City of Barrie
Transportation Asset Management Plan

May 2021
Final

Prepared by Corporate Asset Management Department

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Executive Summary

Introduction

The purpose of this Transportation Asset Management Plan is to support the City's stewardship of its transportation assets, including compliance with regulatory requirements such as Ontario Regulation (O. Reg.) 588/17 Asset Management Planning for Municipal Infrastructure. The Transportation Asset Management Plan summarizes the following:

a) The assets the City relies on to support transportation services to the community.
b) The current levels of service provided by these assets.
c) The assets that will be needed in the future to continue to deliver services safely and reliably, including assets that will be assumed from developments.
d) The activities needed to sustain assets throughout their lifecycles at the lowest possible cost.
e) The funds needed for these assets and activities.
f) The steps to improve future versions of this Transportation Asset Management Plan.

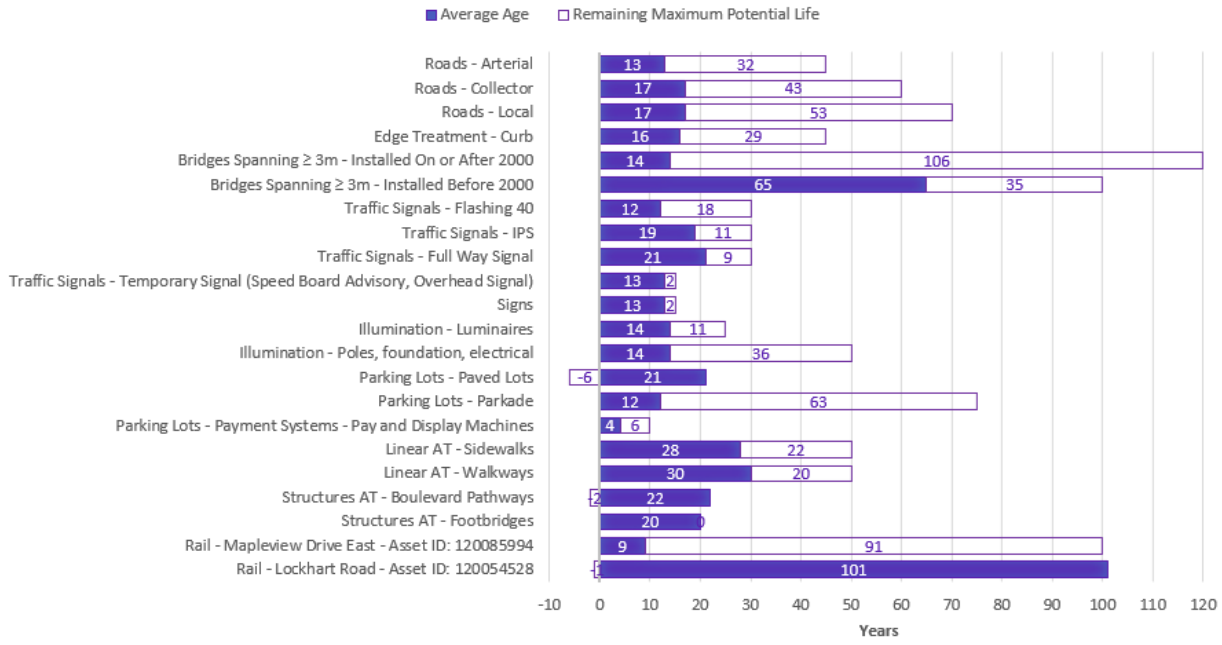
State of Local Infrastructure

The City owns transportation assets with a Current Replacement Value (CRV) of approximately $1.122 billion, including almost 1,600 lane-km of paved roads, 1,140km of curbs, 10 bridges, 2 rail bridges and other assets as shown in Table ES.1. On average, the City's transportation assets are in the early to mid-stages of life, as shown in Figure ES.1

Table ES. 1 - Transportation Asset Portfolio

Asset Type	Unit	Quantity (2020)	CRV (2021$M)
Roads – Pavement – Curbs	Lane-km km	1,583 1,136	$690.5 $119.3
Structures	m^2	5,678	$36.9
Traffic Control	count	20,913	$30.5
Illumination	count	11,743	$101.3
Parking – Lots – Collier St. Parkade	m^2 count	74,731 1	$10.2 $16.7
Active Transportation – Sidewalks, walkways, paths – Pedestrian bridges	 km m^2	 642 493	 $97.1 $2.0
Rail Structures	m^2	199	$14.2
TOTAL			**$1,118.6**

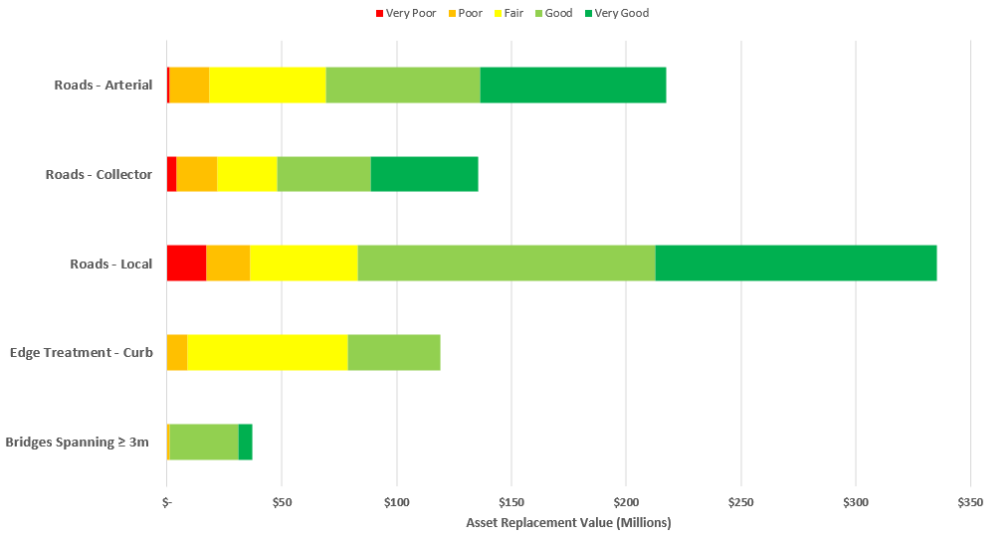
Figure ES. 1 - Average Asset Age



Moreover, in Figure ES.2, the road, curbs and bridge asset conditions, which represent the highest percentage of the transportation asset group (based on replacement costs), are shown in relation to their replacement costs to provide a visual representation of the condition of these assets. this Considering the entire transportation portfolio, the City's transportation assets are generally in **GOOD** condition, with **87.5%** of these assets in fair or better condition, which is referred to as a **"state of good repair"**. However, **12.5%** or **$140.5 million** in City transportation assets are in poor or very poor condition (nearing end of life) and may require short term financial investment. Most of these poor and very poor condition assets are local roads.

<u>Road – Pavement and Bridge Assets</u>

Figure ES. 2 - Transportation Asset Condition



Levels of Service

The purpose of owning assets is to enable service delivery. O. Reg. 588/17 requires that the City track prescribed technical metrics related to the levels of service (LOS) for transportation assets; the transportation technical metrics are listed in Tables ES.2 to ES.4. Performance results are reported for 2020 and will be treated as a baseline for current service level until proposed service level targets are developed as part of the work to meet the next legislated milestone. Targets will be established based on the risk and cost associated with various service level alternatives.

Table ES. 2 - Average Pavement Condition Index

Road Classification	Definition	Current Qualitative Performance (PCI)
Arterial Roads	Mainly provide for thoroughfare traffic along with a high level of connectivity on a relatively regional scale. The City's arterial roads typically receive large traffic volumes. Examples of Arterial Roads are Huronia Road, Essa Road, Mapleview Drive West and East, Big Bay Point Road, Dunlop Street West and East, Ferndale Drive North and South, Cundles Road West and East, Bayfield Street, and Duckworth Street.	77
Collector Roads	Mainly serve to facilitate and distribute traffic between arterial and local roads, and provide a mixture of thoroughfare traffic and property accessibility. The City's collector roads typically receive medium-level traffic volumes and are designated as Major or Minor Collector Roads. Examples of Major Collector Roads are Mapleton Avenue, Bayview Drive, Leacock Drive, and Sunnidale Road.	75
Local Roads	Mainly function to provide non-thoroughfare traffic and property accessibility. The City's local roads typically receive a relatively low level of traffic and include Commercial / Industrial Local Roads and Residential Local Roads.	72
All Roads		75*

*Based on all City owned roads; Private roads and Unassumed roads excluded.

Table ES. 3 - Percent of Bridges with Loading or Dimensional Restrictions

Asset	Percentage (%)
Bridge	8.8

Based on winter weight restrictions and any dimensional restrictions

Table ES. 4 - Average Bridge Condition Index

Asset	Average BCI
Bridge	74.11

Based on 34 Bridges

All three (3) tables are required by O. Reg. 588/17 and summarize the condition of the City's road network and bridges. The City has an overall pavement condition index (PCI) score of 75 for roads and an approximate BCI score of 74 for bridges, representing good condition for both asset types.

Asset Management Strategy

The City plans and undertakes asset lifecycle activities to ensure that it will achieve established service levels. These asset lifecycle activities include creation or acquisition, upgrade, operations, maintenance, rehabilitation, disposal, and replacement. Non-asset solutions are also considered, such as promotion of transit services and active transportation to minimize the need for additional vehicle lanes.

The City has defined asset lifecycle activities specific to each asset type and has forecast that the lifecycle activities needed to sustain the current level of transportation service (excluding growth and upgrade needs) will cost the City **$575M** over the next ten years, as outlined in the Table ES.5.

Table ES. 5 - Operations, Maintenance, and Renewal Needs

Service Attributes	Lifecycle Activity	Comments	10-year Total Needs (2021 to 2030) in 2021$M
Quality and Reliability	Renewal	To bring assets up to a state of good repair	$382
	Maintenance and operations	To maintain assets at a state of good repair	$193
		TOTAL City Costs	**$575**

Funding Implications

The Asset Funding Ratio is an important financial performance indicator as it reports the percentage (%) of funding projected to be available to undertake the lifecycle activities forecast to be needed over the next ten years against a target of 1.0. The following table shows that the City has substantial gaps between needs and available funding forecasts for growth / upgrade and renewal activities over the next ten years.

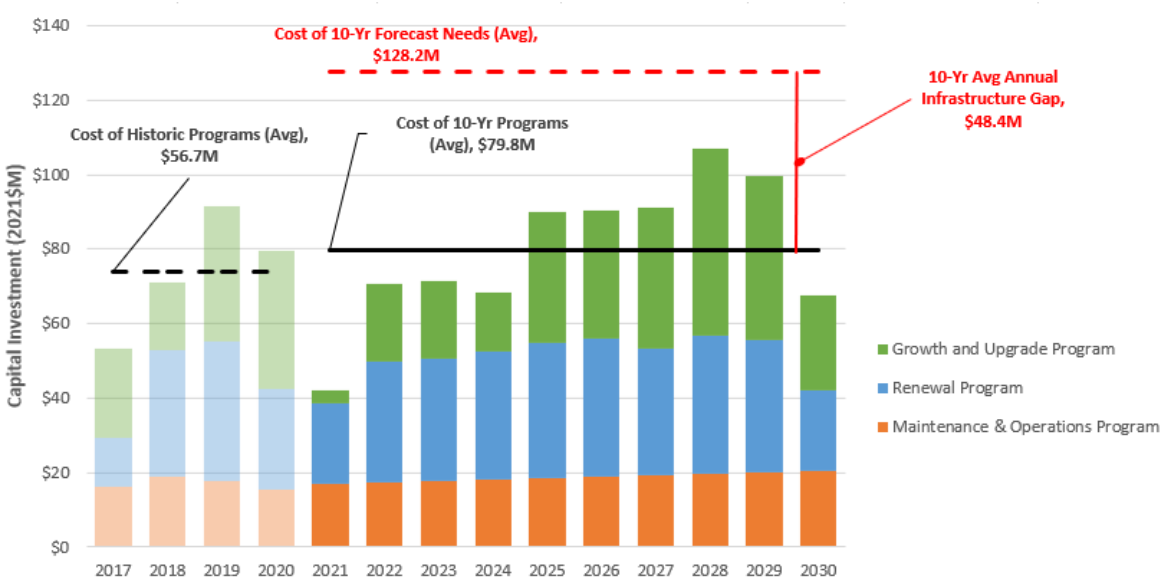
Table ES. 6 - Financial Summary

Service Attributes	Asset Lifecycle Activity	10-year (2021 – 2030) Average Annual Amounts (2021$M/year)			Funding Ratio (Target = 1.0)
		Forecast Needs	Planned Funding	Gap	
Capacity, Use and Function	Growth and upgrade	$70.7	$28.8	$41.9	0.4
Quality and Reliability	Renewal	$38.2	$32.4	$5.8	0.8
	Operations and maintenance	$19.3	$18.6*	$0.7	0.96
TOTALS		**$128.2**	**$79.8**	**$48.4**	**0.6**

*Operations and maintenance budgets are developed annually. Average planned funding for 2021-2030 is based on an assumed 2%/year increase.

The following graph summarizes the data from the preceding table. It shows the total cost of the forecast needed lifecycle activities over the next ten years as **$128.2M per year** (dashed red line) and the budgeted annual funding projected to be available to undertake the forecast needed lifecycle activities over the next ten years as **$79.8M per year** (solid black line). Since the needs exceed the funding, the City has a transportation infrastructure gap of **$48.4M per year** for each of the next ten years. The graph also shows the historical expenditure (light bars and black dashed line as the average at $56.7M per year) and planned expenditures (dark bars).

Figure ES. 3 - Transportation Financial Sustainability



The risks associated with these proposed funding levels and the suggested strategies to manage those risks are as follows:

Table ES. 7 - Risk Mitigation Summary

Service Attributes	Lifecycle Activity	Identified AM Lifecycle Risks	Risk Management Strategy
Quality and Reliability	Renewal	The identified asset renewal needs are not fully funded which may result in impact on asset reliability and service levels. Addressing the backlog of asset renewal needs will add pressure to existing staff resources to deliver a larger renewal program.	Investigate financial implications of expanding the current transportation asset renewal program. Investigate resourcing to deliver a larger renewal program.
	Operations and Maintenance	The operations and maintenance needs associated with a growing asset portfolio will increase operating expenditures. The continued inability to close the gap in the pavement renewal funding will cause increased maintenance requirements for City roads.	Fund operations and maintenance activities to keep transportation assets in a state of good repair.
Capacity, Use and Function	Growth and upgrade	The identified asset growth and upgrade activity needs are not fully funded which may result in poor level of service, failure to meet 2019 Growth Plan and other regulatory obligations. However, progress on development build out may be delayed for unrelated reasons, such as delayed growth. Addressing a backlog of growth and upgrade projects will add pressure to existing staff resources to deliver a larger number of projects.	Monitor the build out of developments and continue to adjust the timing of growth and upgrade projects, and associated cost forecasts as appropriate.

Funding Sources

Current revenue to fund growth related capital transportation projects comes primarily from development charges. Revenue for other capital transportation upgrade and renewal works is provided by general property taxes (through the Tax Capital Reserve), with some coming from the Canada Community-Building Fund (formerly the Federal Gas Tax Fund), as well as grant and debt funding. Current revenue for operations is funded by general property taxes.

Monitoring and Improvement Plan

This Asset Management Plan complies with Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure. The following improvement activities are planned to enable the City to continue to comply with Ontario Regulation 588/17 and improve its asset management practice.

a) **State of Infrastructure:** Continue to improve knowledge of current inventory, value, age, and condition, including regularly recording condition of assets to enable forecasts of remaining life based on observed condition rather than age.

b) **Levels of Service:** Continue to assess current and forecast future performance (over the next 10 years) and define levels of service targets with consideration of risk to and cost of service delivery and the City's fiscal capacity.

c) **Asset Management Strategy:** Continue to improve the management of risks and reduction of costs associated with service delivery through the understanding of effectiveness of currently applied asset management strategies.

d) **Financing Strategy:** Continue to assess the financial sustainability of service delivery for both current and future generations.

Conclusions

Historically, the City has underinvested in its transportation assets. This Transportation Asset Management Plan forecasts **continued underinvestment** over the next ten years; much of this underinvestment is due to growth and upgrade demands, however there is a significant gap relative to renewal needs as well. **This underinvestment is not sustainable and will result in increased costs to replace failed assets as well as level of service impacts such as traffic congestion, degraded roads, and hazardous conditions for pedestrians and cyclists.**

By July 1, 2025, the City is required by O. Reg. 588/17 to provide the proposed levels of service and details on the costs and risks associated with them over the next ten years, with consideration of the full lifecycle of the assets.

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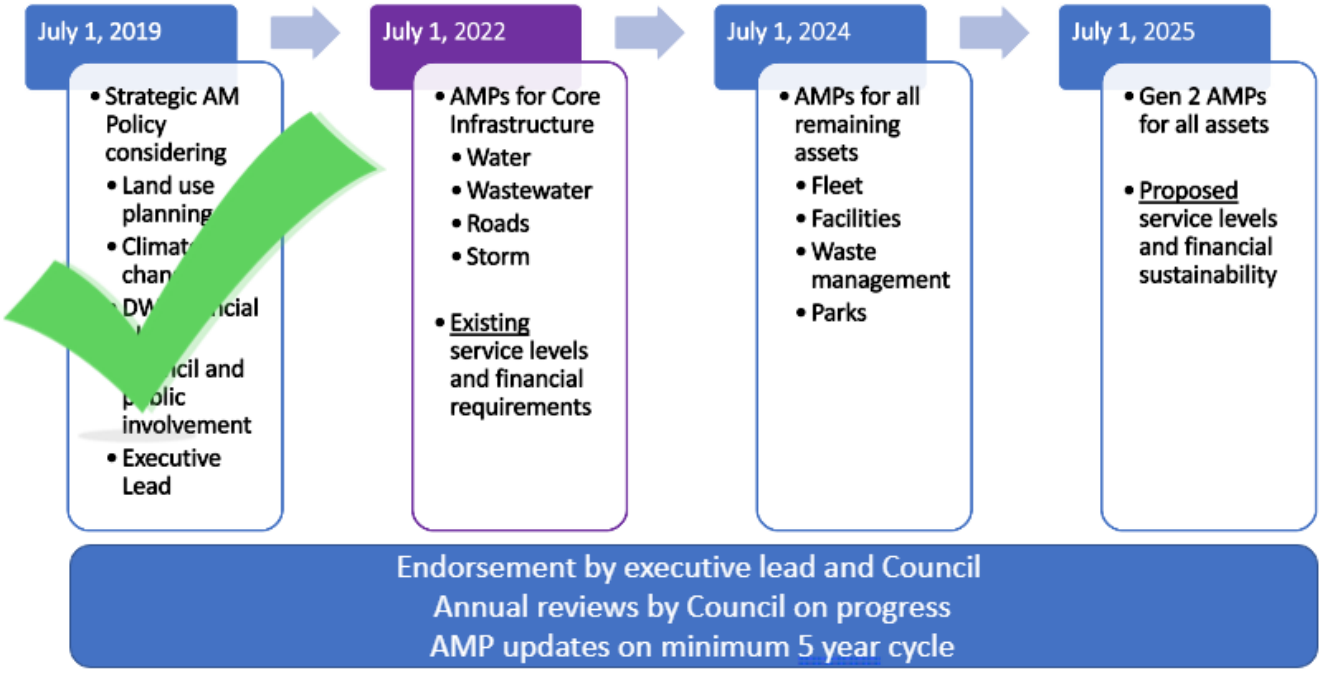
1. Introduction

1.1 Purpose of the Plan

1.1.1 Regulatory Requirements

This Transportation Asset Management Plan (AM Plan) aligns with the City's Corporate Asset Management Policy and year 2022 requirements of Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure (O. Reg. 588/17) made under the *Infrastructure for Jobs and Prosperity Act*. Transportation assets are considered "core municipal infrastructure assets" as defined by the regulation.

Figure 1 - Ontario Regulation 588/17 Requirements



This AM Plan meets the 2022 requirements and covers the next 10-year period. By July 1, 2025, this AM Plan must be updated to also include targets levels of service over the next 10 years, including assessing funding shortfalls and outlining what activities cannot be funded and how the risks of not undertaking those activities will be managed.

Both this Transportation AM Plan and the Strategic Asset Management Policy are posted on the City's website.

1.1.2 Corporate Requirements

The City of Barrie is responsible for a broad portfolio of assets that support transportation services. The City's goals for transportation, provided in the 2010 Official Plan, include:

a) To provide a sustainable transportation system for the safe, efficient, and convenient, movement of people and goods including linkages to the overall Provincial and County transportation system;
b) To provide a transportation system that supports the maximum economic development of the City with minimum social, health and environmental impacts;
c) To promote healthy communities, active living, and energy efficiency; public transit, carpooling, all forms of active transportation, safe integration, and connectivity between these various modes of transportation will be encouraged. Public transit would be a first priority for transportation infrastructure planning and major transportation investments where financially feasible; and
d) To develop the Intensification Areas identified on Schedule I – Intensification Areas of the Official Plan at densities that are transit supportive and provide linkages to major transportation hubs and routes such as the major transit stations.

The City is in the process of updating the OP; the Proposed New OP will continue to promote similar goals/objectives. The wording in the New OP may ultimately be different, but largely the intent will remain the same.

This AM Plan is a short to medium range planning document that is used to support the City's goals by providing a rational strategy for proactively and effectively managing the City's transportation assets. It provides a guide to understanding key items such as:

e) The replacement value and condition of City's transportation asset portfolio
f) The current and any proposed future level of service standards and the City's performance against them
g) The planned activities to sustain current and future transportation assets throughout their lifecycles at minimal cost, while mitigating vulnerabilities
h) The funding sources for planned lifecycle activities
i) The steps to improve future iterations of the AM Plan.

This AM Plan is intended to improve the City of Barrie's ability to achieve its corporate goals and objectives in a way that best serves its customers. It provides a rational framework that enables systematic and repeatable processes to manage costs, risks and levels of service for the City's transportation asset portfolio.

1.1.3 Relationship with Other City Activities and Planning Documents

Transportation AM Planning is a key tactical planning activity that relies on input from strategic planning activities and informs shorter-term decision-making. The AM Plan provides a framework to validate the City's budgeting processes and assist in prioritizing work activities, including capital projects, based on risk. It also discusses levels of service that support goals in the 2018-2022 Barrie City Council Strategic Plan and lifecycle management strategies intended to reduce the overall cost of asset ownership.

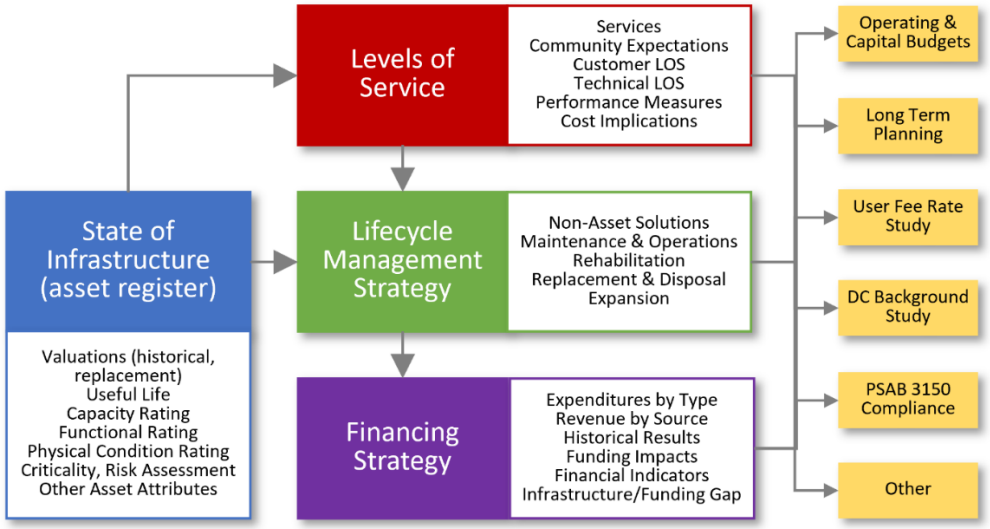
The City's transportation assets are mainly supported by the Tax Capital Reserve and contributions from the Dedicated Infrastructure Renewal Fund (property tax). The Asset Management Plan will provide a detailed valuation of the City's inventory and 10-year needs, which will be used to refine the projected operating and capital budget requirements.

The Asset Management Plan is intended to be read with other City planning documents. This should include the corporate Strategic Asset Management Policy, along with the following associated planning documents:

a) Council's 2018-2022 Strategic Plan
b) Official Plan
c) Climate Change Adaptation Strategy
d) Long-term Master Plans
e) Long Range Financial Plans
f) Operating and Capital Budgets
g) Development Charge Background Study
h) PSAB 3150 Compliance Process.

The relationship of the AM Plan with other City documents is shown below, summarized from the Municipal Finance Officers' Association of Ontario (MFOA) AM Framework.

Figure 2 - Relationship of AM Plan to Other City Documents



1.2 AM Plan Scope, Framework and Methodology

1.2.1 Infrastructure Assets Included in the AM Plan

The AM Plan includes transportation assets owned and operated by the City, like roads, active transportation, and rail bridges (other rail assets such as railbed, tracks, security, facilities, and equipment are not included in this AMP).

1.2.2 Key Stakeholders in the Plan

Key stakeholders of this AM Plan include:

- The City of Barrie community
- Internal Stakeholders:
  - City Council
  - Senior City staff
  - Departmental staff from Infrastructure, Development Services, Corporate Asset Management, Operations, Geographic Information Systems (GIS) and Finance.

1.2.3 Framework and General Methodology

The information presented in the AM Plan is based on O. Reg. 588/17 requirements, the Guide for Municipal Asset Management Plans, originally issued by the Ontario Ministry of Infrastructure, and best in class asset management practices.

The Transportation AM Plan was developed by City staff through:

a) Review of background materials available on the City's web site and internal data including planning documents and budgets.
b) Workshops with internal stakeholders.
c) Regular meetings within the City's project team.
d) Review of interim outputs between the City's project team and other stakeholders.

2. State of the Local Infrastructure

This section describes the City's transportation asset inventory and provides a snapshot of the valuation, age, distribution, and condition of the City's transportation assets. In this Asset Management Plan, the focus will mainly be on pavement, bridges, and rail bridges as they not only make up the majority of the replacement costs for the City's transportation assets, but they are also considered the assets with the highest risks within the transportation asset portfolio.

2.1 Asset Inventory

This Transportation AM Plan covers roads (including pavement, structures, traffic control, illumination, roadside assets, and parking), active transportation, and rail. The City is working to improve its GIS data as it relates to the construction date of roads built before 2000, as well as improving data related to street signs, traffic signals and lights, pay and display machines and retaining walls.

The total estimated replacement value for existing (2020) transportation assets included in this AM Plan is **$1,118 million** (expressed in 2021 dollars), as summarized in Table 1.

Table 1 - Asset Hierarchy, Count and Replacement Value

Sub-Service	Major Asset Group	Process (Sub-Asset Group)	Asset Quantity (2020)	Unit	Replacement Value (2021$)	Comments
Roads	Pavement*	Arterial/Parkway	1,612,586	m2	$217,699,147	
		Collector	1,011,750	m2	$136,586,286	
		Local	3,203,117	m2	$336,222,247	
		Edge Treatment	1,135,731	m	$119,251,755	Install year assumed to be same as road base
	Structures	Bridges Spanning >= 3m	5,678	m2	$36,903,672	
	Traffic Control	Traffic Signals	251	No.	$24,485,750	Install Year prior to 2007 estimated (2007 to 2014 based on PSAB and 2015 to 2021 estimated)
		Signs	20,662	No.	$5,991,214	Install Year prior to 2007 estimated (2007 to 2014 based on PSAB and 2015 to 2021 estimated)
	Illumination**	Luminaires	11,743	No.	$6,165,075	Install Year prior to 1985 estimated (1985 to 2014 based on PSAB and 2015 to 2021 is estimated)
		Pole, Foundation, Electrical	11,743	No.	$95,174,629	Install Year prior to 1985 estimated (1985 to 2014 based on PSAB and 2015 to 2021 is estimated)
	Roadside	Retaining Walls	4871	m2	$3,988,264	Limited install year information & City vs Public owned uncertainties
	Parking	Paved Lots	67,258	m2	$7,062,040	Other parking facilities are included in Facilities and Parks AMPs.
		Parkade	1	No.	$16,700,000	
		Street Parking	7,473	m2	$784,665	
		Payment Systems	127 Pay & Display	No.	$1,470,025	limited install year information available
			392 Meters	No.	$882,000	No install year information on meters
Active	Linear	Sidewalks	617.8	km	$92,671,900	
		Walkways	7.6	km	$1,139,300	
		Boulevard Pathways	9.8	km	$1,135,900	
		Waterfront Bike Path	6.7	km	$2,152,500	
	Structures***	Footbridges	58.0	m2	$230,285	
Rail (BCRY)#	Railbed		-	km	-	Not included
	Trackage		-	km	-	Not included
	Structures	Bridges Spanning >=3m	199	m2	$14,189,890	
	Security	Barrier Wall	-	m	-	Not included
	Facilities	Shed	-	No.	-	Not included
	Equipment	Locomotives	-	No.	-	Not included
Transit	Bus Pads		-	No.	-	Not included (shelters are privately owned)
	Facilities		-	No.	-	Included in Facilities AMP
	Fleet		-	No.	-	Included in Fleet AMP

*Pavement includes surface pavement and road base
**Streetlights without poles account for approximately 10% of illumination assets. Some of these assets seem to be included in PSAB but are not included in this AMP.
***Structures within a park or a trial network were not captured within this AMP
#The City has a full rail system including rail tracks, signals, lights, etc., but the only assets that are captured in this AMP are the two (2) existing rail structures (bridges)

2.2 Installation Profile and Age

The following graphs show the replacement value of the transportation system assets by decade of installation. The road installation profile, Figure 3, below reflects the significant amount of infrastructure construction starting in the 1980s and peaking in the 1990s. The other transportation asset figures show significant construction occurring in various decades, with the majority happening in the 1990's and 2000's. On each of the figures, percentages can be found above the bars indicating the relative proportion of that decade's cohort to the total installed portfolio.

Figure 3 - Installation Profile - Roads

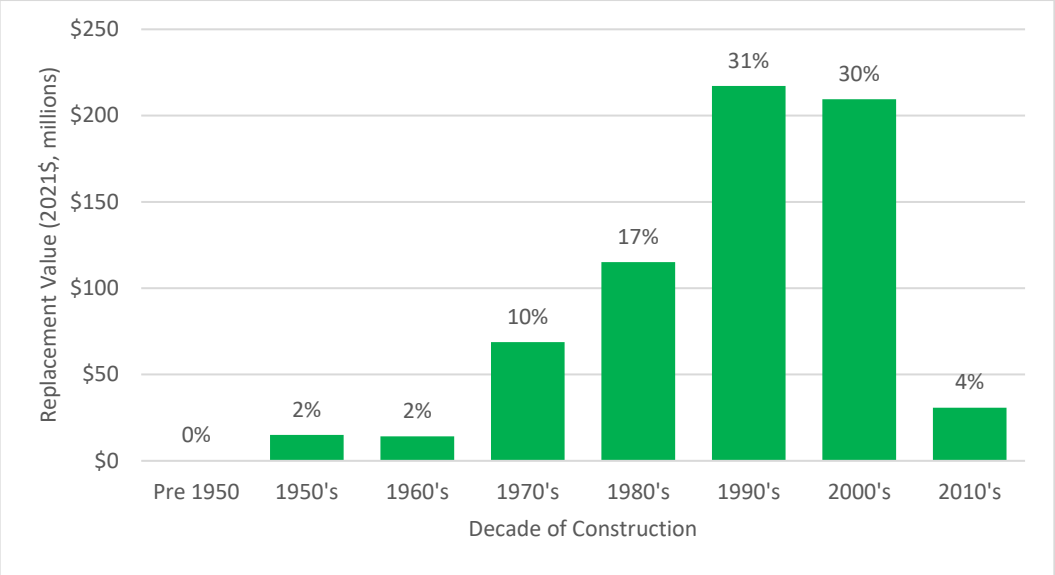


Figure 4 - Installation Profile - Bridges

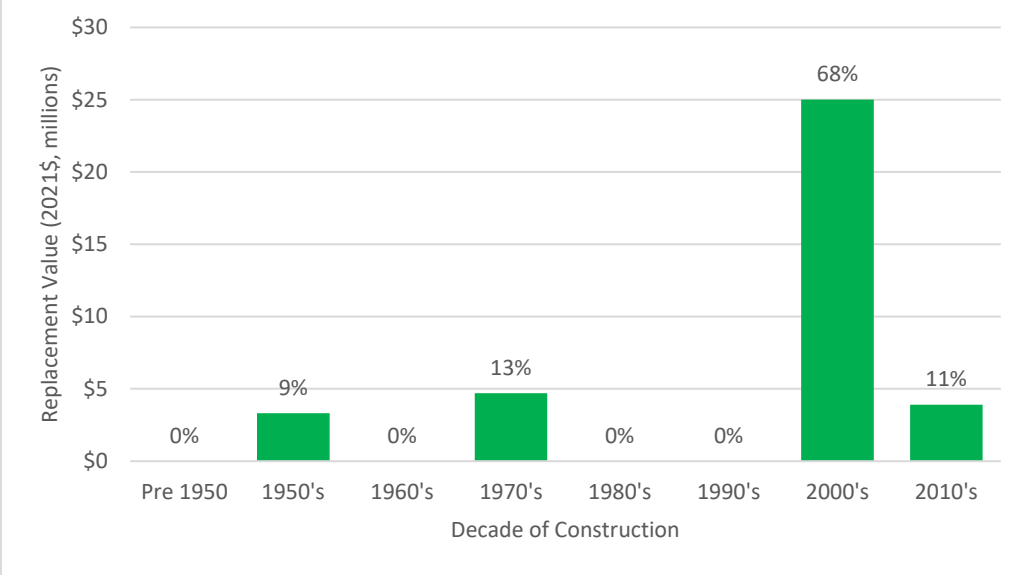


Figure 5 - Installation Profile - Rail - Bridges

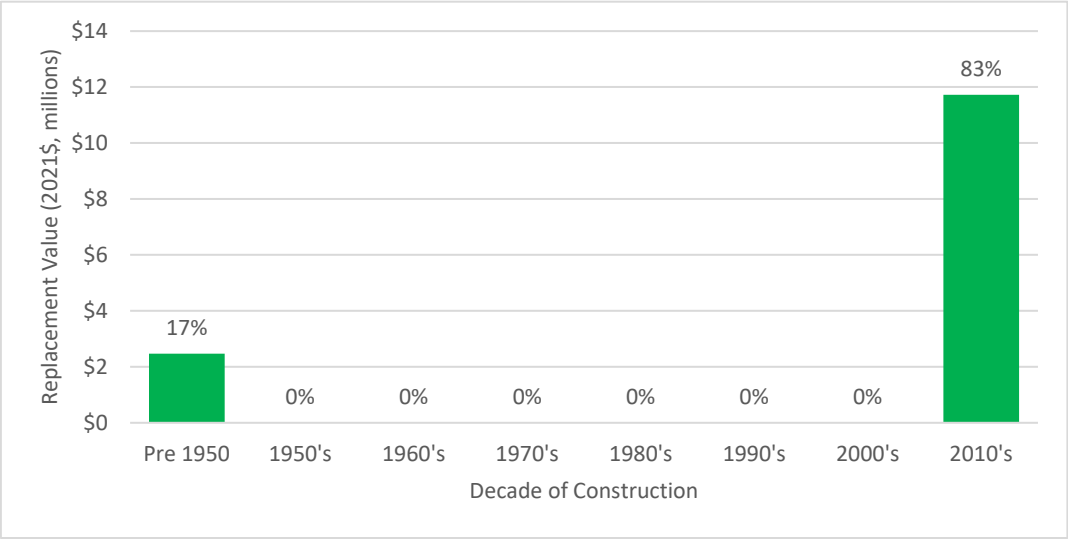
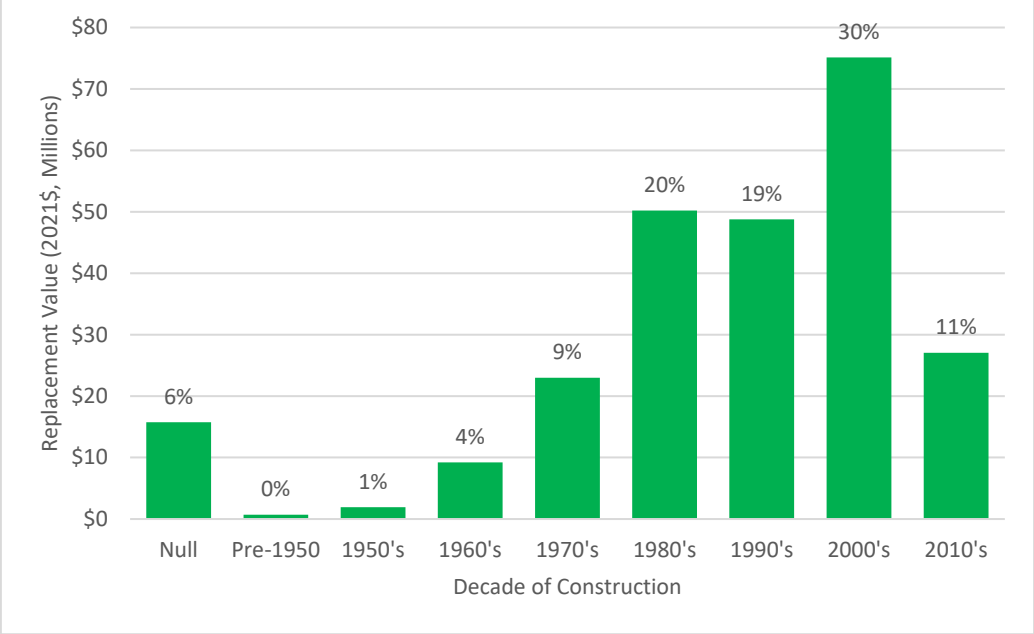


Figure 6 - Installation Profile - Remaining Transportation Assets

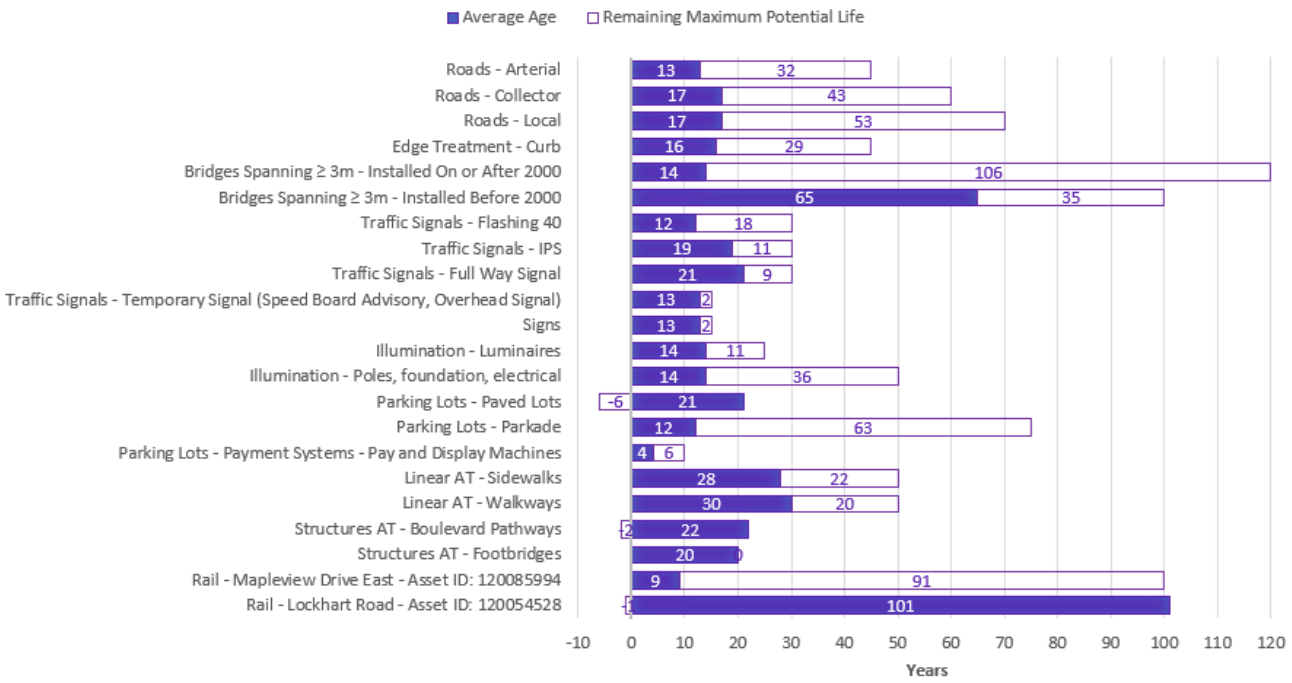


The average age and remaining life of the City's transportation assets are summarized in Figure 7. Due to the substantial infrastructure growth in the past few decades, the majority of road infrastructure has approximately 70 to 75% of its maximum potential life (MPL) remaining. This is expected considering the relatively recent construction dates noted in Figure 3. The importance of preserving roads is significant for a municipality with such a large quantity of relatively young roads, as allowing them to fall into poor condition would result in a very large expense to reconstruct these roads over a short period of time. These cohorts of Barrie's pavement assets as well as the implications of not investing in pavement preservation will be further discussed in Section 4 of this AM plan.

Bridges that were constructed after 2000 still have approximately 90% of their life remaining and bridges that were built before 2000 have approximately 35% of their life remaining on average. Due to the lower MPL of traffic signals/sign/etc., the estimated remaining life of these assets varies widely between 15% to 60%.

The average age of the City's parking lots is currently over the MPL for that asset class. This means that many parking lots are approaching or have passed the end of their useful lives and will require replacement or renewal in the near future. In the active transportation asset class, sidewalks and walkways have approximately 40 to 45% of their life remaining, while boulevard pathways and footbridges are, on average, currently at or past their MPL. Finally, it is important to note that the Lockhart Rail Bridge is currently 1 year over its MPL of 100 years. Any asset with its average age greater than its MPL generally means that the asset will require replacement shortly.

Figure 7 - Average Transportation Asset Age



2.3 Asset Condition

In this Transportation AM Plan, the term “condition” refers to the degree of physical deterioration of the asset. Asset condition is a measured or estimated assessment of an asset’s current position or place on an asset deterioration curve. An industry standard general condition grading system that provides ratings from Very Good to Very Poor asset condition is summarized in the table below. This generic rating scale is used to translate technical condition information in a way that is easily understood and allows for comparison between different asset classes.

Table 2 - General Condition Grading System

Grade	Description	Condition Criteria)
VG	Very Good	Very Good Condition – Asset is physically sound and is performing its function as originally intended. Required maintenance costs are well within standards & norms. Typically, asset is new or recently rehabilitated.
G	Good	Minor Defects only – Asset is physically sound and is performing its function as originally intended. Required maintenance costs are within acceptable standards and norms but are increasing. Typically, asset has been used for some time but is within mid-stage of its expected life.
F	Fair	Requires Maintenance – Asset is showing signs of deterioration and is performing at a lower level than originally intended. Some components of the asset are becoming physically deficient. Required maintenance costs exceed acceptable standards and norms and are increasing. Typically, asset has been used for a long time and is within the later stage of its expected life.
P	Poor	Requires Renewal – Asset is showing significant signs of deterioration and is performing to a much lower level than originally intended. A major portion of the asset is physically deficient. Required maintenance costs significantly exceed acceptable standards and norms. Typically, asset is approaching the end of its expected life.
VP	Very Poor	Asset unserviceable – Asset is physically unsound and/or not performing as originally intended. Asset has higher probability of failure or failure is imminent. Maintenance costs are unacceptable, and rehabilitation is not cost effective. Replacement / major refurbishment is required.
	Failed	Asset unserviceable – Asset is physically unsound and/or not performing as originally intended. Asset has higher probability of failure or failure is imminent. Maintenance costs are unacceptable, and rehabilitation is not cost effective. Replacement / major refurbishment is required.

Some assets undergo inspections intended to locate and prioritize existing and potential unsafe conditions and determine if asset conditions are compliant with a specific standard. In other cases, inspections focus on condition assessment and tend to focus on performance rather than compliance. These condition assessments are intended to help locate where on the decay curve an asset is, from 100% to 0%. Condition Assessments do not ignore unsafe conditions; however, their goal is to evaluate the asset performance throughout all stages of its lifecycle. Pavement, structures, and parking lots undergo condition assessments and are assigned condition ratings by the City. Other assets, such as sidewalks, curbs, traffic control, and illumination assets are inspected to identify compliance with set standards. For these other assets, condition rating is subjectively estimated based on age.

2.3.1 Road Pavement Condition

The City has typically retained a contractor to conduct a network-wide pavement condition assessment on a four-year cycle, with the most recent assessment completed in 2019, and previously in 2014. In 2019, the City of Barrie performed surface distress assessment for all flexible, composite, and rigid pavements in accordance to the latest version of ASTM 6433, Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys. This assessment included the collection of surface distress data.

The most recent 3 pavement condition assessments used automated data collection methods. In 2019, the City hired a contractor to obtain and process continuous surface condition data, including bleeding, bumps and sags, corrugation, cracking (longitudinal, transverse, edge, alligator, block), depressions, lane / shoulder dropoff, patching, polished aggregate, potholes, ravelling, rutting, shoving, swelling, and weathering. The severity and extent of each distress was recorded using lasers, and other truck mounted data collection systems. The severity reports how bad the defect is (e.g., the width and depth of the cracking), while the extent is a record of how much of the area is affected by the distress. This information is used to calculate the Pavement Condition Index (PCI) for each road segment. A pavement surface starts with a PCI value of 100, meaning it is perfect. Based on the severity and type of distresses observed, the PCI is reduced to determine the final score. More information regarding this methodology can be found in ASTM D6433.

The conversion scale used to determine the Very Good to Very Poor condition ratings for roads based on the PCI is provided in the Figure 8 below.

Figure 8 - Condition Grading Scale for Roads

PCI	100	>90	>85	>80	>75	>70	>65	>60	>55	>50	>45	>40	>35	>30	>25	>20	>15	>10	<=10
Road																			
Grade Scale	Very Good			Good			Fair			Poor			Very Poor/Failed						

The current PCI grading scale for roads differs from that used in the previous AMP. In the previous Transportation AMP, the PCI grading scale had been broken down into different ranges and ratings for each road classification (Arterial, Major Collector, Minor Collector and Local). This had the benefit of incorporating the relative criticality of the different road classifications into the grading scale. However, this way of portraying road conditions created problems in interpreting the condition rating as, for example, a "good" local road might in reality look as bad or worse than a "poor" arterial road. This made it difficult for staff to communicate road condition ratings to various stakeholders. The new condition grading scale will be more useful as it will better reflect what residents and councillors see throughout the city. The grading scale shown in Figure 8 is based on the City's pavement management system, Streetlogix, as well as industry best practice.

In addition to the PCI, the City tracks other pavement performance metrics, which are discussed in Section 3, Levels of Service.

As all assets age they deteriorate. At the start of an asset's service life its condition is considered very good, from there it will progressively deteriorate until it requires replacement. For most assets, Life Cycle Activities (LCA) can be completed to extend service life and defer more costly activities such as reconstruction. Life cycle activities are further discussed in Section 4.

2.3.2 Structure Condition: Bridges

Bridges currently undergo a detailed inspection every two years following the guidelines in the Ontario Structure Inspection Manual (OSIM). The OSIM sets standards for the visual inspection and condition rating of bridges and their elements. It covers the complete inspection process, pre and post inspection operations, inspector qualifications, inspection frequency, inspection descriptions, and technical information to clearly identify structural elements, material defects and performance deficiencies. Although major culverts are classified similarly as bridges under the OSIM, major culverts have not been included in this AMP because they have been included as part of the Stormwater AMP completed in 2020.

During OSIM inspections, the inspector assesses each bridge element and records details about the condition of each element, or the condition of parts of each element as the condition of an element may not be the same throughout. The inspector also records performance deficiencies and recommends maintenance and renewal activities.

The following ratings are used in the OSIM to describe the condition of different bridge elements:

a) Very Good: refers to an element (or part of an element) that is in "new" (as constructed) condition. No visible deterioration-type defects are present, and remedial action is not required. Minor construction defects do not count as visible deterioration-type defects.

b) Good: refers to an element (or part of an element) where the first sign of “light” (minor) defects is visible. This usually occurs after the structure has been in service for a number of years. These types of defects would not normally trigger any remedial action because the overall performance of the element is not affected.
c) Fair: refers to an element (or part of an element) where medium defects are visible. These types of defects may trigger a “preventative-maintenance” type of remedial action (e.g., sealing, coating, etc.) where it is economical to do so.
d) Poor: refers to an element (or part of an element) where severe and very severe defects are visible. In concrete, any type of spalling or delamination would be considered “poor” because these defects usually indicate more serious underlying problems in the material (e.g., corroding the reinforcing steel). These types of defects would normally trigger rehabilitation or replacement if the extent and location affect the overall performance of that element.

Overall bridge condition is reported in terms of a single value called the Bridge Condition Index (BCI). The BCI is calculated as a weighted average of the condition states for each of the elements making up the structure. Since all elements are not of equal importance to the structure, the index is weighted according to the relative value or importance of each element in the total.

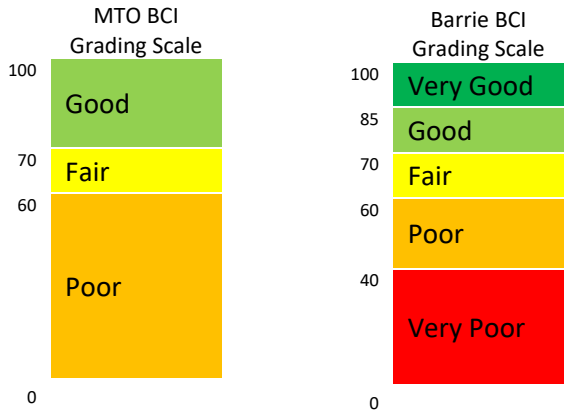
- BCI = Current Element Value / Total Replacement Value × 100

BCI ranges from 100 (new) to 0 (all elements poor condition). A low BCI is an indication that significant maintenance work is required on a bridge in the near term to keep the bridge in service. The BCI rating doesn’t necessarily indicate a bridge’s ability to carry traffic loads. It helps determine which bridges may need repair or replacement and are not a potential for collapse. Upon determining a bridge’s need for significant repair or full replacement, more intensive testing, including destructive testing if appropriate, might be required to determine if major repair or full replacement is required.

According to the Ministry of Transportation, Ontario (MTO website), bridges with a BCI of 70 or above are generally considered to be in good or very good condition, and below 60 to be in poor or very poor condition. This rating scale is translated to the City’s 5-point scale as follows – retaining the 60 to 70 “Fair” band for consistency with the MTO BCI rating scale.

The City maintains a bridge database including an inventory and historical information for each bridge such as the length, number of spans, the area of each span, details of bridge elements, the results from past inspections, and the most recent BCI and condition rating.

Figure 9 - Condition Grading Scale for Bridges



2.3.3 Structures Condition: Rail

Under the Railway Safety Management Systems (SMS) Regulations, a railway company is required to implement and maintain systems to manage safety of all aspects of railway operations. The Bridge Safety Management Plan (BSMP) shall form part of, and be referenced in, a railway company's SMS.

Load Capacity: Each railway authority should determine the load capacity of each of its bridges. The load capacity is intended to be the safe load capacity not the ultimate or maximum load capacity. The railway bridge load capacity may be expressed in terms of numerical values related to a standard system of railway bridge loads but should in any case be stated in terms of weight and length of individual or combined cars and locomotives, for the use of transportation personnel.

Bridge Inspection: Each railway authority's BSMP should provide for an effective bridge inspection program. The railway authority should clearly define and document the different types of inspections to be undertaken for their bridges, including the frequencies of these inspections in their BSMP. Types of inspections include but are not limited to cursory, visual, detailed, mechanical, electrical, underwater, special, etc. The railway authority should conduct regular comprehensive visual inspections of each bridge, at least once every year with not more than 540 days between any successive inspections, and maintain records of those inspections that include the date on which the inspection was performed, the precise identification of the bridge inspected, the items inspected, and accurate description of the condition of those items, and a narrative of any inspection item that is found by the inspector to be a potential problem.

The Barrie Collingwood Railway (BCRY) is operated by Cando on the City's behalf. Cando is responsible for the BSMP and associated inspections for the BCRY. Additionally, the City conducts OSIM inspections on the bridges through the structure inspection program.

2.3.4 Other Transportation Asset Condition

2.3.4.1 Curbs

Curb data was obtained through the 2019 Road assessment project, and a rating from 1 to 3, based on the visual condition only, will be used in this AMP. Translation from the City's 3-point condition rating scale (Good=3, Fair=2, Poor=1) to a 5- point scale was carried out as follows:

Table 3 - Condition Grading Scale for Curbs

5 Point Condition Rating	3 Point Condition Rating		Remaining Life of Asset
Very Good	Rated as Good = 1	and	Remaining Year >= 50% MPL
Good	Rated as Good = 1	and	Remaining Year < 50% MPL
Fair	Rated as Fair = 2	and	Remaining Year >= 50% MPL
Poor	Rated as Fair = 2	and	Remaining Year < 50% MPL
Very Poor	Rated as Poor = 3	and	N/A

2.3.4.2 Traffic Control

In this AMP, the condition of signs was estimated based on age. In the near future, the City is planning to begin assessing sign reflectivity, using a reflectometer, which is being used as best practice throughout the industry as per ASTM D 4956-95 or CGSB 62-GP11M as stated in the Ontario Traffic Manual. Minimum Maintenance Standards regulation, O. Reg. 239/02, requires municipalities to inspect their regulatory and warning traffic signs annually for retro-reflectivity (see: Sections 11. (0.1) and 12. (1)). Sign retro-reflectivity inspection options include the use of a reflectometer or visual inspection by trained personnel. Sign retro-reflectivity inspections using the visual inspection method, as outlined in the Ontario Traffic Manual, must be undertaken at night.

In this AMP, traffic signal condition was also estimated based on age. It is recommended that the City record condition ratings during inspections. According to Minimum Maintenance Standards, for traffic control signal sub-systems, the minimum standard is to inspect, test and maintain the following traffic control signal system sub-systems once per calendar year, with each inspection taking place not more than 16 months from the previous inspection:

1. The display sub-system, consisting of traffic signal and pedestrian crossing heads, physical support structures and support cables.
2. The traffic control sub-system, including the traffic control signal cabinet and internal devices such as timer, detection devices and associated hardware, but excluding conflict monitors.

3. The external detection sub-system, consisting of detection sensors for all vehicles, including emergency and railway vehicles and pedestrian push- buttons. O. Reg. 239/02, s. 14 (1); O. Reg. 47/13, s. 13 (1).

2.3.4.3 Illumination

Illumination assets are assessed on a routine basis by the City's Road Patrol group. Additionally, the public is encouraged to report burned out streetlights via the City's website, Service Barrie, email, or through social media such as Twitter. According to the Minimum Maintenance Standards, all luminaires are to be inspected to check to see that they are functioning at least once per calendar year, with each inspection taking place not more than 16 months from the previous inspection (O. Reg. 23/10, s. 6; O. Reg. 47/13, s. 10 (1)). In this AM Plan, linear deterioration based on age is used to determine the condition rating for luminaires and associated poles and electrical assets.

2.3.4.4 Roadside

Some retaining walls are inspected following the guidelines in Ontario's Structure Inspection Manual (OSIM). The inspection includes assessment of material defects and performance defects which are combined into an overall component condition rating. It is recommended that the City perform these assessments every 2 years as per the OSIM, however more work is needed to document and prioritize the City's retaining wall inventory. Noise walls and guide rails are not specified in the Minimum Maintenance Standards but should also be inspected for failures, following inspection frequencies for similar assets (e.g. two years for retaining walls). It is recommended that the City perform a comprehensive review of its retaining wall asset inventory, including identification of location, material, size, etc. Other information such as ownership and departmental responsibility should also be determined as part of this exercise.

2.3.4.5 Parking

Paid parking lots (in the downtown core) underwent condition assessment as part of the 2019 road condition assessment. The City uses this data to determine the severity and extent of distresses for asphalt parking lots. The PCI values that were calculated for each parking lot allows the City to determine the condition of each of the parking lot as a whole.

For the Collier Street Parkade, age was used to determine the condition. This $16.7M asset is in very good condition because it was recently constructed in 2009 and has an estimated MPL of 75 years.

Street parking and gravel lots were not included in the condition graph because the street parking was encompassed under the road pavement section and there is limited data related to the condition or age of gravel lots. Completing a condition assessment of a gravel lot is very different from completing one on an asphalt lot, and therefore gravel lots are not included in the pavement condition assessment program. Additionally, because a gravel lot is

relatively easy to repair by adding granular material and/or regrading, the risk of failure is lower than that of asphalt lots.

2.3.4.6 Active Transportation – Sidewalks, Walkways, Boulevard Pathways

O. Reg. 239/02 states that "the minimum standard for the frequency of inspecting sidewalks to check for surface discontinuity is once per calendar year, with each inspection taking place not more than 16 months from the previous inspection." The City determines condition of linear active transportation assets by visual inspections that capture types of defects, including:

- Trip Ledge
- Settling
- Cracking
- Heaving
- Other-Sidewalk

These inspections only capture conditions that exceed the thresholds considered acceptable for each defect. The inspection is not a condition assessment in that inspections do not objectively evaluate the assets condition throughout the entire condition range. Inspections only capture conditions that exceed the thresholds considered acceptable. The condition of sidewalks was determined based on age. If there were locations with no installation data, the age of the sidewalk sections was assumed to be the same as the age of the associated road segment.

Boulevard pathways and walkways were assigned a rating based on age due to limited inspection data.

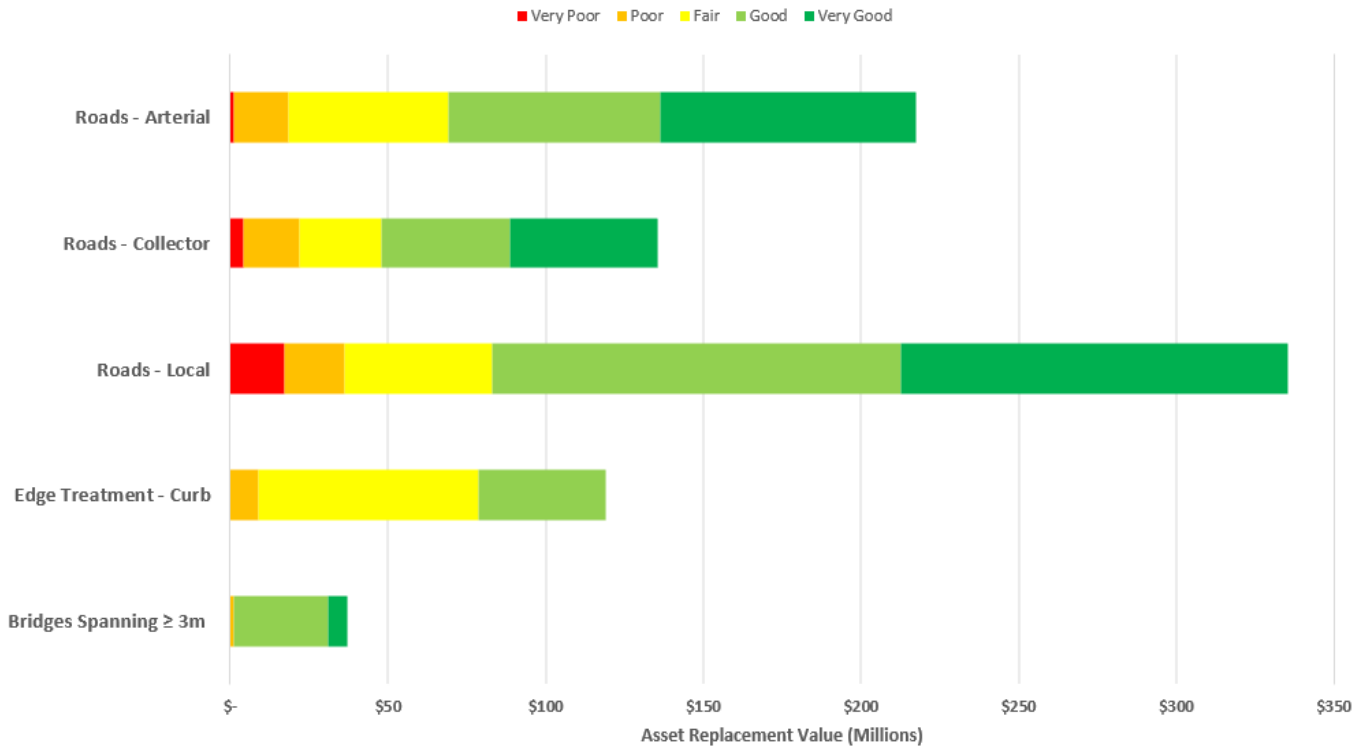
It is recommended that the City obtain a condition assessment of the sidewalks every 6-8 years, either as part of the road condition assessment or as an individual project.

2.3.5 Asset Condition Summary

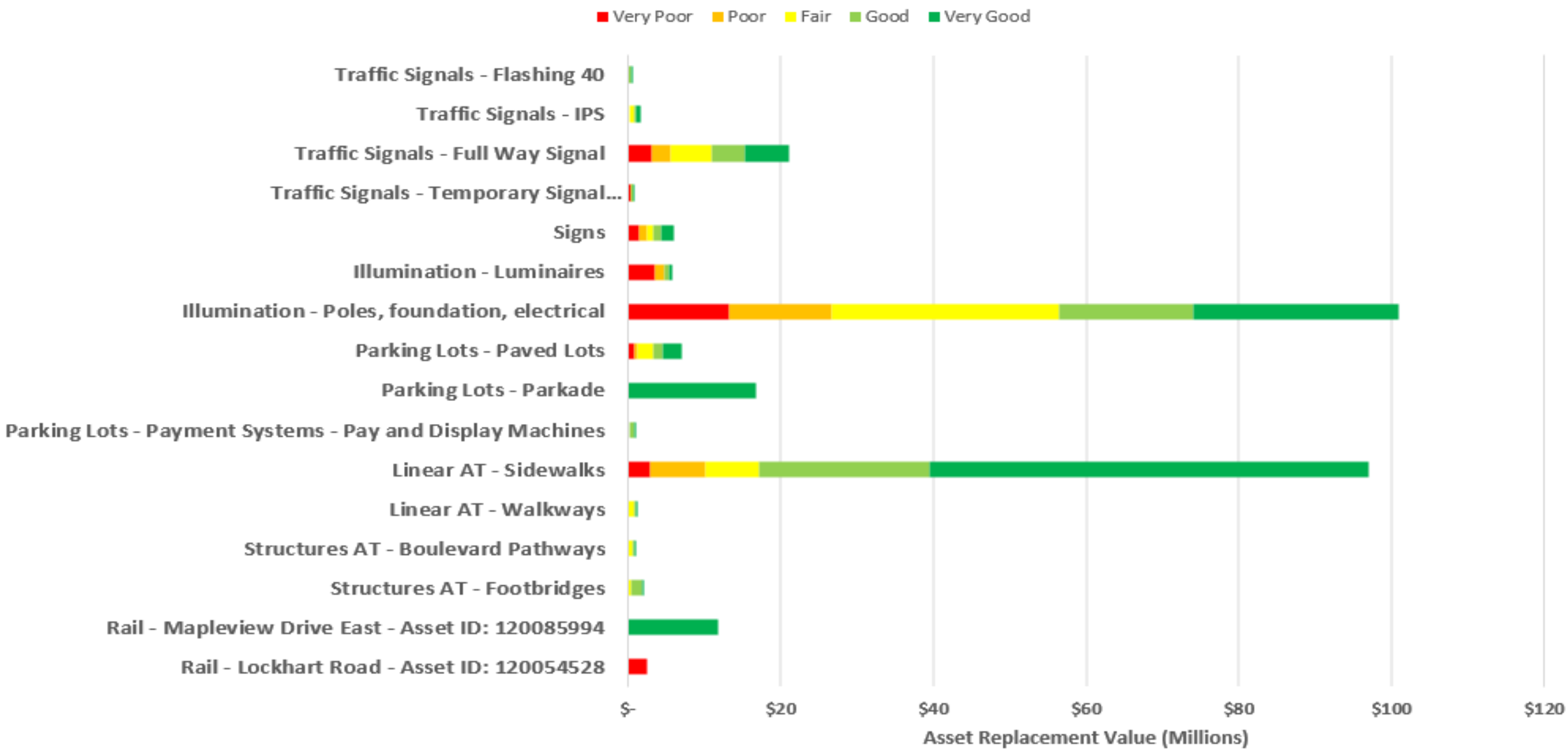
The chart below illustrates the condition of transportation assets by asset value. The City's transportation assets are generally in good condition, with 87.5% of these assets in fair or better condition, which is referred to as a "state of good repair". However, 12.5% or $140.5 million worth of the City's transportation assets are in poor or very poor condition and require short term financial investment. Most of these poor and very poor assets are streetlights, bridges, local roads, and the Lockhart Rail bridge that need replacement.

Figure 10 - Transportation Asset Condition

Road – Pavement and Bridge Assets



Remaining Transportation Assets

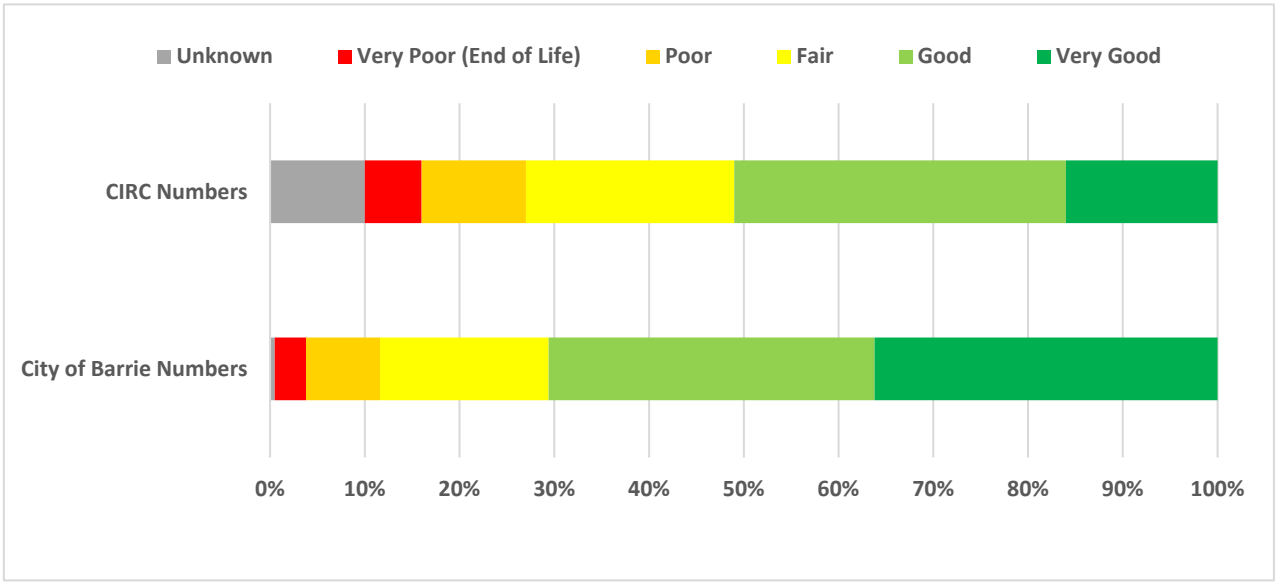


2.4 City of Barrie Transportation Asset Condition in the National Context

The Canadian Infrastructure Report Card (CIRC) provides an assessment of the health of municipal infrastructure as reported by cities and communities across Canada. The 2019 CIRC assessed the state of municipal roads and bridges, public transit, buildings, sport and recreation facilities, stormwater, wastewater, and potable water infrastructure. Each public infrastructure agency qualitatively assessed their infrastructure according to a five-point rating scale ranging from Very Good to Very Poor or Unknown.

The following figure shows the results for transportation (roads and bridges) assets as reported in the 2019 CIRC compared to the City's transportation assets. The condition for a small portion of transportation assets across Canada is unknown (10%), with the City having a much better knowledge of condition. The City's linear assets are in much better condition than the national average, partially due to heavy growth over the last 40 years and the relative youth of the city's transportation system. To ensure generational equity (i.e. that the generation that uses the assets pays for the assets), the City should ensure adequate funding to renewal programs to enable the City to proactively preserve transportation assets to maximize their useful lives and financial efficiency.

Figure 11 - Barrie Transportation Asset Condition vs. National Average



2.5 Data Sources

The inventory was mainly developed based on GIS data (from the City's GIS Data January 26, 2021) and estimated construction costs for each asset class. Unassumed, private and provincially owned assets were excluded from the transportation asset inventories. A summary of data sources is provided in the following table.

Table 4 - Data Sources for Inventory, Cost, and Condition Analysis

Asset	Inventory	Replacement Cost Valuation	Condition Estimate
Roads	GIS	Unit Construction Costs ($/m^2 by road area)	Based on PCI obtained from the Road Condition Assessment (2019)
Structure: Bridges	GIS	Unit Construction Costs ($/m^2 by deck area)	Based on BCI obtained from the Structural Condition assessments (2019 and 2020)
Structure: Rail	GIS	Unit Construction Costs ($/m^2 by deck area)	Based on Bridge Condition Inspection
Curbs	GIS	Unit Maintenance Cost ($/m)	Based on Year of construction
Traffic Signals	GIS	Unit Maintenance Cost ($/unit)	Based on Year of construction
Illumination		Unit Maintenance Cost ($/unit)	Based on Year of construction
Roadside	GIS	Unit Construction Costs ($/m2 by retaining wall area)	Based on Year of construction
Parking	GIS	Unit Construction Costs ($/m2 by asphalt area)	Based on Year of construction
Active Transportation	GIS	Unit Maintenance Cost ($/m)	Based on Year of construction

3. Levels of Service

3.1 Overview

Levels of Service (LOS) are statements that describe the outputs and objectives the City intends to deliver to its citizens, businesses, and other stakeholders. Developing, monitoring, and reporting on LOS are all integral parts of an overall performance management program which is aimed at improving service delivery and demonstrating accountability to the City's stakeholders.

LOS are guided by a combination of customer expectations, legislative requirements, and internal guidelines, policies, and procedures. In many cases, LOS are also implied based on past service delivery, community expectations, and infrastructure system design. Effective asset management requires that LOS be formalized and supported through a framework of performance measures, targets, and timeframes to achieve targets, and that the costs to deliver the documented LOS be understood.

O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure requires municipalities to prepare Asset Management Plans considering the following for each asset category:

- The existing LOS being provided (referred to as Current LOS: required by 2022 for core assets)
- The LOS that the municipality proposes to provide for each of the next 10 years (referred to as Proposed LOS: required by 2025), including an explanation of why the proposed LOS are appropriate for the municipality and should be based on an assessment of the following:
    - The options for the proposed LOS and the risks associated with those options to the long term sustainability of the municipality.
    - How the proposed LOS differ from the current LOS.
    - Whether the proposed LOS are achievable.
    - The municipality's ability to afford the proposed LOS.

In alignment with O. Reg. 588/17, this AM Plan discusses current LOS under community and technical LOS categories, defined as:

- **Community LOS:** Qualitative descriptions that demonstrate the City's customer and other stakeholder expectations of transportation services.
- **Technical LOS:** Technical metrics that translate customer expectations into technical objectives and performance measures.

For transportation assets, O. Reg. 588/17 requires each municipality to discuss and report on the LOS summarized in the following table.

Table 5 - O. Reg. 588/17 Prescribed Levels of Service for Roads

Service Attribute	Community LOS (Qualitative Description)	Technical LOS (Technical Metric)
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 (eg. Very Good, Good, Fair, Poor or Very Poor).

Table 6 - O. Reg. 588/17 Prescribed Levels of Service for Bridges

Service Attribute	Community LOS (Qualitative Description)	Technical LOS (Technical Metric)
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Percentage of bridges in the municipality with loading or dimensional restrictions.
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges. 2. Description or images of the condition of culverts and how this would affect use of the culverts.	1. For bridges in the municipality, the average bridge condition index value. 2. For structural culverts in the municipality, the average bridge condition index value.

3.2 Community Levels of Service

Understanding the expectations of the City's citizens, businesses and internal customers is imperative in order to provide the right services at the right levels. On March 25, 2019, Council approved its 2018 - 2022 Strategic Priorities. The priorities reflect key issues Councillors heard from residents and guide the strategic direction for the City during this four-year period. The Strategic Priorities supported by this AMP include:

- **Improving the Ability to Get Around.** The Transportation Master Plan sets out growth scenarios for both vehicular and active transportation throughout the City. The Transportation Master Plan is a key input to the Asset Management Plan and the documents both aim to improve the City's transportation network.
- **Building Strong Neighbourhoods by growing responsibly.** There are recommendations in the Transportation Master Plan for a connected transportation network throughout the entire City. The Transportation Master Plan sets out recommendations for growing areas within the existing built boundary as well as the

Hewitt's and Salem Secondary Plan Areas. The Transportation Asset Management Plan considered the slower than expected pace of growth the City is facing and looked at a more financially responsible implementation of the Master Plan.

- **Fostering a Safe & Healthy City through building a greener Barrie while mitigating and adapting to climate change.** The Transportation Asset Management Plan incorporates active transportation infrastructure which reduces reliance on traditional vehicles, and in turn mitigates climate change impacts.
- **Offering Innovative & Citizen Driven Services by making tax dollars go further.** The Asset Management Plan addresses this priority through development of lowest lifecycle cost maintenance, operations, and renewal strategies. These customer objectives include maintaining the asset in a state of good repair by measuring and tracking asset condition and completing work as and when required.

3.2.1 O. Reg. 588/17 Community Levels of Service

The City is responsible for managing transportation assets within the municipality. This includes planning, designing, constructing, operating, and maintaining transportation assets within City lands.

As required under O. Reg. 588/17 for the Community LOS for Pavements, the map provided in Appendix A provides qualitative description by displaying the road connectivity throughout Barrie as well as the road pavement condition.

As required under O. Reg. 588/17 for the Community LOS for Bridges, the qualitative description can be found in the below table:

Table 7 - Qualitative Description for Bridges

Service Attribute	Community LOS	(Qualitative Description)
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	The bridges within the City of Barrie are dispersed through the City to provide connectivity across barriers such as watercourses and railways. Since the City is made up of industrial, commercial, and residential sectors, these assets can be exposed to a combination of heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians or cyclists, depending on where they are located within the City.
Quality	1. Description or images of the condition of bridges and how this would affect use of the bridges.	Pictures of typical bridges within the City of Barrie can be found within Appendix B of section 9 of this report. 1. Many of the bridges with Barrie are in good to very good condition, which allows the bridge to continue to function in a way that they were designed for.

3.3 Technical Levels of Service

O. Reg. 588/17 requires that the City track two technical metrics related to the overall proportion of each road classification area to the overall area of the City of Barrie as well as the average Pavement Condition Index (PCI) of each classification of road. Although the regulation only requires the City to show the overall average network PCI, the PCI values are shown below for each road classification as well as the overall average for the road network.

Table 8 identifies the quantity, in lane km, of each road classification and Table 9 shows the current PCI. Table 10 shows the percentage of bridges within Barrie that have load and/or dimensional restrictions on them and Table 11 shows the average BCI for Barrie's bridges.

Table 8 - Technical LOS for Roads: Lane-km

Road Classification	Lane-km	City of Barrie Land Area (km^2)
Arterial Roads	456.8	108.5
Collector Roads	284.4	
Local Roads	841.8	

Table 9 - Technical LOS for Roads: Pavement Condition Index

Road Classification	Definition	Current Qualitative Performance (PCI)
Arterial Roads	Mainly provide for thoroughfare traffic along with a high level of connectivity with regional and Provincial highways. The City's arterial roads typically receive large traffic volumes. Examples of Arterial Roads are Huronia Road, Essa Road, Mapleview Drive West and East, Big Bay Point Road, Dunlop Street West and East, and Ferndale Drive North and South, Cundles Road West and East, Bayfield Street, and Duckworth Street.	77
Collector Roads	Mainly serve to facilitate and distribute traffic between arterial and local roads, and provide a mixture of thoroughfare traffic and property accessibility. The City's collector roads typically receive medium-level traffic volumes. Examples of Collector Roads are Mapleton Avenue, Bayview Drive, Leacock Drive, and Sunnidale Road.	75
Local Roads	Mainly function to provide non-thoroughfare traffic and property accessibility. The City's local roads typically receive a relatively low level of traffic and include Commercial / Industrial Local Roads and Residential Local Roads.	72
All Roads		75*

*Based on all City owned roads; Private roads and Unassumed roads are excluded.

Table 10 - Technical LOS for Bridges: Loading or Dimensional Restrictions

Asset	Percentage (%)
Bridge	8.8

Based on winter weight restrictions and any dimensional restrictions

Table 11 - Technical LOS for Bridges: Bridge Condition Index

Asset	Average BCI
Bridge	74.11

Based on 34 Bridges

The Ontario Ministry of Transportation (MTO) has adopted the long-term target for the number of bridges in good or very good condition of 85% from the Transportation Association of Canada (TAC). On average, bridges in Ontario require major rehabilitation every 30 to 35 years and replacement after 60-70 years. This represents an average annual deterioration rate of 3%. Based on a five-year planning cycle, it is desirable to have only 15% of bridges in need of rehabilitation at any time. This 85% threshold implies that the bridge network is in a steady state. Using this measure, a bridge with a BCI greater than 70 is considered to be in good condition. This is considered the gold standard for the City to strive towards. Currently, the City has 97.5% of its bridges in good to very good condition and only 2.5% in poor condition.

3.3.1 Proposed Performance (Year 2025 O. Reg. 588/17 Requirement)

To meet year 2025 O. Reg. 588/17 requirements, the next AM Plan will document proposed performance levels for the LOS metrics above. The proposed performance levels will include consideration of balancing levels of service with cost and risk. The City's condition data shows that the majority of the City's road network is in good to very good condition which is expected since a large majority of the construction has occurred over the past 20-30 years. If the City does not continue and increase pro-active preservation of its roads, the average network performance will decline as roads will continue to deteriorate and move from one condition rating to another. This will ultimately result in increased expenses to rehabilitate a large number of roads in poor to very poor condition, as well as reduced service levels.

4. Asset Management Strategy

4.1 Overview

The City's ability to deliver the levels of service outlined in the Asset Management Plan is impacted in large part by:

a) aging infrastructure and the associated need for operations, maintenance and renewal investments to sustain it;

b) future population growth and the associated need for additional infrastructure to serve it;

c) the need for upgraded infrastructure to serve changing functional and sustainability needs; and

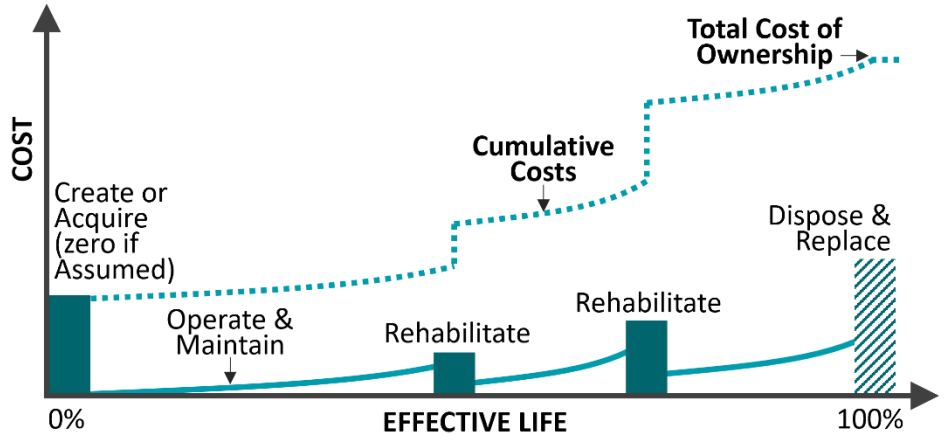
d) affordability.

Asset lifecycle management strategies are planned activities that enable assets to provide the defined levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost. Asset lifecycle management strategies are typically organized into the following categories and are driven by the levels of services defined in the previous section.

- **Renewal activities** – Significant rehabilitation designed to extend the life of the asset and replacement activities that are expected to occur once an asset has reached the end of its useful life and rehabilitation is no longer an option (e.g., preservation activities like resurfacing or end of life activities such as reconstruction).
- **Operations and Maintenance activities** – Operations refers to regular activities during the process of using an asset which consume resources such as labour, equipment rental and purchase, energy, chemicals, and materials (e.g., street sweeping and winter control). Maintenance refers to activities including regularly scheduled inspection and maintenance, or more significant repair and activities associated with unexpected events to keep an asset in an appropriate service condition (e.g., road patrol, filling potholes, replacing light bulbs).
- **Upgrade activities** – Planned activities to increase the level of service or meet other requirements such as expansion to accommodate the higher population (e.g., adding active transportation infrastructure to an existing road).
- **Expansion activities** – Planned creation or acquisition of assets required to extend services to previously developed areas or expand transportation services to meet growth demands (e.g., building a new road or widening an existing road).

The City assesses the costs of potential lifecycle activities to determine the lowest lifecycle cost strategy to manage each asset type while still meeting levels of service. The total cost of ownership is the sum of lifecycle activity costs to sustain each asset type over the asset lifecycle. Sufficient investment of the right type and at the right time minimizes the total cost of ownership for each asset and also prevents other potential risks such as interruption to service delivery or damage to other infrastructure. Operations, maintenance, and renewal activities are timed to reduce the risk of service failure from deterioration in asset condition and are part of the total cost of ownership. The conceptual lifecycle model is illustrated in the figure below. Note that although the assets contributed (also known as assumed) by developments are provided at no cost to the City, the costs to sustain them over their lifecycles and to replace them must be paid by the City.

Figure 12 - Conceptual Lifecycle Cost Model



4.2 Criticality Assessment to Inform Lifecycle Strategies

The City's key asset management principle is to meet service levels and manage risk, while minimizing lifecycle costs. The relative importance of each asset to support service delivery, referred to as asset criticality, is a key driver in selection of the most appropriate asset management strategy for each asset. Critical assets include assets that are key contributors to performance, the most expensive assets in terms of lifecycle costs, and assets that are most prone to deterioration or need ongoing maintenance investment. More critical assets are prioritized for expansion, upgrade, inspection, maintenance, and renewal, depending on their current and forecast future performance.

Risk events, such as an asset failure, are events that may compromise the delivery of the City's strategic objectives. Risk management entails understanding the risks that may affect the asset portfolio and establishing strategies to manage the risk to acceptable levels. Risk exposure is calculated by multiplying the criticality or consequence of failure (CoF), which is the direct and indirect impact on the City if an asset failure were to occur, by the probability of failure (PoF), which is the likelihood or chance that an asset failure may occur.

Risk Exposure = Criticality (Consequence of Failure) x Likelihood (Probability of Failure)

4.2.1 Consequence of Failure (COF)

The focus in this section is on asset criticality or consequence of failure which reflects the importance of an asset to the City's delivery of services or, in technical terms, the potential consequences of the asset failing (and therefore failing to provide the required service levels). Asset criticality is determined based on the degree to which the failure of the asset would impact the following considerations:

- **Economic** impact considerations such as asset replacement cost, damages to City or private property and infrastructure, loss of revenue, and fines.
- **Service delivery** considerations such as disruption of non-essential service to widespread and long-term disruption of essential service.
- **Social** considerations such as media coverage, ability to meet Health and Safety related regulatory requirements and degree and extent of injury, from negligible injuries and loss of life.
- **Environmental** considerations such as length and extent of damages to the natural environment.

The following asset criticality (COF) categorization is based on the City of Barrie's "Hazard Identification Risk Assessment" (HIRA).

Table 12 - Asset Criticality (Consequence of Failure)

CoF Rating	Criticality	Economic	Social	Environmental	Service Delivery
C1	Insignificant	Loss of replaceable asset <<$1M	No injuries No media interest	Non-lasting damage	No or few disruptions (<10%)
C2	Minor	Damages, losses or fines < $1M	Minor injuries Local media coverage	Short-term, repairable damage	Minor (isolated) disruption in non- essential service
C3	Moderate	Damages, losses or fines $1M to $10M	Serious injuries, multiple minor injuries Some prov/national media coverage	Long-term damage, with repairable consequences	Major disruption in non-essential service Minor (isolated) disruption in essential service
C4	Major	Damages, losses or fines > $10M	Loss of life, serious injuries Extensive prov/national media coverage	Long-term damage, with lasting consequences	Some essential services unavailable

The above criticality profiles enable risk to be incorporated into the development of asset management strategies. More critical assets are prioritized for expansion, inspection, cleaning, maintenance, and renewal, depending on their current and forecast future performance.

Using the risk methodology described above, the COF ratings in the table below were assigned to the transportation assets.

Table 13 - Transportation Asset CoF Ratings

Sub-Service	Major Asset	Sub-Asset	Criteria		CoF
Roads	Pavement	Arterial / Parkway	Emergency Route or provides access over Hwy 400*		4
			None		3
		Collector	Emergency Route or provides access over Hwy 400*		3
			None		2
		Local	Emergency Route or provides access over Hwy 400*		2
			None		1
		Edge Treatment			1
	Structures		Arterial	Long Detour / Emergency Route	4
			Arterial	Other	3
			Collector	Long Detour / Emergency Route	4
			Collector	Other	2
			Local	Long Detour / Emergency Route	2
			Local	Other	2
	Traffic Control	Traffic Signals	Full Signal		3
			Flashing 40		1
			Temporary Signals	Temporary and Overhead Signals	2
				Speed Board Advisories	1
			Intersection Pedestrian Signal		1
		Signs			1
	Illumination				1
	Roadside	Retaining Walls	<1 m height		1
			1m <= height < 3m		2
			>=3m height		3
	Parking	Parkade			2
		Paved Lots	Waterfront		2
			Other		1
		Payment Systems			1
Active Transportation	Linear	Sidewalks	Downtown / City Centre area		2
			Other		1
		Walkways			1
		Boulevard Pathways			1
	Structures	Footbridges			1
		Culverts			1
Rail	Structures	Railway Underpasses			4

* Emergency Route or provides access over Hwy 400 routes were determined using Staff Report ENG013-10 dated March 8, 2010

For the COF of structures in the table above, the length of detour required was used as a criteria to determine the COF. The definition of "Long Detour" is a detour length greater than 5.0km in the event of bridge failure. The definition of "Medium Detour" is a detour length greater than 2.5km but less than 5.0km in the event of bridge failure. The definition of "Short Detour" is a detour length less than 2.5km in the event of bridge failure.

Note: Detour length for Dyments Creek - Edgehill Drive will be shortened to 2000m when Sproule Drive connects to Ferndale. Detour lengths are unlimited for the following structures:

- Whiskey Creek - McConkey Place: failure of this structure would result in the restricted access to 70 or so homes on McConkey Place and Bristow Court.
- Dyments Drainage - Landfill Entrance: failure of this structure would result in the restricted access to the landfill.
- Detour length for the two railway crossings.

Compared to some assets in the City's portfolio, transportation assets generally have lower consequence of failure ratings. Roads which are congested and in poor condition can still deliver service with low risk, even if the service level is poor. For example, in relation to assets which deliver drinking water or provide flood mitigation, the overall risk profile of transportation is generally lower.

4.2.2 Probability of Failure (POF)

Probability of failure was determined based on the condition ratings developed in Section 2. The general approach is based on the principle that assets in poorer condition are more likely to fail. The 5-point condition rating scale was converted to a 4-point scale by classifying the Poor and Very Poor assets into the probability of failure rating of 4.

Table 14 - Probability of Failure Ratings - General

Level	Title	Probability	Description	Asset Condition
P1	Rare	< 0.25	Event could occur very infrequently or only in exceptional circumstances, but is not expected	Very Good
P2	Unlikely	> 0.25 & < 0.5	Event should occur at some time	Good
P3	Probable	> 0.5 & < 0.75	Event will probably occur regularly or in most circumstances	Fair
P4	Almost Certain	> 0.75	Event is expected to occur very frequently or in most circumstances	Poor, Very Poor

The table above identifies probability of failure ratings based on asset condition when the failure mode is physical condition. Other failure modes, such as capacity, can be used to determine risk. In future Transportation Asset Management Plans or Master Plans, capacity along with other failure modes will be reviewed and analysed in more depth to determine their relationship with risk. For maintenance and renewal decision making, the focus is typically on physical condition to determine asset risk - the risk of allowing assets to deteriorate and fail by not performing adequate rehabilitation treatments. For roads and bridges, the original PCI/BCI score has been converted directly to the 1 to 4 scale (Table 15) to determine the probability of failure.

Table 15 - Probability of Failure Ratings - Roads and Bridges

Level	Title	Probability	Description	PCI/BCI (Pavement & Structures)
P1	Rare	< 0.25	Event could occur very infrequently or only in exceptional circumstances, but is not expected	75 to 100
P2	Unlikely	> 0.25 & < 0.5	Event should occur at some time	50 to 74
P3	Probable	> 0.5 & < 0.75	Event will probably occur regularly or in most circumstances	25 to 49
P4	Almost Certain	> 0.75	Event is expected to occur very frequently or in most circumstances	0 to 24

The following tables represent risk maps. A risk map is a graphic representation of probability and consequence of one or more risks related to a similar objective. After assessing the consequence and probability of each risk, they are plotted on a matrix. Different colours on the map help to visualize the highest risk assets, where the City should focus its resources, time, effort, and dollars.

a) Assets that appear in the red (extreme risk) zone are significant to the City and therefore need to be actively managed and monitored in a more comprehensive manner than other risks (i.e., prioritized)
b) Assets that appear in the yellow (high risk) or green (moderate risk) zones will also be actively managed depending on their nature.
c) Assets that appear in the blue (low risk) zone are generally acceptable without significant mitigation strategies being implemented, although monitoring may still occur in some form.

The risk of not meeting the stated quality / renewal levels of service is influenced by both the asset criticality and asset performance, as represented by asset condition. Combining the asset condition with asset criticality shows that in total, the City has approximately $7.9 million (0.7%) worth of transportation assets that are in the extreme risk category, as outlined in the following risk maps. This is an extremely small proportion of the overall transportation asset portfolio. The risk maps on the left side represent the replacement cost in 2021$ while the right table shows the percentage of each cell relative to the group.

RISK LEGEND: Low | Moderate | High | Extreme

Table 16 - Risk Map for Roads and Curbs

PoF	C1	C2	C3	C4
P4	$2,877,804	$1,761,659	$0	$0
P3	$31,647,794	$11,906,612	$7,582,998	$1,786,454
P2	$153,653,678	$39,467,584	$59,477,539	$19,654,154
P1	$264,832,211	$72,026,641	$86,694,550	$52,598,233

CoF

PoF	C1	C2	C3	C4
P4	0.4%	0.2%	0.0%	0.0%
P3	3.9%	1.5%	0.9%	0.2%
P2	19.1%	4.9%	7.4%	2.4%
P1	32.9%	8.9%	10.8%	6.5%

CoF

Table 17 - Risk Map for Bridges

PoF	C1	C2	C3	C4
P4	$0	$936,000	$0	$0
P3	$0	$0	$0	$0
P2	$0	$0	$29,701,620	$507,520
P1	$0	$0	$3,893,760	$1,864,772

CoF

PoF	C1	C2	C3	C4
P4	0.0%	2.5%	0.0%	0.0%
P3	0.0%	0.0%	0.0%	0.0%
P2	0.0%	0.0%	80.5%	1.4%
P1	0.0%	0.0%	10.6%	5.1%

CoF

Table 18 - Risk Map for Rail Bridges

PoF	C1	C2	C3	C4
P4	$0	$2,471,040	$0	$0
P3	$0	$0	$0	$0
P2	$0	$0	$0	$0
P1	$0	$0	$0	$11,718,850

CoF

PoF	C1	C2	C3	C4
P4	0.0%	17.4%	0.0%	0.0%
P3	0.0%	0.0%	0.0%	0.0%
P2	0.0%	0.0%	0.0%	0.0%
P1	0.0%	0.0%	0.0%	82.6%

CoF

Table 19 - Risk Map for Remaining Transportation Assets

PoF	C1	C2	C3	C4
P4	$46,494,803	$2,979,429	$6,079,284	$0
P3	$43,030,351	$1,281,466	$5,618,354	$0
P2	$40,499,399	$2,074,670	$4,522,433	$0
P1	$79,846,997	$18,834,600	$5,913,141	$0

CoF

PoF	C1	C2	C3	C4
P4	18.1%	1.2%	2.4%	0.0%
P3	16.7%	0.5%	2.2%	0.0%
P2	15.7%	0.8%	1.8%	0.0%
P1	31.0%	7.3%	2.3%	0.0%

CoF

4.3 Asset Management Needs

The City uses its understanding of risk to inform the timing and amount of needed investment in infrastructure assets. The City aims to provide sufficient service capacity to meet demand and manage the upgrade, operations, maintenance, and renewal of assets to meet service expectations. This section of the AM Plan outlines the City's expansion (growth) and upgrade strategies as defined in the transportation master plan to support capacity, use and functional service levels, and the City's operations, maintenance, and renewal activities to support quality and reliability service levels.

4.3.1 Operations, Maintenance and Renewal Needs

Operations, maintenance, and renewal work together to enable the City to meet quality service levels (percentage of assets in fair or better condition). The distinction between renewals (capital programs) and operations and maintenance (operating expenses) is set by accounting policies and standard operating procedures. Operations and maintenance activities ensure that each asset continues to deliver services, while renewal includes activities that extend the asset's useful life as well as replacement at the end of its service life. Renewals, operations, and maintenance are strongly linked; operations and maintenance strategies can accelerate or delay the need for renewals, and if renewals are deferred, operations and maintenance needs will often increase to ensure that assets are kept in a state of good repair.

The estimated costs of projected renewal, operations and maintenance lifecycle activities needed from 2021-2030 are summarized in Table 20.

Over the next 10 years, operations and maintenance needs are expected to increase as more assets will be added to service development in the secondary plan areas. For this AM Plan, the year-over-year increases to operations and maintenance needs from 2021-2030 are estimated based on projected population increases shown below in Table 23. For future AM plans, it is expected that improved data about development in the secondary plan areas will be available to enable more accurate projections of operations and maintenance needs based on the amount and timing of assets that will be added to the City's portfolio.

The projected renewal needs from 2021-2030 are based on the cost and timing of life cycle activities shown in Table 22 for each asset.

Over time, as the City refines the asset management strategies through tracking asset condition and actual costs and benefits of different strategies, the City will improve its understanding of how to achieve the lowest lifecycle cost for each asset type.

The available budget to undertake these needed activities and any gaps between that available budget and forecasted needs are discussed in section 5. The City may choose to increase or decrease the investment levels for these strategies due to factors such as the age of the infrastructure, accumulated backlog of work, risk tolerance, and available funding. **However, eventually, asset operations, maintenance and renewal must be undertaken**

to avoid accumulation of large backlogs of work and associated risks to service delivery.

A summary of the projected costs for the operations, maintenance and renewal lifecycle activities needed to provide the services covered by this AMP are outlined in the following table for the next ten years.

Table 20 - Operations, Maintenance, and Renewal Needs

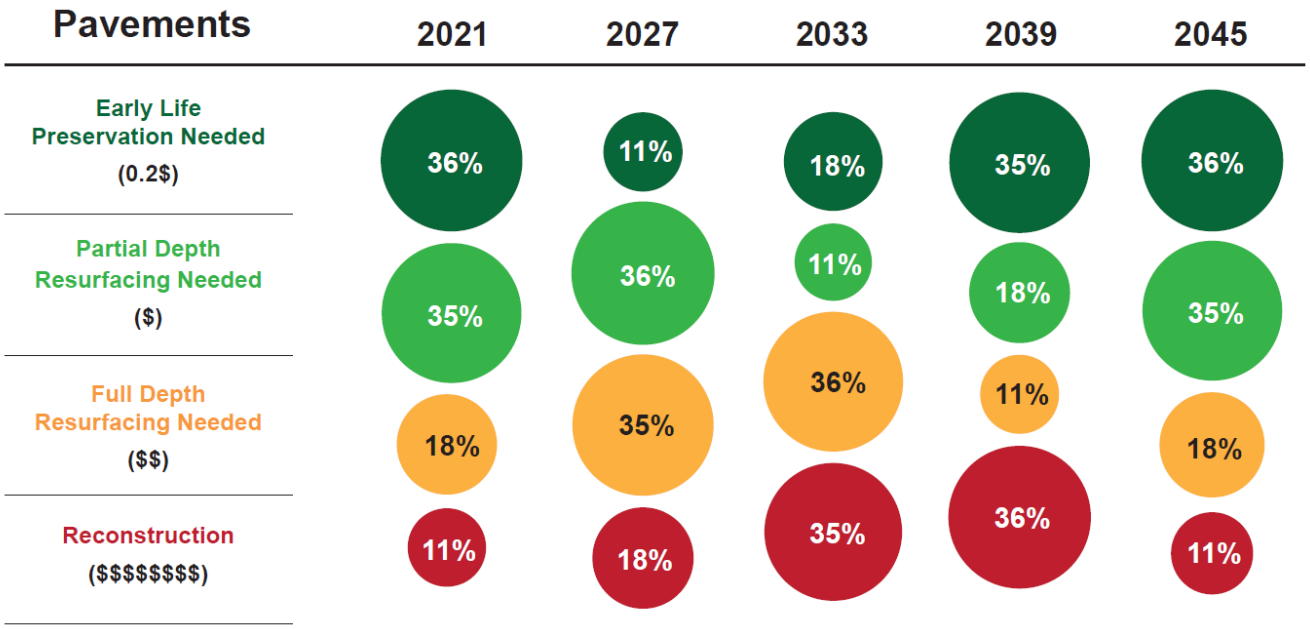
Service Attributes	Lifecycle Activity	Comments	10-year Total Needs (2021 to 2030) in 2021$M
Quality and Reliability	Renewal	To bring assets up to a state of good repair	$382
	Maintenance and operations	To maintain assets at a state of good repair	$193
		TOTAL	**$575**

Due to the fact that much of the City's road network was constructed in the last few decades, a large proportion of Barrie's roads are early in their lifecycle and do not require major reconstruction. As soon as pavement is constructed, the asphalt begins to oxidize. Oxidation of the asphalt leads to distresses such as cracks. This is when early life preservation activities such as crack sealing can be performed. Once the pavement has deteriorated past the point that crack sealing is no longer an effective LCA, the road transitions to the next level of LCA which is road resurfacing, which is considered a level 1 preservation activity, followed by a level 2 preservation activity also known as full depth resurfacing. Full depth resurfacing is completed when the pavement has deteriorated past the point that partial depth resurfacing would be effective, but before it reaches the point that full reconstruction is required. Finally, once the road has deteriorated past the point that all preservation activities are no longer options, full reconstruction is the only viable alternative left, which is also the most expensive option.

Currently, a number of the City’s roads are experiencing minor cracking that can be rectified by crack sealing, but the majority of roads within Barrie currently require partial or full depth resurfacing in order to defer an accumulation of reconstruction needs.

If the City does not continue to increase preservation activities on the large amount of “new” pavement, this large cohort of roads will require reconstruction prematurely, which is illustrated below in Figure 13.

Figure 13 - Cohort Diagram for Road Assets



The above figure shows the impact of ignoring preservation activities on reconstruction spending. Without pavement preservation, large proportions of Barrie's road network will degrade to poor condition and require reconstruction over a short period of time. Reconstruction is the most expensive renewal option for roads. To achieve financial efficiency, the benefits of preservation activities must be maximized. This analysis can also be used for other infrastructure assets such as sidewalks, curbs, etc., however, unlike roads, these assets generally do not have preservation activities that can be used to extend their useful lives and are generally reconstructed or replaced at the end of their service lives.

In the table below, early life preservation, level 1 preservation, level 2 preservation, and reconstruction activities are all compared (assuming a 1 km section of local road with no other surface or subsurface work being completed at the same time).

Table 21 - Cost Comparison between Life Cycle Activities

	Early Life Preservation (Crack Sealing)	Level 1 Preservation (Partial Depth)	Level 2 Preservation (Full Depth)	Reconstruction
Cost - 1 km Local Road	$25,500	$170,000	$340,000	$1,317,500
Factor	0.2	1	2	8

The above table shows that reconstructions is several times more costly than preservation activities. This is a key principle of pavement management; that by completing preservation activities, the City can defer spending money on reconstruction. The amount of time that

reconstruction can be deferred would be determined by which LCA was completed as well as which road classification the work was being completed on. Referring to Table 22, estimated timing can be found beside each of the LCAs as to when each LCA should be completed. Depending on the road classification, these LCAs could defer full road reconstruction by 7-15 years every time an activity (LCA1 or LCA2) is completed.

Details to support the forecasted renewal lifecycle needs are provided in the following table (all costs are in 2021$):

Table 22 - Asset Maintenance and Renewal Life Cycle Activities

Sub-Service	Major Asset	Process (Sub-Asset Group)		MPL (yrs)	Unit	LCA1 Name	Time	Unit Cost	LCA2 Name	Time	Unit Cost	LCA3 Name	Time	Unit Cost
Roads	Pavements	Arterial		45	m2	Mtce	15	$30	Rehab	30	$60	Replace	45	$135
		Collector		60	m2	Mtce	20	$25	Rehab	40	$50	Replace	60	$135
		Local		70	m2	Mtce	23	$20	Rehab	35	$40	Replace	70	$105
		Edge Treatment	Curb	45/60/70								Replace	45/60/70	$105
	Structures	Bridges Spanning ≥ 3m	Installed After 2000	120	m2	Repairs	30	$600	Rehab	60	$2325	Replace	120	$6500
			Installed Before 2000	100	m2	Repairs	25	$600	Rehab	50	$1750	Replace	100	$6500
	Traffic Control	Traffic Signals	Flashing 40	30	Per Unit							Replace	30	By asset
			IPS	30	Per Unit							Replace	30	By asset
			Full Way Signal	30	Per Unit							Replace	30	By asset
			Temporary Signal	5	Per Unit									By asset
			Temporary Signal (Speed Board Advisory, Overhead Signal)	15	Per Unit							Replace	15	By asset
		Signs		15	-							Replace	15	$300
	Illumination	Luminaires		25	-							Replace	25	$542
		Poles, foundation, electrical		50	-							Replace	50	$8125
	Parking Lots	Paved Lots		15	m2							Replace	15	$105
		Parkade		75	-							Replace	75	By asset
		Payment Systems	Pay and Display Machines	10	Per Unit							Replace	10	$10000
Active	Linear	Sidewalks		50	m	Mtce	25	$15				Replace	50	$116
		Walkways		50	m							Replace	50	$116
		Boulevard Pathways		20	m							Replace	20	$116
	Structures	Footbridges		20	m2	Repairs	10	$375				Replace	20	$3950
		Culverts		25	m2	Repairs	12	$375				Replace	25	$3950
Rail	Structures	Mapleview Drive East	Asset ID: 120085994	100	m2	Repairs	25	$4700	Rehab	50	$18500	Replace	100	$52000
(BCRY)		Lockhart Road	Asset ID: 120054528	100	m2	Repairs	25	$4700	Rehab	50	$14000	Replace	100	$52000

4.3.2 Life Cycle Activities for Roads

The City currently conducts condition assessments on its pavement network every 4-5 years, with the latest occurring in 2019. It is recommended to continue this schedule in the future.

At this time, **early life preservation** activities for pavement consist of crack sealing 100% of the length of the segment at an estimated cost of $5/m. **Preservation** (LCA1 and 2) activities mainly consist of partial depth and full depth resurfacing (mill and inlay/shave and pave); the estimated value for this work can range between $30-60/m^2 depending on the road classification as well as LCA type (partial or full depth). Finally, **replacement** (LCA3) consists of the removal and replacement of the existing asphalt, granular base and subbase, including an allowance for earth excavation.

The City is continually reviewing and piloting alternative pavement lifecycle treatments to improve the effectiveness of the lifecycle plan. Treatments being piloted or under consideration to protect the pavement surface are discussed below.

4.3.2.1 Micro-surfacing

Micro-surfacing is a mixture of polymer-modified asphalt emulsion, high-quality frictional aggregate, mineral filler, water, and other additives, mixed and uniformly spread over the pavement surface using a self-propelled continuous feed mixing machine.

Micro-surfacing is used to correct superficial distresses such as cracking, raveling and segregation, flushing, and loss of friction. Because micro-surfacing contains high-quality crushed aggregate, it is also used to fill in ruts and surface deformation to the depth of up to 1.5 inches. As a preventive maintenance treatment, it can be used to seal the surface from water infiltration when minor cracking or moderate raveling appears. Micro-surfacing has excellent frictional properties and is used on high-speed roads.

The surface on which micro-surfacing is applied should have uniform characteristics and provide a good bond. Areas that exhibit considerably more severe defects (raveling, cracking, or rutting) than the remainder of the section should be treated with an additional course of micro-surfacing or repaired by other means. When the surface of the pavement has minor distortions or has ruts exceeding about 0.25 inches, two courses of micro-surfacing are recommended. The first (scratch) course is designed to improve the profile of the pavement, and the second course provides the wearing surface.

Many agencies rout and seal working cracks (e.g., transverse cracks) shortly before micro-surfacing is applied. However, micro-surfacing may not bond to the new crack sealant resulting in the loss of material. Some agencies require that routing and sealing of cracks is done a year before micro-surfacing. Other agencies carry out routing and sealing several months after micro-surfacing. This sequence is recommended because it eliminates the possibility of debonding and ensures that only cracks that are not sealed by micro-surfacing are routed and sealed.

4.3.2.2 Asphalt Rejuvenators

Rejuvenators consist of a sprayed application of a bituminous material or specialty product to the surface of existing asphalt cement pavements that have oxidized and hardened for the purpose of replenishing the lighter oils and softening a weathered surface. Although rejuvenators will seal minor cracks, they are not generally suited for sealing cracks or for use on rutted pavement. These seals can also slow the progression of raveling and aggregate loss; however, the pavement should be in good condition and should be broomed before the emulsion is applied.

Asphalt consists of two main fractions:

- ≈ Asphaltenes which are the hard brittle component, insoluble and not affected by oxidation.
- ≈ Maltenes which are oily and resinous in appearance and are highly reactive.

The relationship of the asphaltene and maltene percentages becomes out of balance in the aging process. This aging process can start as early as initial hot plant production and continues through the pavement life cycle due to environmental effects such as weather and sun exposure. An asphalt rejuvenator has the ability to penetrate into the pavement and restore the reactive components that have been lost due to oxidation.

Reclamite is a widely recognized rejuvenator with over 25 years of experience. It has been evaluated by many agencies including the U.S. Army Corps of Engineers. Studies have documented the ability of Reclamite to lower the viscosity of the asphalt binder, to reduce the incidence of small cracks, and to reduce fines loss over a period of at least three years. The recommended procedure for using Reclamite is to:

- ≈ Sweep street
- ≈ Apply rejuvenator with asphalt distributor
- ≈ Hand spray corners and hard to reach areas
- ≈ Cover with sand or screenings after penetration has occurred (after about 1 hour)
- ≈ Sweep up sand after 24 hours
- ≈ Dark colour fades in about 45 days.

4.3.3 Life Cycle Activities for Bridges

Life cycle activities for road bridges includes the following activities:

- **Repairs** consist of minor repairs to the wearing surface, expansion joints and bearings, and other miscellaneous minor repairs.
- **Rehabilitation** consists of repair and overlay of the deck, replacing the wearing surface, expansion joints and bearings, and other miscellaneous repairs, as applicable to the various bridge and culvert structure types.
- **Replacement** consists of demolition of the existing structure and replacement with a structure of similar type and size.

4.3.4 Remaining Transportation Assets

Traffic control, illumination, parking lots and active transportation assets generally do not have many life cycle activities that are used to extend their useful lives. Normally, operation and maintenance activities are performed on these assets until they have reached the end of their useful lives, at which time they are replaced.

4.3.5 Expansion (Growth) and Upgrade Needs

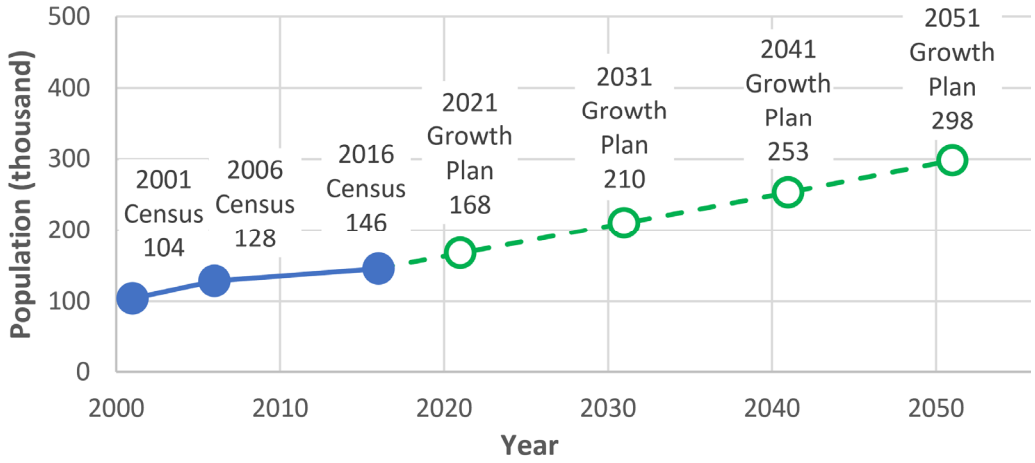
Expansion (Growth)

Barrie has been one of Canada's fastest growing municipalities for the past several decades. Based on the 2019 Growth Plan, the City's population and employment numbers are expected to continue to increase through 2051, as summarized in the table and figure below. Ensuring that this level of growth is managed in a sustainable, efficient, and financially responsible manner is central to the long-term health, prosperity, and well-being of the City and its residents.

Table 23 - City of Barrie Population and Employment Forecasts

Year	Population	Population Compounded Growth Rate	Employment
2016	145,800	-	73,800
2021	167,600	2.8%	83,400
2031	210,000	2.3%	101,000
2041	253,000	1.9%	129,000
2051	298,000	1.7%	150,000

Figure 14 - Population History and Forecasts



Growth can result in an increased need for assets in two ways; increased population densities in already developed areas may require increasing the size of assets (e.g. roads) to accommodate for increased traffic, and growth in previously undeveloped areas requires new assets to service these areas. Sometimes these new assets are built by the City, to enable the development to occur, and sometimes they are built by developers and later assumed by the City.

Upgrade

Upgrade activities enable the City to meet its functional objectives which include provision of a resilient transportation network. This includes improvements to services or adding new services, such as active transportation infrastructure, to existing areas.

Non-Asset Solutions

Asset management can also include non-asset solutions; the purpose of which is to achieve outcomes related to level of service or risk without adding assets, or changing the operations, maintenance, or renewal activities applied to assets. One non-asset solution that assists in reducing demand on the City's transportation infrastructure is public education. Efforts focus on educating residents, staff and City council about the benefit of transit and active transportation. These efforts emphasize the benefits of active transportation with the goal of minimizing the amount of vehicular traffic on Barrie's road network. Reducing the demand on the City's transportation infrastructure can reduce the need for upgrade and expansion projects and also assist in combating climate change by reducing greenhouse gas emissions.

Summary of Expansion (Growth) and Upgrade Needs

The following table summarizes the growth and upgrade activities outlined in the Transportation Master Plan over a period of 21 years from 2019 to 2041 in 2021$M and annually in 2021$M.

Table 24 - 2041 Growth and Upgrade Needs Forecast

Item	Cost (2021$M) 21 years	Cost (2021$M) Annual
Transportation • Widening existing arterial and collector roads • Building new arterial and collector road within the secondary plan areas • Addition of Active Transportation (sidewalks, multiuse trails, etc.) • assumes done as part of road renewal project	$2,120.2	$106.0
TOTAL	**$2,120.2**	**$106.0**

A summary of the projected costs for the growth and upgrade lifecycle activities needed to provide the services covered by this Asset Management Plan are outlined in the following table for the next ten years, expressed as a total. The Transportation Master Plan projects out 20 years to 2041 and identifies transportation needs throughout that time period. For this AMP, in recognition of the fact that growth is occurring more slowly than expected, the forecasted implementation of the Transportation Master Plan has been extended from 2041 to 2051. The annual growth and upgrade needs presented in this AMP are based on averaging these growth needs over 30 years (from 2021-2051). The table below shows the 10-year total for the forecasted growth and upgrade needs based on this change to the timelines from the Transportation Master Plan.

Table 25 - 2031 Growth and Upgrade Needs Forecast

Service Attributes	Lifecycle Activity	Comments	10-year Total Needs (2021 to 2031) in 2021$M
Capacity, Use and Function	Growth and upgrade	City constructed assets to increase capacity for transportation purposes (1)	$707
		TOTAL City Costs	**$707**

(1) Forecast is based on even distribution of Transportation Master Plan needs from 2021 to 2041, extended from 2021-2051, and considered in this report for a 10-year period

5. Funding Implications

5.1 Overview

The information presented in the preceding sections of the Asset Management Plan inform the financial requirements: the state or condition of the assets, the expected levels of service, the risks to service delivery, and the lifecycle activities needed to reduce the risks to acceptable levels.

A global leader in asset management, the Local Government Association of Australia defines financial sustainability within the municipal government context as *"… a government's ability to manage its finances so it can meet its spending commitments, both now and in the future. It ensures future generations of taxpayers do not face an unmanageable bill for government services provided to the current generation".*

A municipality is in a financially sustainable position if it:

- Provides a level of service commensurate with willingness to tax and ability to pay.
- Can adjust service levels in response to changes in economic conditions or transfer payments.
- Can adjust its implementation plans in response to changes in the rate of growth.
- Has sufficient reserves and/or debt capacity to replace infrastructure when it needs to be replaced and keeps its infrastructure in a state of good repair.

The key challenges to financial sustainability are:

- A mismatch between level of service decisions and fiscal capacity.
- Growth that does not materialize as expected.
- The future cost of infrastructure investments.
- Unforeseen shocks to revenue or spending.

O. Reg. 588/17 requires a financial strategy that provides an estimate of the annual costs for each of the 10 years of undertaking the needed lifecycle activities, separated into capital expenditures and significant operating costs, and the annual funding projected to be available to undertake the lifecycle activities. Although the reporting period is for 10 years, the assessment of preferred lifecycle activities is to include the full lifecycle of the assets. This City will be required to meet this requirement by July 1, 2025.

5.2 Financial Sustainability

5.2.1 Overview

This section compares the planned expenditures (budgets) against the forecast needs for the lifecycle activities identified in the previous section (growth and upgrade, renewal, and operations and maintenance).

The following table summarizes the average annual cost of forecast needs compared with planned funding over the 10-year period 2021 to 2030. The asset funding ratio is an important financial performance indicator as it reports the funding projected to be available to undertake the lifecycle activities as a proportion of the needs over the next ten years against a target of 1.0. The City has substantial gaps between needs and available funding forecasts for growth / upgrade and renewal activities over the next ten years. The City also has a substantial backlog in road renewal and reconstruction and must plan for increased operations and maintenance costs to accommodate new transportation assets.

Table 26 - AM Plan Financial Summary

Service Attributes	Asset Lifecycle Activity	10-year (2021 – 2030) Average Annual Amounts (2021$M/year)			Funding Ratio (Target = 1.0)
		Forecast Needs	Planned Funding	Gap	
Capacity, Use and Function	Growth and upgrade	$70.7	$28.8	$41.9	0.4
Quality and Reliability	Renewal	$38.2	$32.4	$5.8	0.8
	Operations and maintenance	$19.3	$18.6*	$0.7	0.96
TOTALS		**$128.2**	**$79.8**	**$48.4**	**0.6**

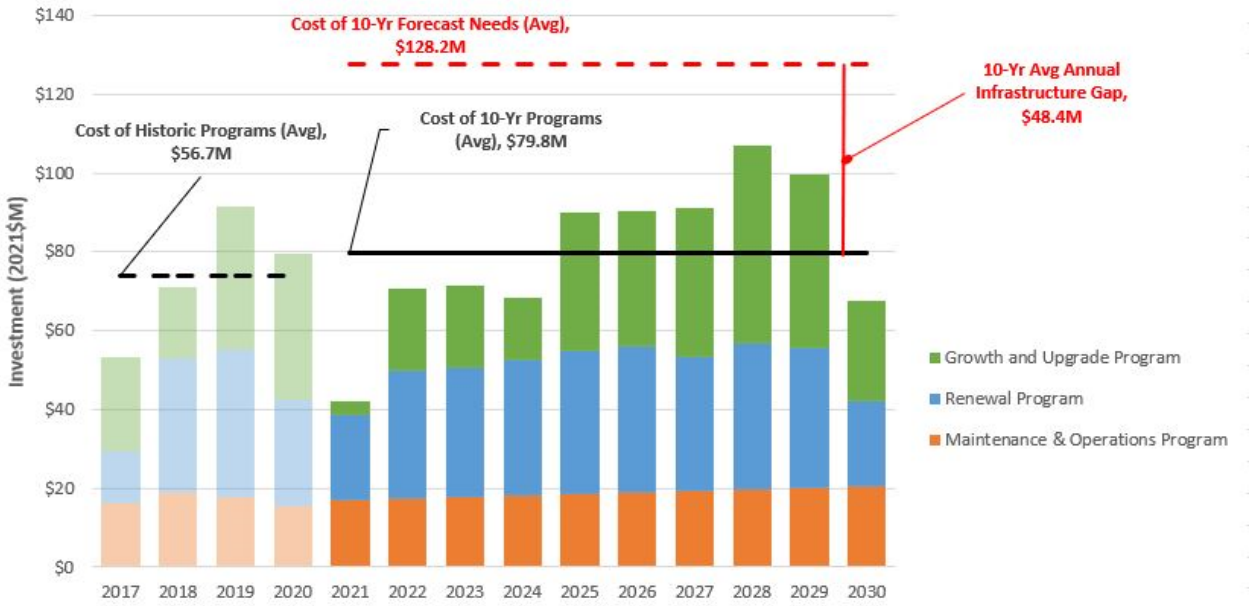
*Operations and maintenance budgets are developed annually. Average planned funding for 2021-2030 is based on an assumed 2%/year increase.

The following graph summarizes the data from the preceding table. It shows the total cost of the forecast needed lifecycle activities over the next ten years as **$128.2M per year** (dashed red line) and the budgeted annual funding projected to be available to undertake the forecast needed lifecycle activities over the next ten years as **$79.8M per year** (solid black line). Since the needs exceed the funding, the City has a transportation infrastructure gap of **$48.4M per year** for each of the next ten years. The graph also shows the historical expenditure (light bars and black dashed line as the average at $56.7M per year) and planned expenditures (dark bars).

The gap of $41.9M per year relating to growth and upgrades is largely a function of growth proceeding at a slower pace than had previously been anticipated and is outside of the City's control. Capital costs relating to growth will be recovered through development charges to the greatest extent possible, as regulated by the Development Charges Act, and expended as growth proceeds.

For this analysis, the growth needs have been spread out over 30 years, to 2051 rather than over 20 years to 2041 as identified in the Transportation Master Plan. This stretching of the growth work ties to the slower-than-expected pace of growth that the City is seeing. In addition, the costs and resources required to implement these needs over a 20-year time frame are considered unachievable. It is important to note that although this growth construction is being spread out to 2051, it does not include any growth-related work that is required to address additional growth projections from 2041 to 2051. Also, as some of the delayed growth and upgrade projects have elements that will address capacity or level of service needs for the existing Barrie community, the City is acknowledging that a lower level of service will be provided at some locations throughout the City until these projects can be completed.

Figure 15 - Financial Sustainability Summary



The risks associated with these proposed funding levels and the suggested strategies to manage those risks are as follows:

Table 27 - Risk Mitigation Summary

Service Attributes	Lifecycle Activity	Identified AM Lifecycle Risks	Risk Management Strategy
Quality and Reliability	Renewal	The identified asset renewal needs are not fully funded which may result in impact on asset reliability and service levels. Addressing the backlog of asset renewal needs will add pressure to existing staff resources to deliver a larger renewal program.	Investigate financial implications of expanding the current transportation asset renewal program. Investigate resourcing to deliver a larger renewal program.
	Operations and Maintenance	The operations and maintenance needs associated with a growing asset portfolio will increase operating expenditures. Historical tax rate increases have not kept pace with increases in asset portfolios. The continued inability to close the gap in the pavement renewal funding will cause increased maintenance requirements for City roads.	Fund operations and maintenance activities to keep transportation assets in a state of good repair.
Capacity, Use and Function	Growth and upgrade	The identified asset growth and upgrade activity needs are not fully funded which may result in failure to meet 2019 Growth Plan and other regulatory obligations. However, progress on development build out may be delayed for unrelated reasons, such as delayed growth. Addressing a backlog of growth and upgrade projects will potentially add pressure to existing staff resources to deliver a larger number of projects.	Monitor the build out of developments and continue to adjust the timing of growth and upgrade projects, and associated cost forecasts as appropriate.

The following sections provide further details on the planned expenditures versus forecasted needs, by lifecycle activity type.

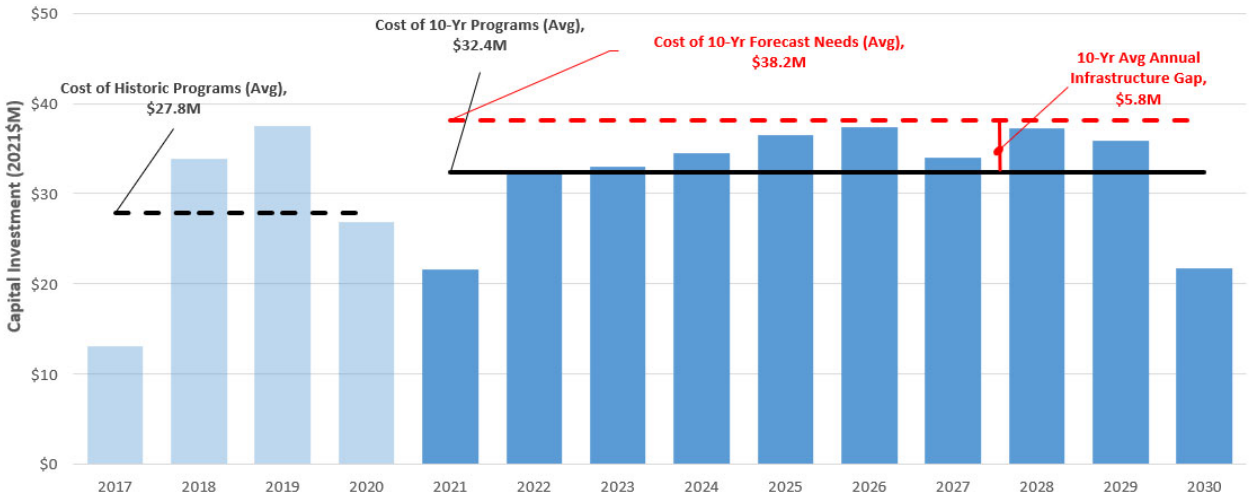
5.2.2 Renewal Financial Sustainability

Asset renewal activities enable the City to meet reliability service objectives through rehabilitation and replacement of existing assets to extend the life and maintain the assets in a state of good repair.

The following graph summarizes the financial sustainability of asset renewal activities. It shows the cost of the forecasted lifecycle needs over the next ten years as **$38.2M per year** (dashed red line) and the budgeted annual funding projected to be available to undertake the needed renewal over the next ten years as **$32.4M per year** (solid black line). Since the needs exceed the funding, the City has an average transportation infrastructure renewal gap of **$5.8M per year** over the next ten years. The graph also

shows the historical expenditure (light bars and black dashed line as the average at $27.8M per year) and planned expenditures (dark bars).

Figure 16 - Renewal Financial Sustainability



Roads make up the majority of the City's $1.122 billion in transportation assets. Therefore, the financially efficient management of the City's roads represents a key opportunity to optimize the use of scarce financial resources. In order to keep our roads in good condition at the lowest overall life cycle cost, the City must continue to be smart with the limited funding that is available for renewal projects. Emphasis should be given to preservation activities such as the Road Resurfacing Program and the Crack Sealing Program. In recent history, the City has been increasing renewal spending, specifically for the Road Resurfacing Program and it is recommended that these increases continue. The City will also continue to monitor the results of the Early Life Pavement Preservation Pilot Program, which started in 2018 and finished in 2021. If the monitoring shows positive results, some of these techniques could be used as additional preservation techniques to extend the life of pavement within the City of Barrie in a financially efficient way.

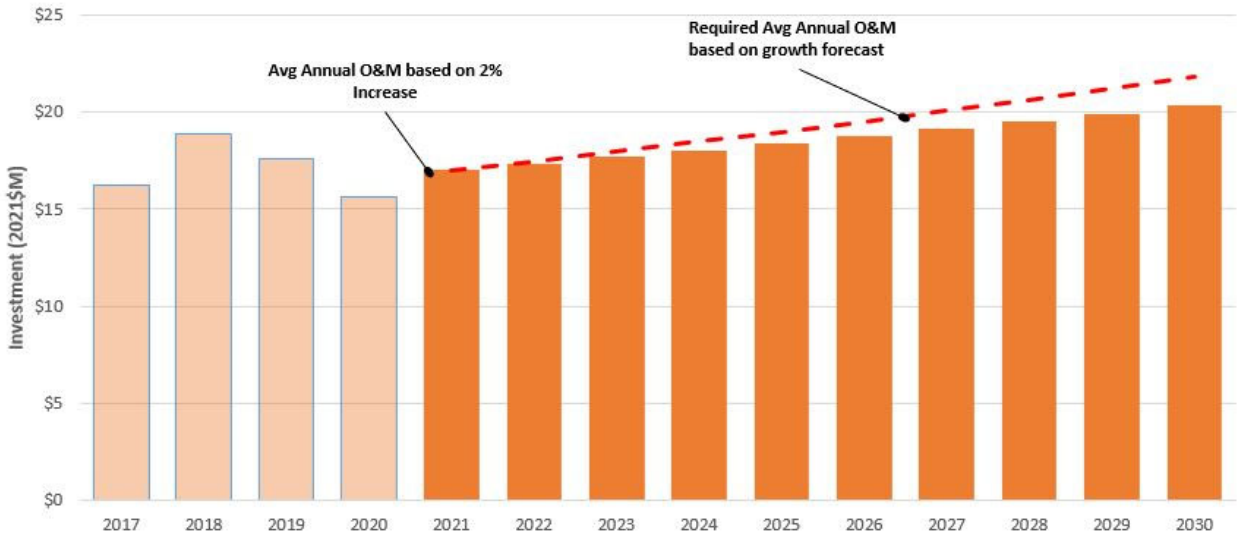
5.2.3 Operations and Maintenance Financial Sustainability

Asset maintenance and operations activities enable the City to meet reliability service objectives by maintaining the assets in a state of good repair and to appropriately use the asset to deliver services.

The following graph depicts the cost of the 2021 budget as **$17.0M** (orange bar in year 2021) and the cost of undertaking the forecast needed operations and maintenance activities over the next 10 years, increasing from **$17.5M in 2022 to $21.8M in 2030** to accommodate increased operations and maintenance needs due to growth of the asset portfolio. Existing Level of Service (LOS) is based on the existing budget that is available. As the number of assets the City owns increases, the O&M budget must also increase or a service level reduction will be experienced. The graph also shows the historical expenditure (light orange bars).

Note that the existing operations and maintenance budget has been determined based on historical spending. In the next Asset Management Plan, the optimal spending to link needs, risk and cost will be investigated.

Figure 17 - Operations and Maintenance Financial Sustainability



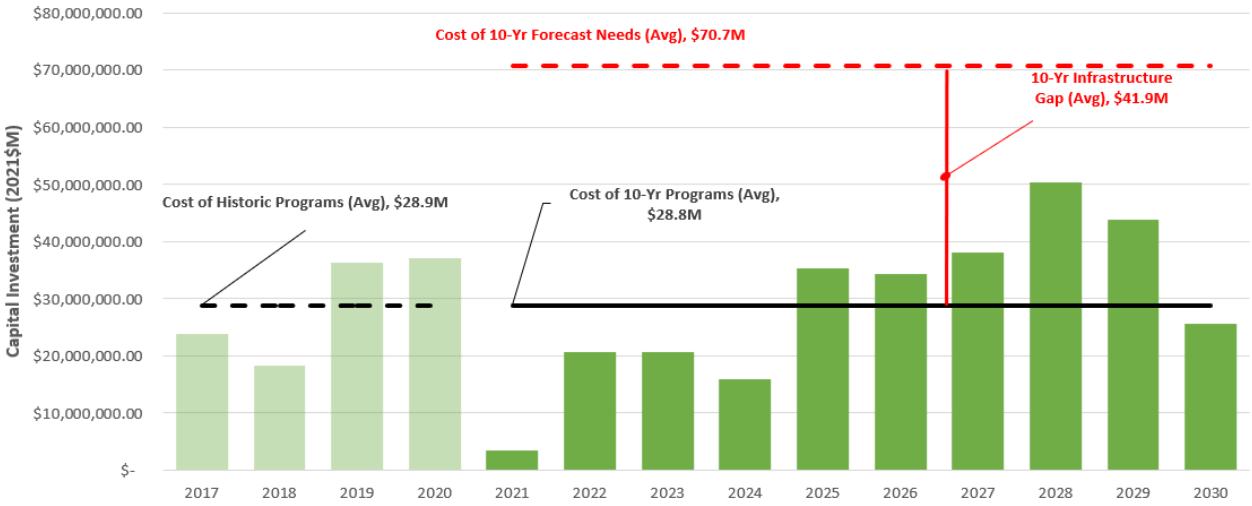
5.2.4 Expansion (Growth) and Upgrade Financial Sustainability

Asset growth and upgrade activities enable the City to meet capacity, use and functionality service objectives through expansion of the assets into previously unserviced areas, increased capacity, or enhanced functionality.

The following graph summarizes the financial sustainability of asset growth and upgrade activities. It shows the cost of the growth and upgrade needs identified in the Transportation Master plan over the next ten years as **$70.7M per year** (dashed red line) and the average annual budgets for growth and upgrade transportation projects over the next ten years as **$28.8M per year** (solid black line). As noted above, the gap of **$41.9M** per year relating to growth and upgrades is largely a function of growth proceeding at a slower pace than had previously been anticipated and is outside of the

City's control. Growth and upgrade funding can be expected to increase as development continues. The graph also shows the historical expenditure (light bars and black dashed line as the average at $28.9M per year) and planned expenditures (dark bars).

Figure 18 - Growth and Upgrade Financial Sustainability



In past years, the City has struggled to fund and deliver transportation growth projects, largely due to:

- Limited funds available due to slow development and competing projects; and
- Limited human resources to deliver projects.

The proposed spending in the 2021-2030 Capital Plan represents a high priority being given to transportation projects as reflected by maintaining the budget forecasts and outlook compared to historical budgets. The forecast and outlook years of the budget are subject to revenues being available as projected. If growth does not materialize as expected, there is potential that those revenues linked to Development Charges may not meet expectations.

To meet the population forecasts set out by the provincial Growth Plan 2019, the City will need to increase the capital growth and upgrade program substantially between 2030 and 2041, while still maintaining the capital renewal program.

5.2.5 Funding Sources - Revenue and Funding Source Forecasts

Through the annual budget process, capital project and operating expenditure information is gathered from service areas, including investment needs, trends and priorities to enable preparation of the ten-year capital and annual operating plans. The ten-year capital program includes the current one-year budget, a four-year forecast, and a five-year outlook. Once the expenditure plans are finalized, a financing plan for proposed expenditures is developed. The plan includes several key sources of funding and financing as outlined in the table below.

Table 28 - Funding Sources

Funding Source	Financing Method
Development Charges (DC)	• Reserves (from current and prior years' development charges collections in accordance with the DC Act)
Front Ending Agreements / Development Contributions	• Reserves (from current and prior years' developer front ending agreements in accordance with the DC Act and developer contributions in accordance with the MOU with the Secondary Plan Area landowners)
Debt	• Long term borrowing, to be paid for by future taxpayers unless DC debt which is paid by DC reserves and development charges
Canada Community-Building Fund (formerly the Federal Gas Tax Fund)	• Funding available for eligible projects
Grants	• Project specific grants / subsidies
Tax Capital Reserve	• Reserves (primarily from current and prior years' property taxes)

Development Charges (DCs) are collected by the City from developers under the City's DC Bylaw. DCs are held in designated DC reserve funds and used to fund a portion of growth-related infrastructure as prescribed by the City's DC Bylaw. Projections relating to DC revenues are based on DC rates and the projected growth in developments.

Grants from the Provincial or Federal governments, including the Canada Community-Building Fund, are also used to finance the capital program. However, many grants are a result of stimulus or other one-time funding that may be more difficult to forecast. Grants are not included in the budget forecast until confirmed.

Capital reserves are established as a source of pay-as-you-go funding for the City's capital program. Funding for these reserves is obtained annually through contributions from property tax supported budgets. The annual reserve contributions are based on forecasted financing requirements and provisions required to sustain reserve balances at appropriate levels to address infrastructure replacement costs in the future and inherent uncertainties in capital funding needs. Reserve contributions are evaluated annually to ensure adequate funds are raised to meet future capital requirements and to smooth out the impact on the annual operating budget.

Current revenue for growth related capital transportation projects is funded primarily by development charges and DC related debt. Revenue for capital transportation upgrade and renewal works is funded by general property taxes (tax capital reserves), with some federal, grant and debt funding. Current revenue for operations is funded by general property taxes.

6. Monitoring and Improvement Plan

6.1 Overview

Development of AM Plans is an iterative process that includes improving data, processes, systems, staff skills, and organizational culture over time. This section provides an overview of the compliance of this AM Plan with Ontario Regulation 588/17 for current levels of service and the improvements required to become compliant with Regulation 588/17 for proposed levels of service by July 1, 2025.

The following improvement activities are planned to enable the City to comply with Ontario Regulation 588/17 Asset Management Planning for Municipal Infrastructure, Proposed Levels of Service by July 1, 2025.

- **State of Infrastructure:** Continue to improve knowledge of asset replacement costs and current condition of the assets based on asset criticality.
- **Levels of Service:** Continue to assess current performance and, for each asset category, document the LOS that the City proposes to provide for the next 10 years and an explanation of why the proposed LOS are appropriate.
- **Asset Management Strategy:** For each asset category, identify the lifecycle activities that would need to be undertaken to provide the proposed LOS for each of the next 10 years, based on risk and lowest lifecycle cost analyses.
- **Financing Strategy:** For each asset category, provide the costs of the lifecycle activities that would need to be undertaken to achieve the proposed LOS for each of the next 10 years, separated into capital expenditures and significant operating costs. Also provide the annual funding projected to be available to undertake lifecycle activities and the options examined to maximize the funding projected to be available. For any funding shortfalls, identify which lifecycle activities will be funded and, for those not funded, the risks of not undertaking them.
- **Other:** Provide an overview of the risks associated with implementation of the AM Plan and any actions that would be proposed in response to those risks. Provide an explanation of any other key assumptions underlying the plan that have not previously been explained.

The following table provides a summary of compliance with current LOS and improvements required to comply with proposed LOS and to improve asset management practices.

Table 29 - O. Reg. 588/17 Compliance Status and Other Opportunities

Plan Section	O. Reg. 588/17 Compliance Practices (Current LOS)	O. Reg. 588/17 Compliance Improvements (Proposed LOS)	Other Opportunities
State of Local Infrastructure	For each asset category, the AM Plan provides a summary of the assets, the replacement cost of the assets, the average age of the assets, the condition of the assets, and the approach to assessing the condition of the assets.	Continue to improve knowledge of asset replacement costs and current condition of the assets based on asset criticality.	Complete asset inventories for asset groups that are lacking accurate information (traffic control, illumination, retaining walls).
Levels of Service	For each asset category, the AM Plan provides the current LOS being provided. For core assets, the 2021 AM provides the qualitative community descriptions and technical metrics as required by O. Reg. 588/17, and the current performance.	For each asset category, provide the LOS that the City proposes to provide for the next 10 years and an explanation of why the proposed LOS are appropriate based on an assessment of: the options for the proposed LOS and the risks associated with those options to the long term sustainability of the City, how the proposed LOS differ from the current LOS, whether the proposed LOS are achievable, and the City's ability to afford the proposed LOS. For each asset category, provide the proposed performance for each year of the next 10-year period.	Continue to develop levels of service metrics that support lifecycle asset management activities for specific asset types. Continue to track and report on 10-year funding rates (the budgeted funds / forecast needs) specific to backlogged lifecycle activities. Use additional data from condition assessments to create a Barrie-specific degradation curve for roads, and better predict road conditions and renewal needs.
Asset Management Strategy	The AM Plan provides the population and employment forecasts as set out in Schedule 3 to the 2019 Growth Plan. For each asset category, the AM Plan provides the lifecycle activities that would need to be undertaken to maintain the current LOS for each	For each asset category, provide the lifecycle activities that would need to be undertaken to provide the proposed LOS for each of the next 10 years, based on risk and lowest lifecycle cost analyses.	Continue to optimize the lifecycle activities by searching out and testing various operations, maintenance and renewal activity and timing options, and then evaluating the benefits against the costs of each option over time to determine the lowest cost option for the required benefits.

Plan Section	O. Reg. 588/17 Compliance Practices (Current LOS)	O. Reg. 588/17 Compliance Improvements (Proposed LOS)	Other Opportunities
	of the next 10 years, based on risk and lowest lifecycle cost analyses.		
Financing Plan	The AM Plan provides the estimated 10-year capital expenditures and significant operating costs required to maintain the current levels of service to accommodate projected increases in demand caused by growth as set out in Schedule 3 to the 2019 Growth Plan. For each asset category, the AM Plan provides the costs of providing the lifecycle activities that would need to be undertaken to maintain the current LOS for each of the next 10 years.	For each asset category, provide the lifecycle management financial strategy that sets out the following for the 10-year period: • For each asset category, provide the costs of the lifecycle activities that would need to be undertaken to achieve the proposed LOS for each of the next 10 years, separated into capital expenditures and significant operating costs. • Provide the annual funding projected to be available to undertake lifecycle activities and the options examined to maximize the funding projected to be available. • For any funding shortfalls, identify which lifecycle activities will be funded and, for those not funded, the risks of not undertaking them.	Track spending amounts to the LOS Framework: to lifecycle activity type, technical LOS type, and customer LOS type. Track spending amounts to asset and asset type.
Other	The AM Plan indicates how the background information and reports upon which the state of infrastructure section within AM Plan is based will be made available to the public.	Provide an overview of the risks associated with implementation of the AM Plan and any actions that would be proposed in response to those risks. An explanation of any other key assumptions underlying the plan that have not previously been explained.	

6.2 Monitoring and Review Procedures

This AM Plan will be reviewed during annual budget planning processes and amended to show any major changes in service levels and/or resources available to provide those services as a result of budget decisions.

The AM Plan will be updated every four to five years to ensure it represents the current service level, asset values, projected operations, maintenance, capital renewal and replacement, capital upgrade/new and asset disposal expenditures and projected expenditure values incorporated into the long-term financial plan.

6.3 Performance Measures

The effectiveness of the asset management plan can be measured in the following ways:

- The degree to which the required projected expenditures identified in this asset management plan are incorporated into the long-term financial plan.
- The degree to which the current one-year budget and four-year forecast take into account the forecasted needs provided by the AM Plan.
- The degree to which the existing and projected service levels and service consequences (what we cannot do), risks and residual risks are incorporated into Council's Strategic Plan and associated plans.
- The Asset Funding Ratio achieving the target of 1.0.

6.4 Recommendations for Future Improvements

To assist in the improvement of the AM Plan's confidence level rating and improve future versions of this AM Plan, it is recommended that the City of Barrie focus on the following recommendations:

Table 30 - Recommendations for Future Improvements

Number	Recommendations for Future Improvements
1	It is recommended that the City determine an appropriate methodology to complete a condition assessment of sidewalks, either as part of the road condition assessment, as an individual project, or as part of mandatory sidewalk inspections under O. Reg. 239/02.
2	It is recommended that the City obtain better and more complete inventory and condition data for traffic signals, signs, illumination and retaining walls. The City should develop processes to ensure that asset inventories are accurate. Information regarding asset ownership should also be improved for asset classes for which this data is lacking (eg. retaining walls). A priority for this data collection should be to ensure that the next AMP does not rely on the use of any PSAB data, which is not sufficient to produce accurate asset management analysis.
3	As the City incorporates performance management processes and indicators into its business practice, the next AMP should establish benchmarks for performance beyond the provincially mandated LOS. These should be backed by at least 2 years of data. This may include expanding on the use of customer feedback systems. Tracking complaints can be used to calibrate LOS targets and actual performance. Capacity of the road network, and active transportation should be considered for measurement.
4	The City should work with its railway operator to understand and complete an asset management plan for all of its rail assets.
5	For high consequence of failure assets (e.g. bridges) where condition is a predictor of remaining life, the City should consider improving it's ability to predict the timing of critical interventions, including detailed condition assessments where appropriate.
6	For future AM Plans, the City should consider switching from a HIRA 4-point methodology risk matrix to a HIRA 5-point methodology. This will align better with the Stormwater, Water and Wastewater AMPs.
7	Before the next Transportation AMP, the City should improve its tracking of operations and maintenance expenditures to better support asset management planning.
8	The City should continue to explore alternative treatments for renewal of assets, including "do nothing", asset (replace, rehabilitate, maintain/operate differently) and non-asset (failure management plan, rebate for failure, different level of service). Programs should be piloted to assess the effectiveness and cost of these alternative treatments prior to implementing network wide application.

9	Financial assumptions in the next AMP should be linked to other financial documents within the City including Long Range Financial Plans.
10	By the next AMP, the City should incorporate more demand and levels of service processes and performance indicators into its business practice, the AM Plan can then identify specific failure modes that prevent meeting customer and other stakeholder levels of service.

7. Conclusions

The City has historically underinvested in its transportation assets. This Transportation Asset Management Plan forecasts continued underinvestment over the next ten years.

Although the City has made some progress on reducing the renewal gap over the past five years, through funding increases to the Road Resurfacing Program, there is still a significant gap which must be closed to ensure the financially efficient management of our existing assets.

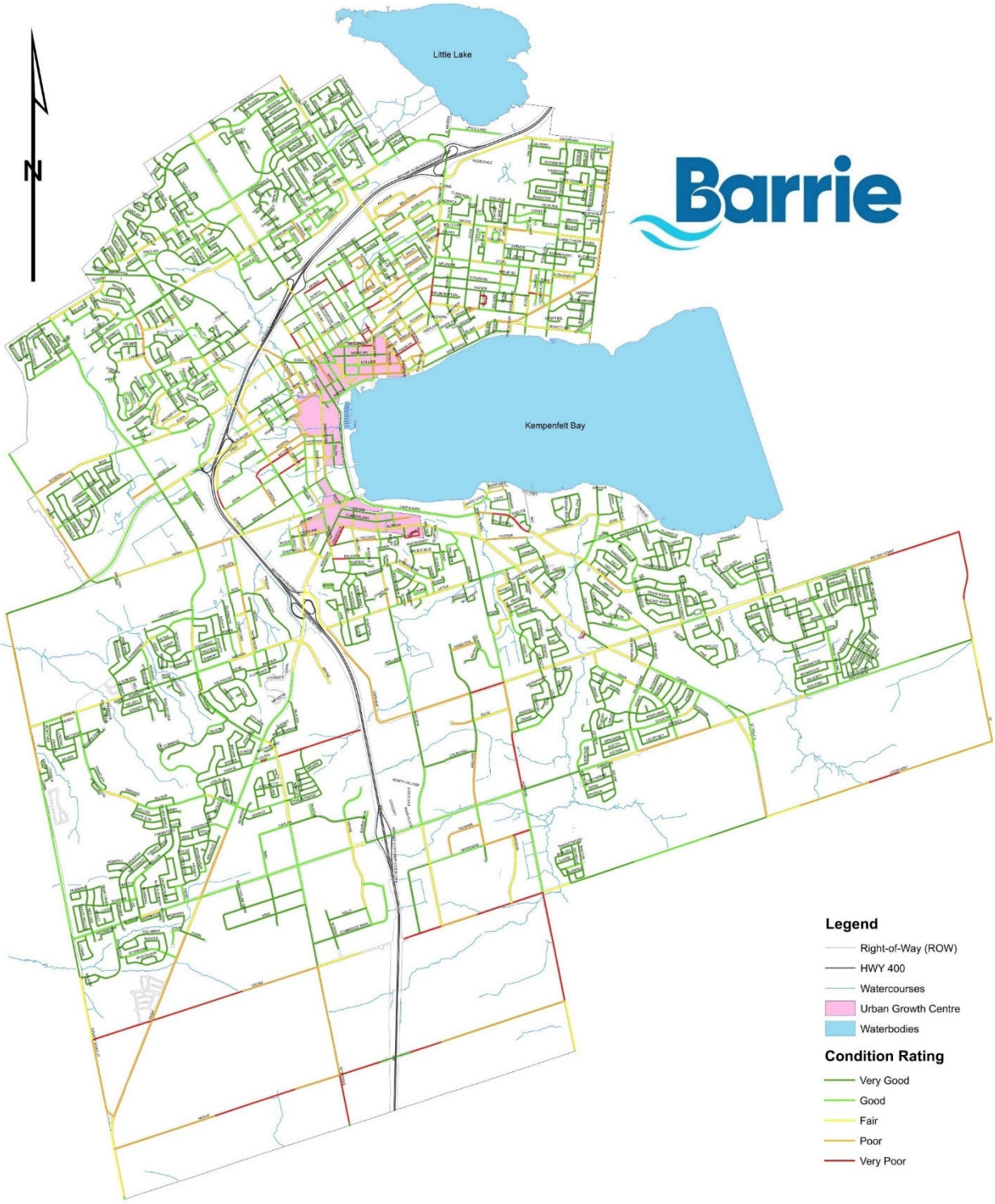
Growth and upgrade projects for the transportation system are also substantially underfunded over the next 10 years based on the needs identified in the Transportation Master Plan. Some of this is due to the fact that development in the secondary plan areas has occurred more slowly than expected and is therefore out of the City's control. The City must continue to monitor development with the aim of ensuring that necessary projects are completed at the right time to support growth. It must also be acknowledged that some growth and upgrade projects have elements of benefitting the existing Barrie community. In these cases, delays to growth and upgrade projects may result in impacts to levels of service such as traffic congestion and inadequate service for pedestrians and cyclists.

It will also be important for the City to provide appropriate funding for operations and maintenance in the context of a growing asset portfolio, and potentially, an asset portfolio that is degrading over time due to insufficient renewal investment. The risks of underinvestment in operations, maintenance, and renewal include increased costs to replace failed assets as well as more risk in the form of traffic congestion, degraded roads, and hazardous conditions for pedestrians and cyclists.

Staff will use this asset management plan and subsequent revisions to continue to improve the City's understanding of its asset management needs, including development of level of service targets. By July 1, 2025, the City is required by O. Reg. 588/17 to identify the proposed levels of service and details on the costs and risks associated with them over the next ten years, with consideration of the full lifecycle of the assets. Ongoing development of the City's asset management programs will enable an improved understanding of investment needs as well as optimal life cycle strategies to maintain the City's transportation network to achieve appropriate levels of service and acceptable levels of risk, at the lowest overall life cycle cost.

8. Appendix A

Figure 19 - Road Connectivity and Pavement Condition Map



9. Appendix B

Figure 20 - Typical Bridge Condition Photo

Figure 21 - Typical Bridge Condition Photo

Figure 22 - Typical Bridge Condition Photo

Figure 23 - Typical Bridge Condition Photo

Figure 24 - Typical Bridge Condition Photo

Figure 25 - Typical Bridge Condition Photo