines AECOM's recommended initiatives to advance transportation asset management practices across the City.

Table E-4: Recommended Improvement Initiatives

AMP Section	Improvement Initiative	Actions
State of Infrastructure	Continuously maintain and refine inventory data	• It is recommended for the City to continue maintaining the transportation inventory, keep tracking renewal/replacement records, and update the inventory as soon as a new asset is acquired, or when assets are decommissioned. • The City is recommended continuously refining inventory data for sidewalks and bike lanes, including key attributes such as install years, condition if have, ESLs, treatment unit costs, and completed work activities. • The City's reconstruction unit costs are used to estimate road replacement costs. Historical unit costs are periodically tracked for paved roads, but not for unpaved (gravel) roads. Given the City has over 600 lane-km of gravel roads, it is recommended to review and update the previous total replacement cost estimate for these gravel roads.
	Establish data ownership and accountability	• It is recommended to develop a Data Strategy document that defines roles for data ownership and accountability, strengthens asset data integrity, and improves decision-making. A strong data governance framework ensures consistent, accurate, and reliable data, which is essential for effective planning and management. By clarifying responsibilities and aligning data practices across systems and departments, the strategy will reduce organizational silos and enhance collaboration. It will also streamline information workflows, making it easier to access and utilize data efficiently.
	Develop a condition assessment process for gravel roads and bike lanes.	• The current asset inventory lacks most recent condition and installation data for gravel roads and bike lanes, which presents challenges for conducting lifecycle financial analysis. Therefore, it is recommended to develop a consistent and structured condition assessment process for gravel roads (at least every five years), while bike lanes can be assessed with sidewalks. This process will allow the City to better forecast these assets replacement needs and avoid failures and the resulting economic, social, and environmental costs.
Levels of Service	Refine the Levels of Service Framework.	• Continue to collect asset performance data for identified key performance indicators (KPIs) including associated costs.
	Continue update and review the LoS performance measures.	• Review the LoS performance measures on an annual basis, and update asset performance data as required.
	Develop a strategy to achieve the desired LoS target.	• Periodically assess proposed LoS to confirm alignment with shifting community expectations, regulatory changes, City priorities, available

AMP Section	Improvement Initiative	Actions
		resources, and observed performance trends—supporting adaptive and responsive service delivery. • Continuously enhance demand management by routinely evaluating future demand drivers that influence service delivery and asset use, integrating these insights into long-term capital planning to ensure LoS remains responsive to changing needs.
	Continuously improve stakeholder engagement	• Building on existing efforts, it is recommended that the City continue to refine its Customer Communication & Consultation Plan to engage the public and other stakeholders on the LoS Framework, and to further assess stakeholder willingness to pay for enhanced service levels.
Lifecycle Management Strategies	Strengthen proactive maintenance and lifecycle efficiency	• Implement proactive maintenance schedules and systematic condition monitoring to identify issues early and reduce unplanned downtime. Use condition data to intervene at optimal times, minimizing reactive repairs and overall maintenance costs. • Incorporate energy-efficient technologies and best practices into road and transportation operations to improve lifecycle cost-effectiveness.
	Explore and expand lifecycle strategies	• Explore and expand minor treatments, preservation techniques, or rehabilitation techniques (including green technologies) for operational and capital programs, and establish proper implementation and quality control to maximize its benefits. • Review existing internal and external processes and alternative construction standards to enhance work activities.
	Revisit lifecycle strategy selection logic	• It is recommended that the treatment selection logic (decision trees) in the City's PMS be revisited regularly (e.g., every 3 to 5 years). Over time, changes in material, technology, policy can make original logic outdated, resulting in resource misallocation, missed optimization, and inefficient planning.
	Assess the current PMS	• The City does not have a dedicated staff to operate PMS and communication with software provider sometimes results in long response times and unanticipated costs, hindering timely updates and decision-making. To improve the effectiveness of pavement planning, it is recommended that the City initiate a study to evaluate the existing PMS or pursuing a new PMS to meeting the evolving needs. It is recommended the study to assess operational and resource gaps, explore alternative systems or service delivery models, and provide recommendations for a more streamlined and sustainable solution that ensures timely analysis, long-term AM planning and other functional requirements.
Financial Strategies	Identify lifecycle stage for the cost items	• It is recommended to add lifecycle stage to the cost items (including acquisition, operation/maintenance, renewal/replacement, and disposal) during actual investment to have a better understanding of the cost of ownership and support long-term needs forecast and planning.
	Keep updating treatment unit cost	• The City has established a strong practice of tracking treatment unit costs for paved road work over the years. A comparison of unit costs from 2013, 2016, and 2024 shows significant fluctuations driven by inflation and other socio-economic factors. To ensure accurate lifecycle financial planning and intervention analysis in dTIMS, it is recommended to regularly update treatment unit costs.
	Ensure consistent inflation rate	• The City currently applies a 3% inflation rate for financial planning, whereas dTIMS uses a 1.5% rate in its analysis. It is recommended to revisit the inflation settings in dTIMS to ensure alignment with the City's financial assumptions and improve consistency in future planning.
	Conduct quantitative risk assessment and implement it into pavement management	• It is recommended to develop a quantitative risk framework or model with refined criteria and weighting specific to road assets. The model should be integrated with GIS to allow for efficient updates and visualization of risk information. This risk-based approach will enhance project prioritization and support more effective pavement management.
	Incorporate gravel and surface-treated roads in the PMS analysis	• To improve the analysis, the City is recommended incorporating gravel and surface-treated roads by assessing their condition, traffic volumes, and maintenance history in dTIMS model. Including these networks would provide a more comprehensive view of capital reinvestment needs, support equitable funding decisions, and ensure all road users benefit from long-term planning and investment strategies.

AMP Section	Improvement Initiative	Actions
	Balance funding needs and road performance	• The full funding needs analysis indicates that implementing all recommended treatments (Unlimited Scenario) over the next 10 years would require approximately $4.7 billion. Under the current 10-year budget of $322 million, the City would face an average annual decline of 1.2 PCI points. However, by adopting an Incremental Budget scenario (Scenario #4) supported by a dedicated infrastructure levy—resulting in a total budget of $804 million—the City could maintain arterials in Good condition and keep collectors and local roads in Fair condition throughout the next 10-year.
	Explore additional funding sources	• The City could explore some additional funding sources, as described in **Section 5.5**.
	Adopt additional non-financial solutions	• Key approaches include project bundling, optimizing tender timing, phased delivery, and leveraging ROI- or risk-based prioritization. Coordination across utilities, managing disruptions, and engaging councillors also build efficiency and support. The City is encouraged to use internal resources, adjust service levels, and continue multi-year budgeting. Additionally, rationalizing infrastructure by removing underused assets supports long-term sustainability and cost-efficiency.
Continuous Improvement	Improve alignment between operating and capital activities	• Develop a criteria-based framework to guide policies and decisions for rationalizing the road and sidewalk network, supporting coordinated operating and capital planning. • Develop a quantitative, risk-based framework with refined criteria and asset-specific weightings for road assets to improve project prioritization, strengthen pavement management, and better align capital investments with ongoing operating needs.
	Continuously refresh AMP	• Continuously refreshing this AMP at least every five years to align with evolving infrastructure conditions, service level expectations, financial realities, and regulatory requirements. Regular updates allow municipalities to incorporate new data, reassess risks, refine lifecycle strategies, and adjust investment priorities.
	Continue to improve AM initiatives across the City by maintaining a high level of AM awareness through training, communication, and knowledge sharing.	• Develop a Knowledge Retention Strategy & Internal Communications Plan to document staff AM knowledge and experience for reporting and succession planning purposes. Communicate AM improvement initiatives and enhance natural AM awareness internally through internal communication.

1. Introduction

AECOM Canada ULC (AECOM) was retained by The City of Greater Sudbury (the "City") to develop an Asset Management Plan (AMP) to update its current 2021 Roads and Transportation Asset Management Plan (RTAMP) to comply with O. Reg. 588 / 17 in respect to its roads and transportation assets. This AMP focuses on presenting proposed service levels for roads and the required capital and maintenance funding to maintain agreed service levels. The purpose of this AMP is to allow a continued increase in information through the Long-Term Financial Planning exercise to allow the City to continue to improve the road network as required. The scope of work for this investigation is outlined in AECOM's proposal dated November 24, 2023, and subsequent project correspondence.

1.1 Background and Objectives

Asset Management is the systematic coordination of activities and practices of an organization to optimally and sustainably deliver on its service objectives through the cost-effective lifecycle management of assets. The City of Greater Sudbury delivers services to the community based on managing existing assets in an environmental, social, and economically sustainable manner to reduce costs and risks, while complying with regulations.

The City, like most Canadian municipalities, must overcome multiple challenges in managing assets including aging infrastructure; expectations of higher levels of service with minimal financial impact; increasingly demanding and complicated legislation with environmental requirements; and mitigation of the increased risk involved with the execution of service delivery.

As a result, the City is moving to implement a focused and calculated approach to address these challenges of managing infrastructure assets with the development and implementation of the Enterprise Asset Management Plan (EAMP). In 2021, the City developed the RTAMP[2], which supports the EAMP in a phased approach to meet the requirements of Ontario Regulation 588 / 17 (O. Reg. 588 / 17)[3]:

The 2021 RTAMP supports the achievement of goals under five of the pillars of the City of Greater Sudbury Strategic Plan 2019-2027. These reinforce the need to maximize the value of investments in physical infrastructure and initiatives to enable service delivery, climate change resilience, community health and promote economic competitiveness. As **Figure 1-1** shows below, the supported strategic plan pillars are included.



Figure 1-1: City of Greater Sudbury Strategic Plan Pillars

The 2021 RTAMP includes the following tasks:

- Assess existing paved and unpaved road conditions.
- Report on road asset inventory quantities, classes, and replacement cost.
- Document existing levels of service.
- Outline existing maintenance, renewal and rehabilitation activities.
- Discuss incorporation of risk.
- Review of current road asset investment and funding.
- Discussion of the Community Energy and Emissions Plan (CEEP) and climate change adaptation strategies.

[2] City of Greater Sudbury, Roads and Transportation Asset Management Plan, 2021.
[3] Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure.

- Establish a preliminary list of demand drivers.

However, the 2021 RTAMP does not include information about the proposed Levels of Service (LoS) required by the O. Reg. Thus, the 2025 RTAMP provides updates to integrate proposed LoS and address associated lifecycle costs, risks, available funding, and funding strategies. Specifically, the following tasks identified in the 2021 RTAMP have been addressed.

- Develop proposed level of service options which will include a review of the following:
    - Identify differences between existing service levels and proposed service levels.
    - Assessment of risk for proposed level of service options.
    - Estimate asset performance over 10 years for various levels of service options.
    - Review affordability of proposed service levels and determine if service levels are achievable.
    - Select the target level of service that is appropriate for the community.
- Identify improvement opportunities to operating and capital programs, recommend action items to provide improved alignment between operating and capital activities.
- Update road network valuation and incorporate into the pavement management system.
- Implement risk analysis into the pavement management system.
- Provide options for lifecycle management and associated financial strategies.
- Develop long-term financial strategy options (60 years).
- Incorporate considerations for future growth and development demand.
- Identify opportunities for implementation of green technologies.
- Identify impacts and strategies to manage risks associated with climate change.
- Identify future improvement opportunities.

Lastly, the overall objective of this RTAMP is to inform the decision-making processes required for establishing a method of sustainable management of assets in consideration of acceptable condition, risk, costs and other influencing factors. The goals of this RTAMP include:

1. Identify existing asset data information.
2. Document existing levels of service and the financial impact of potential alternatives.
3. Complete technical reviews of the assets using a life cycle approach.
4. Identify, assess and evaluate risks and establish risk tolerance.
5. Develop options or criteria for guiding long-term financial planning decisions.
6. Promote asset management strategies to attract growth and development, improve community health, and build climate change resilience.

To meet these objectives, the following elements are included within the scope of this RTAMP:

- Asset hierarchy, a summary of the asset inventory, including the replacement cost of the assets, the average age of the assets, the condition of the assets, and data gaps analysis (Sections 2).
- The City's level of service objectives, stakeholder identification, and current levels of service (LoS) 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 and funding need to maintain current LoS, minimize associated asset risks, and to optimize costs over the whole lifecycle of the asset (Section 4 and Section 5).

1.2 In-Scope Assets

The City's in-scope roads and transportation assets contain roads, sidewalks, and bike lanes, as shown in **Table 1-1**.

Table 1-1: In-Scope Roads and Transportation Assets

Asset Category	Sub-Assets
Roads	Arterial roads; Collector roads; Local roads.
Sidewalks	-
Bike Lanes	AT trail; On-road bicycle lanes; Paved Shoulders; Cycle tracks; Multi-use paths (MUP); Signed Bike Route with Edgelines

The City of Greater Sudbury's largest asset class in terms of replacement cost is the road network. **Figure 1-2** provides an overview of the City's transportation network.

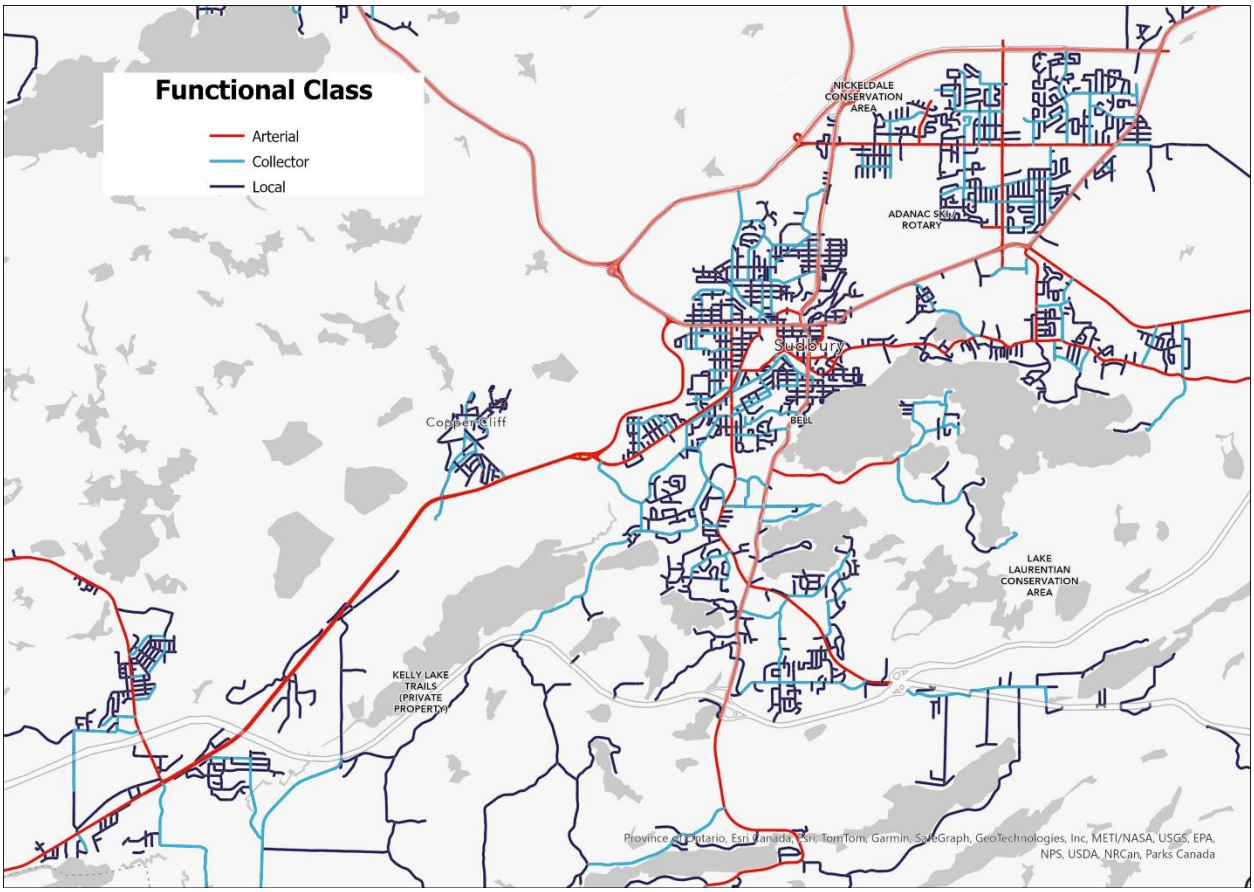


Figure 1-2: The City of Greater Sudbury Road Network

Additionally, the City categorized roads by two types of attributes as functional class and pavement type, as **Table 1-2** shows below. It should be noted that the Primary Arterial, Secondary Arterial, and Tertiary Arterial are combined as Arterial which is used consistently in the rest of this report to align with O. Reg. 588 / 17[3].

Table 1-2: Road Network Classifications

Attribute	Priority Class		Function
Functional Class	Arterial	Primary Arterial	• Connect the City with other major centres outside the City and/or communities within the City. • Facilitate long distance person or goods movement travel through the City or between major activity areas within the City. • Traffic movement is primary consideration.
		Secondary Arterial	• Connect two or more communities or major activity centres. • Connect two primary arterial roads. • Connect a community or activity centre with a primary arterial road. • Traffic movement is major consideration.
		Tertiary Arterial	• Connect small / rural communities. • Connect communities to primary or secondary arterial roads. • Traffic movement is major consideration.
	Collector		• Connect neighborhoods. • Connect a neighborhood with an arterial road. • Traffic movement and land access of equal importance.
	Local		• Connect properties within a neighborhood. • Land access is a primary function.
Pavement Type	Paved		• Asphalt over Concrete (A/C). • Concrete (CON). • High Class Bituminous (HCB). • Low Class Bituminous (LCB).
	Unpaved		• Gravel, Stone (G/S).

1.3 Asset Management at the City of Greater Sudbury

The City is unique due to its large area and relatively high number of road lane kilometres per capita. As shown in **Figure 1-3**, in 2019, the City had a total of 3,592 lane km of municipal roads, which equates to a total of approximately 22 lane km per 1,000 population. It is the largest value submitted by participating municipalities that reported to the 2019 MBNCan (Municipal Benchmarking Network Canada) data call. The City's northern location also differentiates the community from others due to factors such as higher construction costs, harsher climate and the reliance on the industrial base which will affect service level alternatives.

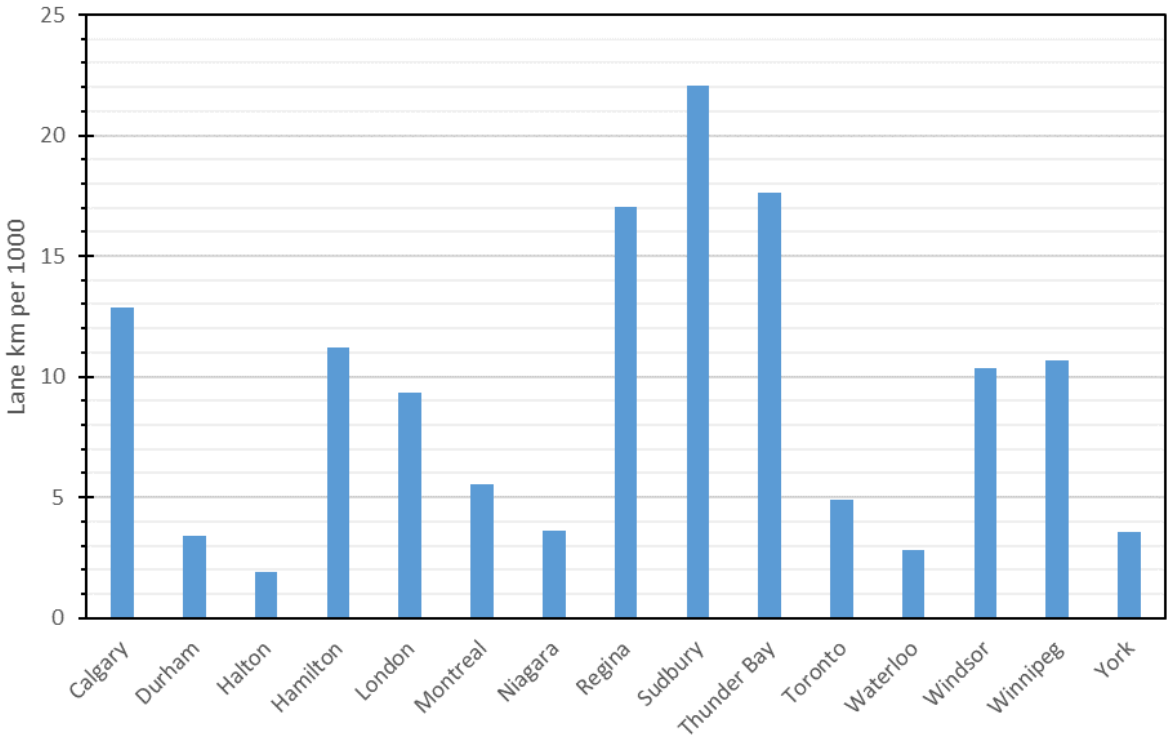


Figure 1-3: Municipality Comparison of Road Length versus Population

Council has encouraged the use of new technologies and materials to explore methods for the reduction of infrastructure maintenance costs and economic extension of expected asset life. Enhancements to the coordination of road improvement projects with the improvement of other assets such as water and wastewater infrastructure have been made in recent years to better align the preferred road structure treatments with underground infrastructure work.

The City remains committed to continuous improvement in the review of existing internal and external processes, emerging technologies and alternative construction standards to enhance work activity efficiencies and provide efficient capital program recommendations.

1.4 Asset Management Provincial Requirements

Ontario Regulation (O. Reg.) 588/17 came into effect in 2018 and stipulates specific AM requirements to be in place within Ontario municipalities. The development of this RTAMP provides the City with guidance about proposed LoS, and relevant requirements outlined by O. Reg. 588/17. The O. Reg. 588 / 17 roads LoS are presented in accordance with the qualitative descriptions and the technical metrics shown in **Table 1-3**.

Table 1-3: O. Reg. 588 / 17 LoS for Roads

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

O. Reg. 588/17 requires that all AMPs include the current LoS being provided, determined in accordance with the qualitative descriptions and technical metrics provided in **Table 1-3**. **Table 1-4** shows the requirements and timelines for municipal infrastructure AM planning in Ontario based on the O. Reg. 588/17 requirement.

Table 1-4: AM Planning for Municipal Infrastructure

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 LoS that the municipality proposes to provide, the lifecycle activities and associated costs needed to achieve those LoS, available funding, any funding shortfalls, and the risk of failing to meet the proposed LoS.

1.5 Relationships to Other Corporate Documents

There have been a number of site-specific and general planning documents for roads and other transportation assets that have been published prior to the creation of this RTAMP. Some of these strategic documents speak to the need of incorporating AM and risk management to drive the development of asset inventories, and inspection programs and to understand lifecycle costing related to maintenance and replacement to ensure sufficient budgeting from both capital and operational perspectives.

This RTAMP is a tactical plan which links "top-down" strategic objectives with "bottom-up" operational activities. **Figure 1-4** demonstrates the line-of-sight between AM strategic objectives and tactical and operational AM elements, including the relationship this RTAMP has to the other plans in the City's hierarchy of documents.

This RTAMP aims to update the RTAMP developed in 2021 to meet the requirements of O. Reg. 588 / 17, while providing guidance for future updates to the City's Transportation Master Plan (TMP). The TMP is prepared to support and inform the vision of the City's Official Plan as a modern and vibrant city that is healthy and sustainable. It presents background information, policy recommendations and network improvements to be considered through the development of a sustainable, multi-modal transportation system. The TMP recommends a sustainability-focused transportation network which places an emphasis on modes of transportation other than motorized vehicles, including walking, cycling and supporting greater public transit use.

First recommended in the TMP, in June 2018, the City adopted the Complete Streets Policy, becoming only the sixth municipality in Ontario to do so at the time of adoption. This policy commits the City to plan, design, construct, operate and maintain the transportation network to provide a comprehensive and integrated network of facilities that are safe and convenient for people of all ages and abilities travelling by foot, bicycle, public transit or vehicle. This policy applies only to capital projects where a reconstruction is required or where a roadway is planned to be substantially improved within the existing road allowance.



Figure 1-4: The City's Asset Management Line of Sight

2. State of Infrastructure

The City's asset inventory includes physical infrastructure assets that depreciate over time. This section covers a review of the current state of infrastructure including roads, sidewalks, and bike lanes to communicate asset performance and guide AM and investment decisions. It serves as a baseline for discussing infrastructure and precedes specific AM plans. While no major issues were found at the network level, individual assets will continue to degrade and require future funding. By 2023, the City has improved the maturity and availability of datasets for major asset classes.

2.1 Asset Hierarchy

Figure 2-1 illustrates the City's Roads and Transportation Asset hierarchy. As mentioned earlier, the scope of this RTAMP covers roads, sidewalks, and bike lanes. Roads are classified by functional class as arterials, collectors, and local roads. Sidewalks are classified by material type as asphalt, concrete, gravel, and pavers. The types of Bike Lanes include Active Transportation (AT) trails, on-road bicycle lanes, paved shoulders, multi-use paths (MUPs), cycle tracks, and signed bike routes with edgelines.

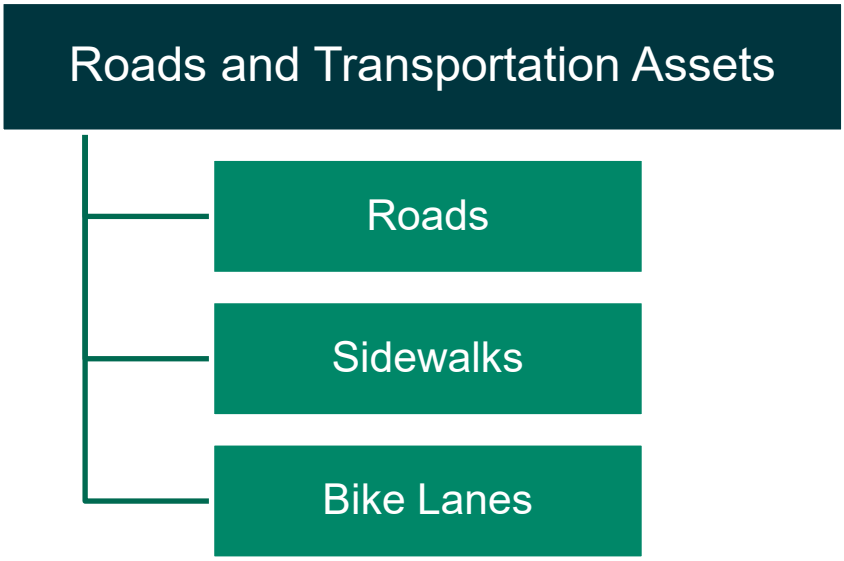


Figure 2-1: City of Greater Sudbury In-Scope Roads and Transportation Assets

2.2 Asset Inventory

The linear asset quantities can be summarized by "centreline kilometer" and "lane kilometer". 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. One kilometre of two-lane road represents two lane kilometres (two lanes x one kilometre = two lane kilometres), while five kilometres of four lane road represents 20 lane kilometres (four lanes x five kilometres = 20 lane kilometres). Note that the intersections were separate entities while the sections between the intersections were separate.

The City's road network currently owns and maintains approximately 3,675 lane km of municipal roads (equating to 1,744 centreline km); 406 centreline km of sidewalk; and 244 lane km of bike lanes (equating to 141 centreline km), as highlighted in **Table 2-1**. Note that for AT trail and MUP, one lane is assumed for the length due to the lack of inventory data.

Table 2-1: Asset Inventory

Asset Type	Categorization Attribute	Asset Category	Centreline km	Lane km
Roads	Functional Class	Arterials	283	762
		Collectors	302	609
		Local Roads	1,159	2,304
	Total Roads		**1,744**	**3,675**
Sidewalks	Material	Asphalt	23	-
		Concrete	358	
		Gravel	1	
		Pavers	10	
		Unknown	15	
	Total Sidewalks		**406**	-
Bike Lanes	Type	AT Trails	25	25[2]
		On-Road Bicycle Lanes[1]	20	37
		Paved Shoulders[1]	58	115
		Cycle Tracks	7	13
		Multi-Use Paths (MUP)	7[2]	7
		Signed Bike Route with Edgelines[1]	25	48
	Total Bike Lanes		**141**	**244**

[1] *Covered within Roads category*

[2] *Assume lane length = centreline length*

Figure 2-2 summarizes the City's roads length percentage by functional classes and pavement type, respectively. A total of 21% of the roads are arterial, 16% are collector roads, and 63% are local roads. Approximately 83% of the road network is predominantly paved by high class and low-class bituminous asphalt, with 17% constructed as a gravel roadway. 0.07% is paved with asphalt over concrete, and 0.02% is paved with concrete.

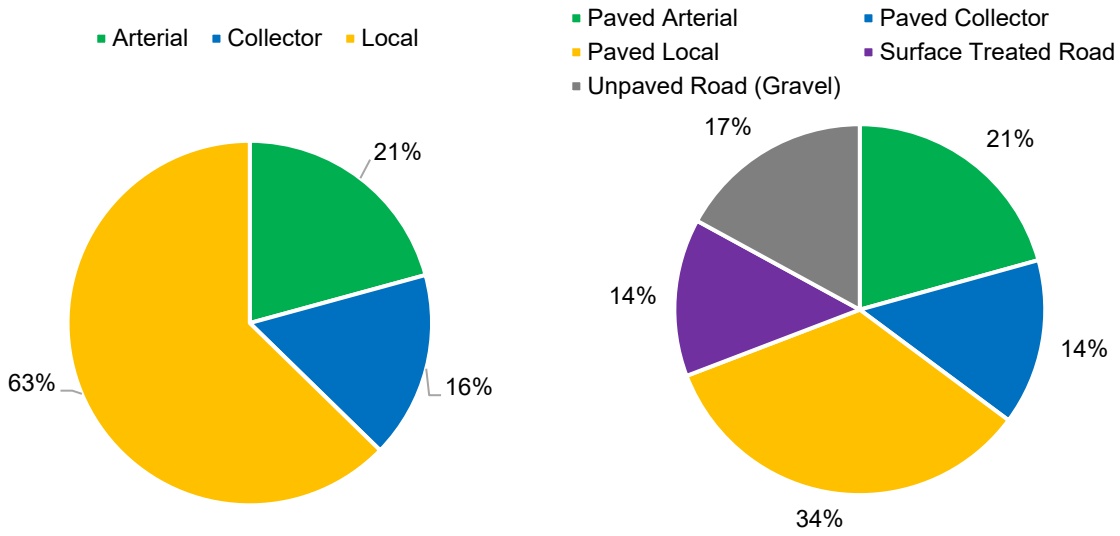


Figure 2-2: City's Roads Lane Length Percentage by: Functional Classes (Left) and Surface Type (Right)

The sidewalk data collection was performed in 2022[4]. In **Figure 2-3**, 88% of the sidewalks in centreline kilometres are made of concrete, while 6% are made of asphalt.

[4] ARA, Sidewalk Data Collection and Asset Management, 2023.

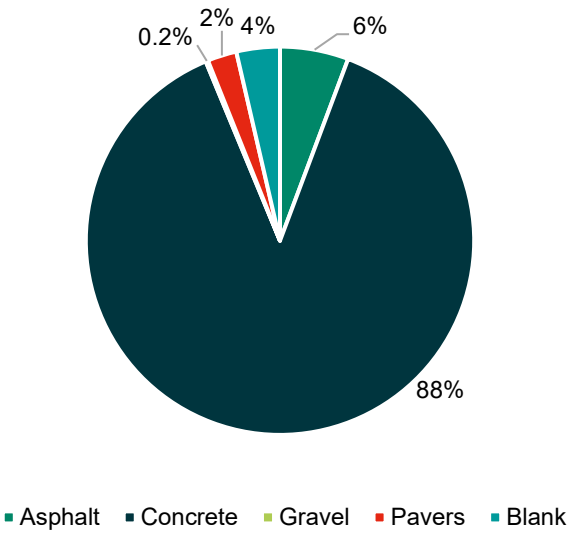


Figure 2-3: City's Sidewalk Centreline Length Percentage by Material

The bike lanes are classified by its type in centreline kilometres in **Figure 2-4**. The Paved Shoulders dominates, making up 41% of the total centreline length. Signed Bike Route with Edgelines follows, comprising 18%. AT Trails accounts for 17%, while On-road Bike Lanes comprises 14%. MUP represent a smaller portion at 5%, and Cycle Tracks also comprises 5%.

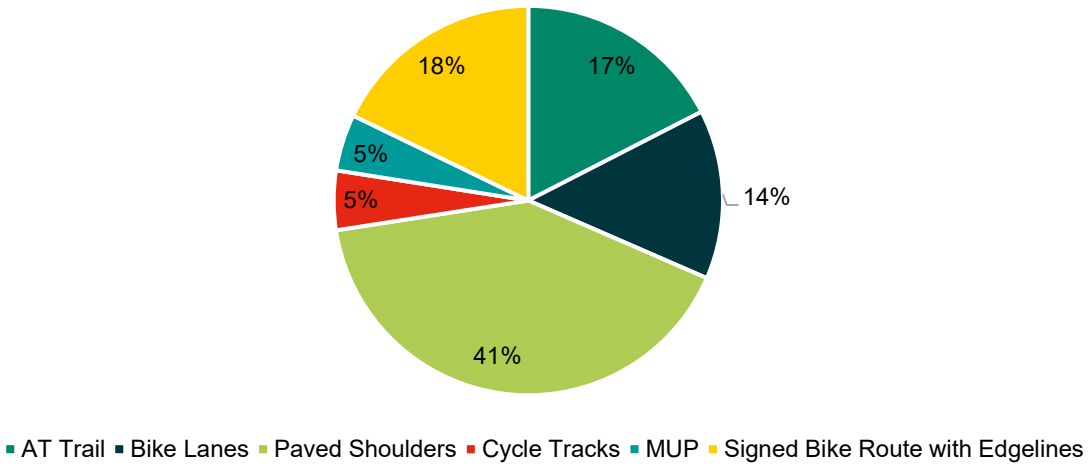


Figure 2-4: City's Bike Lanes Centreline Length Percentage by Type

2.3 Current Replacement Value

The asset replacement value is the estimated cost that would be incurred to replace an existing asset with a new one of similar functionality, at current market prices or construction costs. This value represents the monetary amount required to reproduce or procure an asset equivalent to the one being assessed. Examining the distribution of asset replacement values allows the City to comprehend which asset categories hold the highest value for both the City and the public.

Asset valuation is determined by reviewing construction costs, current market demand, supply issues, construction standards and legislation. Valuation of paved and unpaved roads must also consider road cross-section type and structure. This will include rural (roads with ditches) or urban (roads with curbs) cross sections, road pavement structure, gravel road structure and subsurface drainage systems (road subdrains).

Enhancements to the pavement management system which include valuation of paved road assets is currently in progress. This will be developed with data that can be used to calculate asset value from historic records and capital construction programs from previous years.

The replacement value for roads was estimated using 2024 road construction costs that includes pavement removal and reinstatement. The unit costs were based on the City's reconstruction costs for roads. The unit costs were computed based on arterial, collector, local paved, and local unpaved. **Figure 2-5** illustrates replacement value for roads by functional class.

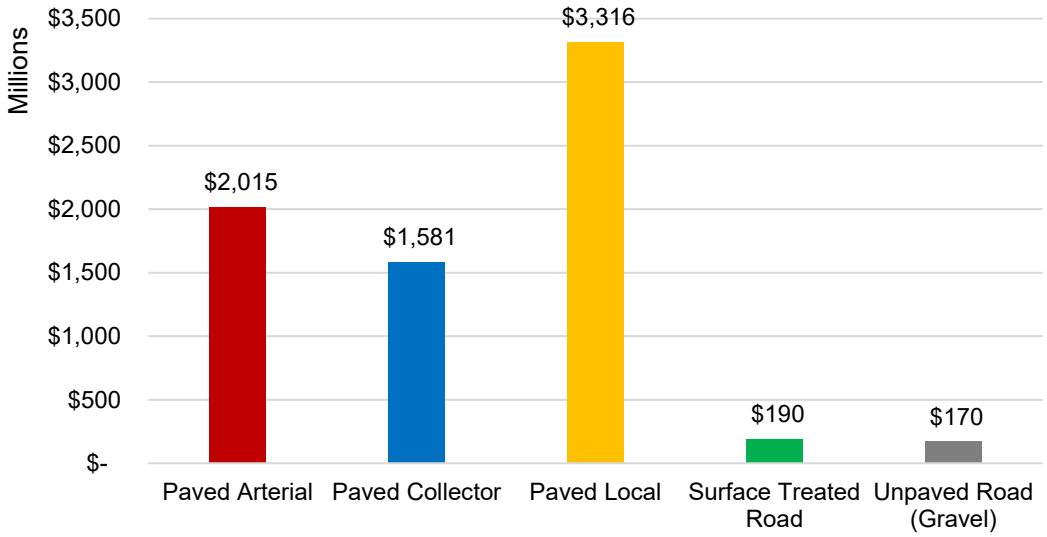


Figure 2-5: Road Replacement Value by Functional Class

The replacement value for sidewalks was estimated based on the cost to replace all sidewalks built in the City inflated in 2024 dollar values from Non-Residential Building Construction Price Index (NRBCPI)[4, 5]. While this value doesn't factor into any prioritization tasks, it is valuable reference number when reviewing work plan outcomes, particularly repair cost totals. The replacement value for bike lanes was estimated using standard practices and based on unit costs by a high-level assessment. As the centreline kilometer data is not available for MUP, the lane length was assumed to be the centreline length.

Table 2-2 summarizes replacement values for roads and transportation assets. The total estimated replacement value of the City's roads is approximately $7,272 million. The current replacement value for the City's sidewalk and bike lanes is estimated at approximately $112 million and $8.6 million, respectively.

[5] Past inflation data obtained from NRBCPI using the non-residential; yearly result taken from an average of quarterly results. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810027601

Table 2-2: Current Replacement Value

Asset Type	Categorization Attribute	Asset Category	Unit Replacement Cost (2024 Dollars)	Total Replacement Value
Roads	Surface Type	Paved Arterial	$616-768/m^2	$2,015,122,000
		Paved Collector	$616-768/m^2	$1,580,578,000
		Paved Local	$580-722/m^2	$3,316,077,000
		Surface Treated Road	N/A	$190,000,000
		Unpaved Road (Gravel)	N/A	$170,000,000
		Total Roads		**$7,271,777,000**
Sidewalk	Material	Asphalt	$262/m	$6,074,000
		Concrete	$297/m	$106,346,000
		Total Sidewalks		**$112,420,000**
Bike Lanes	Type	AT Trail	$118/m	$2,894,000
		Cycle Tracks	$289/m	$3,838,000
		Multi-Use Paths (MUP)	$289/m	$1,910,000
		On-Road Bicycle Lanes*	-	
		Paved Shoulders*	-	
		Signed Bike Route with Edgelines*	-	
		Total Bike Lanes		**$8,642,000**

** Covered within Roads category*

2.4 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 renewal or replacement of sections, 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, and the cost to upgrade to an updated technology that would result in cost savings are likely to render this approach uneconomical.

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

The estimated life of road assets will vary with existing road structure, drainage, traffic, maintenance activities and weather. The Deighton Total Infrastructure Management System (dTIMS) age data was used. In general, the average

useful life for paved roads can be assumed to be 60 years, which applies to the whole road cross-section including the base, sub-base, and surface layer (asphalt or concrete). Normally, the design life of surface layer for most asphalt pavements is approximately 15-20 years and should be rehabilitated or replaced two to three times in order for the roadway to last to its ESL of 60 years.

Figure 2-6 shows the average age weighted by replacement value as a proportion of the average ESL for roads for each functional class. Currently, the City's local roads are approximately more than 36% through the asset's expected service life, collectors are about 40% through the asset's expected life, while arterials are about 43% through the asset's expected service life.

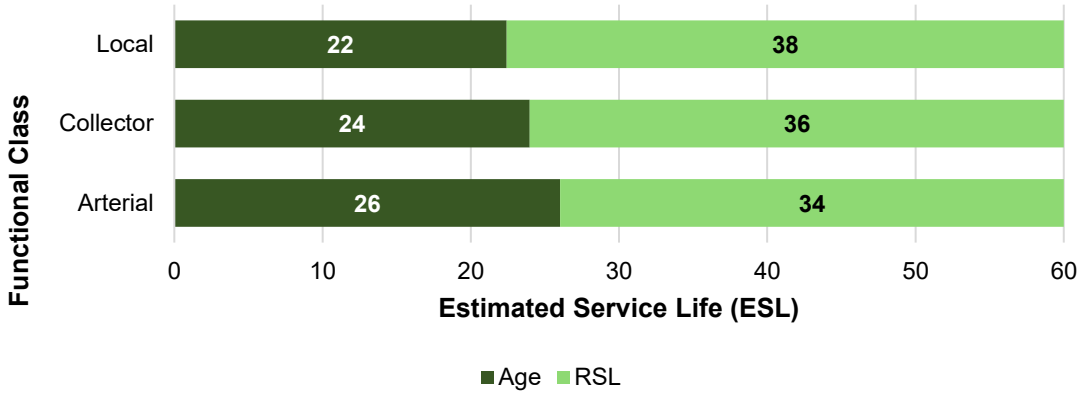


Figure 2-6: Weighted Average Age and Remaining Service Life for Roads

The estimated life for multi-use paths and cycle tracks is assumed at 50 years. **Figure 2-7** shows the average age weighted by replacement value, indicating the City's multi-use paths are 20% through the asset's expected service life, while cycle tracks are about 12% through the asset's expected service life. Both types of bike lanes are relatively new through the asset's service life.

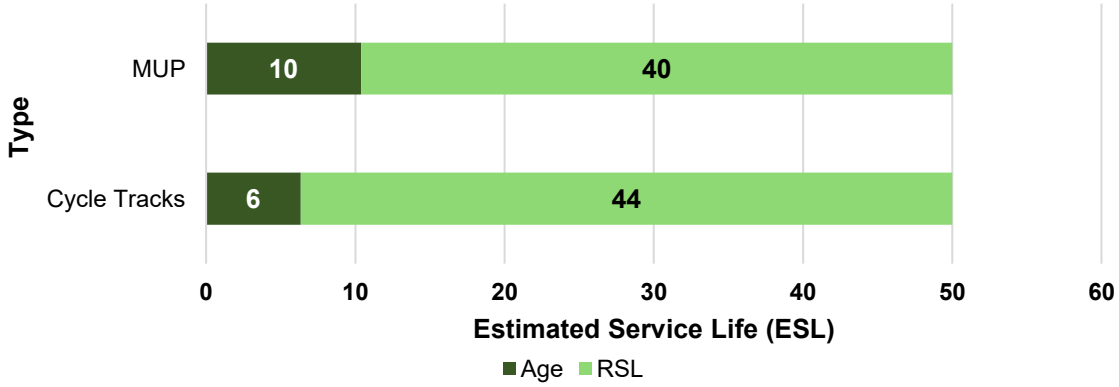


Figure 2-7: Weighted Average Age and Remaining Service Life for Bike Lanes

2.5 Asset Condition Profile

2.5.1 Asset Condition Assessment Approach

2.5.1.1 Condition Rating Approach

Table 2-3 presents the condition state, condition rating, and condition score ranges for field condition assessment and age-based condition rating approach. The condition scores and rating scales are aligned with the City's overall condition rating strategy, where a five-point condition rating scale has been adopted. **Table 2-3** also demonstrates how the five-point condition rating scale from Very Good to Very Poor, the Pavement Condition Index (PCI) for paved roads, the Gravel Road Index (GCI), the Sidewalk Condition Index (SCI), and aged based condition scores for bike lanes align. Since 2000, the City has used a pavement management system called Deighton's Total Infrastructure

Management System (dTIMS) to assist in evaluation of the condition of the road network and preparation/planning of road maintenance and construction projects. The pavement management system provides an objective analysis of the road network and provides proposed multi-year construction programing that reflects the City's established criteria based on planned capital budgets. Various pavement management strategies for each road segment are determined based on the categories and performance index. These strategies are compiled and analyzed to develop the program which will deliver the highest benefit to the road network given various budget scenarios.

Table 2-3: Condition Rating Scale for Roads, Sidewalks, and Bike Lanes

Condition		Field Condition Assessment					Age Based Condition Assessment		
		Roads				Sidewalks	Bike Lanes		
State	Rating	Paved*		Unpaved		SCI	Weibull Distribution Score	Range % of ESL Consumed	Range % of Operational Life Consumed
		PCI	Description	GCI	Description				
1	Very Good	85-100	Sound pavement with few defects perceived by drivers	Not Applicable		86-100	1-1.5	0% – 71%	0% – 47%
2	Good	55-85	Slight rutting and/or cracking and/or roughness becomes noticeable to drivers	60-100	Routine maintenance is required, existing conditions generally include adequate platform width, existing ditches may require cleaning, horizontal and vertical alignment are generally comfortable, no or few roadside hazards exist, roadside vegetation is minor.	66-85	1.5-2.2	72% - 84%	48% - 56%
3	Fair	40-55	Multiple cracks are apparent, and/or rutting may pull at wheel and/or roughness causes drivers to make minor corrections	40-60	Corrective maintenance is required, improvements may be required, existing conditions may include platform width that requires widening, existing ditches that require cleaning, significant ditching work, deficiencies may exist in horizontal and vertical alignment, roadside hazards may be present, roadside vegetation in ditch area may be significant and require normal clearing maintenance work.	41-65	2.2-2.8	85% – 92%	57% – 60%
4	Poor	25--40	Significant cracks may cause potholes and/or rutting pulls at vehicles and/or roughness is uncomfortable to occupants. Drivers may need to correct to avoid road defects.	0-40	Increased maintenance or road rehabilitation or significant roadside work is required, existing conditions may include existing platform width which requires improvement, ditches that need to be established, issues exist with horizontal and vertical alignment, roadside hazards may be present, roadside vegetation in ditch area is significant and will require extensive removals.	26-40	2.8-3.5	93% - 99%	61% - 66%
5	Very Poor	0-25	Significant cracks with potholes and/or rutting pulls at vehicles and/or roughness is uncomfortable to occupants. Drivers will need to correct to avoid road defects.	Not Applicable		0-25	3.5-5	>=100%	67% -100%

** The City's rating scale for paved roads based on PCI*

As shown in **Table 2-3**, the City uses a composite index, PCI, to indicate the overall condition of a paved road. PCI is calculated based on four types of surface distress indices. These indices are calculated by starting with a maximum value and deducting based on the severity and extent of distress observed in the road section. Higher severity and extent result in larger deductions, lowering the overall index. The indices and associated distresses are listed in **Table 2-4**.

Table 2-4: Pavement Condition Indices and Associated Distresses

Index	Pavement Distress	Measurement Unit
Structural Cracking (STCK)	Longitudinal Wheelpath Cracking	m
	Fatigue	m^2
Non-Structural Cracking (NSTC)	Longitudinal Cracking	m
	Transverse Cracking	m
	Block Cracking	m^2
Roughness (RUFF)	International Roughness Index (IRI)	mm/m
Rutting (RUT)	Rut Depth	m

The PCI serves as a key indicator of pavement condition and is calculated by combining the indices of the four variables listed in **Table 2-4**. The process involves specific curve expressions and curve filters that ensure the index accurately reflects the pavement's condition. If any of the indices are missing, the weights can be adjusted to accommodate the situation to obtain PCI. The details of calculating PCI under various circumstances are provided in **Appendix A.1**.

dTIMS also currently utilizes an Overall Condition Index (OCI) to prioritize road segments and provide a recommended capital road program. The road construction treatments are triggered as described above and the road capital program is adjusted by the OCI. The OCI is currently comprised of five categories being pavement condition index, safety opportunity index, water and wastewater opportunity index, economic development opportunity/public needs assessment index and a mobility opportunity index (environment and congestion). These indices are currently under review and adjustments are expected to be recommended. In particular, coordination with other assets and the economic opportunity index will be reviewed, and the assessment of risk will be incorporated.

The resulting recommended construction program provided by dTIMS provides the alternative for maximum benefit to the network pavement condition. The recommended program is then reviewed and adjusted as required to suit coordination opportunities with development, other City assets such as water and wastewater, and other priorities that may arise.

Gravel road parameters reviewed include road platform width, ditching/drainage, road shoulders, roadside vegetation, roadside embankments and alignment. Temporary conditions such as surface deficiencies were not included in the evaluation.

Gravel road parameters reviewed include road platform width, ditching/drainage, road shoulders, roadside vegetation, roadside embankments and alignment. Temporary conditions such as surface deficiencies were not included in the evaluation. **Table 2-3** indicates conditions used to establish an estimate of the Gravel Road Index (GCI).

An overall Sidewalk Condition Index (SCI) was calculated for each segment for to assess the sidewalk condition. The SCI considers pavement surface distresses by severity, extent, and type. SCI provides a numerical rating system where 0 indicates the worst possible condition (failed) and 100 represents the best condition (newly paved/constructed). The SCI is determined by counting distressed panels, converting these counts to percentages, and using these percentages to find deduct values. The sum of these deducts is subtracted from the maximum allowable deduct to obtain the SCI. The distresses evaluated to determine SCI are as follows[4]:

- Longitudinal and Transverse Cracking
- Shattered Slab
- Corner Break

- Faulting
- Spalling
- Scaling
- Popouts
- Patching

The condition of bike lanes was evaluated by applying the two-parameter Weibull distribution function based on assets' Age and ESL, a statistical method commonly used in reliability studies and lifetime prediction models. Scores are established by assigning greater scores to older assets. As the condition data is unavailable, Age is used to estimated ESL.

2.5.1.2 Data Collection Approach

The City employs a variety of techniques and solutions to collect and assess condition data at different frequencies, as summarized in **Table 2-5**.

Table 2-5: Condition Data Collection Methods and Frequencies

Asset Category		Condition Data Collection Techniques	Collection Frequencies
Roads	Paved	The City reviews the condition of the asphalt including cracking, rutting and roughness to calculate four defined indices. These indices are rutting, roughness, non-structural cracking and structural cracking. The methods and procedures of this data collection are completed in conformance with ASTM D6433 – Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys.	Every two years
	Unpaved	The gravel road network is evaluated through a visual dashboard review using methods outlined in Ministry of Transportation document "SP-025 Manual for Condition Rating of Gravel Surface Roads" and modified to suit local data requirements. The evaluation framework is based on MTO standard[6] and local experience of CGS Roads Operations staff to establish a condition rating for gravel roads and deficiencies within the right-of-way.	As Needed
Sidewalks		The sidewalk condition was assessed utilizing the RUBIX system for data collection, employing an e-bike equipped with a camera to survey the City's sidewalks. The georeferenced imagery was uploaded to cloud servers and cross-referenced with GIS segments. Trained raters then assessed the data for distresses and other parameters, such as sidewalk locations, surface type, and compliance with maintenance standards. In addition to surface distresses, the parameters evaluated or verified for all sections included: • Sidewalk locations (GPS coordinates). • Surface Type. • Minimum Maintenance Standards (O.Reg. 239/02) deficiencies, particularly trip hazards. • Sidewalk width. • Boulevard width and type. • Embankments, slopes, and walls. • Obstructions and obstacles; • Barrier-free deficiencies (Compliance with the Accessibility for Ontarians with Disabilities Act (AODA)), for example, presence of ramps and tactile plates. • Presence of manholes, service covers, etc. • Winter maintenance status (provided by the City).	Every two years
Bike Lanes		Not Applicable	

[6] MTO, SP 025 Manual for Condition Rating of Gravel Surface Roads for gravel roads.

2.5.2 Current Asset Condition Profile

2.5.2.1 Roads

Figure 2-8 illustrates the condition profile of network paved roads by lane-length and replacement costs. In either case, a total of 45% of all the paved roads is currently in a Good to Very Good condition, which are likely not requiring rehabilitation interventions within the next 10 years. Roads in Poor to Very Poor condition (around 27%) 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.

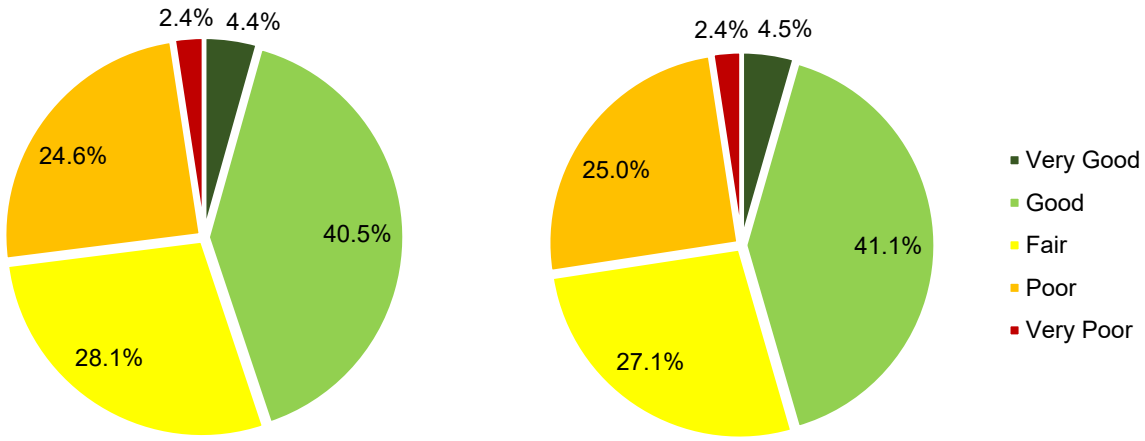


Figure 2-8: Roads Condition Summary by Lane Length (Left) and Replacement Cost (Right)

Figure 2-9 shows the road condition distribution by road class in lane length and replacement cost. Both measures generate similar results. Around 75% of Arterials are in Very Good or Good condition, while this percentage is 35% for Local roads. Noticeably, around 35% of Local Roads are Poor or Very Poor.

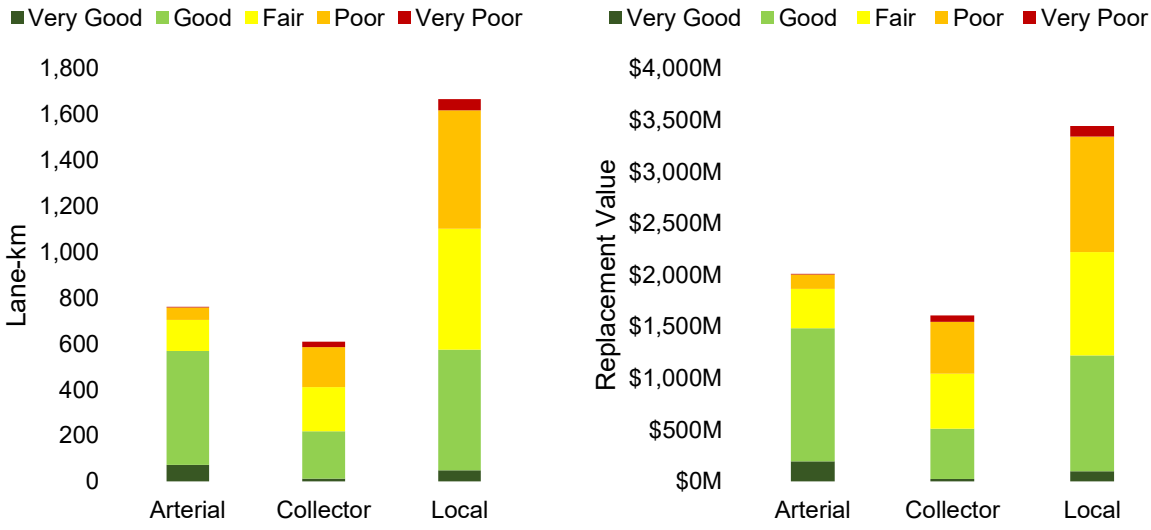


Figure 2-9: Roads Condition Distribution by Lane Length (Left) and Replacement Cost (Right)

2.5.2.2 Sidewalks

The mean SCI values have been calculated weighted by area. **Figure 2-10** shows that the majority of the sidewalk is in Very Good to Good condition, and 13% is in Fair condition. Only a small portion is rated as Poor (1%), with Very Poor being negligible.

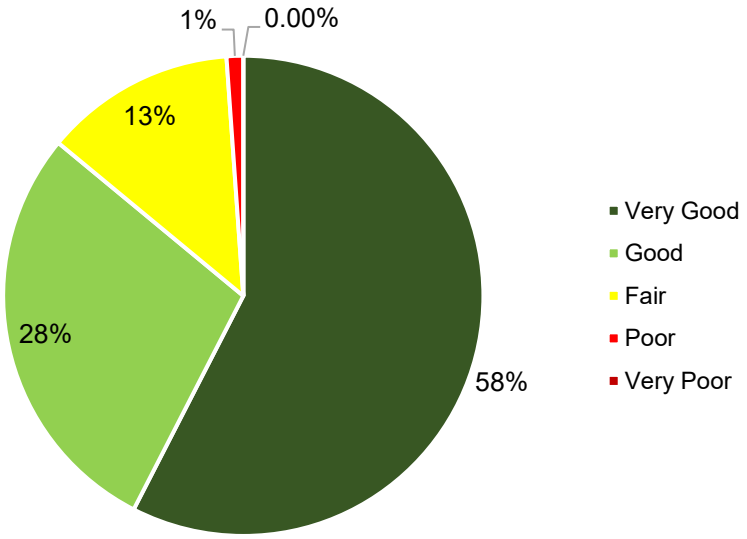


Figure 2-10: Sidewalk Condition Summary

2.5.2.3 Bike Lanes

The on-road bicycle lanes, paved shoulders and Signed Bike Route with Edgelines shared with roads are included in the roads condition assessment. The condition of other bike lanes was assessed based on the age. Since the City's bike lanes are relatively new as per **Figure 2-7**, the multi-use paths and cycle tracks are all in very good condition.

2.6 Data Sources and Assumptions

A variety of data sources were utilized to develop the figures and graphs presented in this RTAMP. **Table 2-6** summarizes the platforms and processes the City uses to manage inventory, condition, and replacement cost data.

Table 2-6: Inventory, Condition and Valuation Data Sources

Asset		Inventory	Condition	Replacement Costs
Roads	Paved	ArcGIS	dTIMS	Estimated unit costs
	Unpaved	ArcGIS	dTIMS	Estimated unit costs
Sidewalk		ArcGIS	MS Excel Spreadsheet	Estimated unit costs
Bike Lanes		MS Excel spreadsheet	Assessed based on Age	Estimated unit costs

The City's corporate GIS database houses the road and sidewalk network inventory, which is integrated with various enterprise systems such as the pavement management system (dTIMS), the roads work order management system (Cityworks), and the traffic engineering system. These datasets encompass a range of information, including location, traffic data, pavement structure, and lengths. The pavement management system alone maintains approximately 120 data fields for each paved road segment. The bike lanes were documented in an MS Excel spreadsheet, while some data were missing for specific types (e.g., centreline length for MUP).

The replacement value for sidewalks was inflation-adjusted based on estimates made in 2022.

The age of roads and bike lanes is assumed to be the duration since the last rehabilitation or installation, while the current age database is incomplete. Construction data for sidewalks were not available.

For paved roads, condition data is sourced from dTIMS, a tool that provides detailed and reliable information on road deterioration and maintenance needs. Unpaved road conditions are documented in the 2021 Gravel Roads Report. Sidewalk conditions were systematically evaluated in 2022. Bike lane conditions, however, are estimated based on the age of the lanes due to the lack of direct assessment data.

3. Levels of Service

Levels of Service (LoS) assess how well assets serve customers, the community, and the environment. This approach extends beyond simply evaluating asset condition to focus on the actual services provided. Known as serviceability, this method prioritizes customer and stakeholder needs in decision-making. It is crucial to measure service performance to establish a baseline for strategic future AM planning. To evaluate Roads service and determine their alignment with established goals, it is essential to define both the current and target (proposed) service levels. This section presents a performance measurement framework that aligns LoS with corporate priorities, regulatory requirements, associated risks, lifecycle activities, and costs.

The O. Reg. 588/17 mandates that AMPs must include the current and proposed levels of service (LoS) for all municipal infrastructure, determined by qualitative and technical metrics. Municipalities were required to have an AMP for core infrastructure assets (e.g., water, wastewater, roads) by July 1, 2022, and for all other assets by July 1, 2024. The AMPs must detail the proposed LoS, the rationale behind them, associated lifecycle costs, funding availability, and the risks of not meeting the proposed LoS. This last step should be done by July 1, 2025.

3.1 Purpose

The primary objective of establishing well-defined LoS is to align with stakeholder values, achieve strategic goals, make informed decisions, and effectively manage asset lifecycles.

Documenting LoS is an established practice that empowers the City to:

- **Align Strategic Objectives**: Documenting LoS allows the City to connect corporate strategic objectives with customer expectations and technical operations.
- **Balance Customer Needs**: It helps strike a balance between meeting customer needs and evaluating operational effectiveness. This assessment ensures that the right LoS is provided at an optimal cost.
- **Transition to Serviceability**: Moving away from an “Asset Stewardship” approach, LoS emphasizes decision-making based on cost, risk, and goals related to the City’s assets.
- **Effective Communication**: LoS communicates the physical nature of infrastructure owned by the City, facilitating discussions with stakeholders about funding options tied to desired LoS outcomes.
- **Better Achieve Cost-Effectiveness**: Documenting LoS enables minimizing future renewal costs while maintaining adequate service levels for future generations.
- **Assess Impact Factors**: It assesses internal (e.g., program changes) and external (e.g., climate change) factors that may affect service delivery and LoS.
- **Continuous Improvement**: Implementing a corporate continuous improvement program optimizes AM across all service areas.

3.2 Legislated and Regulatory Requirements

Road assets are critical to the City’s ability to provide essential services to the community, and for protecting the health and safety of the public. As such, key legislative requirements exist for the City’s infrastructure assets, which ensure that minimum requirements are met and standards are in place that promote a high quality of life (i.e., clean drinking water and safe roads, etc.). A sample of key Federal and Provincial legislated requirements are outlined below in **Table 3-1**.

Table 3-1: Legislated and Regulatory Requirements

Federal	Provincial
• Canadian Environmental Protection Act, 1999 (CEPA) • Federal Sustainable Development Act • Canada Transportation Act • Railway Safety Management System Regulations • Railway Safety Act • Grade Crossings Regulations • Canadian Rail Operating Rules • Canadian Transportation Accident Investigation and Safety Board Act	• Highway Traffic Act • Ontario's Drive Clean Program • Environmental Assessment Act • Ontario Regulation 231 – Transit Projects and Metrolinx Undertakings • Environmental Protection Act • Highway Traffic Act • Municipal Act • Ontario Regulation 239 – Minimum Maintenance Standards for Municipal Highways • Public Transportation and Highway Improvement Act • Ontario Traffic Manual • Ontario Regulation 588/17 (Asset Management Planning for Municipal Infrastructure)

3.2.1 Minimum Maintenance Standard for Municipal Highways (O. Reg. 239/02)

Ontario Regulation 239/02, known as the Minimum Maintenance Standards for Municipal Highways, is a regulation under the Municipal Act, 2001. It outlines the minimum standards that municipalities in Ontario must follow to maintain their highways and roads. The primary goal of this regulation is to ensure that municipal highways are kept in a condition that promotes safe and efficient travel, thereby protecting the public and reducing the liability risk for municipalities.[7]

Under Ontario Regulation 239/02, the key requirements for municipal highway maintenance include:

- **Road Classification**: Roads are classified based on traffic volume and speed limit. The standards for maintenance vary according to these classifications.
- **Patrol and Inspection Requirements**: Municipalities are required to regularly patrol and inspect their roads. The frequency of patrols depends on the road classification, with more frequent patrols for higher-class roads.
- **Winter Maintenance**: The regulation sets standards for winter maintenance, including snow clearing and ice control. It specifies the maximum allowable snow accumulation before plowing must begin and the maximum time allowed to restore the road to a specified condition after a winter event.
- **Surface Maintenance**: Standards are provided for maintaining road surfaces, including filling potholes and addressing other surface defects. The regulation specifies timelines for repairs once a defect is identified, based on the severity and classification of the road.
- **Sidewalk Maintenance**: Similar to road maintenance, standards are also set for the maintenance of sidewalks, including snow and ice removal.
- **Streetlight and Sign Maintenance**: The regulation includes standards for the maintenance of streetlights and road signs, ensuring they are functional and visible.
- **Documentation and Record-Keeping**: Municipalities must keep detailed records of inspections, patrols, and maintenance activities to demonstrate compliance with the regulation.

[7] Minimum Maintenance Standards for Municipal Highways, https://www.ontario.ca/laws/regulation/020239

3.3 Stakeholder Identification

Stakeholders are individuals or organizations that can influence, be impacted by, or perceive themselves as affected by a decision or activity. Stakeholder analysis involves comprehending the needs, expectations, and perceptions of stakeholders in relation to their level of interest and influence within an organization.

The following groups were identified as key stakeholders for the Road and Transportation assets. 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.

Table 3-2: City's Stakeholders and Their Interests

Key Stakeholder Group	Description	Stakeholder Priorities / Interests
Council	A council is a formal group or body of individuals convened to discuss, deliberate, and make decisions or recommendations on specific matters	The priorities and interests of the City's Council for roads and transportation include improving road safety, maintaining and upgrading infrastructure, enhancing public transit services, promoting sustainable and active transportation options, implementing policies such as the Complete Streets initiative to ensure accessibility, and ensuring efficient traffic flow to support economic growth and community connectivity. The Council is primarily focused on aligning levels of service with their strategic goals.
Residents	Local inhabitants of the city.	Safe, well-maintained roads and sidewalks to ensure daily commutes are smooth and hazard-free; efficient public transit options to reduce reliance on personal vehicles; minimal traffic congestion to save time and reduce stress.
Industrial, commercial & institution (ICI)	Businesses and institutions operating in the city.	Reliable transportation infrastructure to ensure timely delivery of goods and services; minimal disruptions during construction or maintenance to avoid business interruptions; easy access to commercial areas to attract customers and employees.
Railway authorities	Organizations managing railway operations.	Safe and efficient railway crossings to prevent accidents; coordination with road networks to ensure smooth traffic flow; minimal disruptions to rail services during road construction or maintenance.
Provincial regulatory agencies	Provincial bodies overseeing regulations.	Ensuring compliance with provincial standards for road and transportation projects; prioritizing safety and environmental considerations in planning and execution; monitoring and enforcing regulations to maintain public trust.
Federal government agencies	National bodies like Navigation Protection Act.	Ensuring compliance with federal regulations related to transportation infrastructure; protecting navigable waters from potential impacts of road and bridge construction; coordinating with local authorities on large-scale projects.

Key Stakeholder Group	Description	Stakeholder Priorities / Interests
Indigenous groups	Local Indigenous communities such as Atikameksheng Anishnaabeg, First Nations, Métis, and Inuit	Respecting land rights and traditional territories in planning and construction; including Indigenous perspectives and knowledge in decision-making processes; protecting cultural and historical sites from development impacts.
Developers	Entities involved in construction and development.	Streamlined approval processes for new projects; ensuring access to development sites for construction activities; receiving support for necessary infrastructure improvements to facilitate development.
Neighboring municipalities	Adjacent local governments.	Coordinating cross-boundary transportation projects to ensure seamless connectivity; sharing resources and information for regional planning; collaborating on infrastructure projects that benefit multiple municipalities.
Other city departments	City planning, transit, traffic, and parks departments.	Integrating transportation planning with other city initiatives to maximize efficiency; ensuring resources are used effectively across departments; aligning transportation projects with broader city goals and policies.
Suppliers	Providers of materials and services.	Reliable access to construction sites to deliver materials on time; clear communication about project timelines and requirements; minimizing delays and disruptions to maintain project schedules.
Third-party utility groups	Utilities like Bell, Rogers, water, hydro, and gas.	Coordinating infrastructure projects to avoid conflicts and service interruptions; ensuring access to utility lines and facilities during road construction; minimizing disruptions to utility services for residents and businesses.
Emergency services	Fire, police, and medical services.	Ensuring quick response times by maintaining clear and accessible routes; prioritizing the safety and reliability of transportation infrastructure; planning for emergency access during road closures or construction.
Environmental organizations	Groups like Conservation Sudbury, Sudbury Green Action Project.	Protecting natural areas and ecosystems from the impacts of road and transportation projects; promoting sustainable practices in planning and construction; advocating for measures to reduce environmental impact and enhance green spaces.
Cycling and pedestrian advocacy groups	Groups like Sudbury Cyclists Union, Bike Sudbury.	Ensuring safe and accessible bike routes and sidewalks to promote active transportation; advocating for infrastructure improvements that prioritize cyclists and pedestrians; encouraging policies that support sustainable and healthy transportation options.

3.4 LoS Framework

The LoS framework serves as a critical bridge between the City's goals and the physical assets that support service delivery. LoS encompasses a set of parameters that define the quality, performance, and outcomes expected from these assets. By aligning stakeholder expectations with asset management practices, LoS enables transparent decision-making, efficient resource allocation, and strategic planning. In the following sections, the key components of the LoS framework are explained in more detail.

3.4.1 Corporate Objectives (Enterprise AM Goals)

Defining LoS objectives is important for drawing a line of sight between the City's corporate AM objectives and the tangible asset performance outcomes.

Stakeholders have interests in the service being provided. The City's enterprise AM goals from the City's Enterprise AM Policy have been specified as:[8]

- Ensure legislative requirements are achieved.
- Create understanding about and optimize asset life-cycle costs while maintaining acceptable LoS.
- Ensure existing and future asset needs are prioritized.
- Link investment decisions to service outcomes.
- Demonstrate financial sustainability through full life-cycle cost planning.
- Focus on long-term considerations and decision making.

3.4.2 LoS Statements

The LoS Statements for Roads and Transportation AM are as follows[9]:

- Roads are capable of supporting essential services and multimodal transportation.
    - All roads are maintained in a condition to allow passage of emergency vehicles and essential vehicles as seasonal conditions permit.
    - Roads will provide access to active transportation modes such as cycling, transit and walking where deemed appropriate.
- Roads are constructed and maintained in an environmentally responsible manner.
    - Capital construction and operational activities are reviewed for opportunities to employ new/green technologies. Advancements in recycled asphalt technology are monitored and implemented where appropriate.
    - A salt management plan was developed in 2017 and was followed with a salt optimization plan in 2018 to provide guidance to winter control activities and environmentally conscious road salt management.
- Roads are maintained at an acceptable cost.
    - Roads are maintained and improved to be in a condition commensurate with use and traffic volumes.
    - Collector and Local roads are in fair condition based on average pavement condition index.
    - Arterial roads are in good condition based on average pavement condition index.
- Roads are safe, accessible, and have sufficient capacity.
    - Roads and intersections are reviewed using a road safety network screening program.
    - Roads are maintained in summer and winter to provide access for the traveling public.
    - Road capacity is reviewed in five-year intervals as part of the Transportation Master Plan.

[8] City of Greater Sudbury Enterprise Asset Management Policy, https://greatersudbury.ca/sites/sudburyen/assets/File/Enterprise%20Asset%20Management%20Policy%20Final%20Final.pdf

[9] City of Greater Sudbury, Enterprise Asset Management Plan, 2023

3.4.3 LoS Categories

LoS refers to a series of statements that describe the services provided to maintain and operate the assets included in the Roads assets. Service levels have been defined within the following three categories which align with the Enterprise Asset Management Plan (EAMP[10]):

- Community
- Asset (Technical)

3.4.3.1 Community LoS

Community LoS represent high-level statements that outline the City's current objectives. Community LoS refers to the standards or benchmarks set by the City to determine the quality, efficiency, and accessibility of public services and infrastructure. These levels reflect the community's expectations and needs, guiding decision-making processes related to service delivery, maintenance, and improvements.

3.4.3.2 Technical LoS

Technical LoS are quantitative measure that defines the performance expectation for an asset to produce the desired levels of service. These services are measurable (Key Performance Indicators, KPIs) and can include asset condition, performance indicators, responsiveness, expenditure, and asset value.

3.5 O. Reg. 588/17 LoS Metrics

Based on the current understanding, O. Reg. 588/17 mandates community LoS for core assets. Community LoS utilize qualitative descriptions to articulate the extent and quality of service provided by each asset category. Additionally, O. Reg. 588/17 stipulates legislated technical LoS for core assets, which employ metrics to quantify the scope and quality of service delivered by each asset category. **Table 3-3** summarizes the City's Road and Transportation service level for O. Reg. 588/17 metrics, along with corresponding current LoS performance in 2023.

Table 3-3: O. Reg. 588/17 LoS Metrics

O. Reg. 588/17 LoS Performance Measure	Service Attribute	Unit	LoS Category	Current LoS Performance (2023)
Description, which may include maps, of the road network in the municipality and its level of connectivity.	Scope	Map / text	Community	The City of Greater Sudbury Road Network (**Figure 1-2**)
Number of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality.	Scope	#	Asset (Technical)	Arterial = 0.21 Lane km / km^2 Collector = 0.17 Lane km / km^2 Local PCI = 0.63 Lane km / km^2
Description or images that illustrate the different levels of road class pavement condition.	Quality	Images / text	Community	See **Figure 3-1**
For paved roads in the municipality, the average pavement condition index value.	Quality	0-100 weighted by lane km	Asset (Technical)	Overall PCI = 54 Arterial PCI = 65 Collector PCI = 51 Local PCI = 50
For unpaved roads in the municipality, the average surface condition (e.g. good, fair or poor).	Quality	0-100 or categorical rating	Asset (Technical)	59 (2020)

[10] City of Greater Sudbury, Enterprise Asset Management Plan, 2023

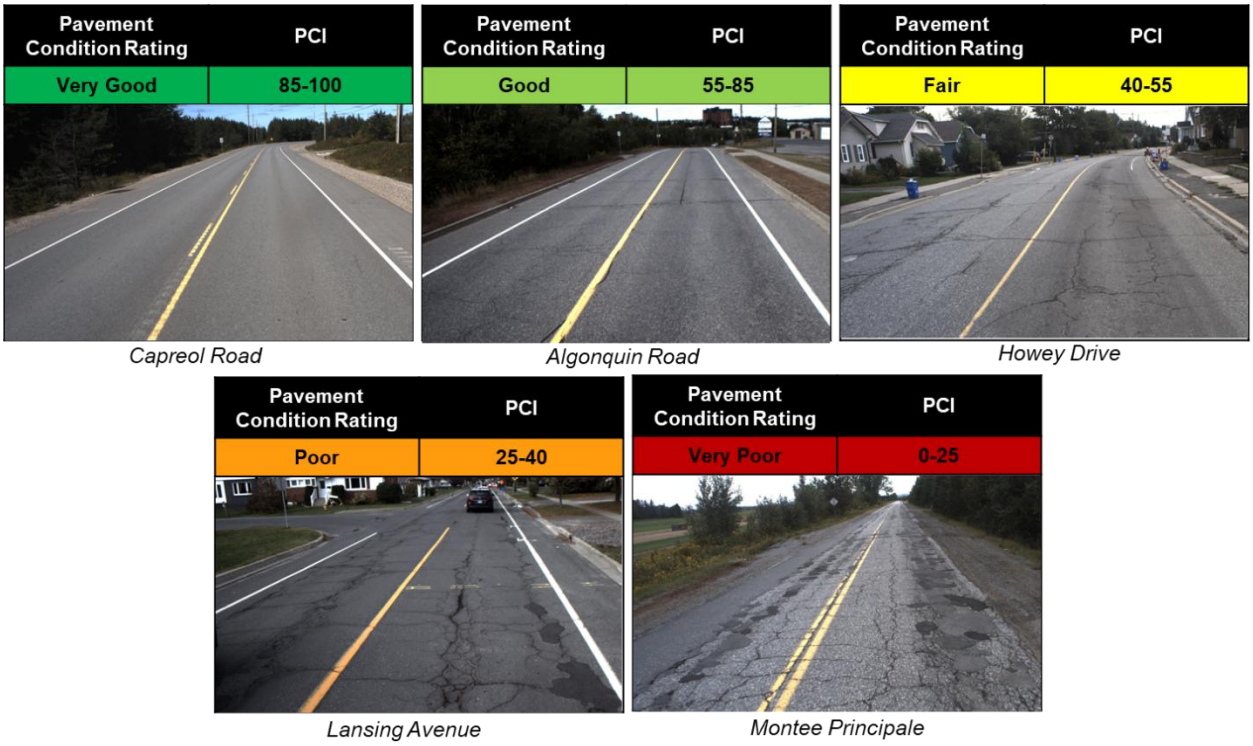


Figure 3-1: Image of Pavement Inspection Compared to Asset Management Condition Rating

3.6 Proposed LoS

Strategic targets for LoS are essential for ongoing improvement and effective performance management. Without well-defined targets, evaluating goal achievement or identifying gaps becomes difficult. By integrating targets into the City's LoS Framework, several advantages arise.

- Measuring Progress: LoS targets allow organizations to track performance against predefined benchmarks.
- Gap Identification: When actual performance falls short of the targets, it highlights gaps. These gaps can then be addressed through corrective actions.
- Reasonable Expectations: Setting reasonable targets ensures that expectations align with what is achievable. Unrealistic goals can lead to frustration and inefficiencies.
- Objective Evaluation: By considering cost-benefit trade-offs, organizations can objectively evaluate whether LoS targets are met.

In municipal settings, establishing infrastructure performance targets poses a significant challenge due to potential biases and political motivations. Consequently, it becomes crucial to engage with internal and external stakeholders, particularly the customers most affected by service delivery changes, when reviewing LoS targets. Evaluating LoS targets involves considering user willingness to pay for the service. While regulatory requirements set a minimum standard, cost remains a vital factor in assessing service enhancements. Addressing financial constraints is essential 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.

Ensuring realistic and attainable targets is crucial. Therefore, the City should refrain from setting firm targets until a comprehensive assessment of their current performance is conducted. As per O. Reg. 588/17, AMPs must incorporate proposed LoS and a formalized financial strategy by July 1, 2025.

The City has determined the list of performance measures to set the target, as shown in **Table 3-5**. Each metric was indicated with its current trend and target trend for the next 10 years, represented by legends, taking into account the nature of the measure, data availability, analysis feasibility, and whether the trend impacts positively or negatively on the proposed LoS. The LoS trend legends are described in **Table 3-4**.

Table 3-4: LoS Trend Legend

Symbol	Name	Description	Example
	Positively Increasing	The KPI is trending in a good direction, showing continuous improvement over time. This indicates progress toward desired goals and positive performance outcomes.	*The percentage of roads in good condition is increasing.*
	Positively Stable	The KPI is at a strong and desirable level, with no expected increase or decrease. Maintaining this trend ensures consistent performance and long-term stability.	*The number of medical incidents reported is 0 and should be maintained at this level*
	Positively Decreasing	The KPI is trending in a good direction while decreasing over time. A lower value in this case represents an improvement, helping achieve desirable service levels.	*Fuel usage is currently desirable and decreasing with better technology*
	Negatively Increasing	The KPI is trending in a bad direction and worsening over time. This suggests an ongoing issue that may require intervention to prevent further negative impacts.	*The maintenance backlog is increasing into an even larger gap.*
	Negatively Stable	The KPI remains at a poor level, with no expected improvement or further decline. While the situation is not worsening, it also means no progress is being made toward improvement.	*Road conditions are poor, current replacement efforts may prevent the condition from worsening but will not improve the overall condition.*
	Negatively Decreasing	The KPI is trending in a bad direction while decreasing over time. A declining value in this case indicates a worsening condition, requiring attention to mitigate risks and negative consequences.	*The number trained staff members are decreasing.*

Table 3-5: LoS Framework - Proposed

LoS #	Service Area	LoS Measure	Unit of Measure	LoS Category	Current Performance	Current Trend	Proposed Trend	Proposed LoS	Lifecycle Activities to Meet Proposed LoS	Associated Cost	Risk of Not Meeting Proposed LoS	Note
1	Roads	Description, including Maps of the road network in the municipality and its level of connectivity	Maps	Community LoS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	-
2	Roads	# of lane-kilometres of each of arterial roads, collector roads and local roads as a proportion of square kilometres of land area of the municipality	#	Asset (Technical) LoS	Arterial = 0.21 Lane-km / km^2 Collector = 0.17 Lane-km / km^2 Local = 0.63 Lane-km / km^2	↑ ↑	To be established	To be established	To be established	To be established	To be established	• The City recently completed upgrading the final segment of its arterial road network. However, several collector roads have been identified as necessary to support growth. • Subdivision development is not anticipated to involve extensive construction of new roads. While a limited number of collector roads are expected to connect to existing arterials, the majority of development will focus on infill within the current road network. • Local road upgrades are undertaken as required. In areas experiencing intensification, particularly where rural cross-sections are present, the City typically mandates an upgrade to urban cross-sections, including the addition of sidewalks. • For roads impacted by growth, the City prioritizes infrastructure upgrades to accommodate increased pedestrian activity and vehicular traffic effectively.
3	Roads	Road summer maintenance cost per lane km	$	Asset (Technical) LoS	$16.8 million (2020) $17.9 million (2021)	→	→	To be established	No additional	Increase due to inflation	High level of risks including accelerated asset deterioration, increased long-term repair costs, reduced service levels, higher vehicle operating costs for users, safety hazards, liability risks, traffic disruptions, diminished economic activity, environmental degradation, and loss of public trust.	• The City is currently underfunded by approximately $10 million annually to achieve an acceptable level of service. • While the overall budget has been adjusted for inflation, it has not accounted for an increase in the scope or volume of activities. Operating costs have been proportionally increased each year, including a 3% adjustment in the most recent budget cycle to align with inflation rates. • Although reduced snowfall has allowed for reallocation of funding to summer maintenance, this shift is weather-dependent and does not represent a consistent or reliable trend.
4	Roads	Description, or images that illustrate the different levels of road class pavement condition	Images	Community LoS	N/A	N/A	N/A	N/A	N/A	N/A	N/A	See **Figure 3-1**.
5	Roads	Pavement Condition Index (PCI) and pavement condition category: Paved Network	0-100; categorical rating	Asset (Technical) LoS	52, Fair (2016) 49, Fair (2019) 56, Good (2024)	↑	↓	Fair	dTIMS and others	$804 million*	Poor condition, leading to increased accidents, reduced ride quality, higher vehicle operating costs, accelerated asset deterioration, increased maintenance costs, disrupted traffic flow, liability risks, reduced economic efficiency, environmental impacts, and impaired emergency response..	• A significant challenge within the City's geography is ensuring adequate subsurface drainage, which often requires extensive rock excavation and the installation of new storm sewers. However, these requirements are not captured in the dTIMS analysis. • The City's current total funding level is $322 million for the next 10 years. • See **Section 5.3.1** detailed discussion with Proposed Levels of Service Scenarios for Roads: S#4 - Incremental Budget Option B. • It is essential to consider varied priorities for local roads, beyond traditional factors. • For local roads, it is also essential to consider varied priorities rather than focusing solely on road condition, e.g., social and environmental perspectives such as complete streets, stormwater runoff management, and alignment with the City's climate change plans. • Some sample KPIs can be included, such as the Neighbourhood Equity Index (NEI). This index, which combines various factors, rates neighborhoods differently. Future reporting could include road condition and spending trends for communities based on their NEI scores.
6	Roads	PCI and pavement condition category: Arterial	0-100; categorical rating	Asset (Technical) LoS	58, Good (2016) 57, Good (2019) 69, Good (2024)	↑	→	Good	dTIMS and others	$391 million*	Fair condition, leading to increased accidents, reduced ride quality, higher vehicle operating costs, accelerated asset deterioration, increased maintenance costs, disrupted traffic flow, liability risks, reduced economic efficiency, environmental impacts, and impaired emergency response..	
7	Roads	PCI and pavement condition category: Collector	0-100; categorical rating	Asset (Technical) LoS	49, Fair (2016) 48, Fair (2019) 51, Fair (2024)	→	→	Fair	dTIMS and others	$165 million*	Poor condition, leading to increased accidents, reduced ride quality, higher vehicle operating costs, accelerated asset deterioration, increased maintenance costs, disrupted traffic flow, liability risks, reduced economic efficiency, environmental impacts, and impaired emergency response..	
8	Roads	PCI and pavement condition category: Local	0-100; categorical rating	Asset (Technical) LoS	50, Fair (2016) 47, Fair (2019) 52, Fair (2024)	↑	→	Fair	dTIMS and others	$248 million*	Poor condition, leading to increased accidents, reduced ride quality, higher vehicle operating costs, accelerated asset deterioration, increased maintenance costs, disrupted traffic flow, liability risks, reduced economic efficiency, environmental impacts, and impaired emergency response..	

LoS #	Service Area	LoS Measure	Unit of Measure	LoS Category	Current Performance	Current Trend	Proposed Trend	Proposed LoS	Lifecycle Activities to Meet Proposed LoS	Associated Cost	Risk of Not Meeting Proposed LoS	Note
9	Roads	Gravel Condition Index (GCI); condition category	0-100; categorical rating	Asset (Technical) LoS	59, Fair (2020)	Not Available	↓	Fair	Ditching, grading, resurfacing, patching, dust control, condition assessment (once every five years), etc.	$1.5 million Annually + 62 km of ditching annually	Poor condition, leading to seasonal load constraints, insufficient maintenance, temporary inaccessibility, commute delays, disproportionate impact, dust issues in summer, resident complaints, EMS access challenges, safety concerns..	• The assessments of gravel road conditions are largely anecdotal, with poor road conditions often linked to drainage issues. • Gravel road conditions are being assessed regularly and professionally. A potential schedule would be adopted with professional evaluations every three years by road engineers, complemented by annual assessments conducted by road patrollers. • Gravel road maintenance has historically been underfunded, with current funding levels at approximately $1.5 million annually and no significant increases in recent years. • Many gravel roads were not constructed to proper standards initially, resulting in recurring issues and increased maintenance needs. Substantial capital investment is necessary for proper reconstruction to ensure long-term sustainability and reduce ongoing maintenance costs. • Inadequate or non-existent ditching systems further compromise road longevity and accelerate degradation. • It is essential to clearly communicate to the community that increasing the annual maintenance budget alone will not address underlying issues. Without significant reconstruction, gravel roads will fail to meet modern best practices. • Maintaining a consistent level of service for gravel roads poses challenges. • Rural municipalities with exclusively gravel roads often allocate more resources to maintenance, achieving a higher level of service. • A preliminary calculation has been conducted for annual ditching activities based on lifecycle activity assumptions, such as addressing 10% of 60+ km of ditching annually. • It is recommended that gravel road condition assessments be conducted at least once every five years to support informed decision-making and effective maintenance planning.
10	Roads	Roads Condition Assessment Frequency	Once every # years	Asset (Technical) LoS	Every Two Years**	→	↑	Every Two Years**	To be established	To be established	Increase risk of accidents, increase risk of failures of key assets, etc.	• Rock faces and gravel roads are identified as high-risk assets that require consistent monitoring and maintenance to mitigate potential hazards. • Proactive monitoring programs, including road patrols and hazard assessments, are essential for accident prevention and risk mitigation. • Integrating data analytics with real-time field observations enhances asset management effectiveness by providing comprehensive insights. • Transparent communication about ongoing monitoring and maintenance efforts fosters confidence in the system and minimizes resource allocation disputes.
11	Roads	% of roads (excluding surface-treated and gravel roads) in fair (PCI>55) or better condition based on asset replacement value	%	Asset (Technical) LoS	74% (2024)	↓	↓	60%	dTIMS and others	$804 million*	Refer to LoS #7	• Different asset replacement values were used previously. This RTAMP incorporates updated and significantly higher asset replacement values, reflecting more accuracy. • See **Section 5.3.1** detailed discussion with for Proposed Levels of Service Scenarios for Roads: S#4 - Incremental Budget Option B. • Levy Impact: The levy is expected to contribute with incremental budget. • Council Approval: The plan builds on an existing council-approved program, providing a strong foundation for potential future extensions and establishing it as a defensible initiative.
12	Sidewalks	Sidewalk operating rate ($ spent on O&M / Total Replacement Value)	%	Asset (Technical) LoS	Around 1.5% ($1,697,000 / $112,420,000)	Not Available	→	Increase	Sanding, addressing tripping hazards, etc. as per MMS	$22 million*	Insufficient infrastructure to support active transportation and public transit, increase reliance on vehicles, physical health and safety impact.	• Sidewalks are essential infrastructure supporting mobility, accessibility, and community well-being. Prioritizing sidewalks recognizes their role in enhancing the quality of life.

LoS #	Service Area	LoS Measure	Unit of Measure	LoS Category	Current Performance	Current Trend	Proposed Trend	Proposed LoS	Lifecycle Activities to Meet Proposed LoS	Associated Cost	Risk of Not Meeting Proposed LoS	Note
												• Promoting walkability reduces vehicle reliance, lowers greenhouse gas emissions, and supports climate action goals for greener, more sustainable urban living. • Sidewalk maintenance during winter often generates more controversy compared to road maintenance.
13	Bike Lanes	% of Cycling Infrastructure (implemented versus planned)	%	Asset (Technical) LoS	To be confirmed	↑	↑	Increase	To be established	To be established	To be established	• Certain infrastructure, such as separated cycle lanes, may have a longer lifespan than roadways. • Maintenance frequency depends on infrastructure type: • Separated cycle lanes on boulevards require less frequent maintenance. • On-road infrastructure maintenance is already integrated into existing processes.

** Total budget for the next 10 years*

*** For paved roads; gravel roads at least once every five years; Road patrol all year round.*

Performance Legend:

↑ Positively Increasing	→ Positively Stable	↓ Positively Decreasing	↑ Negatively Increasing	→ Negatively Stable	↓ Negatively Decreasing

3.7 Future Demand Drivers

Demand management within AM, involves implementing strategies and practices to optimize asset utilization while minimizing costs and environmental impact. This entails assessing and forecasting the demand for transportation services and aligning asset maintenance, expansion, and rehabilitation efforts accordingly. In this context, effective demand management is crucial for maintaining infrastructure performance and ensuring a sustainable and efficient transportation system. Demand drivers at the City include population, legislation, demographics, aging population, seasonal factors, technological advancement, economic, and environmental awareness.

Additionally, according to Statistics Canada, in 2023, The City had a population of 179,965. The population experienced a 2.8% percent change from 2016 to 2021. Given this growth rate, the City requires additional assets, resources, and funding to maintain, operate, and renew or replace existing infrastructure. O. Reg. 588/17 mandates that municipalities estimate capital expenditures and significant operating costs to achieve the proposed LoS and accommodate projected increases in demand resulting from population and employment growth. These estimates encompass costs related to both new construction and upgrades to existing municipal infrastructure assets.

Additionally, the City has defined visions and principles of demand management as follow, based on the Transportation Demand Management Plan:

- Vision: The City is a community that embraces sustainable mobility through efficient use of the transportation network and services to ensure that all residents have equal and equitable access to the services they need, the destinations they want to go to and the people that they want to see.
- Principles: The principles guide how the City will achieve the abovementioned vision.
    - Safe: The City will provide the residents and visitors within the community with sustainable transportation options that will help people feel safe and secure when they are moving around the City.
    - Shift travel behaviours: the City will create a set of programs and measures that will encourage residents to use sustainable travel modes throughout the year and over the long-term to develop a culture that embraces sustainable travel.
    - Integrated: The City will create a set of policies, programs and measures that will create a seamless sustainable transportation network to encourage the use of sustainable modes. It will also help interested parties to better define their role and assist in the delivery and promotion of sustainable transportation.
    - Effective: The programs, policies and measures developed must be reflective of the community and cost-effective. They must also lead to measurable results indicating that changes in travel behaviours are occurring.
    - Inclusive: a set of TDM-based programs and sustainable infrastructure which allows all visitors, residents and workers, regardless of age, gender or socio-economic background to travel throughout the City using any sustainable mode they choose. This will allow for greater access to sustainable travel modes without creating large economic or social barriers to accessing transportation services and infrastructure.

Within the City's EAMP[11], a list of drivers was developed which is being illustrated in **Table 3-6**. The demand drivers are aligned with the City of Greater Sudbury Outlook for Growth to 2024[12].

[11] City of Greater Sudbury, Enterprise Asset Management Plan, 2023
[12] City of Greater Sudbury Outlook for Growth to 2046, 2018, https://vmcdn.ca/files/sudbury/pdfs-for-web/planningcommittee_agenda_180409_16_full_report.pdf

Table 3-6: Demand Drivers, Projections, Impact on Services and Management Plan[13]

Demand Driver	Present Position	Projection	Impact on Services	Demand Management Plan
Population	City of Greater Sudbury Population: 166,004 (2021)	Population (2046): - Low: 165,090 - Mid-Range: 172,990 (Reference Scenario) - High: 181,290	The City's population is anticipated to remain relatively constant. This will minimize the impact on the existing road network. However new development will require new road construction.	The City will continue to monitor population. Should the population deviate from the expected constant, the data will be analyzed to formulate an appropriate plan.
Legislation	Minimum Maintenance Standards Highway Traffic Act Accessibility for Ontarians with Disabilities Act (AODA)	Maintenance standards are anticipated to remain constant. AODA and Barrier-Free needs are expected to evolve.	Maintenance standards have been established. Review of potential for safety improvements i.e. pedestrian crossings, tactile strips and intersections.	Maintenance standards will be reviewed regularly. Additional investment may be required as items are identified within the capital program and with the potential for safety improvement.
Demographic	Households: 69,152	Households (2046): - Low: 72,890 - Mid-Range: 75,250 (Reference Scenario) - High: 77,590	The anticipated increase in housing will be monitored and services provided by the road network will be adjusted accordingly.	Through development approvals, the City plans for additional road network assets.
Aging Population	Median Age from 2016 Canada Census: 43.2	There is an anticipated increase in median age of population. By 2037 the population of seniors (75+) in Ontario is expected to increase to 2.1 times its current size.	The increase in median age of population is expected to have minimal impact on the road network.	Changes to use of public transit may affect traffic characteristics. The biennial pavement condition data collection will capture changes to pavement condition performance.
Seasonal Factors	Shifts in temperature and precipitation from summer to winter months	Per climate change models, shifts in temperature and precipitation from summer to winter months are expected to continue for the foreseeable future.	Seasonal changes have an impact on the road network. The City's operations, maintenance and capital programs are driven by seasonal change. The City has and will continue to collect, analyze and monitor condition data as it relates to seasonal factors.	The road network will be monitored. The biennial pavement condition data collection will capture changes to pavement degradation due to seasonal factors. Maintenance and operational requirements may change with potential changes to snow removal, street sweeping and pothole repair.
Technological Advancement	The City reviews available technology to improve the level of service provided by the road network.	The need for additional investment in technology is anticipated.	Technological advancement will provide the opportunity to investigate process improvements.	Changes in technology will be reviewed for opportunities for implementation into the asset renewal program.
Economic	Jobs: 79,440	Jobs (2046): - Modest: 81,230 - Mid-Range: 85,750 (Reference Scenario) - High: 90,460	The City's employment is expected to grow with the minor projected increase in population. Impact on the road network is anticipated to be minimal.	The City will continue to monitor employment. Should the employment deviate from the expected constant, the data will be analyzed to formulate an appropriate plan.
Environmental Awareness	Through legislation and the City's own actions, the City has demonstrated that it recognizes the need for environmental and climate protection. The City has adopted the CEEP and a complete streets policy.	Environmental awareness is anticipated to result in additional legislative requirements and stricter best practices.	Addition of sidewalks and bike lanes may result. Investigation of Rapid Transit Bus Lanes on high importance GOVA routes.	Alternate green methods of road resurfacing and rehabilitation will be used. New methods will be reviewed and piloted where deemed appropriate. Active transportation planning included in capital projects where identified in Transportation Master Plan and deemed appropriate. CEEP and climate change considerations will become integral part of project planning.

[13] City of Greater Sudbury, Enterprise Asset Management Plan, 2023

4. Lifecycle Management Strategies

4.1 Asset Lifecycle Management Introduction

Asset lifecycle management focuses on the specific activities that should be undertaken during all phases of the asset lifecycle. Considering the entire asset lifecycle ensures that the City makes sound decisions that take into account present and future service delivery needs.

The overarching goal of lifecycle management is to maximize the long-term benefits and services that the City's 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 activities undertaken throughout its service life. Part of the purpose of the AM planning process is to fully understand and predict the long-range financial requirements for the City's roads and transportation infrastructure, facilitating 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 ongoing operations and maintenance, renewal & replacement, and disposal costs accumulate up to many multiples of the initial acquisition costs. As such, it is important to fully understand the entire lifecycle costs before proceeding with asset acquisition.

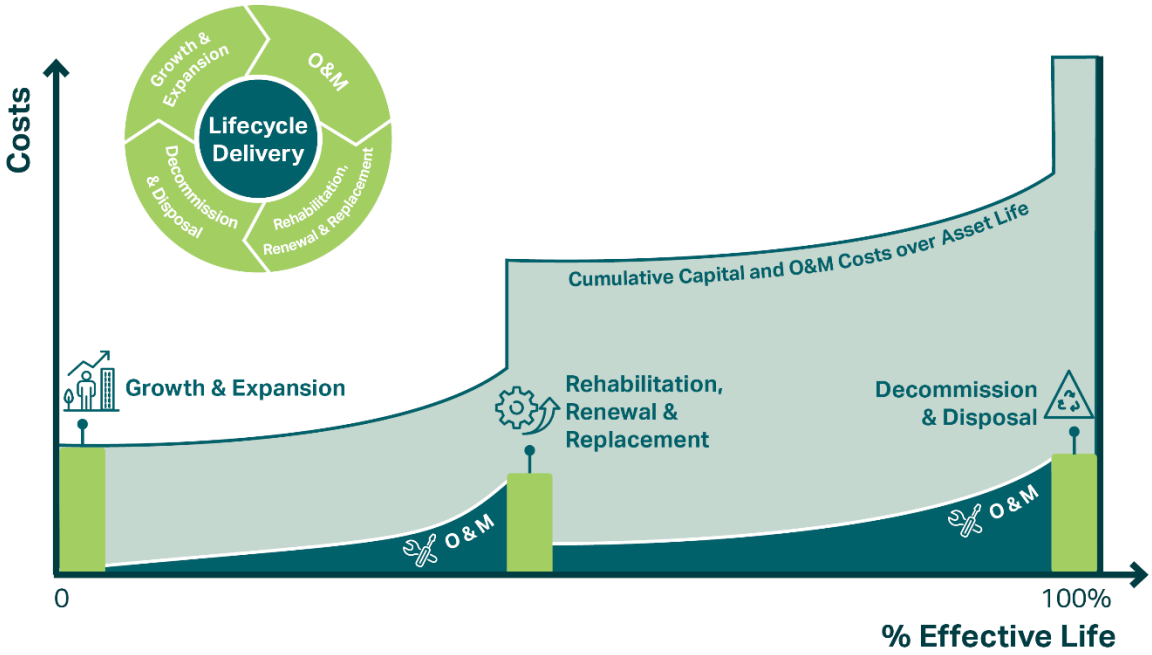


Figure 4-1: Lifecycle Cost Accumulation Over Asset Life

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



1. **Growth and Expansion**: It includes expansion activities and upgrading activities to extend services to previously unserved areas or meet the demands of growth and functional requirements. When acquiring new assets, the City should evaluate credible alternative design solutions, considering how the asset will be managed at each of its lifecycle stages. AM and full lifecycle considerations for the acquisition of new assets include, but are not limited to, the following:
    - The asset's operability and maintainability.
    - Supply chain considerations.
    - Availability and management of detours.

- Staff skill and availability to manage the asset.
- The manner of the asset's eventual disposal.

2. **Operations and Maintenance (O&M)**: As new infrastructure is commissioned, the City assumes the responsibility of operating and maintaining the infrastructure according to O&M standards to ensure its safety and reliability. The operations staff provides the necessary day-to-day support for operating the assets. 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 needed. Inadequate funding for O&M will adversely impact the lifespan of assets. The number of O&M resources required in any period is a function of the current inventory of infrastructure and the total O&M needs for each asset. As the inventory of infrastructure grows, total O&M requirements will also increase.



3. **Rehabilitation, Renewal and Replacement:** The third aspect of full lifecycle costing pertains to the renewal and replacement of assets that have deteriorated to the point where they no longer provide the required service. Renewal or rehabilitation costs may be incurred during the life of an asset where an investment is made to improve its condition and/or functionality. Replacement activities are expected to occur once an asset has reached the end of its useful life and renewal is no longer a viable option.



4. **Decommission and Disposal:** Roads and transportation assets may require decommissioning when they become non-compliant, obsolete, costly to maintain, or negatively impact service delivery or the environment. Key factors include deterioration, high maintenance costs, technological advances, and changes in service needs. Decommissioning and disposal considerations should focus on environmental impacts, land rehabilitation costs, and potential residual value. A strategic approach is essential to minimize costs and risks while ensuring alignment with the City's infrastructure needs and service objectives. These factors should be included in capital investment decisions.



5. **Non-Infrastructure Solutions**: Actions or policies that provide additional information or direction to effectively maintain assets that can lower costs or extend asset life. This includes planning studies and policies as well as demand and failure management studies.

4.2 Current Asset Management Strategies

4.2.1 Growth or Expansion

The City's pursuit of road and transportation assets is driven by growth, primarily guided by the City's Official Plan, the City's Transportation Master Plan, City of Greater Sudbury Strategic Plan 2019-2027, Transportation Demand Management Plan, and the Community Energy and Emissions Plan. The most critical factors in selecting projects for new construction or expansion of transportation assets include asset condition, economic development and industrial growth, regulatory and compliance requirements, road safety improvements, council policy initiatives, and traffic demand/congestion.

4.2.2 Operations and Maintenance

Effective O&M of assets is crucial for sustainable performance and longevity. Managing O&M costs involves developing comprehensive strategies that optimize resource utilization while ensuring asset reliability. Proactive maintenance schedules and condition monitoring can help identify potential issues before they escalate, reducing unplanned downtime and minimizing repair costs. Implementing energy-efficient technologies and best practices in road and transportation AM also contributes to cost-effectiveness over the asset's lifecycle.

Table 4-1 summarizes the five-year annual average historical O&M costs (2020-2024) for the City's road and transportation assets. The detailed O&M activity breakdown is provided in **Appendix A**. Refer to **Section 4.3.1** for detailed pavement management intervention strategies.

Table 4-1: O&M Historical Costs for Roads and Transportation Assets

Asset Group	Activity Category	Total 5-Year Annual Average Historical O&M Cost
Roads	Summer Maintenance	$6,565,000
	Winter Maintenance	$14,743,000
	Drainage*	$684,000
	Traffic & safety	$2,387,000
	Other	$1,927,000
	Miscellaneous	$789,000
Sidewalks	Sidewalk & Curbs Repairs and Maintenance	$1,697,000
Bike Lanes	Summer Maintenance	No direct charges for bike lanes; May be consolidated with general road operations
	Winter Maintenance	

**Stormwater items covered by Road's budget*

4.2.3 Rehabilitation, Renewal and Replacement

Renewal often involves upgrading or refurbishing existing assets to extend their lifespan, while replacement entails acquiring new assets. The costs associated with these activities include not only the direct expenses of acquisition but also indirect costs such as downtime during the transition, training for new technologies, and potential disposal or recycling costs. Roads with condition scores of Poor and Very Poor are reconstructed or renewed when projects align with strategic priorities from the Transportation Master Plan and Industrial Lands Strategy, or when work can be coordinated with other asset priorities such as watermain or sewer replacement.

Table 4-2 summarizes the renewal and replacement activities, along with the five-year capital budget forecast associated with the City's road and transportation assets,

Table 4-2: Renewal and Replacement Activities for Road and Transportation Assets

Asset	Capital Program	Activities Undertaken by the City	Forecasted Annual Average Budget
Roads	Asset Condition Assessment, Pre-Engineering, and Soil Characterization	• Asset Condition Assessment, • Pre-Engineering services • Soil Characterization • Storm Sewer Condition Assessment/Flushing/CCTV (Roads)	$227,000[4]
	Arterial/Collector Rehabilitation	• Pavement Rehabilitation (addition of paved shoulders) • Culvert replacement and drainage improvement • Road reconstruction	$18,109,000[4]
	Road Spot Improvement	• Large asphalt patching	$2,863,000[4]
	Road Safety Program	• Implement traffic calming measures as per the City's Traffic Calming Policy • Implement the pedestrian crossover program, carry out road safety assessments, • Road safety education.	$5,015,000[1, 4]
	Local Roads Rehabilitation	• Road & drainage improvements • Pulverization of existing pavement • Granular overbuild • Surface treatment • Resurfacing • Pavement Rehabilitation • Drainage improvement	$4,972,000[4]

Asset	Capital Program	Activities Undertaken by the City	Forecasted Annual Average Budget
Sidewalks[2]	•	Curb & Sidewalk Repair/Replacement	$578,000[3]
Bike Lanes	•	Active transportation improvements and drainage improvements. • Resurfacing • Replacement at the end of life	$578,000[3]

1. 2023 Estimates
2. Sidewalk renewal activities may be included in Road renewal activities
3. Council approved budget
4. City's Infrastructure Capital Planning Budget – 2024-2027

A road safety network screening program is also used to evaluate road segments and intersections to determine if there is a higher-than-expected number of collisions. The screening program is based on the Highway Safety Manual (HSM), produced by the American Association of State Highway and Transportation Officials (AASHTO). This screening provides a quantitative approach to determine sites that are most likely to respond to safety improvements. Screening analysis considers the number of predicted collisions, traffic volumes, and observed collisions.

The safety evaluation results in a score called "Potential for Safety Improvement" (PSI). All roads and intersections in the City have been scored and prioritized by the screening program using the PSI score and the top 20 locations have been identified. Each of the prioritized locations is reviewed to determine what countermeasures may be implemented to improve safety. Where countermeasure improvements have been identified in the prioritized locations, they are scheduled into the City's capital works program.

Currently, five locations plus those locations that are within an identified capital project are reviewed on an annual basis to determine if suitable countermeasures can be implemented.

4.2.4 Decommission and Disposal

Effective asset decommission and disposal are integral components of strategic AM. As the City's road and transportation assets approach the end of their lifecycle or become obsolete, a systematic methodology for their removal and decommissioning is essential. This process involves careful planning, environmental considerations, and adherence to the City's regulatory requirements. In fact, it is rare for the City to decommission and dispose of a roadway without a plan to reconstruct it in place. More commonly, the City is requested to assume private roadways rather than decommission existing ones. Error! Reference source not found.

4.2.5 Risks Associated with Lifecycle Activities

In the context of AM, risk is defined as the consequence or impact of uncertainties on AM objectives. These uncertainties span a spectrum of events, including financial market fluctuations, unexpected asset failures, changes in regulatory environments, and other factors capable of influencing the performance or condition of assets. Risk management, developed to handle uncertainties in a systematic and timely manner, is a practical framework that ensures thoughtful decision-making and protects the achievement of goals. The risk management process generally follows a series of steps, as outlined in **Table 4-3**.

Table 4-3: Key Steps in the Risk Management Process

Step		Description
1.	Establish the context	• Define the scope of the risk management process and the objectives that the City seeks to achieve through effective risk management. • Consider the City's internal and external factors and understand stakeholder expectations.
2.	Risk identification	• Identify potential risks that could impact the City's AM objectives.
3.	Risk analysis	• Utilize qualitative or quantitative analysis methods to assess risks.
4.	Risk evaluation	• Evaluate the likelihood and impact of identified risks. • Prioritize risks based on their criticality.
5.	Risk treatment	• Develop strategies to reduce the likelihood and impact of identified risks. • Implement preventive measures to address potential issues proactively.

Step		Description
		• Establish contingency plans for managing risks that cannot be eliminated.
6.	Monitor and review	• Regularly update risk assessments to reflect evolving circumstances. • Develop KPIs and monitoring tools to track the effectiveness of risk treatment strategies. • Learn from the City's past experiences and continuously improve risk management strategies.

Over the course of an asset's service life, the accelerating rate of deterioration with age poses inherent risks, inevitably leading to a corresponding increase in maintenance costs. As roads deteriorate, the cost of maintenance experiences a rapid escalation, especially closer to the final phase of the asset's service life, highlighting the financial risks associated with prolonged neglect. This phenomenon underscores the critical importance of preventive maintenance in the early stages of an asset's service life. By addressing risks proactively during these initial periods, the potential financial burden tied to accelerated deterioration in later stages can be effectively mitigated.

Beyond the general guidance, the City's approach to risk management should be tailored to its overarching goals, financial resources, and willingness to tolerate uncertainties. Key considerations include:

4.2.5.1 Safety

The City faces challenges in managing roads and transportation assets, especially concerning slip, trip, and fall incidents among residents, which could potentially result in insurance claims. The exposure to such risk is heightened due to the dynamic nature of outdoor pathways and public spaces. Uneven surfaces, weather-related hazards, and varying traffic conditions all contribute to difficulties in mitigating pedestrian safety incidents. To minimize this risk, the City prioritizes regular maintenance, promptly addressed potential tripping hazards, and implements preventive measures such as anti-slip surfaces.

Assets are operated and maintained in compliance with O. Reg. 239/02 – Minimum Maintenance Standards, which provides the City with a defense against liability from actions arising with regard to levels of care on roads and transportation assets. These standards set a minimum level of care for how roads and transportation assets are operated and maintained. Renewal and reconstruction of roads with critical needs in a timely manner can also reduce the safety risk, avoid premature asset failure, and achieve cost-effectiveness.

4.2.5.2 Accessibility in Active Transportation Infrastructure

As the demand for active transportation options increases, the City faces a growing need to ensure that its active transportation infrastructure caters to diverse accessibility requirements, accommodating the evolving demand of pedestrians, cyclists, and other users. To ensure effective accessibility for active transportation users, the City is implementing innovative solutions and strategies to enhance accessibility and promote the use of active transportation methods.

4.3 Lifecycle Intervention Strategy

Over the life of an asset, appropriate maintenance and rehabilitation treatments should be implemented at appropriate times to maximize the useful life of the asset prior to full reconstruction. Treatments for paved roads would include rehabilitation treatments, periodical treatments, maintenance treatments, and ancillary treatments before the reconstruction of the road.

4.3.1 Pavement Lifecycle Intervention Strategy

4.3.1.1 Pavement Performance Curve

The variables contributing to the PCI (i.e., Rutting, Roughness, Structural Cracking, and Non-Structural Cracking), are calculated based on different scenarios, due to the variability of road sections in the road network. All road segments are categorized and grouped with three characteristics as follow, comprising 12 scenarios for each index calculation:

- Traffic load: Low, Medium and High
- Pavement structure: Strong and Weak

- Drainage conditions: Good and Poor

The calculation of each index varies depending on the scenario, with different weights applied according to these categories. The performance curves for each index under different scenarios are provided in **Appendix A.2**. These curves provide a means of preparing a road program that considers the continued deterioration of individual road segments over time, which helps to determine the benefit of a strategy.

4.3.1.2 Pavement Treatments

Maintenance and construction treatments provided in the pavement management system output include crack sealing, surface treatment, overlay, single grind and single overlay, double grind and double overlay, rehabilitation, reconstruction, as well as ancillary treatments including curb and sidewalk replacement, widening and drainage improvements. gravel roads are maintained and repaired through maintenance activities outlined in **Section 4.2.2** only.

A treatment can be considered as a response to a certain condition. One or more Treatments constitute a Strategy. Intervention strategies for each road segment within the City's network were determined based on its condition state as mentioned.

The City has three types of Treatments. Major treatments include Surface Treatment, Overlay, Single Grind & Single Overlay, Single Grind & Double Overlay, Double Grind & Double Overlay, Rehabilitation, and Reconstruction. Minor Treatment refer to Crack Seal. Ancillary treatments include Widening, Replace Curb, Replace Sidewalk, and Drainage Improvement. **Table 4-4** provides the list of treatments, criteria, . The treatment trigger and reset logic are detailed in **Appendix A.3**.

Table 4-4: Roads Lifecycle Treatments and Costs

Treatment	Description	Trigger Condition	Reset After Treatment Applied	Treatment Type
Crack Seal	Sealing cracks in pavement	Provided in **Appendix A.3**		Minor
Surface Treatment	Applying a thin protective layer to improve surface texture and seal minor cracks			Major
Overlay	Adding a new asphalt layer over existing pavement to restore surface condition and extend pavement life			Major
Single Grind & Single Overlay	Milling the top layer of pavement and applying a single new asphalt overlay (40 mm)			Major
Single Grind & Double Overlay	Milling the top layer of pavement and applying two layers of asphalt overlay (40mm of surface layer, 50mm of base layer), potentially create a grade change.			Major
Double Grind & Double Overlay	Milling two layers of pavement and applying two new asphalt overlays (40mm of surface layer, 50mm of base layer)			Major
Rehabilitation	Comprehensive repair involving full depth resurfacing to extend pavement life, including pulverize and pave, full-depth resurfacing, and cold in place recycling, etc. Typically includes significant ancillary work			Major
Reconstruction	Complete removal and replacement of the pavement structure, often involving subgrade improvements			Major
Widening Road	Expanding the road width			Ancillary
Replace Curb	Removing and replacing damaged or outdated curbs to maintain proper drainage and appearance			Ancillary
Replace Sidewalk	Removing and replacing deteriorated or damaged sidewalks for safety and accessibility			Ancillary
Widening Shoulder	Expanding the road shoulder			Ancillary
Drainage Improvement	Drainage Improvement			Ancillary

4.3.2 Capital Work Prioritization Strategy

Understanding risk exposure to assets helps the City prioritize maintenance activities and allocate investments to effectively reduce risks. As infrastructure ages, it becomes increasingly challenging to allocate limited capital for repairs, rehabilitation, or replacement. The City aims to manage risks to meet service objectives within acceptable levels. While the City's risk model is still under development, this section offers guidance on how it can be designed to support daily decision-making and prioritize capital improvements for roads and transportation assets.

Effective asset management applies risk exposure and the concept of infrastructure "criticality" in evaluating the effectiveness of competing alternatives. Risk assessment will assist in prioritization and optimization of capital spending and decision-making. The assessment process involves evaluation of Probability of Failure (PoF) and the Consequence of Failure (CoF). This will assist in clarification and development of a shared understanding of the risk associated with decisions made in Operating and Capital programs. According to the following risk equation, the estimated risk exposure posed by a given asset can be measured by CoF and PoF by applying the **Equation [1]**:

Risk Exposure = Probability of Failure x Consequence of Failure **[1]**

PoF reflects the relative "likelihood" of a given asset failure to provide its required LoS. In other words, PoF score does not represent the true probability that the asset will fail, but a general indication of its likelihood given the conditions under which it operates. Assessing this relative likelihood of failure increases the understanding of the stresses individual assets may experience. PoF is assessed based on the condition of the asset, whose factors are assigned with a score based on an established scale.

CoF reflects the relative "impact" of a given asset's failure. While traditionally CoF has been looked at in purely economic terms (i.e., repair cost, loss of revenue, etc.), the truth is that investment decisions are often driven by non-economic factors. Understanding both the economic and non-economic impacts associated with loss or limitation of service helps in categorizing an asset's "criticality" and justifying infrastructure decisions in a consistent, defensible manner. CoF of assets can be evaluated based on the following triple-bottom-line indices:

- Economic – influence of the asset's failure on monetary resources.
- Social – influence of the asset's failure on society.
- Environmental – influence of the asset's failure on the environment.

Risk factors not currently included in the City's pavement management system analysis will be reviewed for possible inclusion into the decision-making process. These include:

- Potential for safety improvement;
- Congestion;
- Preventative and planned maintenance;
- Vulnerability (i.e. flooding);
- Climate change;
- Data quality;
- Truck and transit routes;
- Traffic Volume;
- Replacement Cost;
- Environmental considerations;
- Social consequence;
- Critical public use facilities.

A conceptualized version of the City's risk framework is presented in **Figure 4-2**, which illustrates the potential factors and their relationships with the risk assessment. It is recommended that the City develop the criticality factors and weighting further and use the risk assessment results to prioritize capital work planning in the future.

CITY OF GREAT SUDBURY
RISK FRAMEWORK – ROADS & TRANSPORTATION ASSETS

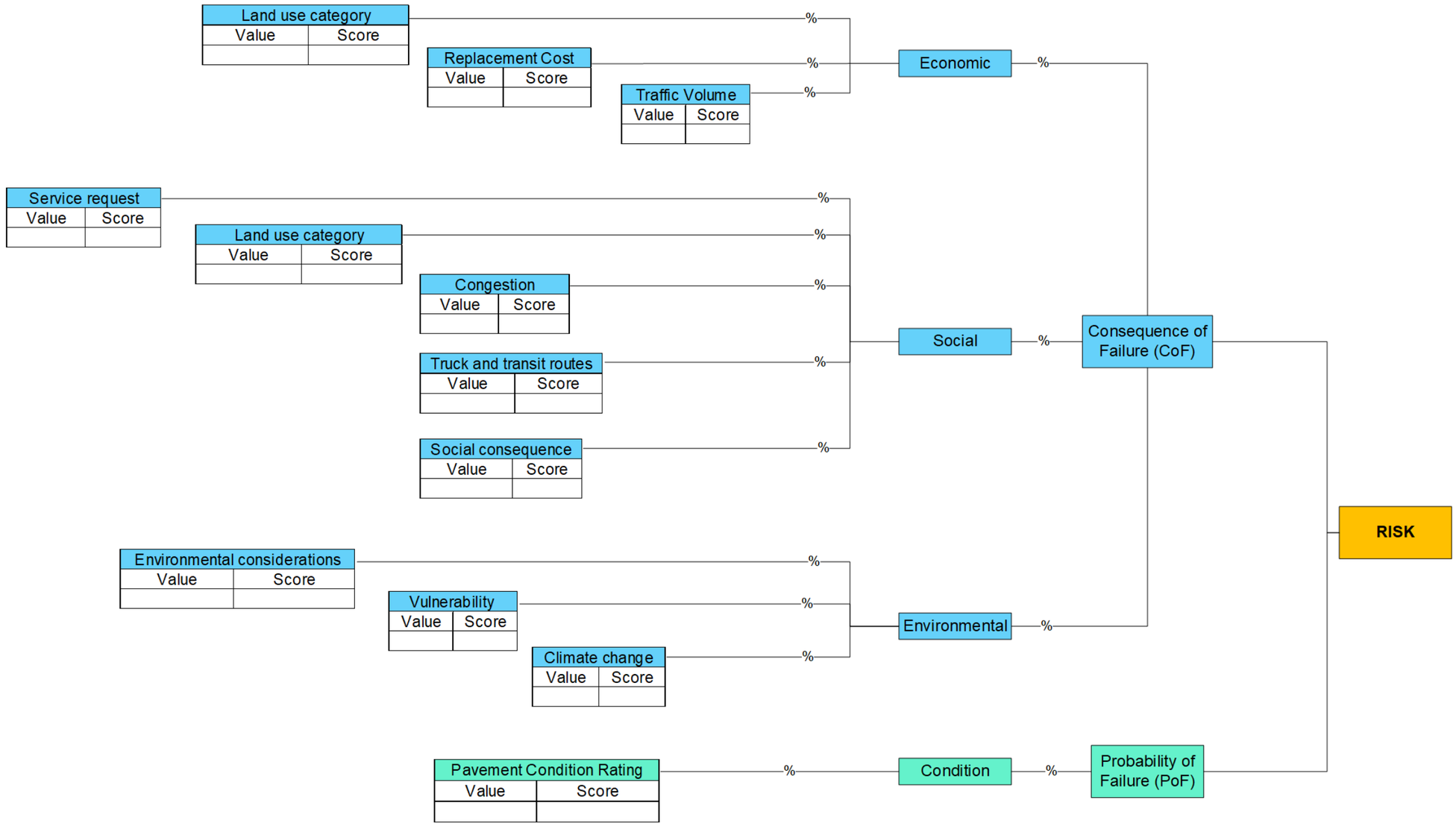


Figure 4-2 City of Greater Sudbury's Conceptualized Risk Framework

4.4 Community Energy and Emissions Plan

In September 2020, the Council authorized staff to proceed with the next steps in the implementation of the Community Energy and Emissions Plan (CEEP). The CEEP outlines 18 goals that are to be achieved to attain the City's target of becoming a net-zero GHG emission community by 2050.

The City has been involved in the adoption of asphalt recycling technologies such as Cold In-place Recycled Asphalt Expanded Asphalt Mix (CIREAM) or Cold In-place Recycling (CIR) asphalt as recycling methods to be the main rehabilitation method other than Pulverize and Overlay, which contributes significantly to the Community Energy and Emission Plan by reducing energy use and lowering greenhouse gas emissions.

Additionally, Warm Mix Asphalt (WMA) has been adopted as a permissible additive that aligns with the City's commitment to reducing energy consumption and greenhouse gas emissions in its pavement management activities. By producing asphalt at lower temperatures compared to traditional Hot Mix Asphalt (HMA), WMA reduces the energy required for heating and results in lower emissions of greenhouse gases and volatile organic compounds. Additionally, the use of WMA can extend the paving season due to its enhanced workability at lower temperatures, while also improving working conditions by minimizing exposure to fumes.

Other City initiatives include annual funding for new sidewalks and bike lanes, and development of a Traffic Congestion Index for evaluation and development of solutions to traffic flow issues within the transportation system. Solutions will be expected to reduce travel times and reduce GHG emissions.

As part of the ongoing work of AM planning and prioritization, environmental scans of different technologies will be completed and the evaluation will result in recommendations for consideration for technologies into operational and capital programs.

4.5 Climate Change Adaptation

A primary goal of an AM plan is to maintain the asset in a way that is resilient and sustainable. This means the LoS will meet the needs of the present community without compromising the needs of the future community. At the City LoS is reviewed with a climate change lens with risk assessment. Climate change may affect such parameters as freeze/thaw cycles, precipitation, storm intensity and changes to construction season length. In addition to the possibility of negative impacts, there could be some positive impacts, s. Service levels will be reviewed on an ongoing basis to determine if they need to be adjusted or scaled back as a result of the potential for changes in priorities.

To analyze the effects of climate change, the City apply online resources including, but not limited to:

- Climatedata.ca, undertaken with the support of Environment and Climate Change Canada;
- Climateatlas.ca, undertaken with the support of Environment and Climate Change Canada, Public Health Agency of Canada, and Health Canada.

Climatedata.ca and Climateatlas.ca analyze parameters called pathways named Representative Concentration Pathway (RCP) 4.5 and RCP 8.5. RCP is a greenhouse gas concentration trajectory. The greenhouse gas concentration trajectory is not to be confused with current emissions, although emissions impact the atmospheric concentrations. These are defined as indicated below:

- RCP 4.5: This pathway is intermediate because global emissions would peak by 2040. CO_2 emissions must reduce to half of the 2050 levels by 2100, CH_4 emissions must decline by 75% in the decade leading to the year 2050, and SO_2 emissions must decline by 80% of the SO_2 emission level from 1980. Similar to RCP 2.6, this scenario requires negative CO_2 emissions equivalent to a minimum of two Gigatons/year every year from natural sources to keep the global temperature rise between 2°C and 3°C by the year 2100. Many plant and animal species will not be able to adapt to the effects of RCP 4.5 or higher.
- RCP 8.5: This pathway is business as usual. Emissions will continue to rise at the current global pace throughout the 21st century.

Global Climate Models depict how the climate is likely to change in the future. As no single climate model is correct, the AMP will consider the effect of Low Carbon (RCP 4.5) and High Carbon (RCP 8.5) pathways on the road network. The two scenarios are appropriate as RCP 4.5 assumes a drastic and sustained reduction of emissions in the coming

decades, while RCP 8.5 represents the current global pace; emission of very large amounts of carbon dioxide from the burning of fossil fuels.

Table 4-5 provides the results of several Global Climate Models for the City of Greater Sudbury geographic area with high and low carbon emission scenarios and the anticipated impact on the road network. It is important to note that the anticipated impact of climate change on infrastructure is not the potential impact of infrastructure contribution to climate change.

Table 4-5: Climate Change Scenarios and Impact on Services[2]

Variable	Current Mean	RCP	2021 – 2050 Mean	2051 - 2080 Mean	Anticipated Impact
Precipitation (mm)	848	High 8.5	904	938	The increase in precipitation may increase the risk of ROW flooding or washout and may increase stress on pavement structures. An increase in precipitation is expected to result in increased gravel road costs.
		Low 4.5	890	924	
Mean Temperature	4.3°C	High 8.5	6.5°C	8.8°C	Review of asphalt mix design.
		Low 4.5	6.3°C	7.3°C	
Tropical Nights (+20°C)	1	High 8.5	5	17	Review of asphalt mix design.
		Low 4.5	4	7	
Very Cold Days (-30°C)	5	High 8.5	1	0	The decrease in very cold days may reduce the frost penetration depth.
		Low 4.5	2	1	
Very Hot Days (+30°C)	6	High 8.5	18	39	Review of asphalt mix design.
		Low 4.5	16	24	
Frost-Free Season (days)	137	High 8.5	163	184	Impact cannot be projected as there could be benefits or drawbacks (i.e. extended early spring temperatures and moisture or additional days of sound dry road structure)
		Low 4.5	157	168	
Freeze-Thaw Cycles	68	High 8.5	64.2	61.5	Close monitoring required.
		Low 4.5	65.4	64.3	
Mild Winter Days (-5°C)	120.1	High 8.5	103.6	84.2	Impact cannot be projected as there could be benefits or drawbacks. (i.e. less snow removal or negative impact on road structure)
		Low 4.5	104.5	96.6	
Summer Days (+25°C)	42.9	High 8.5	68.9	93.8	Review of asphalt mix design.
		Low 4.5	65.2	77.4	
Winter Days (-15°C)	58.4	High 8.5	42	24.8	Impact cannot be projected as there could be benefits or drawbacks. (i.e. less snow removal or negative impact on road structure)
		Low 4.5	43.9	35.3	

5. Financial Strategies

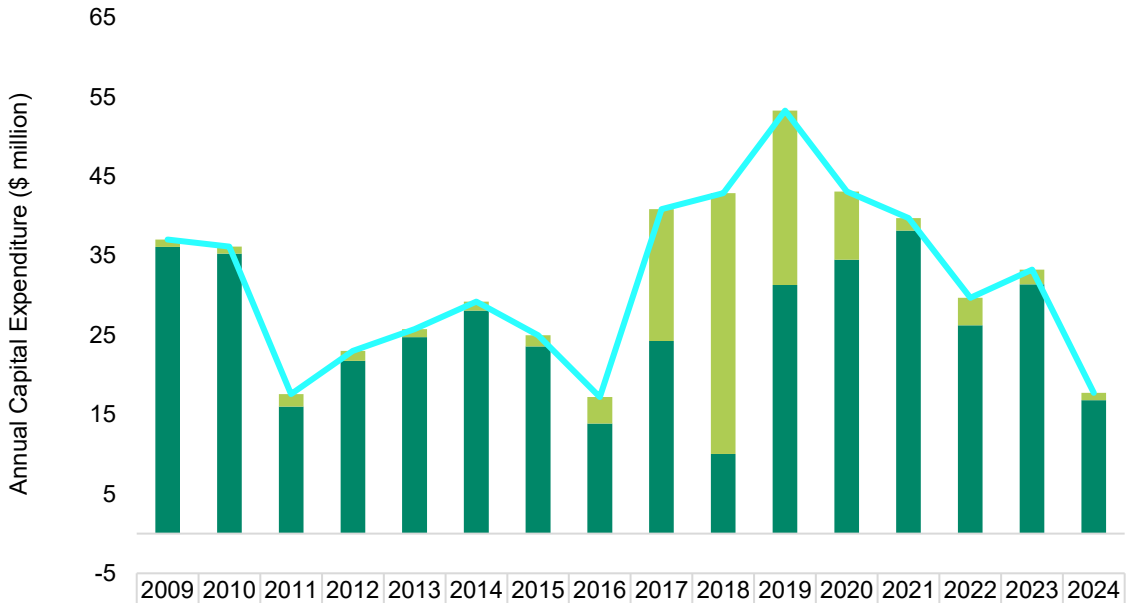
5.1 Expenditure History

5.1.1 Historical Capital Expenditure

Figure 5-1 presents the historical capital investment expenditure for Roads from 2009 to 2024. These amounts reflect investments specifically in arterial, collector, and local road projects, and exclude bridges and other road-related projects.

Between 2009 and 2016, annual investments in road assets ranged from approximately $17.6 million to $37.0 million. A notable increase occurred between 2017 and 2020, with investment levels rising significantly, peaking at $53.3 million in 2019. It is important to note that the investment trendlines may fluctuate due to external funding and Council directives. Significant one-time government grants, for example, can result in temporary spikes in annual capital investment.

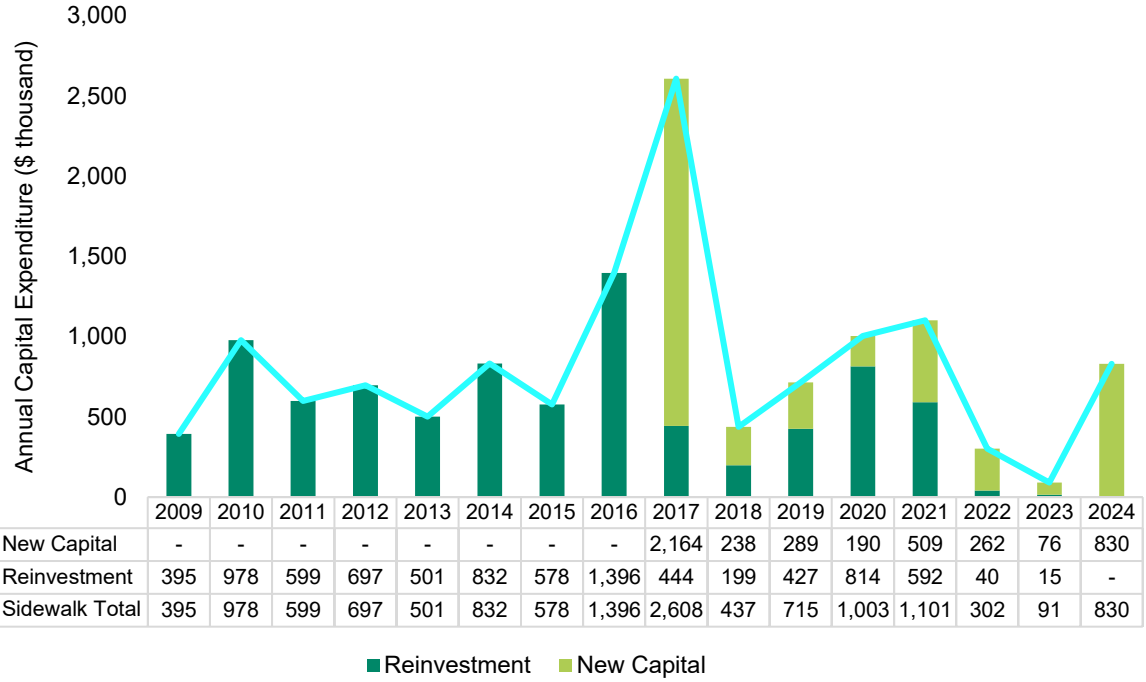
Reinvestment in existing road infrastructure increased following the completion of several large projects, with a five-year (2020-2024) average of approximately $25 million. This trend is likely influenced by a shift in available manpower toward reinvestment activities.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
New Capital	1.0	0.9	1.6	1.3	1.0	1.1	1.4	3.3	16.6	32.8	21.9	8.6	1.6	3.5	1.9	0.9
Reinvestment	36.1	35.2	16.0	21.7	24.7	28.1	23.6	13.9	24.3	10.0	31.3	34.5	38.2	26.2	31.4	16.8
Roads Total	37.0	36.2	17.6	23.0	25.8	29.2	25.0	17.2	40.9	42.9	53.3	43.1	39.7	29.7	33.3	17.7

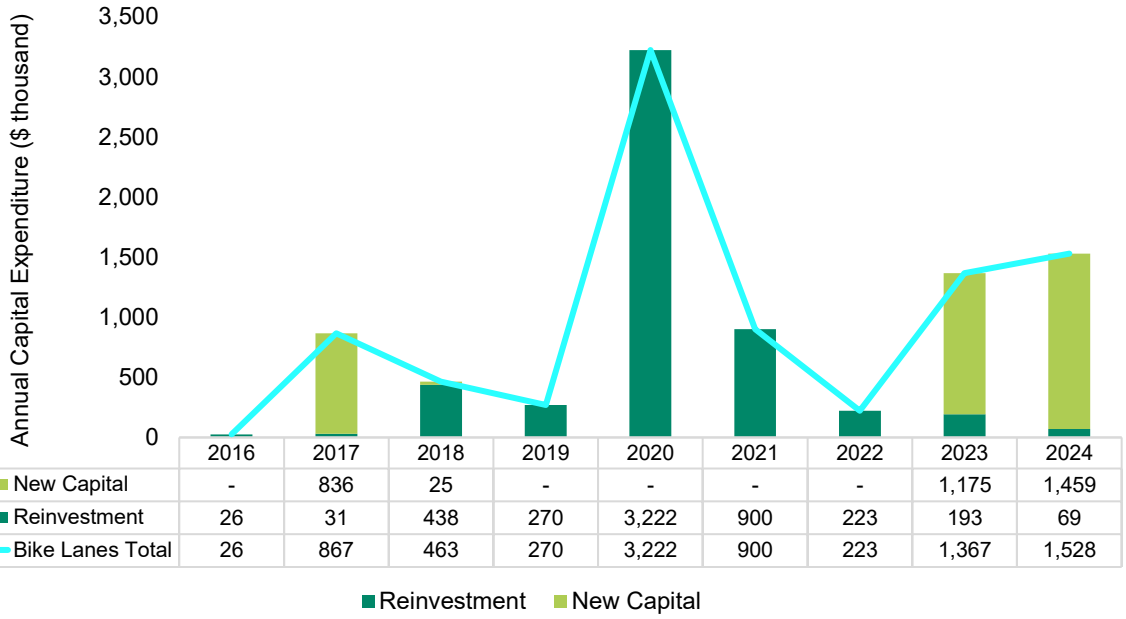
Figure 5-1: Historical Annual Capital Expenditure on Roads

Investment in sidewalks and bike lanes are shown in **Figure 5-2** and **Figure 5-3**, respectively. Sidewalk capital expenditures ranged between $0.4 and $1.4 million annually, while dedicated funding for bike lanes began in 2016. These investments support Council's active transportation strategy, including Improvements to the Notre Dame Avenue and Paris Street corridor. It is important to note that the sidewalks and bike lanes' expenditures presented reflect one-off or Council-directed standalone projects and may not capture the full extent of investment in these assets. In many cases, sidewalks and bike lanes infrastructure are integrated within broader road reconstruction projects, and their associated costs are embedded within the overall project budgets. Currently, the City's budget documents and cost centers are not structured to isolate sidewalks and bike lanes costs within road projects. As such, a departmental review of how new investments and reinvestments are tracked and reported will be considered.



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
New Capital	-	-	-	-	-	-	-	-	2,164	238	289	190	509	262	76	830
Reinvestment	395	978	599	697	501	832	578	1,396	444	199	427	814	592	40	15	-
Sidewalk Total	395	978	599	697	501	832	578	1,396	2,608	437	715	1,003	1,101	302	91	830

Figure 5-2: Historical Annual Capital Expenditure for Sidewalks



	2016	2017	2018	2019	2020	2021	2022	2023	2024
New Capital	-	836	25	-	-	-	-	1,175	1,459
Reinvestment	26	31	438	270	3,222	900	223	193	69
Bike Lanes Total	26	867	463	270	3,222	900	223	1,367	1,528

Figure 5-3: Historical Annual Capital Expenditure for Bike Lanes

5.1.2 Historical Operating and Maintenance Expenditure

The total historical annual budget for roads-related O&M counting all other activities (e.g., traffic, miscellaneous) is around $27.1 million.

The summer maintenance activities budget for roads, such as asphalt patching, ditching, and roadside maintenance, has a 5-year annual average historical cost (2020-2024) of approximately $6.6 million.

Winter maintenance, covering activities such as plowing, snow removal, sanding, anti-icing, asphalt patching during winter, and spring clean-up, has a historical annual budget of $14.7 million.

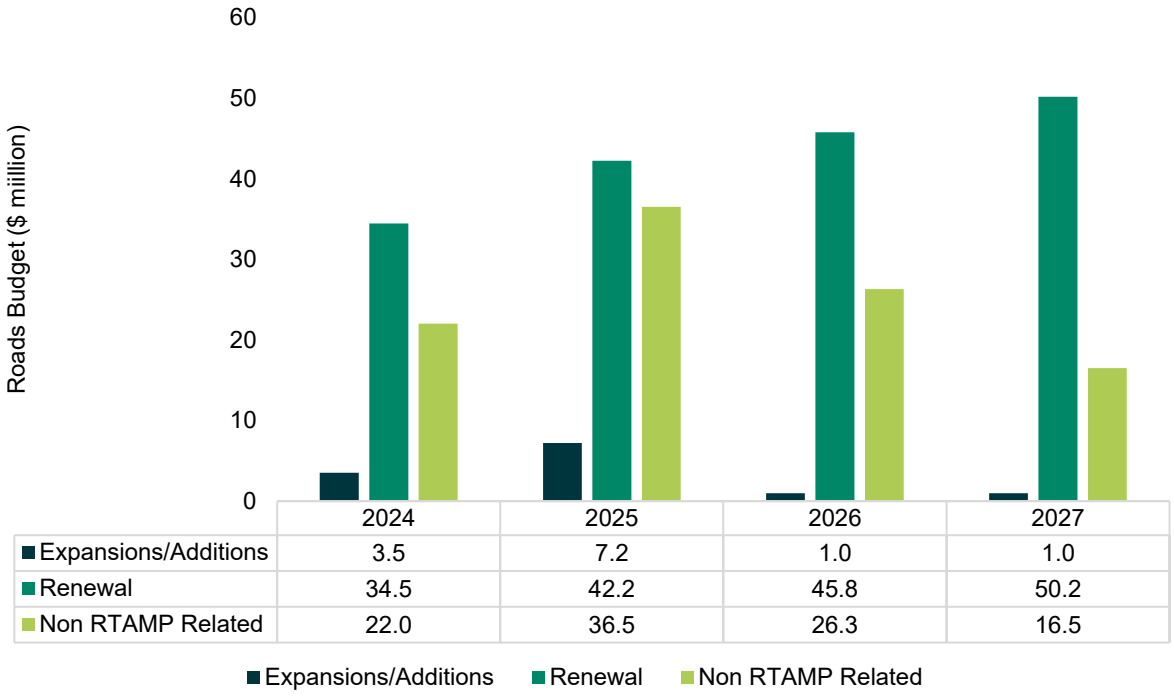
The sidewalk operating budget, which includes repairs and maintenance such as replacement, patching, and sweeping, has a 5-year annual average historical budget of $1.7 million. It is worth noting that some sidewalk renewal can be covered within road project budgets when undertaken as part of roads operations.

Operations for bike lanes are typically performed along with general roads operations, with the budget being covered under roads. Additional details can be found in **Table 4-1** and **Appendix B**.

5.2 Budget Forecast

The approved 2024-2027 Capital Budget, with 2025 Budget amendments for the Roads section is detailed by investment type in **Figure 5-4**. The budget is presented in three types of investments.

1. Renewal budget will be utilized to improve the pavement condition index through resurfacing, reconstruction and surface treatments.
2. Expansions and additions budget is primarily the Lasalle Eisabelle Industrial Area improvements as part of the Employment Land Strategy and developer led cost share projects in 2024-2027.
3. Non-RTAMP related projects are primarily for asset categories accounted for in other AMPs, such as bridges, stormwater and facilities, as well as other capital needs not directly related to RTAMP.



	2024	2025	2026	2027
Expansions/Additions	3.5	7.2	1.0	1.0
Renewal	34.5	42.2	45.8	50.2
Non RTAMP Related	22.0	36.5	26.3	16.5

Figure 5-4: Roads Approved Budget 2024-2027

The figure above indicates that the investment in existing RTAMP is increasing as a result of the allocation of the Special Capital Levy approved in 2024 to provide additional investment in existing roads network.

5.2.1 Growth-Related Capital Forecast

In 2024, Council approved the 2024 Development Charges Background Study that outlines potential growth-related road projects. The impact of adding additional infrastructure from growth related projects must be considered in the forecast of lifecycle costs. When the City approves growth related projects, it has also established a process to account for increases in operating budgets resulting from the addition or expansion of assets, including sidewalks and bike lanes. Incremental operating costs are identified and incorporated through three primary processes:

- **Capital Budgeting Process**: During the capital budget development process, future operating budget impacts are assessed. Operating departments identify expansion projects and quantify network growth (e.g., an

additional 500 metres of sidewalks). As the capital budget spans four years, the corresponding incremental operating costs are added to the appropriate future operating budget year[14].

- **New Subdivision Information**: Following year-end, Finance staff provide information on infrastructure growth from new subdivisions. Based on this data, incremental operating costs are incorporated into the subsequent year's budget.
- **Council Resolution**: If Council approves an in-year service level change or asset expansion, the associated operating cost increase is reflected in the following year's operating budget.

The planned growth-related capital budget is detailed in **Table 5-1**. It is important to note that actual spending may not always align precisely, as individual projects can contribute to multiple asset classes or investment types to varying extents.

Table 5-1: Growth-Related Capital Budget Forecast

Asset	Category	Growth Budget ($ thousand)*		
		2025	2026	2027
Roads	Council Approved	6,230	-	-
	DC Study – CGS Led Projects**	-	2,588	2,588
	DC Study -Developer Led Projects***	-	1,487	1,487
Sidewalks	Council Approved	600	600	600
Bike Lanes	Council Approved	600	600	600
Total		**7,430**	**5,275**	**5,275**

** All costs are presented in 2024 dollars and reflect only the portion of expenditures attributable to growth.*
*** As per DC Study, there is no committed funding for these projects as of 2024-12-31.*
**** Timing of Developer Led Projects Subject to Change.*

5.2.2 Capital Reinvestment Forecast

The projected capital reinvestment budget for roads is presented in **Table 5-4**.

Table 5-2: Capital Budget Forecast – Renewal

Asset	Capital Renewal Budget ($ thousand)		
	2025	2026	2027
Roads*	31,517	46,776	51,188

**Based on the City's budget forecast used for PMS scenarios analysis*

There are no dedicated capital renewal budget items specifically allocated for sidewalks and bike lanes in the current budget structure. Sidewalk replacements are funded under the O&M budget as part of the curb and sidewalk replacement program, as described in the next section. The rest of sidewalk renewal are included within broader road project budgets when undertaken as part of roads projects. For bike lanes, capital renewal activities are incorporated within general road rehabilitation projects.

5.2.3 Operating and Maintenance Forecast

The planned operating budget for the transportation assets included in this RTAMP is outlined in **Table 5-3**. The forecast was developed based on the 2025 approved annual O&M budget. For the period from 2026 to 2034, no significant increases in funding have been identified; therefore, a standard 3% annual inflation rate (CPI) has been applied to both Roads and Sidewalks to account for anticipated cost escalation. At present, the City does not have a dedicated budget allocation for bike lane O&M activities. As mentioned, the associated budget for the O&M activities for bike lanes are consolidated with general road operations.

[14] City of Greater Sudbury, 2024|2025 Budget. Available at greatersudbury.ca/city-hall/budget-and-finance/2024-2025-budget/proposed-budget1/proposed-2024-2025-budget/

Table 5-3: O&M Budget Forecast

Asset	Activities	O&M Budget ($ thousand)									
		2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Roads		29,330	30,210	31,117	32,050	33,012	34,002	35,022	36,073	37,155	38,270
Sidewalks	Curb & Sidewalk Replacement	294	303	312	321	331	341	351	361	372	383
	O&M	1,631	1,680	1,730	1,782	1,835	1,890	1,947	2,006	2,066	2,128
Bike Lanes*		-	-	-	-	-	-	-	-	-	-
Total		**31,255**	**32,193**	**33,158**	**34,153**	**35,178**	**36,233**	**37,320**	**38,440**	**39,593**	**40,781**

** O&M budget for bike lanes is covered under general road operations.*

5.3 Capital Reinvestment Need

5.3.1 Road Capital Reinvestment Need Analysis

5.3.1.1 Road Scenario Analysis Settings

The City utilizes the Pavement Management Software (PMS), dTIMS, to forecast road conditions over the next 10 years and evaluate funding requirements. The financial parameters for the analysis include an analysis period from 2025 to 2034, an inflation rate of 1.5%, and a discount rate of 4%. The inflation rate is applied to adjust treatment unit costs annually within the analysis period, while the discount rate, representing the opportunity cost of time, is used to convert future costs into present value. The discount rate is also incorporated into the dTIMS optimization process.

In collaboration with the City, AECOM developed a series of evaluation scenarios outlined in **Table 5-4**.

Table 5-4: Road Analysis Scenario Setup

#	Scenario	Arterial	Collector	Local
1	Current Budget	$14.3 M / year	$12.3 M / year	$5.6 M / year
2	Maintain Arterial and Delay Others	PCI = 69	PCI > 40	PCI > 40
3	Incremental Budget Option A	Considers an annual budget increase due to levy increase		
4	Incremental Budget Option B	Considers an annual budget increase due to levy increase with Arterials needs receiving funding first		
5	Maintain Current Condition	PCI = 69	PCI = 51	PCI = 52
6	Maintain Current Condition + 10%	PCI = 76	PCI = 56	PCI = 56
7	Maintain Current Condition – 10%	PCI = 62	PCI = 46	PCI = 46
Ref	Do-Nothing	No budget for any intervention		
Ref	Unlimited Budget	Budget is unlimited and all treatments will be implemented once triggered		

As mentioned, the Infrastructure Capital Planning (ICP) programs were reviewed to determine the 2025 budget, which serves as the annual average road capital reinvestment budget for Scenario #1 – Current Budget.

Scenario #2 – Maintain Arterial and Delay Others reflects a strategy where arterial roads are preserved at their current condition, while collector and local roads are maintained from falling into Poor condition.

Scenarios #3 and #4 both assume an increased annual budget resulting from the road levy. While the total 10-year budget is identical in both scenarios, Scenario #3 allocates around 40% to arterials, compared to Scenario #4, which allocates more funding up to approximately 49% to arterials and less to collectors and local roads.

Scenario #5 targets maintaining all road classes at their current condition levels over the next 10 years. In contrast, Scenario #6 aims to improve the overall network condition by 10% and sustain that level for the same period. Conversely, Scenario #7 models a 10% reduction in overall condition.

Additionally, two reference scenarios are included for comparison purposes:

- Do-Nothing, which assumes no reinvestment, and
- Unlimited Budget, which illustrates the optimal outcome without funding constraints.

5.3.1.2 Road Network Condition Forecast

The network road condition in average PCI is forecasted for the analysis scenarios in **Figure 5-5**. This figure also uses colored bands to represent condition categories, aligned with **Table 2-3**.

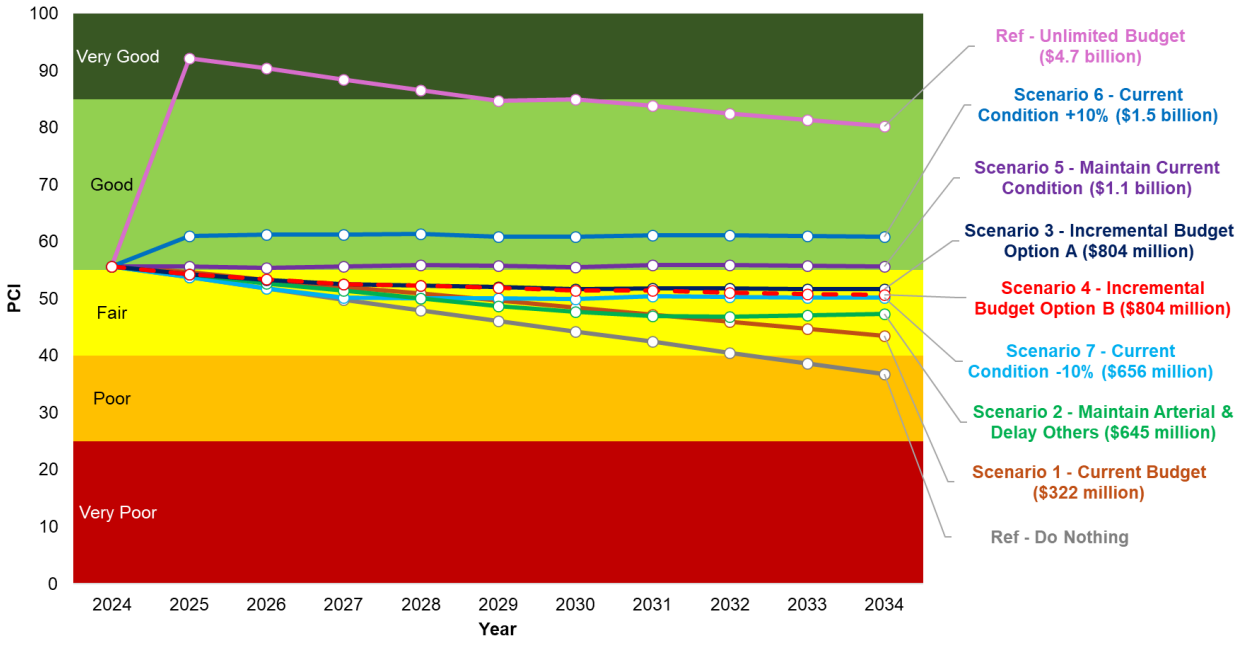


Figure 5-5: Network Average PCI Forecast for the Analysis Scenarios

Scenario 1 – Current Budget ($322 million as 10-year total budget needed) represents the baseline with limited reinvestment, leading to a steady decline in PCI from 56 to around 44, getting close to the Poor condition category by 2034.

Scenario 2 – Maintain Arterial & Delay Others ($645 million) shows marginally better outcomes than Scenario 1 by prioritizing arterial roads while allowing collector and local roads to deteriorate in Fair Condition.

Scenario 7 – Current Condition -10% ($656 million) also shows declining performance but at a slightly higher PCI level than Scenario 1, aiming for a managed deterioration of 10%.

Scenarios 3 and 4 – Incremental Budget Options A and B ($804 million) maintain a stable PCI around 52, staying within the Fair range. While both options allocate the same total funding, Scenario 4 channels more to arterials and less to collectors yet results in similar network PCI performance.

Scenario 5 – Maintain Current Condition ($1.1 billion) achieves network stability, maintaining PCI around 56 in Good condition for the full period. Scenario 6 – Improve by 10% ($1.5 billion) demonstrates a gradual rise to a PCI above 60, placing the network in the Good condition range.

Finally, the Unlimited Budget scenario ($4.7 billion) and Do-Nothing scenario represent two theoretical funding scenarios as references for the analysis.

Figure 5-6 illustrates the forecasted network condition distribution in the percentage of lane length.



Figure 5-6: Network Condition Distribution Comparisons among Analysis Scenarios

In Scenario #1 – Current Budget, the percentage of roads in Good and Very Good condition will decline from 50% to less than 40% over the analysis period. More concerning is the projected increase in Very Poor roads, which will rise sharply from less than 5% to nearly 30% by 2034.

Scenario #2 – Maintain Arterial and Delay Others has similar condition distribution in 2034 as Scenario #1. In comparison, the rest of scenarios demonstrate improved condition distributions, with a higher percentage of roads remaining in Good and Very Good conditions while reducing the proportion of roads classified as Very Poor. The percentage of roads in Good and Very Good conditions for Scenario #5 – Maintain Current Condition, #6 – Maintain Current Condition + 10%, and #7 – Maintain Current Condition – 10%, by 2034 is estimated as around 60%, 70%, and 50% respectively.

5.3.1.3 Arterial Condition Forecast

Figure 5-7 presents the projected PCI trends for arterial roads over the analysis period under different scenarios.



Figure 5-7: Arterial Average PCI Forecast for the Analysis Scenarios

Scenario 1, representing the lowest investment level at $143 million, shows a sharp decline in PCI from 68 to below 50, pushing arterial roads from the Good range into Fair by the end of the period. Scenario 7 ($216 million), which assumes a 10% reduction in current condition, shows a moderate but steady decline. Scenarios 3 and 4, with mid-level budgets of $320 million and $391 million respectively, stabilize PCI around 65, maintaining arterial roads near the lower end of the Good condition band. Scenario 5 ($405 million) maintains current PCI levels around 69, achieving a flat trend line over the decade. Scenario 2 ($422 million), which prioritizes maintaining arterials while deferring maintenance on other road classes, shows a slight PCI increase for arterials, confirming the benefit of focused investment. Scenario 6, the highest-funded option at $664 million, significantly improves PCI to 75, sustaining arterial roads well into the upper Good condition category.

5.3.1.4 Collector Condition Forecast

Figure 5-8 illustrates the projected PCI trends for collector roads over the period 2024–2034 under different scenarios.

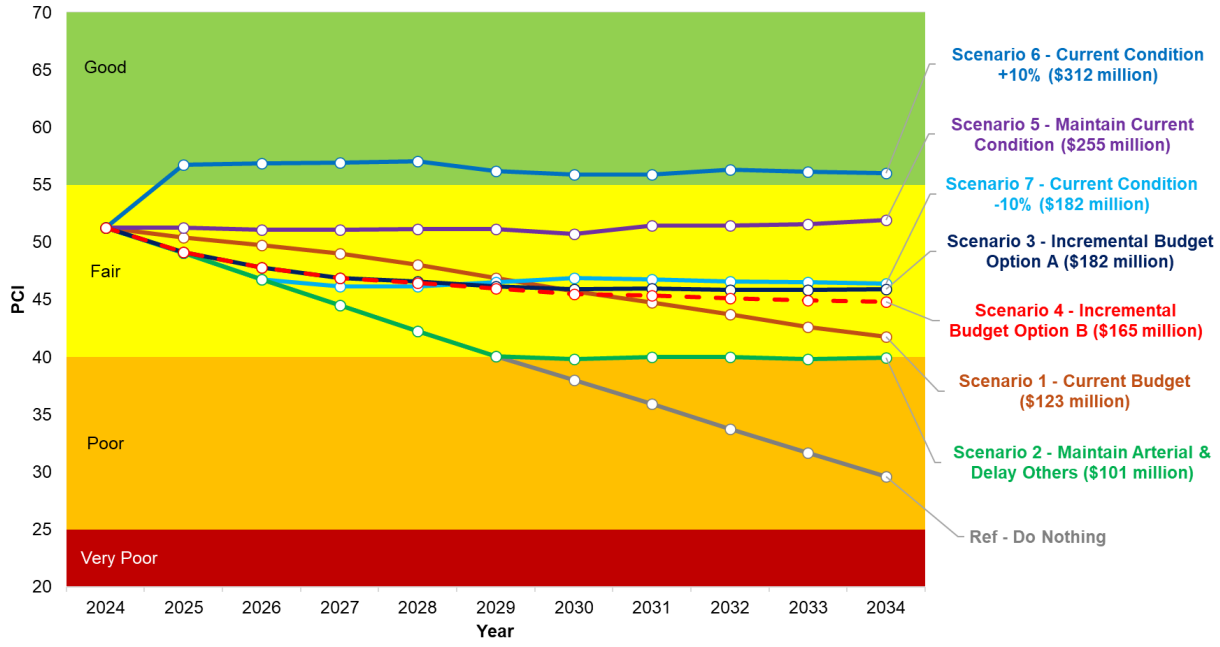


Figure 5-8: Collector Average PCI Forecast for the Analysis Scenarios

Scenario 1 – Current Budget has an investment of $123 million in ten-years, results in a continuous PCI decline from 51 to near 42.

Scenario 2 ($101 million), which prioritizes arterials while deferring maintenance on collectors and locals, shows even faster deterioration, reaching the Poor condition.

Scenario 7 ($182 million), aiming for a controlled 10% condition reduction, shows a slower decline.

Scenarios 3 and 4, with moderate investments of $182 million and $165 million respectively, stabilize PCI around 45. Scenario 5 ($255 million) maintains current conditions with a stable PCI around 51, preventing further degradation.

Scenario 6, the most well-funded option at $312 million, achieves a steady improvement, raising PCI to approximately 56 and moving collector roads into the Good condition.

5.3.1.5 Local Road Condition Forecast

Figure 5-9 presents the projected PCI trends for local roads for different funding scenarios over the next ten years.

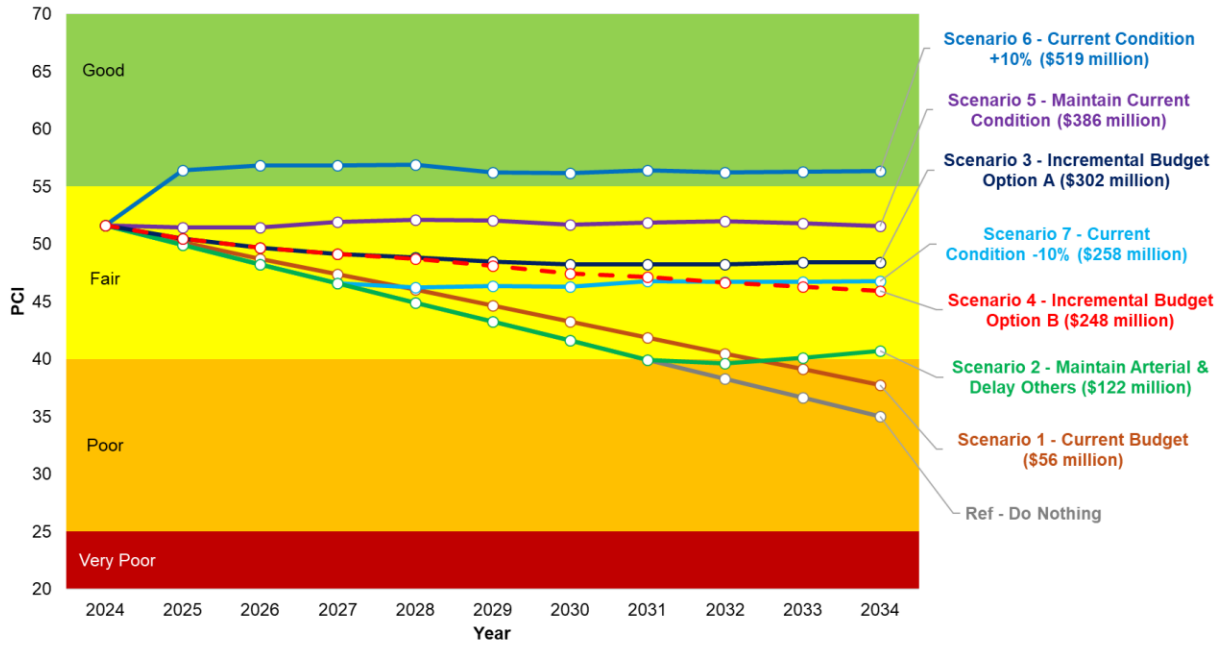


Figure 5-9: Local Road Average PCI Forecast for the Analysis Scenarios

Scenario 1 – Current Budget ($56 million) slows this decline slightly, but PCI continues to deteriorate and drop to Poor condition by 2034, indicating that this funding level is insufficient to maintain current road conditions.

Scenario 2 ($122 million), which prioritizes arterials and delays investment in collectors and locals, shows comparable deterioration, highlighting the vulnerability of local roads under deferred maintenance.

Scenarios 3 and 4, with budgets of $302 million and $248 million respectively, stabilize PCI around 46–48, keeping roads in Fair condition.

Scenario 5 – Maintain Current Condition PCI = 52 ($386 million) stabilizes the PCI at its current level, ensuring that local roads remain in the Fair range over the analysis period.

Scenario 6 – Maintain Current Condition + 10% ($519 million), which supports a moderate PCI increase, is able to maintain local roads within the Good category.

Meanwhile, Scenario 7 – Maintain Current Condition – 10% ($258 million) in light blue line shows a similar trend with Scenario #1 until 2028 and becomes stable afterwards.

5.3.1.6 Road Scenario Discussion

Table 5-5 summarizes the 2034 projected PCI and condition ratings for the road network under seven funding scenarios, highlighting the trade-offs between investment levels and performance outcomes.

Scenario #1 – Current Budget ($32 million/yr) results in the lowest network PCI (44), with local roads degrading to Poor condition, clearly showing that current funding is insufficient to sustain service levels.

Scenario #2 requires almost double the budget of Scenario #1. The improvements on arterials are modest, but changes on collectors and local roads are minimal, demonstrating that deferring collectors and local roads are not cost effective.

Scenario #7 needs similar budget as Scenario #2, attempting to manage a 10% condition decline and performs slightly better than Scenario #2 at the network level.

Scenario #5 ($105 million/yr) maintains current conditions across all road classes, achieving a balanced outcome with Fair to Good condition ratings among road classes. Scenario #6 ($150 million/yr) yields the best results, improving all

categories to Good condition, but requires the highest annual investment. While ideal, this may not be financially feasible.

Scenarios #3 and #4 ($81 million/yr) represent more realistic mid-range funding options that deliver meaningful improvements. Both achieve a Fair network condition near PCI 51–52, and lift collectors and locals into mid-to-high Fair range. The key difference is that Scenario #4 shifts more funding toward arterials, achieving slightly higher arterial PCI (67 vs. 64) at the expense of collectors and locals.

Given available funding and the need to balance overall performance, Scenario #4 offers a feasible and affordable direction, maintaining acceptable conditions without overstretching municipal budgets. Therefore, Scenario #4 reflects the funding needs to meet the proposed service level for roads.

Table 5-5: Summary of Road Condition Rating and PCI (in Parenthesis) by 2034

Scenario	Budget	Network	Arterial	Collector	Local
S#1 - Current Budget	$32 million/yr	Fair (44)	Good (58)	Fair (42)	Poor (38)
S#2 - Maintain Arterial & Delay Others	$65 million/yr	Fair (47)	Good (69)	Fair (40)	Fair (41)
S#3 - Incremental Budget Option A	$81 million/yr	Fair (52)	Good (64)	Fair (46)	Fair (48)
S#4 - Incremental Budget Option B	$81 million/yr	Fair (51)	Good (67)	Fair (45)	Fair (46)
S#5 - Maintain Current Condition	$105 million/yr	Good (56)	Good (68)	Fair (52)	Fair (52)
S#6 - Maintain Current Condition+10%	$150 million/yr	Good (61)	Good (76)	Good (56)	Good (56)
S#7 - Maintain Current Condition-10%	$66 million/yr	Fair (50)	Good (61)	Fair (46)	Fair (47)

5.3.2 Sidewalks Capital Reinvestment Need Analysis

In 2023, a condition assessment was performed for sidewalks, and a ten-year work plan was proposed to meet sidewalk reinvestment needs[15]. The forecast incorporates condition data, trigger values, and business rules to determine when maintenance or rehabilitation is necessary. It leverages the Sidewalk Condition Index (SCI) alongside detailed information on pavement distress types, extent, and severity. The total funding need for the plan is estimated at $4 million in 2022 dollar.

Sections requiring immediate intervention within one year were identified based on trip hazards, which pose safety risks and legal liability to the City. Grinding was recommended for slabs with faulting independent of other distresses, while panel replacement or patching was prioritized for trip hazards coupled with cracking distress. The City has been addressing the recommended the trip hazard mitigation as part of O&M activities.

For Years 2 and 3 in the proposed work plan, sections with SCI scores below 40 and areas with extensive cracking distress (exceeding 60% of the surface area) were programmed for reconstruction. Reconstruction was favored over panel replacement due to cost-effectiveness and to ensure a uniform concrete surface with consistent performance. During Years 4 to 6, repair of shattered slabs was prioritized, as their progressive deterioration and spalled cracks increase safety hazards. For Years 7 to 10, repairs were planned for sections with moderate cracking, such as high longitudinal and transverse cracks or corner breaks. Although localized, these issues can significantly impact user safety and experience.

Since the work plan was developed using 2022 dollars, the funding needs was inflated and presented in inflated dollar values, incorporating the following assumptions:

- The base year used is 2025. Any historic asset replacement values have been inflated using the experienced inflation rate from Non-Residential Building Construction Price Index (NRBCPI).
- Inflation rate: the inflation rates adopted for the financial model are presented in **Table 5-6**. The inflation for 2025 and later is determined based on the City's input.

[15] ARA, Sidewalk Data Collection and Asset Management, 2023.

Table 5-6: Inflation Rate[16]

Year	Inflation Rate
2022	7%
2023	7.1%
2024	6%
2025	3%
2026	3%
2027	3%
2028	3%
2029	3%
2030 - 2034	3%

The total funding need for the rest of capital renewal activities as per the work plan is calculated to be around $4.8 million in inflated dollars for the next 10 years, which give an annual average reinvestment need of $477,000, as shown in **Figure 5-10**.

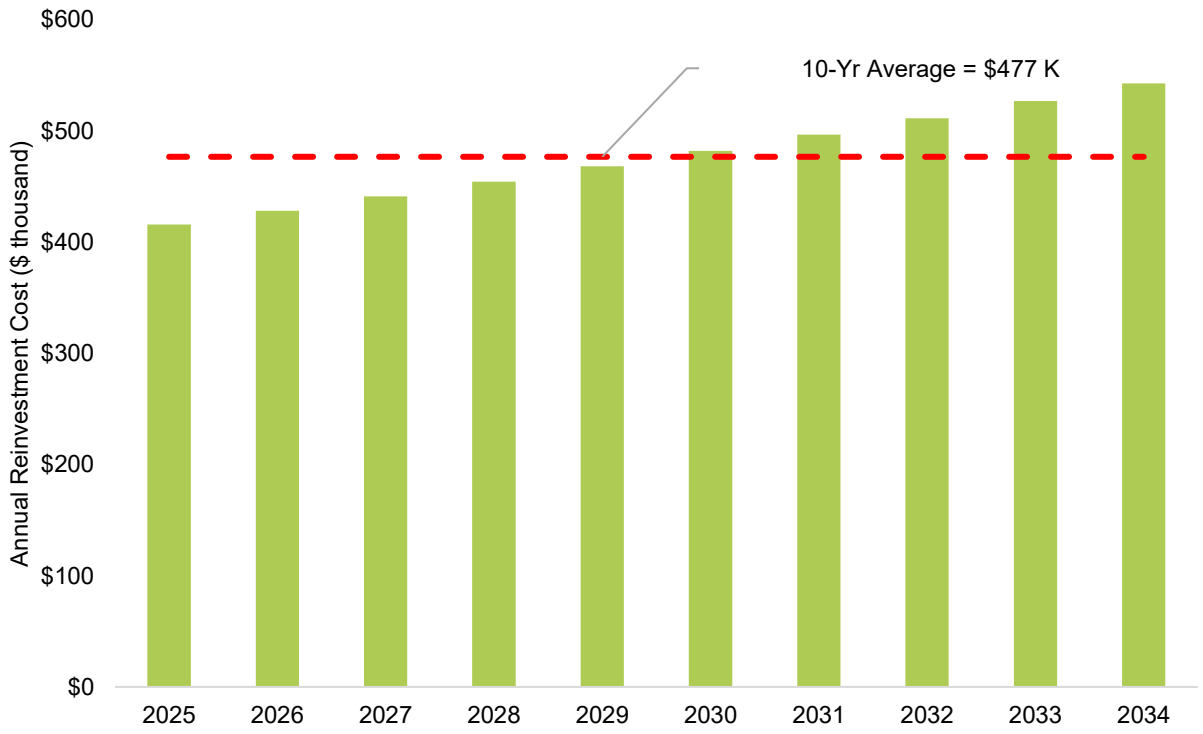


Figure 5-10: Sidewalks 10-Year Reinvestment Need

The detailed 10-year reinvestment needs for sidewalk assets are presented in **Table 5-9** in inflated dollar values.

Table 5-7: Sidewalk 10-Year Total and Annual Average Reinvestment Need

Asset	Annual Average Need	10-Year Total
Sidewalks	$477,000	$4,767,000

[16] Past inflation data obtained from NRBCPI using the non-residential; yearly result taken from an average of quarterly results. https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810027601

5.3.3 Bike Lanes Capital Reinvestment Need Analysis

Table 5-8 shows the assumptions on the reinvestment measures for assets with no installation date. Also, the key assumption in the lifecycle model is to determine which assets need to be replaced for each year in the analysis period based on their ESL and risk levels. Typical assumptions include:

- Replace all assets that have already exceeded their ESL
- Where age information is not available, the assumption was for these assets to be replaced at a uniform rate per year, spread in equivalent numbers over their ESL.
- As the unit replacement cost is in 2024 dollar value, a inflation rate of 3% was applied from 2024-2025 as per **Table 5-6.**

Table 5-8: Bike Lanes Reinvestment Assumptions

Bike Lanes Subclass	ESL	Unit Replacement Cost ($/m) (2024)	Assumptions
AT Trail	25	118	• Annual reinvestment rate = 4%
Cycle Tracks	50	289	• 100% of assets with installation data available are replaced when exceed their ESL
MUP	50	289	• 67% assets with installation data available are replaced when exceed their ESL; • 33% assets with no installation data used 2% annual reinvestment rate
On-road Bicycle Lanes	N/A	N/A	• Included in road estimation
Paved Shoulders			
Signed Bike Route with Edgelines			

The average annual reinvestment cost for the City's Bike Lanes infrastructure is approximately $156,000 over the next 10 years (2025–2034), as shown in **Figure 5-11**. This equates to a total reinvestment requirement of approximately $1.6 million over the 10-year period, based on inflated dollar values.

The forecast includes reinvestment needs for AT trails and MUPs. All Cycle Tracks are currently in Very Good condition and are not expected to require reinvestment over the analysis period.

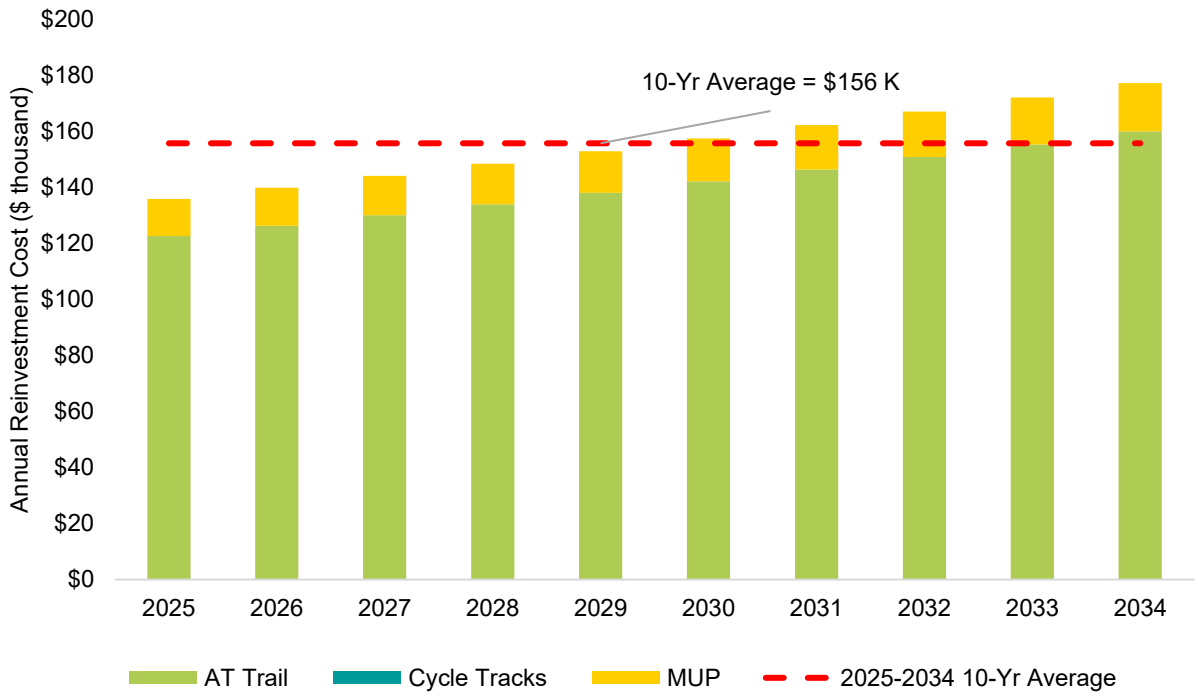


Figure 5-11: Bike Lanes 10-Year Reinvestment Need

The detailed 10-year reinvestment needs for bike lanes assets are presented in **Table 5-9** in inflated dollar values.

Table 5-9: Bike Lanes 10-Year Total and Annual Average Reinvestment Need

Bike Lanes Subclass	Annual Average Need	10-Year Total
AT Trail	$141,000	$1,407,000
Cycle Tracks	-	-
MUP	$15,000	$152,000
On-road Bicycle Lanes*	-	-
Paved Shoulders*	-	-
Signed Bike Route with Edgelines*	-	-
Total	**$156,000**	**$1,558,000**

**Included in road estimation*

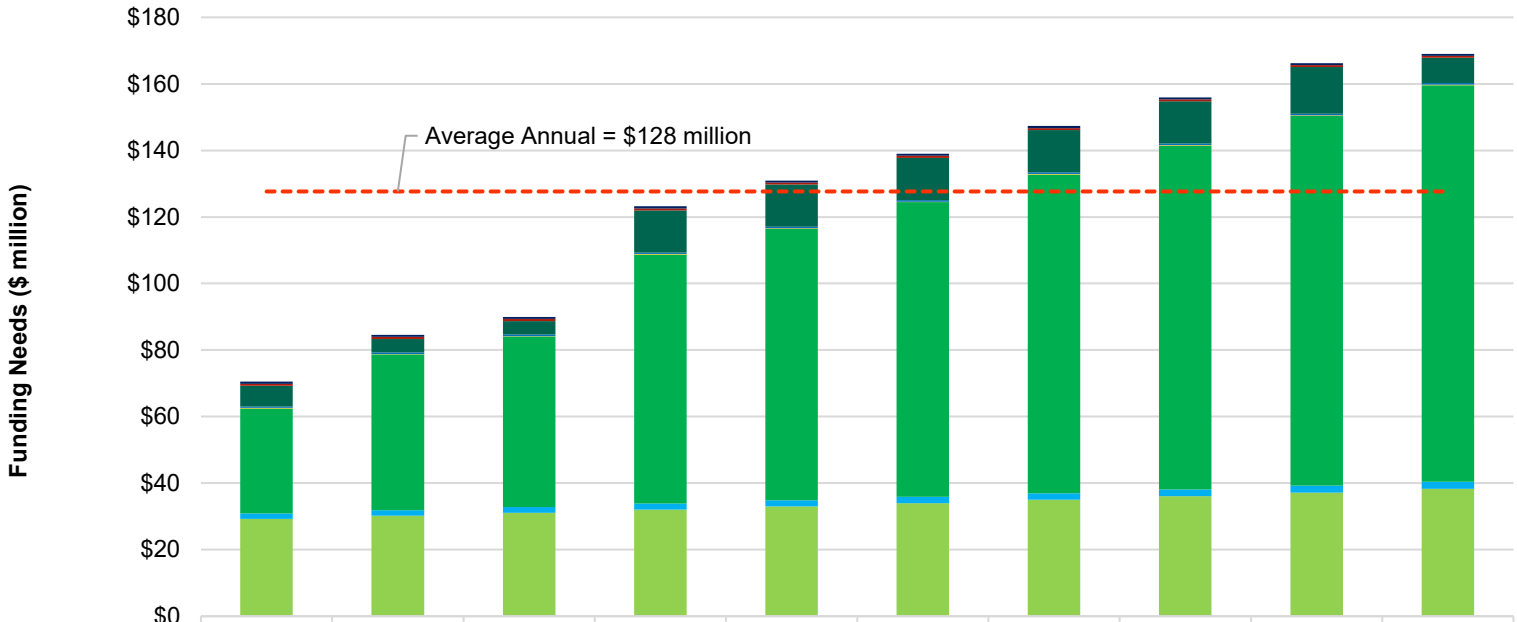
5.4 Full Funding Need

Figure 5-12 shows a full picture of the City's funding need forecast over the next 10 years for roads, bike lanes, and roads. It captures three major lifecycle management strategies: new capital investment, capital reinvestment, and O&M. Overall, the average annual funding need is approximately $128 million.

The most substantial growth is observed in capital reinvestment for roads (Scenario #4, see **Section 5.3.1**), which increases steadily from $31.5 million in 2025 to $119.2 million in 2034. The reinvestment needs for sidewalks and bike lanes are comparatively modest, generally staying below $1 million annually.

O&M expenditures also rise gradually throughout the forecast period. Road O&M grows from $29.3 million in 2025 to $38.3 million in 2034, reflecting inflation and the potential expansion of the asset base. Sidewalk O&M follows a similar trend, increasing from $1.6 million to $2.1 million by 2034.

New capital investments are associated with growth-related investment and is detailed in **Section 5.2.1**.



	1	2	3	4	5	6	7	8	9	10
New Capital - Sidewalks	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6
New Capital - Bike Lanes	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6	$0.6
New Capital - Roads	$6.3	$4.1	$4.1	$12.7	$12.7	$12.7	$12.7	$12.7	$14.0	$7.5
Capital Reinvestment - Sidewalks	$0.4	$0.4	$0.4	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5	$0.5
Capital Reinvestment - Bike Lanes	$0.1	$0.1	$0.1	$0.1	$0.2	$0.2	$0.2	$0.2	$0.2	$0.2
Capital Reinvestment - Roads	$31.5	$46.8	$51.2	$74.9	$81.6	$88.6	$95.8	$103.3	$111.1	$119.2
O&M - Sidewalks	$1.6	$1.7	$1.7	$1.8	$1.8	$1.9	$1.9	$2.0	$2.1	$2.1
O&M - Bike Lanes	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
O&M - Roads	$29.3	$30.2	$31.1	$32.1	$33.0	$34.0	$35.0	$36.1	$37.2	$38.3
Annual Average	$127.7	$127.7	$127.7	$127.7	$127.7	$127.7	$127.7	$127.7	$127.7	$127.7

Figure 5-12: Full Funding Profile for Roads, Bike Lanes, and Sidewalks

5.5 Funding Strategies

Reliable funding is essential for maintaining and improving road and transportation infrastructure in municipalities like the City. This section outlines key federal, provincial, and municipal funding programs that support road rehabilitation and core infrastructure development.

At the federal level, programs such as the Canada Public Transit Fund (CPTF) and the Investing in Canada Infrastructure Program (ICIP) provide long-term support to enhance transit systems and active transportation networks. Provincially, the Ontario Community Infrastructure Fund (OCIF) could offer crucial support for upgrading roads, bridges, and transit corridors.

At the municipal level, property tax revenue plays a critical role in financing transportation infrastructure. Development Charges (DCs), reserve funds, and debt financing also contribute to the overall funding pool. Notably, the City has implemented a 1.5% dedicated infrastructure levy, which has been in place for two years and is reviewed annually by Council. While initially targeted for roads-related assets, this levy has also supported broader infrastructure needs across the municipality.

Table 5-10 presents the currently identified funding sources along with the available allocations for roads and transportation assets. Detailed descriptions of these funding sources are provided below.

Table 5-10: Funding Sources Forecast

Funding Source	Funding Forecast ($ thousands)		
	2025	2026	2027
Municipal Levy operating purposes	36,853	37,958	39,097
Municipal Levy capital purposes	13,025	32,899	41,117
Canada Community-Building Fund	9,478	9,913	9,913
Ontario Community Infrastructure Fund	5,895	9,920	4,420
Other operating revenues	-	-	-
Debt	4,900	-	-
Development Charges (DCs)	-	-	-
Reserve funds	7,673	516	3,365
Other reserve funds	850	850	850
Total/Overall	**78,674**	**92,056**	**98,762**

**Subdivision surface deposits. $850K per year.*

- **Municipal Tax Levies and Their Role in Road & Transportation Funding in the City**

  In the City, municipal property tax levies serve as a crucial funding source for maintaining and improving the City's road and transportation infrastructure. These levies, collected from property owners based on property assessments, help finance essential services such as road resurfacing, bridge repairs, winter road maintenance, and traffic management enhancements. Given the City's expansive geography and diverse road network, property tax revenues play a key role in ensuring safe and reliable transportation across urban and rural areas.

  To address specific infrastructure needs, the City has also implemented dedicated capital levies to fund major road rehabilitation projects. These targeted investments help the City keep up with enhance road safety and support long-term transportation planning. By leveraging property tax levies alongside provincial and federal grants, the City ensures that its road networks remain accessible, efficient, and well-maintained for residents and businesses alike.

  In support of financial sustainability, the City has identified increasing revenues and promoting densification as key strategic priorities. It was noted that recent residential developments within the urban service boundary have not significantly expanded the physical road network or deteriorated pavement conditions. However, these

developments have placed increased pressure on other municipal services, such as waste collection, street lighting, and transit.

Table 5-10 presents previously approved levy funding allocations. It is important to note that only funding that has already received approval is included. The 2028 Capital Budget will be developed to support the prioritized investment needs of the organization as a whole, and future allocations may be adjusted accordingly to reflect emerging priorities.

- **The Canada Community-Building Fund (CCBF)[17]**

  The Canada Community-Building Fund (CCBF) provides long-term funding to support local infrastructure projects. It plays a key role in enhancing transportation by improving public transit, local roads, bridges, and active transportation networks. The funding estimates presented are based on the 2024–2028 allocation figures provided by the Association of Municipalities of Ontario (AMO), with a deduction of $960,000 that has been allocated to support water and wastewater infrastructure.

- **Provincial Funding Programs - Ontario Community Infrastructure Fund (OCIF)[18]**

  The Ontario Community Infrastructure Fund (OCIF) provides formula-based funding to municipalities for core infrastructure projects, supporting economic growth and sustainability.

  For the City, OCIF provides $10 million annually. The funding amounts presented in **Table 5-10** reflect allocations designated for roads. These funds may be applied to bridge infrastructure or other eligible capital investments that align with OCIF program criteria.

- **Debt**

  In 2025, additional road project approved (in area of Arena/Event Centre project) funded by reallocation of available debt from Junction project due to new Federal Grant funding. This debt allocation does not appear in the current budget document summary, as it represents a reallocation of previously approved debt rather than new borrowing.

- **Development Charges (DCs) and Their Role in Road & Transportation Infrastructure**

  In Ontario, Development Charges (DCs) are fees that municipalities impose on new developments to fund the infrastructure necessary to support growth, such as roads, transit systems, water services, and recreational facilities. These charges ensure that growth pays for growth, meaning that developers contribute to the increased demand for infrastructure that new housing and commercial projects create. In the context of roads and transportation, DCs are often used to finance road expansions, intersection upgrades, transit-supportive infrastructure, and active transportation projects like bike lanes and sidewalks. Municipalities set DC rates based on anticipated infrastructure costs, ensuring that new developments contribute their fair share without overburdening existing taxpayers.

  Currently, DCs that collected are used to fund previously completed growth related projects. It is not expected that sufficient DC revenues will be available to support additional growth-related transportation investments in the near term.

5.5.1 Additional Funding Sources

The City is aiming to demonstrate a proactive approach in exploring and implementing a variety of strategies to manage the risks by reflecting on the key financial levers available to address the funding gap and better align long term infrastructure needs with sustainable financing. This section identifies several additional funding sources that the City may consider supporting transportation infrastructure needs. These potential sources could provide supplementary funding for priority projects and help address funding gaps in future capital planning efforts.

[17] https://housing-infrastructure.canada.ca/ccbf-fdcc/pt/bc-eng.html?utm_
[18] Municipal infrastructure support for communities, https://www.ontario.ca/page/municipal-infrastructure-support-for-communities?

- **Federal Funding Programs - Canada Public Transit Fund (CPTF)[19,20]**

  The Canada Public Transit Fund (CPTF) is a long-term funding initiative aimed at strengthening public transit and active transportation infrastructure across Canada. Starting in the 2026-27 fiscal year, the CPTF will allocate an average of $3 billion annually in permanent funding to improve the accessibility, reliability, and sustainability of transit systems nationwide.

  This funding is designed to support municipalities in expanding transit networks, transitioning to low-emission fleets, modernizing infrastructure, and enhancing mobility options for residents. The goal is to reduce greenhouse gas emissions, promote active transportation, and improve urban mobility in alignment with Canada's climate action commitments. The CPTF aligns with broader federal and provincial transportation strategies, ensuring that investments contribute to economic growth, equity in transit access, and the transition to greener, more efficient transportation solutions.

- **Provincial Funding Programs - Ontario Gas Tax for Transit Program[21]**

  The Ontario Gas Tax for Transit Program primarily funds public transit infrastructure and operations, but it also indirectly benefits municipal road networks that support transit systems. Funding allocations are based on municipal transit ridership and population, ensuring that communities receive financial support to improve their transit services and related infrastructure. Relevance to Roads & Transportation Infrastructure:

  - Supports road improvements for transit operations – Municipalities can use Gas Tax funding to enhance road conditions along major bus routes, ensuring smoother transit service.
  - Funds transit-priority infrastructure – Investments may include dedicated bus lanes, transit signal priority systems, and intersection upgrades to improve traffic flow.
  - Encourages road integration with transit systems – Supports complete street designs that accommodate transit, cyclists, and pedestrians.

  In 2019, the program, alongside the Ontario Community Infrastructure Fund (OCIF), provided over half a billion dollars in municipal infrastructure funding.

- **Provincial Funding Programs - Municipal Housing Infrastructure Program – Housing-Enabling Core Servicing Stream[22]**

  Launched in August 2024, the Municipal Housing Infrastructure Program – Housing-Enabling Core Servicing Stream provides $400 million to municipalities for building, maintaining, and repairing core infrastructure that supports housing development. Relevance to Roads & Transportation Infrastructure:

  - Road construction and upgrades – Funds can be used to develop new roads or improve existing ones to support growing residential areas.
  - Bridge and culvert maintenance – Ensures reliable road networks for new housing developments and access to essential services.
  - Enhancing road capacity – Supports infrastructure expansion to accommodate increased traffic demand from new housing projects.

  This funding stream helps municipalities like the City invest in critical road infrastructure improvements that facilitate urban expansion and housing accessibility.

[19] Canada Public Transit Fund, Government of Canada, https://housing-infrastructure.canada.ca/cptf-ftcc/index-eng.html
[20] Housing, Infrastructure and Communities Canada, Government of Canada, https://www.canada.ca/en/housing-infrastructure-communities/news/2024/12/federal-government-commits-more-than-14-million-to-the-city-of-greater-sudbury-through-the-new-canada-public-transit-fund.html
[21] https://www.amo.on.ca/sites/default/files/assets/DOCUMENTS/Reports/2019/OntarioDedicatedGasTaxFundsforPublicTransportationProgramandOntarioCommunityInfrastructureFund20191003.pdf
[22] Ontario Investing $400 Million in Roads and Bridges to Enable More Homes, https://news.ontario.ca/en/release/1004953/ontario-investing-400-million-in-roads-and-bridges-to-enable-more-homes

5.6 Funding Gap

The City intends to continue to invest in the growth and renewal of the roads and transportation assets over the next 10 years. **Table 5-11** compares the City planned capital renewal budget against the capital renewal funding needs. The shortfall between the City planned capital renewal budget against the capital renewal funding needs is referred to as the "funding gap".

Table 5-11: Funding Gap – Capital Renewal Funding Needs vs. Budget Forecast

Asset Class	10-Year Need Total ($million)	10-Year City Budget Total ($million)	10-Year Gap Total ($million)
Roads	$804*	$322	$482
Sidewalks	$4.77	$3.37**	$1.40**
Bike Lanes	$1.56	N/A***	N/A***

** The 10-Year total cost for Scenario #4 Incremental Budget Option B is considered 10-Year Needs. See **Section 5.3.1.6** for more information.*
*** Some sidewalk renewals are included within broader road project budgets when undertaken as part of roads projects.*
**** Capital renewal budget for bike lanes is covered under general road operations*

5.7 Risk Management: Proposed Levels of Service

While the City does not anticipate immediate severe consequences from current funding levels, a sustained lack of reinvestment will gradually lead to more visible and cyclical issues. The risks outlined below are not expected to occur all at once but will emerge progressively over time, with some—such as reputational risks during high-pothole seasons—already being experienced intermittently. The table below highlights key risks and associated impacts across various asset types.

Table 5-12: Risk of Not Meeting Proposed Levels of Service for Roads and Transportation Assets

Key Risk	Potential Consequences / Impacts
Insufficient funding for road renewals and replacement	• Reputational risk to the City, costs more to react than to prevent / increased backlog, negative community and business impacts, unwanted media attention • Regulatory compliance record could be compromised over time • Reduced condition and ride quality lead to higher vehicle operating costs, accelerated asset deterioration, reduced safety for all road users, disrupted traffic flow, more service interruptions and asset failures, increased maintenance costs, more reactive interventions • For gravel roads, it could lead to seasonal load constraints, temporary inaccessibility, commute delays, dust issues in summer, resident complaints, emergency medical services access challenges, safety concerns.
Insufficient funding for O&M	• Cost overruns may be experienced where costs exceed annual maintenance budget • Increased public communications and time spent responding to complaints/inquiries • Emergency response is insufficient to meet resident needs – increased pressures on staff support
Higher vulnerability of assets to emergencies/ extreme weather events	• Accelerated asset deterioration, causing service interruption and/or asset failure • Added costs due to building to a higher standard, leading to additional pressures on existing funding gaps • Regulatory changes from other levels of government, new internal procedures and standards can add costs as well

5.8 Non-Financial Strategies

In addition to securing reliable funding sources, the City continues to adopt a suite of non-financial strategies to enhance the efficiency, affordability, and overall impact of its road and transportation infrastructure investments. These strategies are particularly important in resource-constrained environments where fiscal limitations require innovative, cost-effective approaches to asset management. The City has emphasized the importance of project bundling, lifecycle optimization, and leveraging internal capabilities. Additionally, efforts such as timing tender releases, performing risk-based prioritization, and pursuing cost-sharing agreements have helped maximize value for

money. The City also highlighted the benefits of multi-year budgeting and collaborative procurement models to enhance planning certainty and optimize pricing. **Table 5-13** summarizes key non-financial options identified by the City, outlining their respective focus areas and implementation considerations.

Table 5-13: Non-Financial Strategy Options

#	Non-Financial Option	Description
1	Bundling of projects for cost-efficiency	• Pavement rehabilitation projects on local and collector roads are bundled based on scope, location, and value to optimize seasonal delivery. The City also coordinates bundling with utility projects where feasible to minimize disruption and improve cost efficiency. • Aims to improve cost efficiency, contractor coordination, and unit rates. • City supports flexibility in treatment technologies (e.g., cold in-place recycling) to allow equivalent performance-based methods. • Bundling accommodates specialized expertise and supports cost-effective delivery in Northern Ontario's limited service market, where lower project volumes make it challenging to attract service providers. The City emphasized the importance of fully leveraging available technologies to extend road life under these conditions. • Collaborative approaches, including bulk purchasing and intermunicipal coordination, can be pursued to improve pricing and service delivery. These strategies build on successful past practices, such as joint procurement of road salt, and could be further supported through aligned project scheduling via provincial–municipal meetings or regional working groups.
2	Perform funding prioritization & allocation study for best return on investment	• The City performed a study an Overall Condition Index considering coordination and economic benefit. • Enabled Councillors to provide input on local road priorities, though opportunities remain to enhance clarity and transparency in the final decision-making process. • Future prioritization should enhance transparency and decision logic.
3	Perform Risk Assessment and prioritize projects based on Risk	• The City conducts criticality assessments, though not explicitly reflected in project selection. • Recommendation to formally incorporate risk assessment into prioritization frameworks. • Holding strategies such as asphalt patching can be used under constrained budgets.
4	Phasing of large projects / doing more smaller-scale projects	• Breaking down large projects into smaller, manageable phases provides flexibility in delivery. • Helps align implementation with available annual budgets and resource constraints.
5	Evaluating decision making logic and manage tolerance of construction-related disruptions	• The City is improving its approach to managing and communicating construction disruptions, allowing for improved construction efficiency and productivity. • Efforts aim to minimize public impact while maintaining construction efficiency.
6	Optimizing timing of tenders in relation to construction-related disruption	• Tender timing is being evaluated to align with scope and seasonal conditions (e.g., spring vs. fall). • Optimizing tender release to improve contractor response and secure better pricing.
7	Optimal coordination in road corridors between water, sewer, drainage and roads	• Coordination improves delivery efficiency and reduces rework.
8	Ongoing communication with to promote roads asset management + benefits thereof	• Ongoing communication with Councillors aims to strengthen transparency and reinforce support for asset management decision-making. • This approach facilitates the explanation of project rationale and promotes long-term value-based planning.
9	Internal resources to deliver capital projects	• The City relies primarily on internal resources for road design and delivery. • External consultants are engaged only for specialized needs or during high-capacity years.
10	Adjust Levels of Service: Asphalt to surface treated; surface treated to gravel; asphalt patching	• The City applies large-scale asphalt patching, often funded through the 1.5% levy as a holding treatment which is used to extend pavement life when full funding for rehabilitation is unavailable. • This approach supports deferred intervention by addressing localized deterioration, improving ride quality, and maintaining overall serviceability until more comprehensive rehabilitation can be undertaken.
11	Multi-year budgeting allows construction community to plan	• The City's four-year capital planning framework improves forecasting and cost management.

#	Non-Financial Option	Description
		• This approach supports better resource planning by providing the construction community with greater visibility into upcoming work, enabling contractors to align staffing, equipment, and scheduling capacity accordingly.
12	Cost sharing agreement	• The City has implemented cost-sharing by partnering with developers • Includes senior government funding through programs like the Building Canada Fund. • This strategy leverages external funding sources to supplement municipal budgets and support the delivery of higher-value infrastructure projects.
13	Infrastructure rationalization efforts	• Efforts include downsizing oversized roads to standard cross-sections. • Sidewalk removal in select areas helps reduce long-term maintenance and renewal needs. • Examples include efficiency gains by network reduction on: - Longyear Drive - Crean Hill - Maley Drive.

6. Implementation Plan and Continuous Improvement

Continuous improvement is an important component of any AM program and is achieved by implementing recommended improvement initiatives that support sustainable service delivery. **Table 6-1** provides a list of improvement initiatives recommended to advance overall transportation AM service delivery across the City.

Table 6-1: Recommended AM Improvement Initiatives

AMP Section	Improvement Initiative	Actions
State of Infrastructure	Continuously maintain and refine inventory data	• It is recommended for the City to continue maintaining the transportation inventory, keep tracking renewal/replacement records, and update the inventory as soon as a new asset is acquired, or when assets are decommissioned. • The City is recommended continuously refining inventory data for sidewalks and bike lanes, including key attributes such as install years, condition if have, ESLs, treatment unit costs, and completed work activities. • The City's reconstruction unit costs are used to estimate road replacement costs. Historical unit costs are periodically tracked for paved roads, but not for unpaved (gravel) roads. Given the City has over 600 lane-km of gravel roads, it is recommended to review and update the previous total replacement cost estimate for these gravel roads.
	Establish data ownership and accountability	• It is recommended to develop a Data Strategy document that defines roles for data ownership and accountability, strengthens asset data integrity, and improves decision-making. A strong data governance framework ensures consistent, accurate, and reliable data, which is essential for effective planning and management. By clarifying responsibilities and aligning data practices across systems and departments, the strategy will reduce organizational silos and enhance collaboration. It will also streamline information workflows, making it easier to access and utilize data efficiently.
	Develop a condition assessment process for gravel roads and bike lanes.	• The current asset inventory lacks most recent condition and installation data for gravel roads and bike lanes, which presents challenges for conducting lifecycle financial analysis. Therefore, it is recommended to develop a consistent and structured condition assessment process for gravel roads (at least every five years), while bike lanes can be assessed with sidewalks. This process will allow the City to better forecast these assets replacement needs and avoid failures and the resulting economic, social, and environmental costs.
Levels of Service	Refine the Levels of Service Framework.	• Continue to collect asset performance data for identified key performance indicators (KPIs) including associated costs.
	Continue update and review the LoS performance measures.	• Review the LoS performance measures on an annual basis, and update asset performance data as required.
	Develop a strategy to achieve the desired LoS target.	• Periodically assess proposed LoS to confirm alignment with shifting community expectations, regulatory changes, City priorities, available resources, and observed performance trends—supporting adaptive and responsive service delivery. • Continuously enhance demand management by routinely evaluating future demand drivers that influence service delivery and asset use, integrating these insights into long-term capital planning to ensure LoS remains responsive to changing needs.
	Continuously improve stakeholder engagement	• Building on existing efforts, it is recommended that the City continue to refine its Customer Communication & Consultation Plan to engage the public and other stakeholders on the LoS Framework, and to further assess stakeholder willingness to pay for enhanced service levels.
Lifecycle Management Strategies	Strengthen proactive maintenance and lifecycle efficiency	• Implement proactive maintenance schedules and systematic condition monitoring to identify issues early and reduce unplanned downtime. Use condition data to intervene at optimal times, minimizing reactive repairs and overall maintenance costs. • Incorporate energy-efficient technologies and best practices into road and transportation operations to improve lifecycle cost-effectiveness.

AMP Section	Improvement Initiative	Actions
	Explore and expand lifecycle strategies	• Explore and expand minor treatments, preservation techniques, or rehabilitation techniques (including green technologies) for operational and capital programs, and establish proper implementation and quality control to maximize its benefits. • Review existing internal and external processes and alternative construction standards to enhance work activities.
	Revisit lifecycle strategy selection logic	• It is recommended that the treatment selection logic (decision trees) in the City's PMS be revisited regularly (e.g., every 3 to 5 years). Over time, changes in material, technology, policy can make original logic outdated, resulting in resource misallocation, missed optimization, and inefficient planning.
	Assess the current PMS	• The City does not have a dedicated staff to operate PMS and communication with software provider sometimes results in long response times and unanticipated costs, hindering timely updates and decision-making. To improve the effectiveness of pavement planning, it is recommended that the City initiate a study to evaluate the existing PMS or pursuing a new PMS to meeting the evolving needs. It is recommended the study to assess operational and resource gaps, explore alternative systems or service delivery models, and provide recommendations for a more streamlined and sustainable solution that ensures timely analysis, long-term AM planning and other functional requirements.
Financial Strategies	Identify lifecycle stage for the cost items	• It is recommended to add lifecycle stage to the cost items (including acquisition, operation/maintenance, renewal/replacement, and disposal) during actual investment to have a better understanding of the cost of ownership and support long-term needs forecast and planning.
	Keep updating treatment unit cost	• The City has established a strong practice of tracking treatment unit costs for paved road work over the years. A comparison of unit costs from 2013, 2016, and 2024 shows significant fluctuations driven by inflation and other socio-economic factors. To ensure accurate lifecycle financial planning and intervention analysis in dTIMS, it is recommended to regularly update treatment unit costs.
	Ensure consistent inflation rate	• The City currently applies a 3% inflation rate for financial planning, whereas dTIMS uses a 1.5% rate in its analysis. It is recommended to revisit the inflation settings in dTIMS to ensure alignment with the City's financial assumptions and improve consistency in future planning.
	Conduct quantitative risk assessment and implement it into pavement management	• It is recommended to develop a quantitative risk framework or model with refined criteria and weighting specific to road assets. The model should be integrated with GIS to allow for efficient updates and visualization of risk information. This risk-based approach will enhance project prioritization and support more effective pavement management.
	Incorporate gravel and surface-treated roads in the PMS analysis	• To improve the analysis, the City is recommended incorporating gravel and surface-treated roads by assessing their condition, traffic volumes, and maintenance history in dTIMS model. Including these networks would provide a more comprehensive view of capital reinvestment needs, support equitable funding decisions, and ensure all road users benefit from long-term planning and investment strategies.
	Balance funding needs and road performance	• The full funding needs analysis indicates that implementing all recommended treatments (Unlimited Scenario) over the next 10 years would require approximately $4.7 billion. Under the current 10-year budget of $322 million, the City would face an average annual decline of 1.2 PCI points. However, by adopting an Incremental Budget scenario (Scenario #4) supported by a dedicated infrastructure levy—resulting in a total budget of $804 million—the City could maintain arterials in Good condition and keep collectors and local roads in Fair condition throughout the next 10-year.
	Explore additional funding sources	• The City could explore some additional funding sources, as described in **Section 5.5**.
	Adopt additional non-financial solutions	• Key approaches include project bundling, optimizing tender timing, phased delivery, and leveraging ROI- or risk-based prioritization. Coordination across utilities, managing disruptions, and engaging councillors also build efficiency and support. The City is encouraged to use internal resources, adjust service levels, and continue multi-year budgeting. Additionally,

AMP Section	Improvement Initiative	Actions
		rationalizing infrastructure by removing underused assets supports long-term sustainability and cost-efficiency.
Continuous Improvement	Improve alignment between operating and capital activities	• Develop a criteria-based framework to guide policies and decisions for rationalizing the road and sidewalk network, supporting coordinated operating and capital planning. • Develop a quantitative, risk-based framework with refined criteria and asset-specific weightings for road assets to improve project prioritization, strengthen pavement management, and better align capital investments with ongoing operating needs.
	Continuously refresh AMP	• Continuously refreshing this AMP at least every five years to align with evolving infrastructure conditions, service level expectations, financial realities, and regulatory requirements. Regular updates allow municipalities to incorporate new data, reassess risks, refine lifecycle strategies, and adjust investment priorities.
	Continue to improve AM initiatives across the City by maintaining a high level of AM awareness through training, communication, and knowledge sharing.	• Develop a Knowledge Retention Strategy & Internal Communications Plan to document staff AM knowledge and experience for reporting and succession planning purposes. Communicate AM improvement initiatives and enhance natural AM awareness internally through internal communication.

Appendix A – Pavement Performance Assessment

A.1 PCI Calculations

Table A-1: Summary of Curve Filters and Expressions

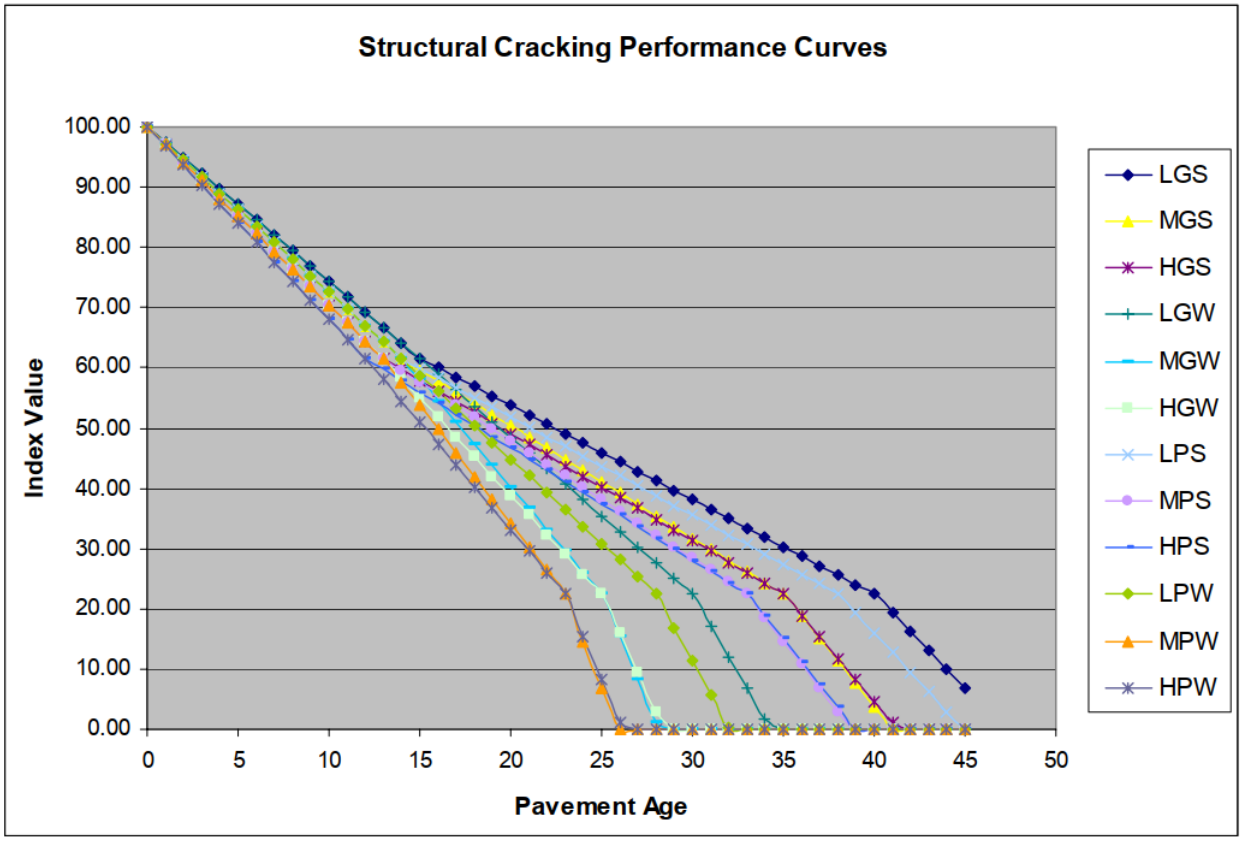
Circumstances	Curve Expression
When no index data is missing	PCI = RUT * 0.15 + RUFF * 0.4 + STCK * 0.3 + NSTC * 0.15
When RUFF index is missing	PCI = RUT * 0.25 + RUFF * 0 + STCK * 0.5 + NSTC * 0.25
When RUT index is missing	PCI = RUT * 0.0 + RUFF * 0.4 + STCK * 0.4 + NSTC * 0.2
When RUFF and RUT indices are missing	PCI = RUT * 0.0 + RUFF * 0.0 + STCK * 0.65 + NSTC * 0.35

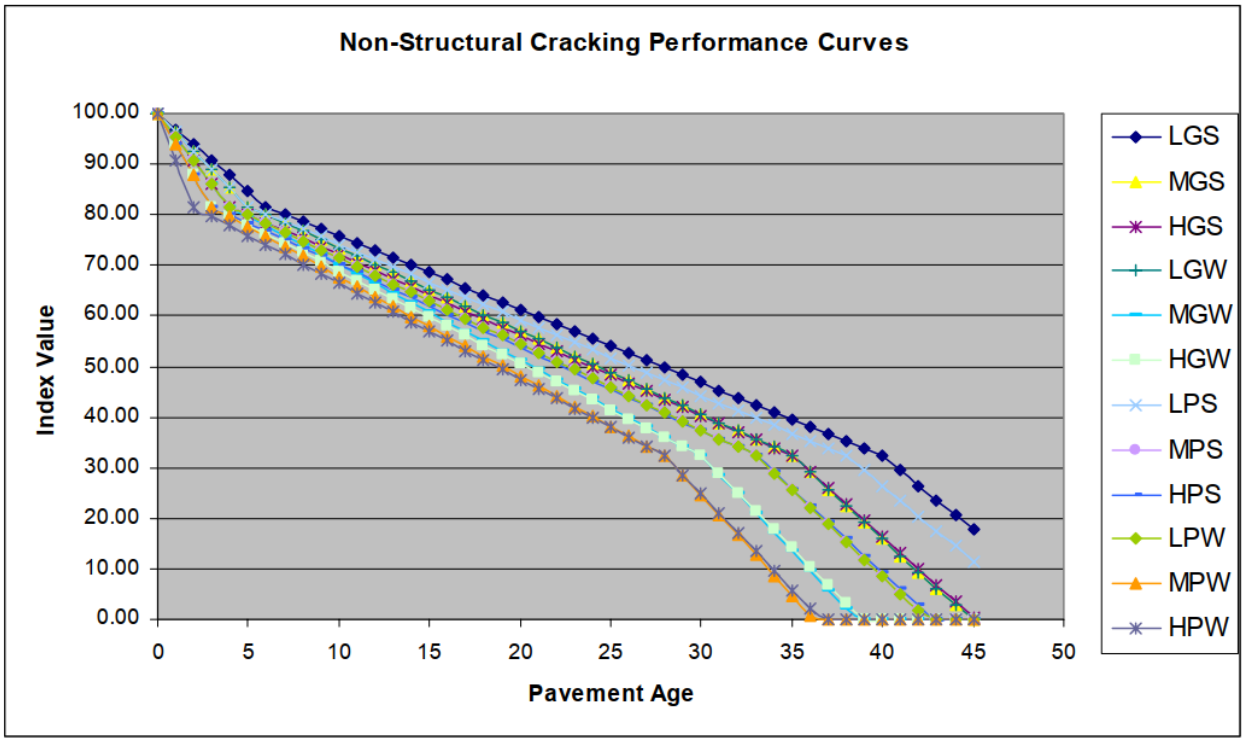
A.2 Performance Curves

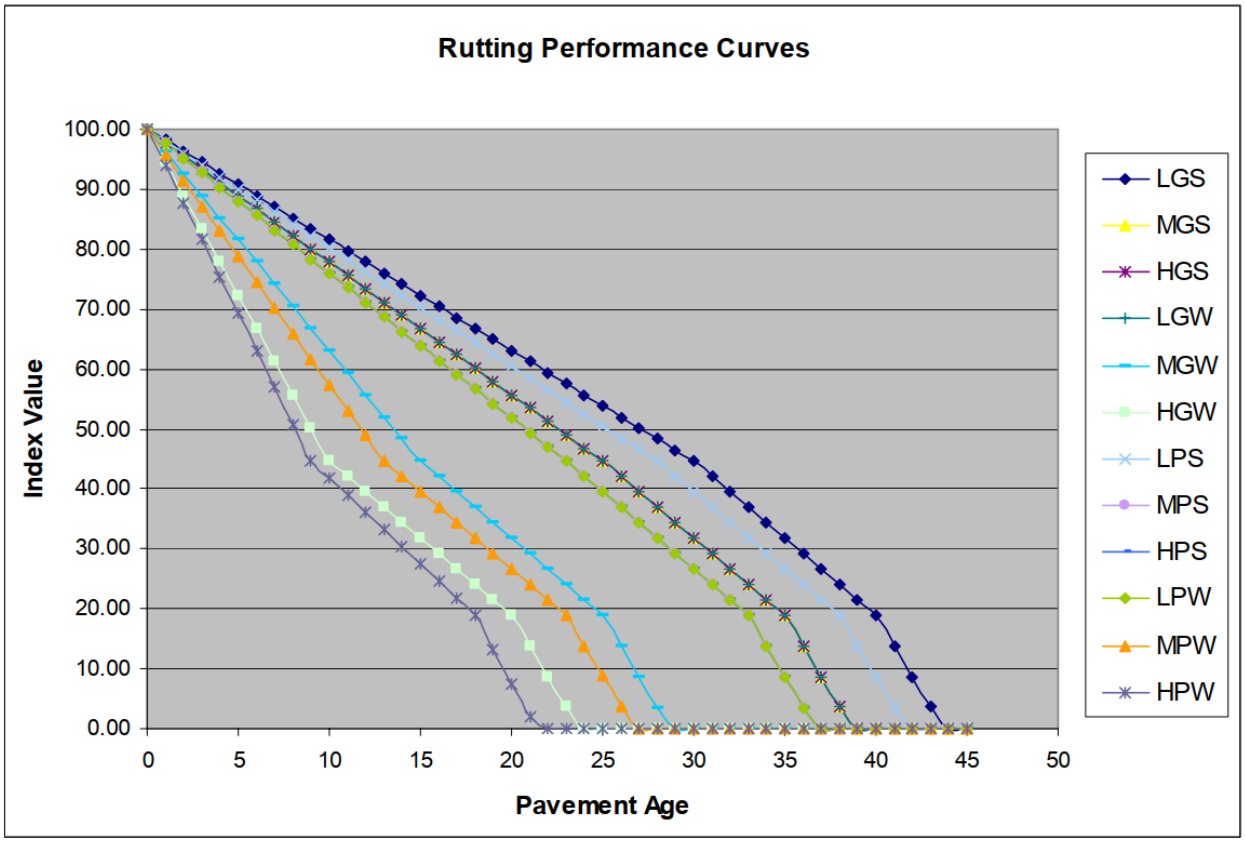
A total of twelve scenarios can be established based on traffic, drainage, and pavement structure conditions, which results in twelve curves for each pavement index. The notation for each scenario is listed in **Table A-2.**

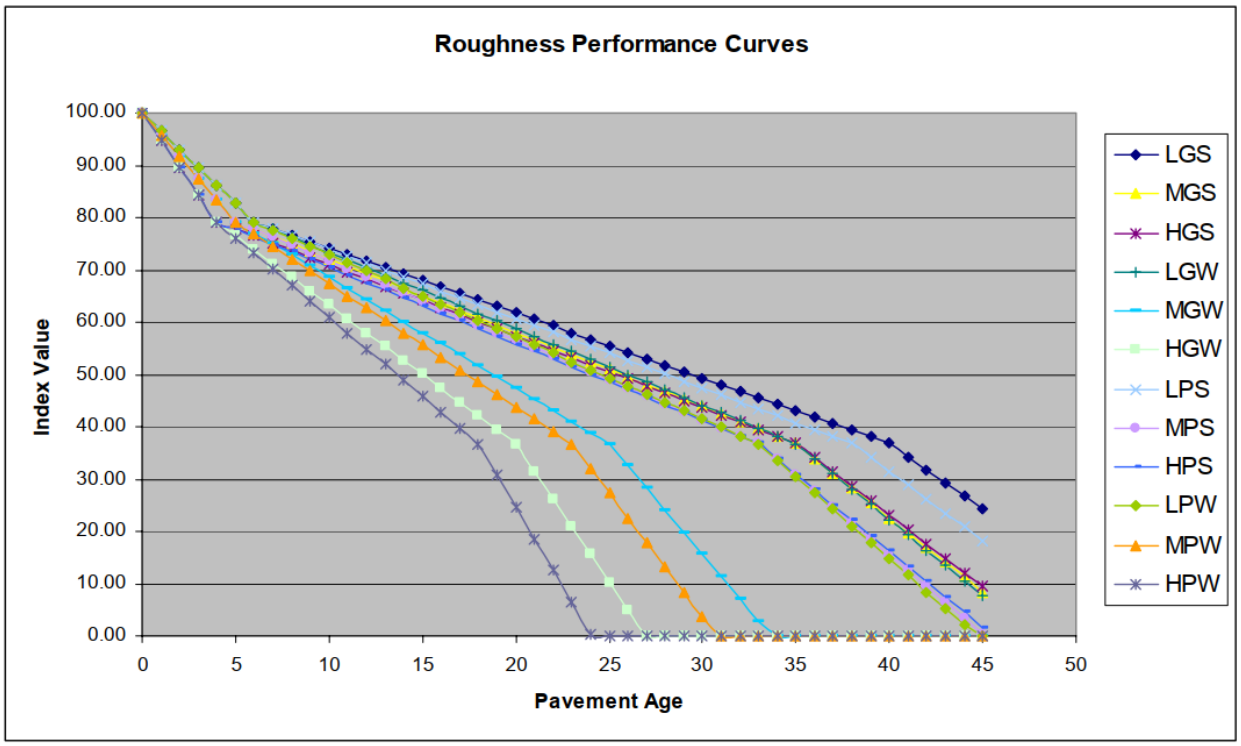
Table A-2: List of Scenarios Representing Different Pavement Condition

Notation	Traffic	Drainage Condition	Pavement Structure
LGS	Low	Good	Strong
MGS	Medium	Good	Strong
HGS	High	Good	Strong
LGW	Low	Good	Weak
MGW	Medium	Good	Weak
HGW	High	Good	Weak
LPS	Low	Poor	Strong
MPS	Medium	Poor	Strong
HPS	High	Poor	Strong
LPW	Low	Poor	Weak
MPW	Medium	Poor	Weak
HPW	High	Poor	Weak




Non-Structural Cracking Performance Curves
Index Value
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0
5
10
15
20
25
30
35
40
45
50
Pavement Age
LGS
MGS
HGS
LGW
MGW
HGW
LPS
MPS
HPS
LPW
MPW
HPW


Rutting Performance Curves
Index Value
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0
5
10
15
20
25
30
35
40
45
50
Pavement Age
LGS
MGS
HGS
LGW
MGW
HGW
LPS
MPS
HPS
LPW
MPW
HPW


Roughness Performance Curves
Index Value
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0
5
10
15
20
25
30
35
40
45
50
Pavement Age
LGS
MGS
HGS
LGW
MGW
HGW
LPS
MPS
HPS
LPW
MPW
HPW

A.3 Treatment Trigger and Reset Logic

Table A-3 is an overview of how each treatment triggers.

Table A-3: Treatment Triggers

Treatment	Budget Category	Trigger Condition
Crack Seal	N/A	N/A
Surface Treatment	Surface treatment	STCK > 28.0 And aav_NSTC > 30.0
Overlay	Capital	STCK > 28.0 And NSTC > 30.0 And RUFF > 35.0
Single Grind & Single Overlay	Capital	Similar to Single Grind & Double Overlay but with a single grind and overlay, suitable for various traffic levels and drainage conditions.
Single Grind & Double Overlay	Capital	Applied in high traffic areas with varying drainage conditions, requiring a single grind and double overlay treatment.
Double Grind & Double Overlay	Capital	Applied primarily in high traffic areas with either good or poor drainage and a strong pavement structure.
Rehabilitation	Capital	Used when rehabilitation is necessary in low to medium traffic areas with good drainage.
Reconstruction	Capital	Targeted for urban, semi-urban, and rural areas, with varied traffic and drainage conditions

Table A-4 details the logic for the variables that are reset when specific treatments are applied. Each treatment affects the four indices in the following ways.

Table A-4: Treatment Reset Logic

Treatment	Reset RUT	Reset RUFF	Reset STCK	Reset NSTC
Crack Seal	N/A	N/A	N/A	N/A
Surface Treatment	Add 10	If Pavement Structure is Strong, add 8 else add 11	If Pavement Structure is Strong, add 7 else add 10	If Pavement Structure is Strong, add 20 else add 15
Overlay	Add 20	If Pavement Structure is Strong, add 10 else add 12	If Pavement Structure is Strong, add 18 else add 34	Add 20
Single Grind & Single Overlay	If Pavement Structure is Strong, add 22 else add 30	If Pavement Structure is Strong, add 10 else add 12	If Pavement Structure is Strong, add 18 else add 34	Add 35
Single Grind & Double Overlay	If Pavement Structure is Strong, add 30 else add 43	Add 12	If Pavement Structure is Strong, add 25 else add 45	Add 40
Double Grind & Double Overlay	If Pavement Structure is Strong, add 32 else add 47	If Pavement Structure is Strong, add 14 else add 22	If Pavement Structure is Strong, add 28 else add 43	Add 45
Rehabilitation	If Pavement Structure is Strong, add 38 else add 58	If Pavement Structure is Strong, add 23 else add 45	If Pavement Structure is Strong, add 32 else add 47	Add 50
Reconstruction	100	100	100	100

Appendix B – Current Asset Management O&M Strategies

B.1 Asset Operations and Maintenance Strategies

Table B-1: O&M Activities for Road and Transportation Assets

Asset Group	Activity Category	Activities Undertaken by the City		Total 5-Year Annual Average Historical O&M Cost
Roads	Summer Maintenance	Asphalt patching	Small Areas	$2,541,000
			Grinding	$212,000
			Machine	$49,000
			Contract patching – shave and pave	$691,000
		Infrastructure – Red patching		$10,000
		Surface Treatment	Preparation	$30,000
		Crack sealing		$169,000
		Gravel Surface Maintenance	Washouts	$503,000
			Gravel resurfacing	$341,000
			Grading	$534,000
			Dust control	$283,000
			Shouldering	$176,000
			Gravel Patching	$322,000
		Roadside Maintenance	Roadside brushing – manual	$101,000
			Roadside brushing – mechanical	$127,000
			Other Roadside Maintenance	$63,000
		Tractor Mowing		$89,000
		Debris pickup		$83,000
		Manual sweeping		$13,000
		Machine sweeping		$166,000
		Intersection sweeping		$57,000
		Street flushing		$5,000
	Winter Maintenance	Grader Mounted Plow		$811,000
		Plow/Spread-Contractors		$3,065,000
		Plow/Spread-Own Crews		$5,362,000
		Snow removal loader		$868,000
		Snow removal operations		$44,000
		Snow dump operation		$159,000
		Stockpile handling winter		$321,000
		Spring clean-up – manual		$88,000
		Spring clean-up – flusher & sweeper		$2,015,000
		Bus stop clearing Snow removal		$175,000

Asset Group	Activity Category	Activities Undertaken by the City		Total 5-Year Annual Average Historical O&M Cost
		Anti-icing		$37,000
		Snow fence maintenance		$15,000
		Asphalt patching winter - Grinding		$1,000
		Asphalt patching winter-hired crews		$840,000
		Asphalt patching winter		$693,000
		Recycled asphalt plant - winter		$86,000
		MPL Winter maintenance MMMS		$163,000
	Drainage*	Open ditches & catch basins – manually		$250,000
		Open ditches – steamer		$167,000
		Winter Ditches		$265,000
		Spring clean-up – catch basins		$2,000
	Traffic & Safety	Lane Line Marking		$587,000
		Pre Marking		$21,000
		Special Marking		$197,000
		Preparation Time		$69,000
		Sign Manufacture		$102,000
		New Signs Installation		$8,000
		Sign Maintenance		$217,000
		Traffic Signal Repairs		$615,000
		Flex Beam Painting		$20,000
		Guide Post Place or Replace		$416,000
		Traffic & Safety-WDFO		$109,000
		Other Safety Devices		$26,000
	Other	Depot/Building		$1,195,000
		Yard & Stockpiles		$596,000
		Facilities Tool Maintenance		$10,000
		Property Restoration		$72,000
		Carpenter Work		$54,000
	Miscellaneous	COVID		$245,000
		Road materials		$30,000
		Tool Repair and Maintenance Roads		$105,000
		Emergency Response		$86,000
		Health & safety training		$323,000
Sidewalks	Sidewalk & Curb Repairs and Maintenance	Sidewalk & Curb Repairs	Curb and sidewalk padding	$170,000
			Curb and sidewalk replacement	$231,000
		Sidewalk & Curb Maintenance	Sidewalk sweeping	$192,000
			Stairs, pedestrian walkway maintenance	$23,000
			Elephant vacuum	$64,000

Asset Group	Activity Category	Activities Undertaken by the City	Total 5-Year Annual Average Historical O&M Cost
		Sanding	$1,017,000
Bike Lanes	Summer Maintenance	Sweeping/cleaning	Under development
		Line painting	
		Shrub/tree pruning	
		Patrol	
		Inspection	
	Winter Maintenance	Plowing	Under development
		Salting	
		Applying abrasive materials	
		Applying other chemical or organic agents	

**Stormwater items covered by Road's budget*

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