Asset Management Plan

Transportation

City of Brampton

27 April 2022

GHD

→ The Power of Commitment

Executive summary

Introduction

The City of Brampton (the City), is located within the Greater Toronto Area (GTA), within the Region of Peel. It is known for being a diverse and rapidly growing City. The City is responsible for delivering an equally diverse range of services to its residents, which includes the management of the City owned Transportation Assets. The Transportation Service Area is the collection of Subject Matter Experts (SMEs) within the Public Works & Engineering Department of the City that is ultimately responsible for the management of the delivery of asset management practices on behalf of the City.

The purpose of this Asset Management Plan (AMP) is to summarize how the Transportation Service Area manages its Transportation Assets, within the City. It also outlines how the Transportation Service Area has advanced its asset management practices which promote financial sustainability while delivering the expected Levels of Service for its community.

State of Local Infrastructure

The AMP describes the replacement value, physical condition and relative age of the City's transportation asset portfolio, organized by asset category. The City owns transportation assets with a total replacement value of approximately **$2.47 billion**, as shown graphically in Figure 0.0.1.

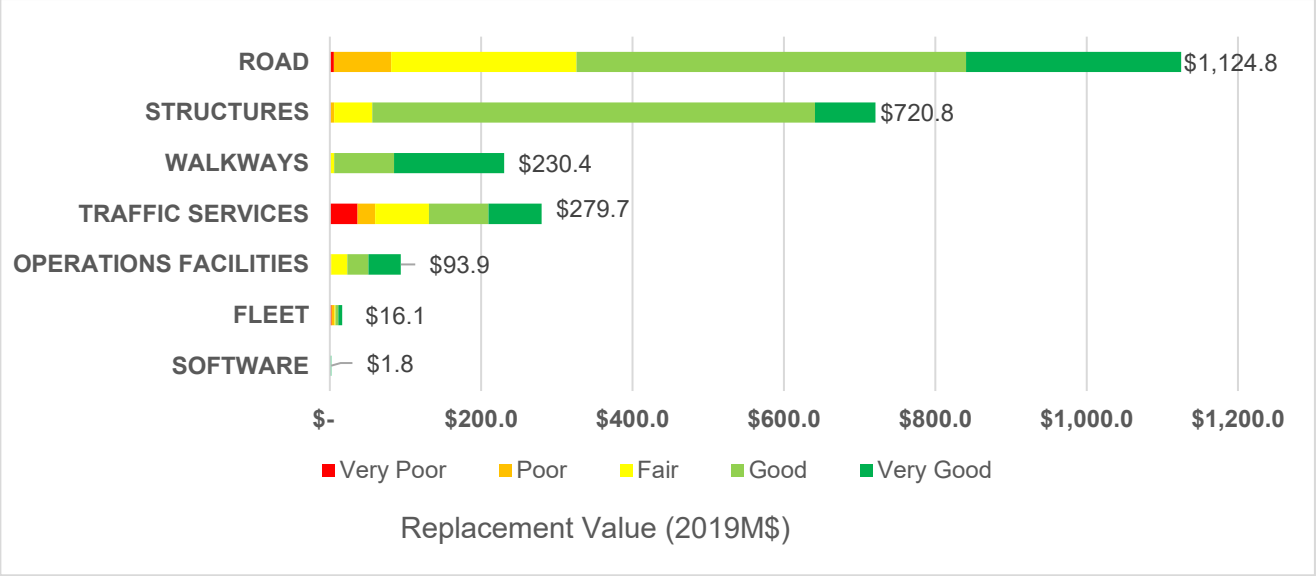

Figure 0.0.1 Replacement Value

The Asset Management Plan identifies that the City's transportation assets are generally in **GOOD** condition, with over **94%** of the assets in fair or better condition, which is referred to as a **"state of good repair"**. The chart above illustrates the distribution of assets, by condition and by asset value.

The Asset Management Plan identifies **6.1% or $150.1 million** in transportation assets that are shown in the poor or very poor physical condition and are approaching the end of their "useful life". Following best practice and to minimize lifecycle costs while appropriately mitigating risks, many non-critical assets are planned for replacement on failure or once assessed to be in poor condition.

Levels of Service

In January 2018, the Province of Ontario enacted Ontario Regulation 588/17 'Asset Management Planning for Municipal Infrastructure' under the Infrastructure for Jobs and Prosperity Act, 2015. The regulation requires municipalities to develop an Asset Management Plan based on Current Levels of Service by July 1st, 2022, for core assets, which include roads and bridges. This requirement extends to all other municipal infrastructure by

July 1st, 2024. By July 1st, 2025, a more advanced Asset Management Plan (Proposed Levels of Service) is required for all assets.

The Asset Management Plan provides the measures for existing performance on current customer and technical levels of service for the City's Transportation services in accordance with the O.Reg. 588/17 requirements. The following table provides the technical metrics (Column 3) of Tables 4 to 5 of the regulation. Customer (also known as community) levels of service are provided in Appendix B.

Table 0.1 City O.Reg. 588/17 Technical Levels of Service

Asset Type	Attribute	Technical Metric	2019 Performance
Roads	Scope	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	Arterial: 2.9 Collector: 1.9 Local: 7.3
	Quality	For paved roads in the municipality, the average pavement quality index value	PCI: 8.3
Bridges & Culverts	Scope	Percentage of bridges in the municipality with loading or dimensional restrictions	Loading: 1.5% Vertical Clearance: 2.0%
	Quality	For bridges in the municipality, the average bridge condition index value	BCI (Bridges): 78
		For structural culverts in the municipality, the average bridge condition index value.	BCI (Culverts): 75

Demand Strategy

Asset management helps the City manage change and business transformation challenges. These challenges are recognized in the form of demand drivers. Services are delivered to the residents of Brampton based upon the requirements and defined capacities, available funding, and allocated resources. The levels of service (LOS) provided is intended to meet the demands for services. Therefore, understanding changes in demand placed on services is advantageous in the planning of affordable, sustainable, and desirable community services.

This AMP summarizes the changes in demand, key drivers, their impacts and strategies to manage the demand:

– **Demand Drivers** – challenges, trends and drivers which may affect current services.
– **Demand Impact or Forecast** – outlines the impact of the demand drivers and forecasts the changes to the transportation assets.
– **Demand Management Strategies** - sets out the City's lifecycle management strategies (maintenance and renewal strategies), or additional infrastructure in response to the demand.
– **Emerging Drivers** – Those challenges, trends and drivers which may affect current services in the future (next 10 years)

Risk Management Strategy

Management of Risks is a critical component of the Transportation Service Area asset management principle, to meet service levels and manage risk while minimizing lifecycle costs. Risk events are events that may compromise the delivery of the City's strategic objectives and services. This Plan considers the risk that applies at different levels of the organization including:

– Enterprise Level
– Service Area Level; or
– Technical (or Asset) Level.

An explanation of the Enterprise Level and the Service Area Level risks is provided in Section 5.

The Summary of the Transportation asset portfolio (Technical Level) has been developed in Table 0. 2. This shows the highest risk calculated across any of the customer LOS attributes. The risk map is expressed in terms of the asset replacement value, in 2019-dollar value, corresponding to the risk of failure score:

– Extreme (red),

– High (orange),
– Moderate (yellow),
– Low (green), and
– Insignificant (grey).

Table 0. 2 Overview of Transportation Asset Portfolio Risk Summary

		Consequence				
		C1	**C2**	**C3**	**C4**	**C5**
Likelihood	P5	$-	$0.40	$35.81	$2.27	$-
	P4	$-	$0.18	$72.79	$25.63	$-
	P3	$-	$0.62	$247.45	$160.67	$-
	P2	$-	$20.08	$809.58	$1,452.38	$-
	P1	$-	$12.38	$147.71	$-	$-

Assets falling in the higher risk categories are an investment priority for the City (have a high consequence of failure and highest probability of failure).

The City has **no assets in the extreme risk category**. It currently has **$63.7 million (2.1%) of assets in the high risk** (orange) category.

Governance

To achieve efficient asset management delivery, it is essential that a clear structure, with appropriate authority, roles and responsibilities is in place. This allows individuals within the organization to understand their role, take ownership and effectively support AM objectives.

Section 6 provides the roles and responsibilities outlined in the *Strategic Asset Management Policy* as it relates to the Transportation Assets. It also outlines key asset management responsibilities, within the Transportation Service Area. The City has recognized the importance of an effective AM Governance structure in contributing to the successful delivery of services and in achieving goals. This AMP builds on the significant recent advancement in AM governance in the identification and documentation of AM roles and responsibilities.

Asset Information

Asset information is a key enabler for effective asset decision-making and hence Asset Management practices. As with the physical assets, asset information itself must be managed effectively, throughout the asset lifecycle, to maximize its value. The management of asset information begins when it is first created at the asset conceptualization phase and continues until the information is no longer required and is either deleted or archived. Section 7 establishes the benefits, data governance structure, asset data management tools and their uses.

Asset Lifecycle Strategies

Asset Lifecycle Strategies summarizes the asset management strategies (i.e., planned actions) that will enable the assets to provide the required levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost. These actions or activities include:

1. Expansion (Growth and Upgrade)
2. Operations
3. Maintenance
4. Renewal (Rehabilitation and Replacement)
5. Disposal

Each of these asset management activities has an inherent cost associated with performing the work. The accumulative cost of all the activities required throughout an asset's lifecycle is referred to as the asset's lifecycle

cost. A visual representation of a theoretical asset's lifecycle and the accumulative lifecycle cost or cost of ownership is shown in Figure 0.0.2.

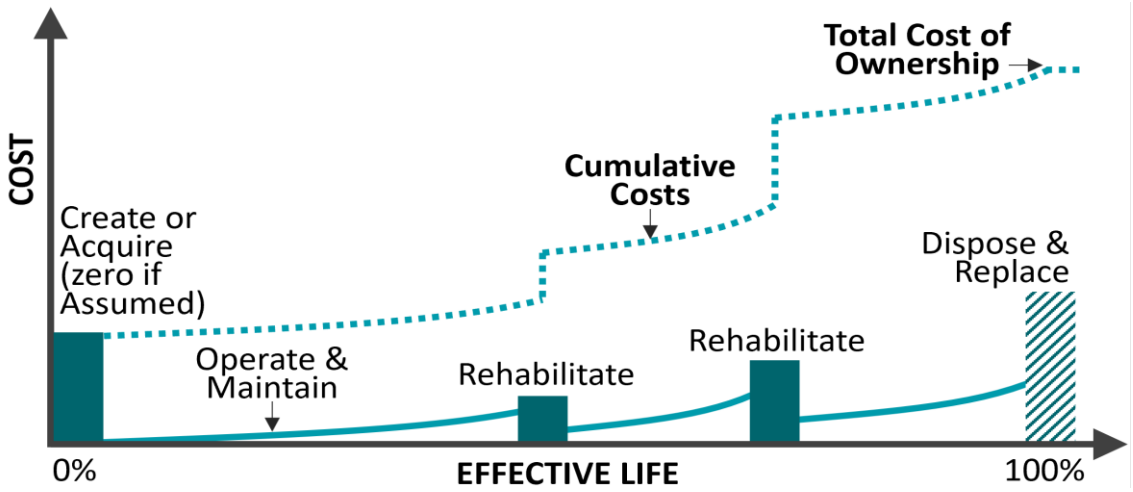

Figure 0.0.2 Illustrative example asset's lifecycle and the accumulative lifecycle cost

A key objective of the Transportation Service Area is to effectively deliver the Levels of Service at the lowest lifecycle cost while managing the risk and maximizing the useful life of the asset. The following sections summarize the strategies and activities which the City of Brampton undertakes to achieve the lowest lifecycle cost.

Financing Plan

To be effective, asset management practices should be integrated with financial planning and budgeting. Financial management principles for asset intensive organizations include recognizing the consumption of asset service potential, categorizing expenditure by lifecycle activity, allocating costs to assets as far as practical, preparing long term forecasts, cost-effective financing, and effective reporting of financial performance.

The development of the costs associated with the asset lifecycle activities is presented in Figure 0. 0.3.

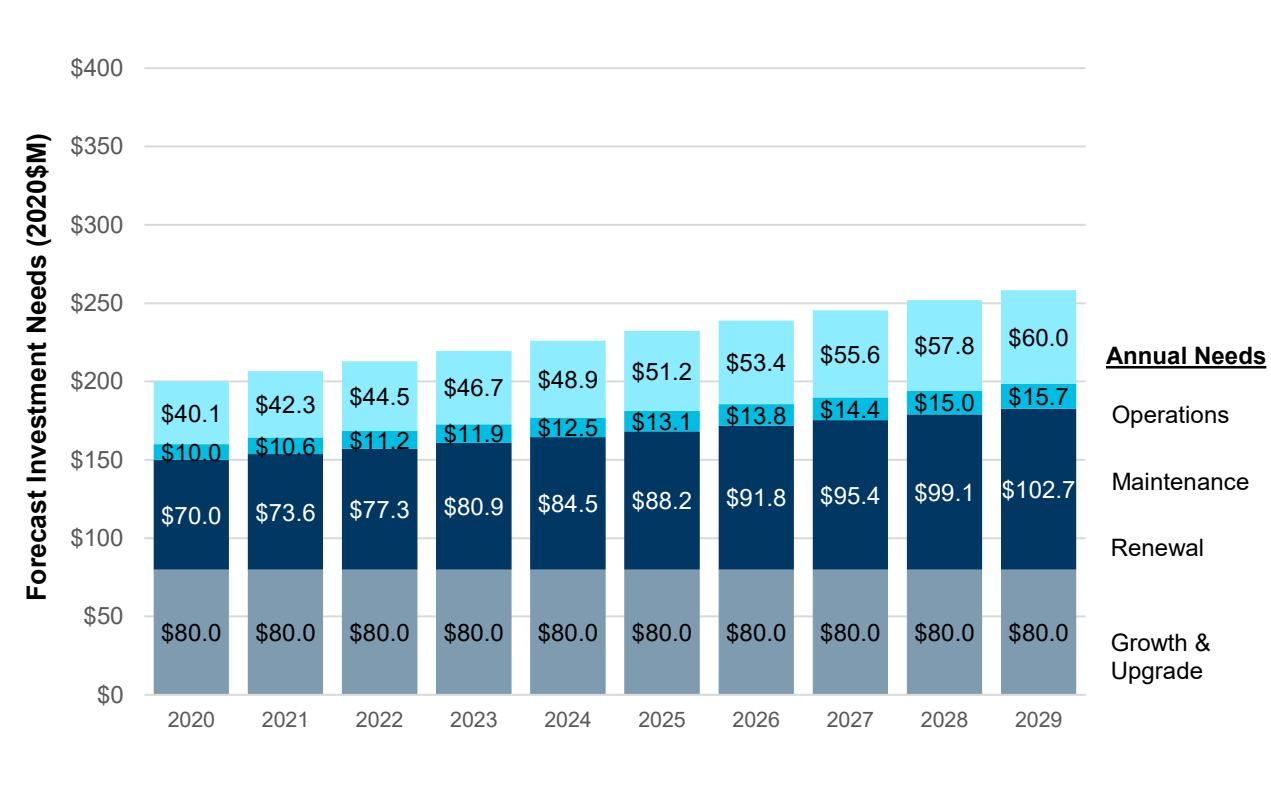

Figure 0. 0.3 Forecast Investment Needs over the next 10 years

Similarly, the Transportation Service Area undertook an assessment of the forecast funding sources and their change (positive or negative) over the next 10 years to enable comparison with the need. The primary and consistent funding sources which the Transportation Service Area will rely on from 2020-2029 are shown in Figure 0. 0.4.

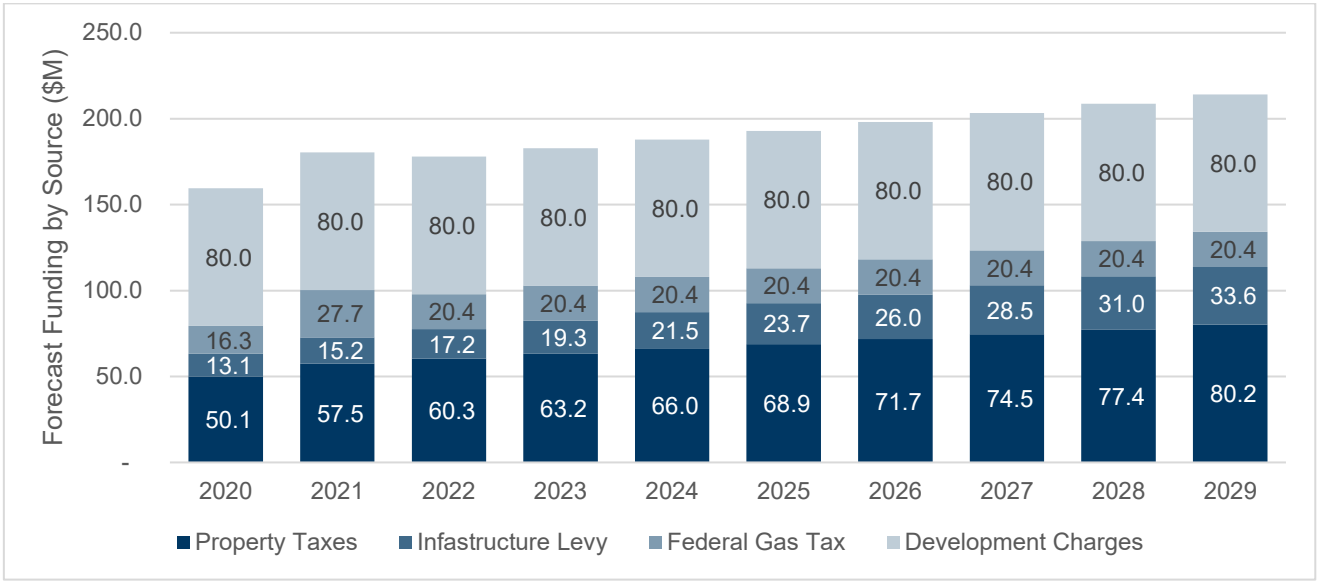

Figure 0. 0.4 Forecast Funding Sources over next 10 years

By comparing the forecast investment need with the funding sources, an understanding of the funding surplus or deficit (referred to as the 'gap') can be determined between 2020 and 2029. This is shown in Figure 0. 0.5.

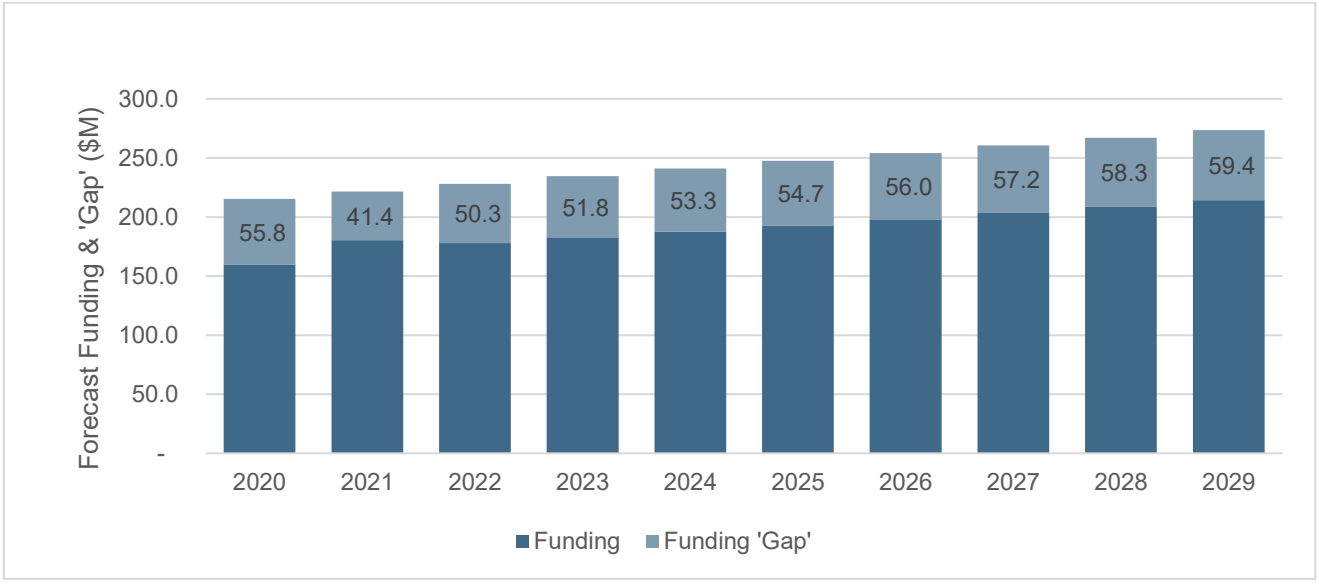

Figure 0. 0.5 Forecast Funding and Gap over the next 10 years

As illustrated in Figure 0. 0.5, The Transportation Service Area has an annual 'funding gap' which is based on the current Levels of Service and lifecycle activities, and projected funding. The average annual cost of the forecast needed lifecycle activities based on this forecast is **$244.4M** and the projected average annual funding as **$190.6 M per year**. Since the "needs" exceed the "funding", the City has an average annual infrastructure "gap" of **$53.8 M per year or a Funding ratio of 0.78**. Although significant work has been conducted to develop this assessment, the Transportation Service Area acknowledges that some assumptions used to create this forecast require further investigation. Based on initial interrogation of these assumptions, the Transportation Service Area expects that the 'gap' may be between **$10.5M and $53.8 M**. It is acknowledged that the current asset management practices (particularly associated with replacement) require additional work to improve maturity and hence certainty in these figures.

Monitoring and Improvement Plan

This 2019 Asset Management Plan complies with Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure, Current Levels of Service (due by July 1, 2022). It is important to note that achieving compliance is not a singular event. It requires regular monitoring, maintenance and adjustment of the system to ensure compliance. Additionally, the requirements for future AMPs will increase as the Ontario Regulation 588/17 requires the incorporation of the Proposed Levels of Service by July 1, 2025.

Although the system is operational and foundational elements of Asset Management have been implemented (including elements of the Proposed Level of Service), it is acknowledged that additional improvements to the system are required. The effectiveness of the AMP can be measured in the following ways:

– Independent assessment of the current Asset Management program maturity against the desired target
– The degree to which the required projected expenditures identified in this asset management plan is incorporated into the long-term financial plan
– The degree to which 1–5 year detailed works programs, budgets, business plans and corporate structures consider the ‘global’ work program trends provided by the AMP
– The degree to which the existing and projected service levels and service consequences (what we cannot do), risks and residual risks are incorporated into the Strategic Plan and associated plans
– The Asset Renewal Funding Ratio achieving the target of 1.0.

Details of the implementation activities required to achieve this are summarized in Section 10.

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Glossary

Table 0.0.3 Glossary Table

Term	Description
Asset	Anything having current or potential value
Asset Categories	Collection of assets that deliver a similar service (aka asset class)
As-Is	Current state
Asset Management Framework	A simplified representation of an organization's processes, and their relationship to each other, that describes the key elements and activities of the business that translate inputs into outputs.
Benchmarking	To evaluate or check (something) by comparison with a standard or with a previous performance threshold
Customer Level of Service	The service as it is experienced by the customer and expressed through the voice of the customer
Data Model	The interaction of the data records and data fields to produce business intelligence
Effectiveness	The extent to which planned activities are realized and planned results achieved
Functionality	Services are suitable for their intended function & minimize health, safety, security, natural & heritage impacts
Key Performance Indicator	A subset of the organization's most important quantifiable measures that are used to evaluate the success of a program, project, process, activity or other outcomes. They demonstrate how effectively the organization is achieving key business objectives
Levels of Service	Parameters, or combination of parameters, that reflect social, political, environmental and economic outcomes that the organization delivers. Note 1: The parameters can include safety, customer satisfaction, quality, quantity, capacity, reliability, responsiveness, environmental acceptability, cost and availability.
Risk	Risk is defined as the possibility that an event will occur that adversely affects the achievement of the City's levels of service
Risk event	Events which may compromise the delivery of the City's strategic objectives and levels of service.
Technical Level of Service	The behind-the-scenes (back of house) activities of the organization in the management of the physical condition, demand condition and functional condition of the assets.

Abbreviations

Table 0.0.4 Table Abbreviation

Acronym	Description
AM	Asset Management
AMP	Asset Management Plan
CIRC	Canadian Infrastructure Report Card
City	City of Brampton
CLOS	Customer Level of Service
CMMS	Computerized Maintenance Management System
COF	Consequences of Failure
EAM	Enterprise Asset Management
GIS	Geographical Information System
KPI	Key Performance Indicator
LOF	Likelihood of Failure
LOS	Levels of Service
MMS	Minimum Maintenance Standards
O&M	Operations and Maintenance
RACI	Responsible, Accountable, Consulted and Informed
SLA	Service Level Agreement
SME	Subject Matter Expert
TCA	Tangible Capital Assets
TLOS	Technical Level of Service

1. Introduction

The City of Brampton (City), located within the Greater Toronto and Hamilton Area (GTHA), in the Region of Peel is a diverse and rapidly growing City. The City is responsible for delivering an equally diverse range of services to its residents including the provision of Transportation Services. Responsibility for the management of these assets within the City resides with the Transportation Service Area, which comprises several groups within the Public Works and Engineering Department.

1.1 Asset Management Plan (AMP) Background

The challenge of maintaining and renewing ageing public infrastructure under current funding/resource levels and structures is widely recognized. Rapid growth, public demands for high levels of service, increased exposure to liability and risk, and downloaded responsibilities add to these challenges. While the City has a long history of implementing advanced asset management practices that incorporate asset renewal, enhanced operation and maintenance practices, policies, and programs, there is now a legislative and regulatory requirement for the development of formal asset management plans.

In January 2018, the Province of Ontario enacted **Ontario Regulation 588/17:** Asset Management Planning for Municipal Infrastructure under the *Infrastructure for Jobs and Prosperity Act, 2015*. This is the primary regulation which stipulated the minimum requirements for the development of a Municipal Asset Management Plan in Ontario. The regulation requires municipalities to develop an AMP based on current Levels of Service by July 1st, 2022 for core assets (Roads, Bridges and Culverts, Stormwater, Water, Wastewater), and by July 1st, 2024 for other municipal infrastructure assets. The City's core assets support the delivery of transportation and stormwater services. By July 1st, 2025, a more advanced AMP (Proposed Levels of Service) is required for all assets. Relevant legislative requirements for Asset Management Plans include the following:

Table 1.1 Applicable Legislation

Legislation	Application
Province of Ontario Municipal Infrastructure Strategy	In August 2012, the Province of Ontario initiated the Municipal Infrastructure Strategy. This initiative focuses on asset management planning for municipalities. Any Ontario municipality or local service board seeking provincial capital funding in the future must submit a detailed asset management plan as part of the grant application process. In 2012, the Province of Ontario published 'Building Together: Guide for Municipal Asset Management Plans' (AMP) to encourage and support municipalities in Ontario to develop AMP(s) in a consistent manner.
Federal Gas Tax Funding	In April 2014, the City entered into a ten-year municipal funding agreement with the Association of Municipalities of Ontario (AMO) for the transfer of Federal Gas Tax funds. The agreement stipulates that the City must develop and implement an Asset Management Plan prior to December 31, 2016. The definition of "Asset Management Plan" as prescribed by the agreement is as follows: "Asset Management Plan" means a strategic document that states how a group of assets are to be managed over a period of time. The plan describes the characteristics and condition of infrastructure assets, the levels of service expected from them, planned actions to ensure the assets are providing the expected level of service, and financing strategies to implement the planned actions. The plan may use any appropriate format, if it includes the information and analysis required to be in a plan as described in Ontario's Building Together: Guide for Asset Management Plans. Future outcomes reporting to be developed and implemented by AMO will require the City to provide a report to AMO demonstrating that Asset Management Plans are being used to guide infrastructure planning and investment decisions and how gas tax funds are being used to address priority projects.
Province of Ontario	The Infrastructure for Jobs & Prosperity Act (IJPA), 2015 was proclaimed on May 1, 2016. The purpose of this Act is to establish mechanisms to encourage principled,

Legislation	Application
Infrastructure for Jobs and Prosperity Act	evidence-based and strategic long-term infrastructure planning that supports job creation and training opportunities, economic growth and protection of the environment, and incorporate design excellence into infrastructure planning. The Act sets out principles which the Province and all broader public sector entities (including Municipalities) should consider when making decisions respecting infrastructure. The Act also stipulates that the Province and all broader public sector entities prepare infrastructure asset management plans. In January 2018, the Province of Ontario enacted **Ontario Regulation 588/17:** Asset Management Planning for Municipal Infrastructure under the *Infrastructure for Jobs and Prosperity Act, 2015*. This is the primary regulation which stipulated the minimum requirements for the development of a Municipal Asset Management Plan in Ontario.
Province of Ontario Development Charges Act	The Development Charges Act (DCA) regulations require detailed asset management plans to support Transit DC By-laws. Less detailed Asset Management Plans that demonstrate that the assets included in the background study are financially feasible over their full lifecycle are also required for all other DC eligible services.

1.2 AMP Purpose

The purpose of this Asset Management Plan (AMP) is to provide a summary on how the City manages transportation assets to deliver essential services to its communities and in so doing meet the stated requirements of O.Reg 588/17. Additionally, this plan represents an important step in developing and achieving an asset management practice which allows the City's Transportation Infrastructure to be managed in a financial sustainability manner while delivering the expected Levels of Service for its community.

1.3 AMP Scope

The Scope of the AMP includes all the assets within the City's Transportation Service Area and the services they deliver. These include:

Table 1.2 Summary of Transportation Asset Hierarchy

Asset Categories	Asset Types
– Roadways	Arterial, Collector, Local
– Structures	Bridge, Culvert, Walls, Rails, Gateway Features, Steps
– Sidewalks/Walkways	Sidewalks, Walkways, Multi-use Paths
– Traffic Services	Traffic Signals, Street Lighting, Traffic Signs
– Operations Facilities[1]	
– Fleet[1]	
– Software[1]	

For details regarding the departments and divisions which are included in the Transportation Service Area, see Section 6. The complete asset hierarchy is provided in Appendix B.

1.4 AMP Context

This Asset Management Plan represents the current asset management practice, at the time the report was created. The plan was developed over a number of years, however, the initial sections

[1] The Operations Facilities, Fleet and Software asset classes are described within the Chapter 2 State of Local Infrastructure only and are not considered in subsequent AMP chapters thereafter (unless explicitly stated). Although these are important assets from a transportation service delivery perspective, they are primarily managed by City departments outside of the Transportation Service Area and therefore will be accounted for in other departmental AMPs.

(SOLI) were created in 2020 and hence the data is from 2019. It is important for the reader to be aware that this report represents a “snapshot in time” and will be built upon and updated by the Transportation Service Area in the future now that the tools and process have been created.

This AMP is a planning document that is used to provide a rational framework for managing the City’s transportation assets. It has been developed to meet Ontario Regulation 588/17 (Proposed Levels of Service) requirements and closely follows the Province’s *Building Together: Guide for Asset Management Plans* to ensure that it meets the requirements for funding applications. It outlines the asset activities for each service area and provides a guide to understanding key items such as:

– Alignment with the City’s strategic goals
– The value and condition of the City’s asset portfolio
– Levels of service and performance measures
– Management techniques to assist in making long term funding decisions
– Lifecycle activities to operate, maintain, renew, develop and dispose of assets
– Budget forecasts for growth and renewal to sustain the City’s asset portfolio

This AMP contains consolidated information that is currently available for the City’s assets to provide a 10- year forecast that considers the full lifecycle of each asset type. This AMP helps in establishing risk mitigation and risk reduction strategies for the City’s assets based on an understanding of customer requirements, regulatory compliance, and the ability of the assets to meet current levels of service.

This AMP identifies future costs and assists in predicting future challenges that may hinder service delivery. This creates opportunities for the City’s asset managers and operators to remove physical and financial barriers before they negatively impact levels of service.

The relationship of AMPs to other City documents and plans is illustrated in the figure below.

Figure 1.1 AMP in the Broader Organizational Context (extracted from ISO 55000)

It should be noted that *Operational Strategies and Plans* should not be confused with Operational or Capital investment, as they refer to plans which guide the day-to-day activities of the Transportation team and supporting contractors.

The AMP is a living document that will continue to reflect the evolution of asset management practices within the City over time. It is intended that continuous improvements to the asset management practices undertaken by the City, including the implementation of the Asset Management System, will

contribute to improvements in the production of future iterations of this AMP. The AM plan will be updated by 2025 to meet the Ontario Regulation 588/17 requirements.

1.5 AM Maturity

An Asset Management Maturity assessment was conducted to assess the maturity of the Transportation Services Area, as part of the Transportation AM Plan project. The maturity assessment was based on the ISO 55000 AM Standard and the IAM Framework using a standard maturity assessment tool based on relevant best in class practices. The maturity rating was determined on a scale of 0-5 (Innocence to Excellence) for the current situation.

Overall, the Transportation Services Area has an average AM maturity rating of establishing (2.5) to competent (3).

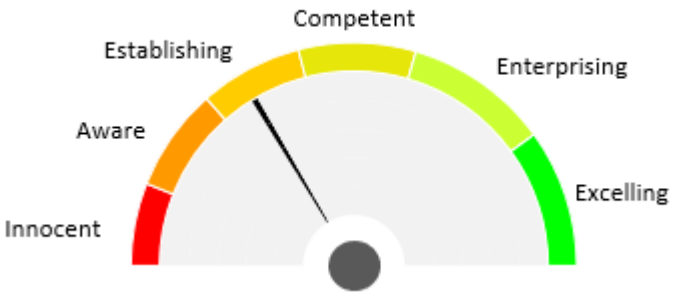


Figure 1.2 The Maturity Assessment Rating Score

By addressing, improvement initiatives (outlined in section 10) the Transportation will be able to increase the maturity of its asset management practices and could achieve a score of “enterprising (4)” in the next five years. The complete process and assessment scoring are provided in *Asset Management Maturity Assessment 2020* report. The Executive Summary of the report is provided in Appendix A.

1.6 AMP Structure

The AMP is organized to meet the requirements of Ontario Regulation 588/17 (Current Levels of Service) and the Province’s “Guide for Municipal Asset Management Plans”. The contents of this AMP follow the recommended elements of a detailed AMP:

- **Executive Summary:** Summary of AMP
- **Introduction:** Outlines scope, background information, relationship to other City documents and plans, and applicable legislation
- **State of Local Infrastructure:** Summarizes the asset hierarchy, inventory, valuation, age distribution, and condition
- **Levels of Service:** Defines levels of service through performance indicators and targets and outlines current performance. Describes external trends or issues that may affect expected levels of service
- **Asset Management Strategy:** Summarizes the asset management strategies (i.e., planned actions) that will enable the assets to provide the required levels of service in a sustainable way, while managing risk, at the lowest lifecycle cost
- **Expenditure Forecasts and Financing Plan:** Summarizes the financial planning and budgeting associated with asset management planning
- **Monitoring and Improvement Plan:** Summarizes next steps to meet Ontario Regulation 588/17 requirements and other asset management improvement recommendations.

2. State of Local Infrastructure

2.1 Overview

This AMP chapter is focused on answering the following questions:

– What do we own? (Section 2.2)
– What is it worth? (Section 2.2)
– What is its condition? (Section 2.3)
– What is the average age of the assets? (Section 2.4)

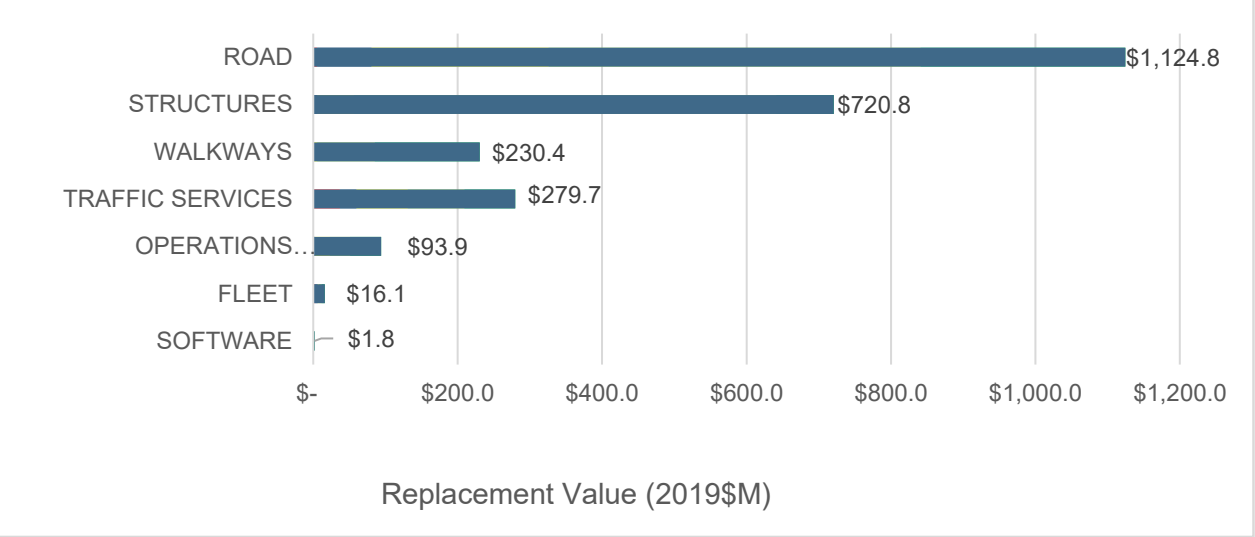
In answering the questions, this Chapter of the AMP amasses key lifecycle attribute data for the transportation assets classes that are the foundation for service planning, lifecycle strategies and informed decision making.

The State of Local Infrastructure for this AMP builds on the City's 2019 State of Local Infrastructure (SOLI) Report and is updated to reflect new data and information where applicable, as well as meet the reporting requirements of O.Reg.588/17.

2.2 Asset Inventory and Valuation

The transportation assets that the City owns have a total replacement value of approximately **$2.47 billion**, as shown below, organized by asset category.

Figure 2.1 Asset Valuation, by Asset Category



Detailed transportation asset class total values are shown in Table 2.1 below. Unsurprisingly the most valuable asset class is the Roadway Network followed by Structures. The valuations are based on known or calculated replacement values, with data compiled from Transportation Service Area information sources.

Table 2.1 Asset Inventory and Valuation, by Asset Sub-Category

Asset Category	Quantity	Unit	Replacement Value (2019$M*)
Transportation (TOTAL)			**$2,467.0**
Roadway Network			**$1,124.8**
Local Roads	1951	Lane KMs	$569.1
Arterial Roads	780	Lane KMs	$305.2
Collector Roads	556	Lane KMs	$204.3

Asset Category		Quantity	Unit	Replacement Value (2019$M*)
	Islands (Part Of Roadway Network)	565,054	Square Metres	$46.3
Structures				**$720.8**
	Roadway Bridges & Pedestrian Bridges	3,812	Metres	$331.7
	Roadway Culverts	6,044	Metres	$350.4
	Gateway Features	2,693	Metres	$12.9
	Noise Walls	4,957	Metres	$9.9
	Retaining Walls	6,070	Metres	$8.0
	Fences	25,299	Metres	$2.8
	Guiderails	31,447	Metres	$4.6
	Handrails	3,272	Metres	$0.5
	Steps	80	Metres	$1.0
Sidewalks/Walkways				**$230.4**
	Sidewalks	1,818	km	$215.7
	Walkways	14	km	$3.9
	Multi-Use Paths	117	km	$10.8
Traffic Services				**$279.7**
	Street Lighting	41,840	Each	$219.7
	Traffic Signals	395	Each	$57.8
	Traffic Signs	45,582	Each	$1.1
Operations Facilities				**$93.9**
	Operations Facilities	12	Each	$93.9
Fleet				**$16.1**
	Licensed Fleet	100	Each	$10.9
	Off-Road Fleet	18	Each	$2.8
	Fleet Equipment	48	Each	$2.4
Software				**$1.8**
	Software	23	Each	$1.8

The City uses three basic methods to estimate replacement costs needed for infrastructure renewal planning:

- **Local price indices:** This is the most accurate method. The City has collected and analyzed recent asset acquisition data at the asset sub-category level of the asset hierarchy.
- **Published price indices:** Where local indices are not available, the City uses published indices which, although appropriate and standardized, may not be as relevant to City assets as local indices.
- **Accounting estimates:** When assets cannot be estimated against either of the above indices, the City uses accounting methodology based on historic cost and inflationary effects to determine replacement value.

2.3 Asset Condition

In this AMP, the term “condition” refers to the degree of physical deterioration of an asset or asset element. An asset that is in poor condition may not be able to suitably perform to meet service standard levels. “Performance” is a more general term that typically describes an asset’s ability to achieve levels of service and can refer to: (i) the state of physical condition, (ii) the capacity relative to

demand, and/or (iii) the ability to perform intended functions. Levels of Service are discussed in Section 3.

To enable the comparison of conditions and condition trends over time between different asset types, a condition grading scale has been used to translate detailed engineering data about transportation assets into information that the public and council can compare across asset groups. For this purpose, the City uses an industry standard general condition grading system in line with the International Infrastructure Management Manual (IIMM), summarized in Table 2.2 below.

Table 2.2 Condition Rating Scale

Rating	Condition Criteria
Very Good Fit for the future	Asset is physically sound and is performing its function as originally intended. Required maintenance costs are well within standards and norms. Typically, asset is new or recently rehabilitated.
Good Adequate for now	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, the asset has been used for some time but is still within the early to mid-stage of its expected life.
Fair Requires attention	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 and component replacement may be necessary. Maintenance requirements and costs are continuing to increase. Typically, asset has been used for a long time and is within the mid- to later stage of its expected life.
Poor At risk of affecting service	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 exceed acceptable standards and norms. Typically, the asset is approaching the end of its expected life.
Very Poor Unsatisfactory for sustained service	Asset is physically unsound and/or not performing as originally intended. Asset has a higher probability of failure or failure is imminent. Maintenance costs are unacceptable, and rehabilitation is not cost effective. Replacement / major refurbishment is required.

An ongoing condition assessment program:

– evaluates current physical condition and performance,
– determines the rate of deterioration over time,
– enables forecasts of future condition, and
– informs the most beneficial type and timing of treatment.

The City conducts detailed inspections on more critical transportation assets while visual assessments may be performed for less critical assets, at an appropriate frequency for the asset group. For those transportation assets with no condition data or where the condition is hidden (e.g., underground assets), the condition is estimated based on asset age compared to the expected service life. The use of age as a proxy for the condition is an established practice but is not ideal, for example, an old asset may still be in good condition but could have extensive renewal treatments programmed prematurely when reliant on just age-based proxies.

The City selects the most appropriate method to determine the current physical condition based on the best numerical representation of the performance. Condition assessments are performed on various rating scales depending on the asset class and nature of the assessment. A summary of rating scales used and their conversion to the Very Good to Very Poor scale is summarized in Table 2-2:

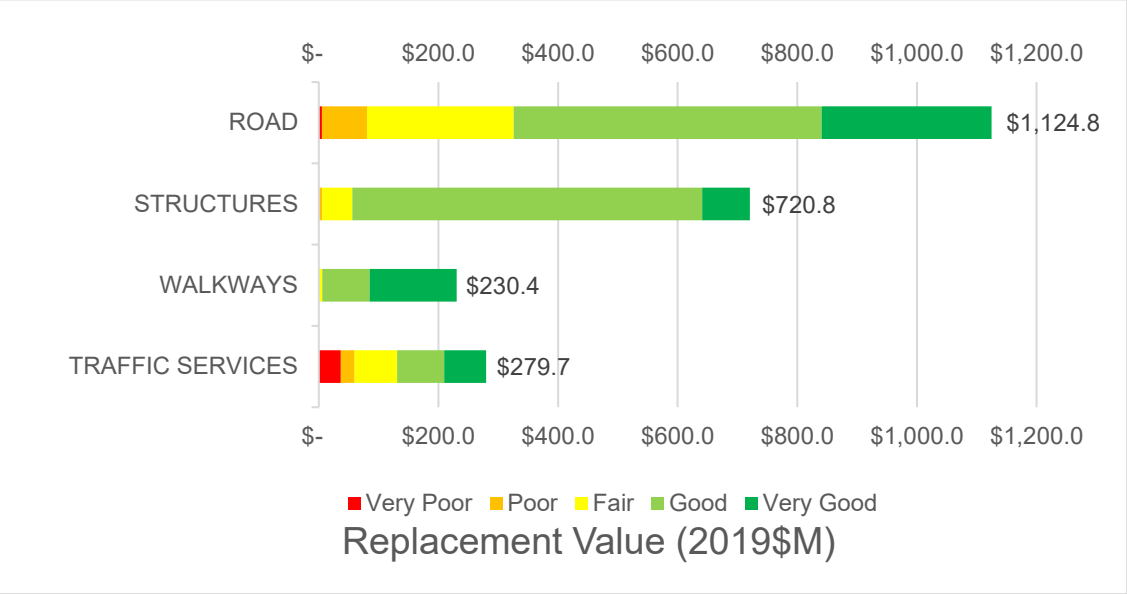
Table 2-2 Condition Assessment Scale Mapping to 5-Point Rating

Grade (Rating: 1 to 5)	Pavement Quality Index (PCI)	Bridge Condition Index (BCI)	Estimated Remaining Useful Life
Very Good (1)	>=8	>=90	>80%

Grade (Rating: 1 to 5)	Pavement Quality Index (PCI)	Bridge Condition Index (BCI)	Estimated Remaining Useful Life
Good (2)	7 to <8	70 to <90	>60 to 80%
Fair (3)	6 to <7	60 to <70	>40 to 60%
Poor (4)	5 to <6	50 to <60	>20 to 40%
Very Poor (5)	0 to <5	0 to <50	<20%

The following graph summarizes the replacement value and the distribution of the physical condition of the City's transportation asset portfolio, organized by the asset groups that mainly comprise the service area. The City's assets are generally in **GOOD** condition, with nearly **94%** of the City's assets in fair or better condition, which is referred to as a "state of good repair".

Figure 2 Condition by Asset Category



Note 1: *2019 SOLI conditions have been adjusted from the 2019 report to reflect an error in the base bridge data found during the 2021 study. The 2019 SOLI had "Very Good" condition assets overrepresented.*

Note 2: *Based on the 2018 condition report all Traffic Services - Street Lighting assets with "Very Poor" condition have been addressed and brought to "Fair" condition by 2020.*

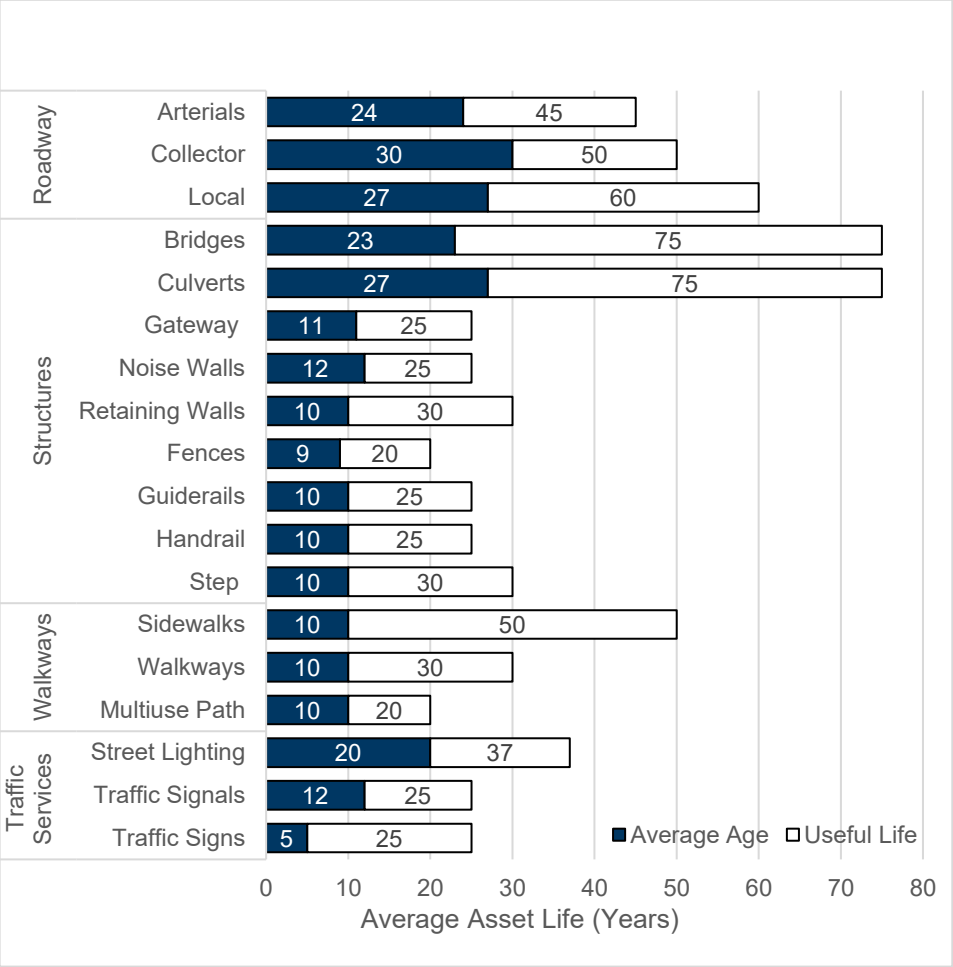
Nonetheless, approximately **$150.1 million** worth of the City's transportation assets, or **6.1 %** of the portfolio's value, are shown in poor or very poor physical condition and are approaching the "end of life". The City aims to deliver the required performance at the lowest cost over an asset's life cycle within an acceptable level of risk. For an asset that poses a low to moderate risk to performance, the lowest-cost decision is often to replace it at the end of its useful life, known as a "run to failure" management strategy. The City prioritizes the assets that are approaching the end of life and are critical to essential service delivery. The City also develops risk mitigation plans for these critical assets and includes them in its capital renewal and maintenance programs, and budget forecasts.

2.4 Average Age

The following figure summarizes, weighted by replacement value, the average age of the City's transportation assets, and the estimated average service life. Overall, the City's transportation assets are currently just under half of their expected service lives. It is important to note that historical data gaps exist for the installation year of some assets (such as traffic signs), resulting in them not being included in the age analysis. The City is proactively looking to fill these data gaps to improve the maturity of future iterations of the AMP.

"Due to lack of confidence on the year of assumption and/ or replacement of these assets the average age is based on the best available information. The City of Brampton is not using this information to plan any lifecycle activities for these assets."

Figure 2-1 Asset Age and Useful Life by Asset Category (2019)



2.5 State of Infrastructure Assumption Summary

Appendix A provides information on replacement value, condition, and the average age for assets classes within each of the asset groups, including assumptions. The background information and reports upon which the State of Local Infrastructure section is based are predominantly derived from the City's 2019 State of Local Infrastructure Report.

3. Levels of Service

3.1 Overview

The most fundamental principle of performance measurement is the need for agreement on high-level objectives or outcomes because they drive the design of the levels of service framework, including the selection of key performance indicators. The levels of service framework that links key performance indicators (KPIs) to service standards within differing levels of service to the ultimate business objectives of each service area must be built from the “top down.”

The following sections describe each layer within the hierarchical model, culminating in the application of these hierarchies in the development of a service delivery framework

3.2 Service Area

This AMP focuses singularly on the transportation service area.

3.3 Service Levels

The City of Brampton has developed the performance measurement framework based on discussions on Transportation Services Area programs and assets employed to contribute to the Levels of Service This has been achieved by reviewing:

– Corporate Levels of Service
– Legislated Levels of Service
– Customer or Community Levels of Service
– Technical or Asset Levels of Service

3.3.1 Corporate Levels of Service

The Brampton 2040 Vision: Living the Mosaic is a bold new vision for the future of Brampton. This is an inspirational document to guide what Brampton will become over the next quarter century. It's about the environment, jobs and urban centers, neighbourhoods, transportation, social matters, health, along with arts and culture.

The 2018-2022 Term of Council Priorities are a key step in moving the City towards Brampton 2040. The 22 priorities are organized into five directions:

– City of Opportunities
– Mosaic
– Green City
– Healthy & Safe City
– Well-Run City

The following investments are called out in the 2020 Transportation Capital Budget [1] in support of these Council priorities:

CITY OF OPPORTUNITIES: City Council is improving livability and prosperity by focusing on economic and employment opportunities, neighbourhood services and programs, and investment strategies for the jobs of the future.

– Approximately $80 Million annual investment for capital projects related to Transportation growth that creates employment opportunities and enables investment in businesses and the community.

GREEN: Building on Brampton’s commitment to sustainability by improving transit and active transportation opportunities, focusing on energy efficiency and revitalizing natural spaces and the urban tree canopy.

– $9M over three years for LED retrofit of streetlights for more efficient energy consumption

– 466 kilometres of cycling infrastructure maintained

HEALTHY & SAFE: Focusing on community safety, improving mental health support, and encouraging active and healthy lifestyles.

– 3,967 lane kilometres of road, 961 kilometres of sidewalks and pathways maintained during winter operations.
– 3,287 lane Kms of roads, 1,949 kilometres of sidewalks and pathways maintained during annual summer operations.
– $650,000 over three years for speed cameras in community safety zones.

WELL-RUN CITY: Continuously improving the day-to-day operations, streamlining service delivery, effectively managing municipal assets, and leveraging partnerships for collaboration and advocacy.

– $41M for updates to roads and active transportation to move people more efficiently.

3.3.2 Legislated Levels of Service

Municipal government as a whole and its each service area is required to comply with broader government regulations, including Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure under Infrastructure for Jobs and Prosperity Act, 2015, S.O. 2015, c. 15, which came into effect on January 1, 2018.

O.Reg. 588/17 requires municipalities to develop an AMP based on current Levels of Service by July 1st, 2022, for core assets (Roads, Bridges and Culverts, Stormwater, Water, Wastewater), and by July 1st, 2024 for other municipal infrastructure assets. The City's core assets support delivery of transportation and stormwater services. By July 1st, 2025, a more advanced AMP (Proposed Levels of Service) is required for all assets. The levels of service requirements for Asset Management Plans, current levels of service are as follows (section 5.(2)):

(2) A municipality's asset management plan must include the following:

6. For each asset category, the current levels of service being provided, determined in accordance with the following qualitative descriptions and technical metrics and based on data from at most the two calendar years prior to the year in which all information required under this section is included in the asset management plan:
    a. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 3.1 and Table 3.2
    b. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.
7. The current performance of each asset category, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency, and based on data from at most two calendar years prior to the year in which all information required under this section is included in the asset management plan.

The levels of service requirements for Asset Management Plans, proposed levels of service are as follows (section 6.(1)):

8. For each asset category, the levels of service that the municipality proposes to provide for each of the 10 years following the year in which all information required under section 5 and this section is included in the asset management plan, determined in accordance with the following qualitative descriptions and technical metrics:
    a. With respect to core municipal infrastructure assets, the qualitative descriptions set out in Column 2 and the technical metrics set out in Column 3 of Table 3.1 and Table 3.2.
    b. With respect to all other municipal infrastructure assets, the qualitative descriptions and technical metrics established by the municipality.
9. An explanation of why the proposed levels of service under paragraph 1 are appropriate for the municipality, based on an assessment of the following:
    a. The options for the proposed levels of service and the risks associated with those options to the long-term sustainability of the municipality.

b. How the proposed levels of service differ from the current levels of service set out under paragraph 1 of subsection 5 (2).
c. Whether the proposed levels of service are achievable.
d. The municipality's ability to afford the proposed levels of service.

10. The proposed performance of each asset category for each year of the 10-year period referred to in paragraph 1, determined in accordance with the performance measures established by the municipality, such as those that would measure energy usage and operating efficiency.

The above-referenced tables are as follows:

Table 3.1 Roads Mandatory LOS

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

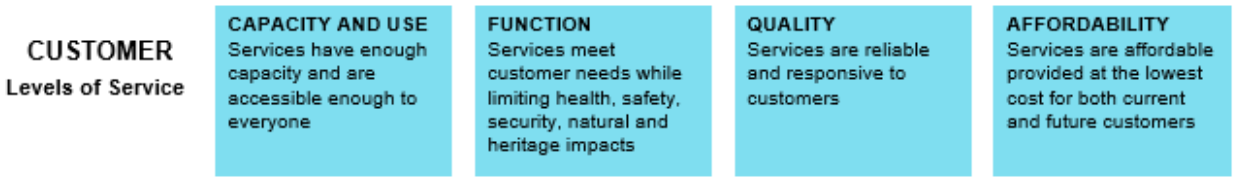
Table 3.2 Bridges and Culverts Mandatory LOS

Column 1 Service attribute	Column 2 Community levels of service (Qualitative descriptions)	Column 3 Technical levels of service (Technical metrics)
Scope	Description of the traffic that is supported by municipal bridges (e.g., heavy transport vehicles, motor vehicles, emergency vehicles, pedestrians, cyclists).	Percentage of bridges in the municipality with loading or dimensional restrictions.
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.

In addition to the Mandatory LOS requirements associated with regulation of O. Reg 588/17 the Transportation Service Area is also required to comply with the requirements of O. Reg. 239/02: *Minimum Maintenance Standards for Municipal Highways*. This sets out the minimum standards of repair for highways under the municipal jurisdiction and describe a desired outcome. Although the Transportation Service Area is very familiar with this standard and the requirements, the City has issued additional standards of service, which align or exceed the levels of service prescribed in the standard.

3.3.3 Customer Levels of Service

Customer levels of service measure how the community receives the service and whether the organization is providing community value. Customer levels of service are typically grouped into four service attribute categories: capacity and use, function, quality, and affordability, as shown below.



In addition, the City has a number of levels of service quality factors or strategic themes, as shown in the following figure.

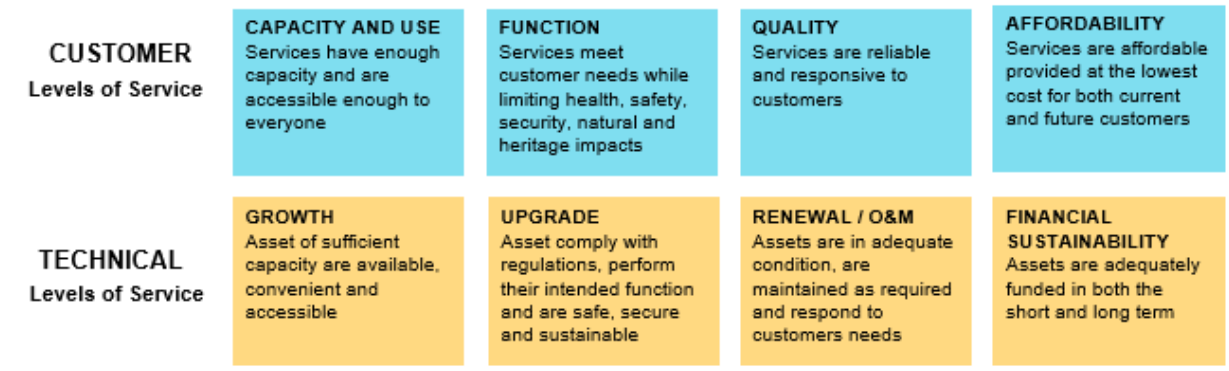
These themes can be grouped into the four service attribute categories: capacity and use, function, quality, and affordability, as shown in the following table.

Table 3.3 City Strategic Themes mapped to Service Attributes

Service Attribute	Strategic Theme	Description
Capacity & Use	Capacity	Sufficient capacity and is convenient and accessible to the community
	Availability	Available always to enable journeys to destinations to be completed efficiently
Function	Regulatory Compliance	Compliant with legislative and corporate standards and by-laws
	Enhanced Safety	Safe for all users and modes of transport
	Resilience	Resilient to any disruptions caused by external hazards
	Enhanced Environment	Contributes to an enhanced environment and supports a sustainable City
Quality	Reliability	Kept functioning as expected within operating conditions
	Customer Satisfaction	Customers kept informed and satisfied
Affordability	Financial Sustainability	Affordable, provided at the lowest cost for both current and future customers

3.3.4 Technical Levels of Service

Technical levels of service align the service activities that the organization undertakes to best achieve the desired community outcomes and demonstrate effective organizational performance. Technical levels of service are also typically grouped into four categories: Growth, Upgrade, Renewal / O&M and Financial Sustainability, and align to the customer LOS categories, as shown below.



3.3.5 Service Delivery Framework

Following leading practices, the service delivery framework for the City includes a hierarchy of corporate, legislated, customer and technical levels of service, as shown below (and follows the relationship logic described in Figure 3.1 of Section 3.3.5). This framework establishes the line of sight between the Organization's strategic objectives and activities undertaken by Transportation Service

Area staff to deliver customer levels of service. It creates a logical and transparent tool to support and inform the resourcing (financial and other) to deliver the asset lifecycle activities. Asset lifecycle activities are undertaken to close gaps between current performance and target service standards throughout the hierarchy of technical, customer, legislated and corporate levels of service.

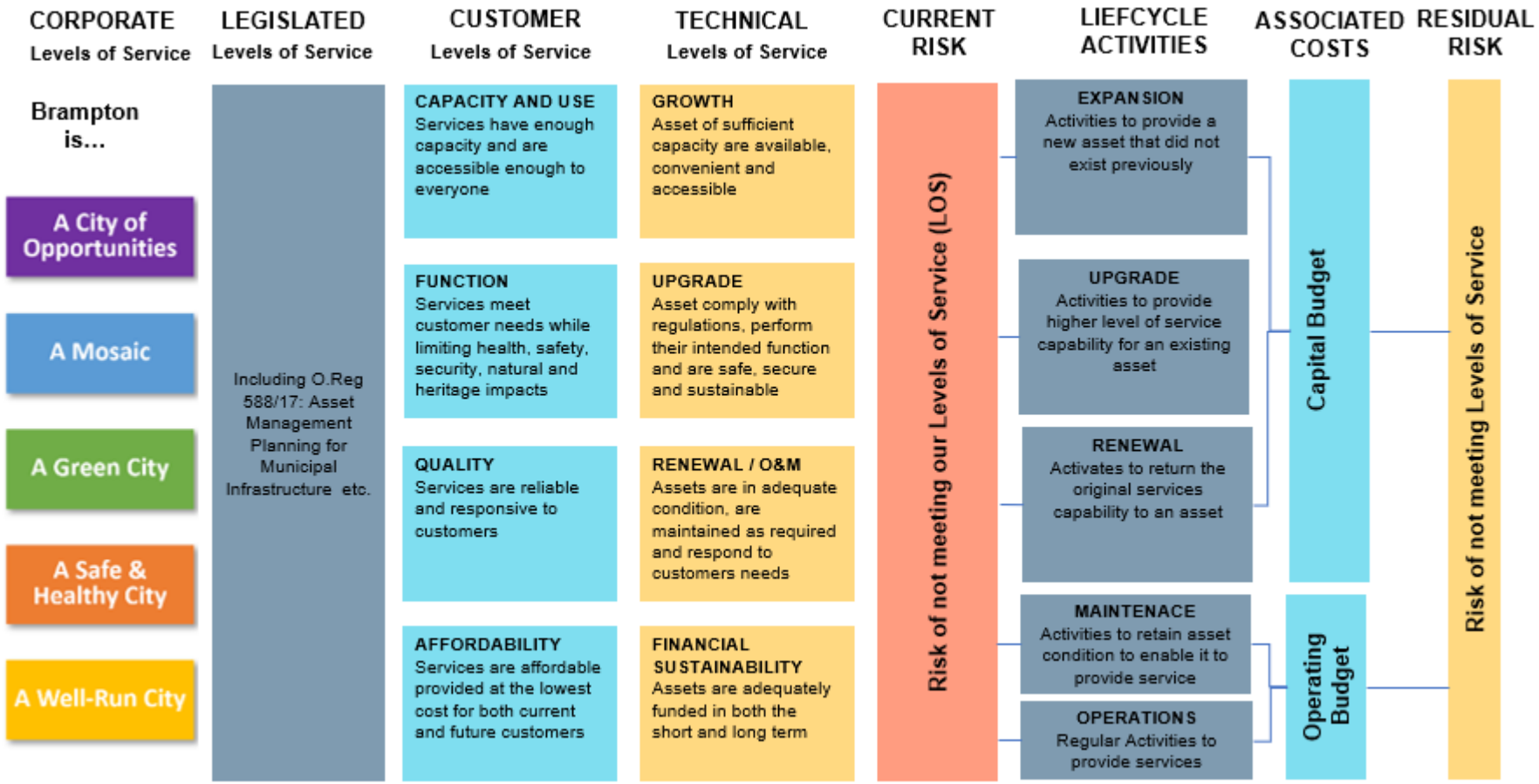


Figure 3.1 The City of Brampton Levels of Service Framework

3.4 Current Levels of Service

This section provides the existing measures and current performance, where available, for the City's core transportation assets (see Section 2.2). Performance and confidence grading tables are provided below. Performance grades are used to articulate how well the City is meeting its customer and technical levels of service for service attributes (themes) related to capacity and use, function, and quality.

Table 3.4 Performance Grades

Grade	Description	Capacity & Use		Function				Quality		
		Capacity	Availability	Regulatory Compliance	Enhanced Safety	Resilience	Enhanced Environment	Physical Condition (Age)	Maintenance	Customer Satisfaction
VG	**Very Good** Fit for the future	Service and assets provide **sufficient current and near future** capacity, convenience and accessibility to the community	Service and assets are always available and enable journeys to destinations to be completed efficiently, **including current and near future needs**	Service and assets are **in compliance** with applicable legislation, **including known upcoming legislative changes**	Service and assets are safe for all **current and potential near future** users and modes of transport	Service and assets are resilient to any **current and potential near future** disruptions caused by external hazards	Service and assets contribute to an enhanced environment and support a sustainable City, **both now and into the near future**	Assets are in **very good state of repair**: physically sound, new / like new (80 to 100% remaining life)	Maintenance work is **always** done as and when required Costs are well within normal levels	Customers are kept **very well** informed and are **very** satisfied
G	**Good** Adequate for now	Service and assets provide **sufficient current** capacity, convenience and accessibility to the community	Service and assets are always available to enable journeys to destinations to be completed efficiently	Service and assets are **in compliance** with applicable **current** legislation	Service and assets are safe for all **current** users and modes of transport	Service and assets are resilient to any **current** disruptions caused by external hazards	Service and assets contribute to an enhanced environment and support a sustainable City, **for now**	Assets are in **good state of repair**: physically sound with minimal deterioration, early to mid-range of expected life (60 to 79% remaining life)	Maintenance work is **mostly** done as and when required Costs are within normal levels, but increasing	Customers are kept **well** informed and are **quite** satisfied
F	**Fair** Requires attention	Service and assets provide **lower than intended** capacity, convenience and accessibility to the community	Service and assets are **mostly** available to enable journeys to destinations to be completed efficiently	Service and assets are **mostly in compliance** with applicable legislation	Service and assets are **mostly safe** for all users and modes of transport	Service and assets are **mostly** resilient to any disruptions caused by external hazards	Service and assets **mostly** contribute to an enhanced environment and support a sustainable City	Assets are in **fair state of repair**: medium deterioration, mid- to later stage of expected life (40 to 59% remaining life)	Maintenance work is **mostly** done mostly as and when required Costs are marginally above normal levels, and increasing	Customers are kept **mostly** informed and are **mostly** satisfied
P	**Poor**	Service and assets provide **much lower**	Service and assets are **somewhat** available to enable	Service and assets are **somewhat in compliance** with	Service and assets are **somewhat safe** for all users	Service and assets are **somewhat** resilient to any	Service and assets **somewhat** contribute to an	Assets are in **poor state of repair**: significant	Maintenance work **is sometimes**	Customers are kept **somewhat** informed

	At risk of affecting service	**than intended** capacity, convenience and accessibility to the community	journeys to destinations to be completed efficiently	applicable legislation	and modes of transport	disruptions caused by external hazards	enhanced environment and support a sustainable City	deterioration, approaching end of expected life (20 to 39% remaining life)	done as and when required Costs are above normal levels, and increasing	and are **somewhat** satisfied
VP	**Very Poor** Unsatisfactory for sustained service	Service and assets **do not provide intended** capacity, convenience and accessibility to the community	Service and assets are **not** available to enable journeys to destinations to be completed efficiently	Service and assets are **not in compliance** with applicable legislation	Service and assets are **not safe** for all users and modes of transport	Service and assets are **not resilient** to any disruptions caused by external hazards	Service and assets **do not** contribute to an enhanced environment and support a sustainable City	Assets are in **very poor state of repair**: unsound/ failing, past end of expected life (< 20% Remaining Life)	Maintenance work **is rarely** done as and when required Costs are significantly above normal levels, and rehabilitation not cost effective	Customers are **not** kept informed and are **not** satisfied
U	Unknown – This score is not currently known, however it will be monitored and included in subsequent revisions of the plan									
NA	Not Applicable									

Table 3-2 Confidence Grades

Grade	Description	General Meaning	Decision Uncertainty
VH	Very High	Performance based on sound records, procedures, investigations and analysis, documented properly and agreed as the best method of assessment. Dataset is complete and estimated to be accurate ± 2%	Serves business process well. Clearly informs decisions.
H	High	Performance based on sound records, procedures, investigations and analysis, documented properly but has minor shortcomings, for example, some of the data is old, some documentation is missing and/or reliance is placed on unconfirmed reports or some extrapolation. Dataset is complete and estimated to be accurate ± 10%	Enables business processes to function. Minor uncertainty around decisions.
M	Moderate	Performance based on sound records, procedures, investigations and analysis although these are out of date, incomplete or unsupported, or extrapolated from a limited sample for which grade VH or H data are available. Dataset is substantially complete but up to 50% is extrapolated data and estimated Accuracy ± 25%	Enables business process to function. Moderate uncertainty around decisions,.
P	Poor	Performance is based on confirmed verbal reports by knowledgeable staff. Dataset may not be fully complete, and most data is estimated or extrapolated. Accuracy ± 30%	Compromises business process. Compromises decision certainty.
VP	Very Poor	Performance is based on unconfirmed verbal reports and/or cursory inspections and analysis. Dataset may not be fully complete, and most data is estimated or extrapolated. Accuracy ± 40%	Compromises business process. Compromises decision certainty.

Both customer and technical levels of service are provided, consistent with the City of Brampton Levels of Service Framework outlined in the preceding section. A short description of the service area is also provided, along with a list of asset categories.

– The **customer levels of service** (CLOS) table, shown on the left in green, outlines the customer measures and current performance grades (very good, good, fair, poor, very poor, unknown), and the confidence in assessments (very high, high, moderate, low, very low, unknown). Those measures with high and very high confidence are typically supported by quantitative technical levels of service based on industry standard measures to enable benchmarking with other agencies and trending over time. Measures marked as “Unknown (U)” are not currently measured but are included to show potential proposed measures.

– The **technical levels of service** (TLOS) table, shown on the right in blue, outlines the technical measures and current performance, asset type, and current performance grades. These technical measures, where they currently exist, support the customer measures. Measures marked as “Unknown (U)” are not currently measured but are included to show potential proposed measures.

3.4.1 Current (2019) Transportation Service Standards

The following tables provide the service standards and current performance on customer and technical LOS service standards for the City's Transportation services. The tables include the O.Reg. 588/17 technical LOS requirements for Asset Management Plans' current LOS. The following O.Reg. 588/17 community LOS requirements are provided in Appendix B:

O.Reg. 588/17 Asset Categories

CORE ASSETS

- Roadway Network
- Structures (Bridges & Culverts)

NON-CORE ASSETS

- Structures (Walls, Rails, Gateway Features, Steps)
- Sidewalks/Walkways
- Traffic Services

– For Roads, a map of the road network and its level of connectivity, and images that illustrate the different levels of road class pavement condition.

– For Bridges and Culverts, images of the condition of bridges and how this would affect the use of the bridges, and images of the condition of culverts and how this would affect the use of the culverts. Traffic that is supported by municipal bridges includes heavy transport vehicles, motor vehicles, transit vehicles, emergency vehicles, pedestrians, and cyclists.

Table 3.5 Current (2019) Transportation Customer LOS Service Standards

CLOS Category	Customer Levels of Service (CLOS) Service Standard	Performance	Confidence
Capacity & Use Services of sufficient capacity are convenient and accessible to the entire community	Transportation network provides convenient access to properties at all times (O.Reg.588: description/maps of road network connectivity)	Very Good	High
	Transportation network provides convenient access to alternative transport modes*	Fair	High
	Bridges and culverts are accessible for designated users and modes of transport	Good	High
	Pedestrian facilities are present along roadways	Good	High
	Bicycling facilities are present on or along roadways	Fair	High
Functionality Services are suitable for intended function & minimize health, safety, security, natural & heritage impacts	Transportation services comply with regulations	Very Good	High
	Roadway bridges are designed to reduce incidents	Good	High
	Traffic assets support safe road conditions	Very Good	Moderate
	Transportation services are green and environmentally sustainable	Good	Low
Quality Services are predictable and continuous, and responsive to stakeholders	Roadway network kept in a good state of repair	Good	High
	Structures kept in a good state of repair	Very Good	High
	Walkways & Paths kept in a good state of repair	Very Good	High
	Traffic assets kept in a good state of repair	Fair	Moderate
	Maintenance work done as and when required	Very Good	Moderate
	Operations work done as and when required	Very Good	Moderate

*Based on Transportation Master Plan 2015 which is currently under review for updates

Table 3.6 Current (2019) Transportation LOS Service Standards

CLOS Category	Customer Levels of Service (CLOS) Service Standard	Perform-ance	Confid-ence
Capacity & Use Services of sufficient capacity are convenient and accessible to the entire community	Transportation network provides convenient access to properties (O.Reg.588: description/maps of road network connectivity)	VG	H
	Transportation network provides convenient access to alternative transport modes*	F	H
	Bridges and culverts are accessible for designated users and modes of transport	G	H
	Pedestrian facilities are present along roadway	G	H
	Bicycle facilities are present along roadway network	F	H

TLOS Category	Technical Levels of Service (TLOS) Service Standard	Asset Type L1 (L2)	Perform-ance
Growth & Utilization Provide a new asset that did not exist previously	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 (lane-km/km2) (O.Reg.588)	Roadways (Arterial)	2.9
		Roadways (Collector)	1.9
		Roadways (Local)	7.3
	% modal share of auto passenger during the PM peak period (2016)*	Roadway Network	15%
	% modal share of transit trips during the PM peak period (2016)*	Roadway Network	10%
	% modal share of walking and cycling during the PM peak period (2016)*	Roadway Network	2%
	% roadway bridges and structural culverts with loading restriction (# with restriction / total #) (O.Reg.588)	Structures (Roadway Bridges & Culverts)	1.5%
	% roadway bridges and structural culverts with dimensional restriction - vertical clearance (# with restriction / total #) (O.Reg.588)	Structures (Roadway Bridges & Culverts)	2%
	Rated performance of sidewalk along roadway network	Walkways & Paths	G
	Rated performance of bicycle facility along the roadway network	Walkways & Paths	F

CLOS Category	Customer Levels of Service (CLOS) Service Standard	Perform-ance	Confid-ence
Functionality Services are suitable for intended function & minimize health, safety, security, natural & heritage impacts	Transportation services comply with regulations	VG	H
	Roadway bridges are designed to reduce incidents	G	H
	Traffic assets support safe road conditions	VG	M
	Transportation services are green and environmentally sustainable	G	L

TLOS Category	Technical Levels of Service (TLOS) Service Standard	Asset Type L1 (L2)	Perform-ance
	Rated performance related to compliance with legislation or Brampton standard whichever is higher	All Assets	VG
	Rated performance of safety measured as availability of protective barriers to avoid vehicle collision with piers on roadway bridges	Structures (Roadway Bridges & Culverts)	G
	% of roadway bridges & culverts that have sidewalks and railings	Structures (Roadway Bridges & Culverts)	95%
	% of roadway bridges that have parapet walls with end protection (e.g., guiderails)	Structures (Roadway Bridges & Culverts)	66%
	% of pedestrian bridges with railings	Structures (Pedestrian Bridges)	95%
	% of pedestrian bridges or underpasses including rails lit at night	Structures (Pedestrian Bridges & Underpasses)	100%
	Rated performance of automated speed enforcement cameras implemented as per plan within the community safety zones	Traffic Services	G
	% of streetlights retrofitted with LED lights for more efficient energy consumption (percentage is overall city owned)	Traffic Services	57%

CLOS Category	Customer Levels of Service (CLOS) Service Standard	Perform-ance	Confid-ence
Quality Services are predictable and continuous, and responsive to stakeholders	Roadway network kept in a good state of repair (O.Reg.588: description/images that illustrate the different levels of road class pavement condition)	G	H
	Structures kept in a good state of repair (O.Reg.588: description/images of the condition of bridges and how this would affect use of the bridges, and of culverts and how this would affect use of the culverts)	VG	H
	Walkways & Paths kept in a good state of repair	VG	H
	Traffic assets kept in a good state of repair	F	M
	Maintenance work done as and when required	VG	M
	Operations work done as and when required	VG	M

TLOS Category	Technical Levels of Service (TLOS) Service Standard	Asset Type L1 (L2)	Perform-ance
Renewal Return the service capability of an asset close to that which it had originally	For paved roads in the City, the average pavement condition index (PCI) value (O.Reg. 588)	Roadway Network	8.3
	% of roadways in fair or better condition	Roadway Network (Arterials)	93%
	For bridges in the City, the average bridge condition index value (O.Reg. 588)	Structures (Roadway Bridges)	78
	For structural culverts in the City, the average bridge condition index value (O.Reg. 588)	Structures (Roadway Bridges)	75
	% of roadway and pedestrian bridges and structural culverts in fair or better condition (with a BCI of 60 or greater)	Structures (Roadway Bridges & Culverts)	99%
	% of Gateway Features in fair or better condition	Structures (Gateway Features)	99%
	% of retaining walls in fair or better condition	Structures (Retaining Walls)	100%
	% of noise walls in fair or better condition	Structures (Noise Walls)	96%
	% of fences in fair or better condition	Structures (Fences)	95%
	% of guiderails in fair or better condition	Structures (Guiderails)	100%
	% of handrails in fair or better condition	Structures (Handrails)	100%
	% of steps in fair or better condition	Structures (Steps)	100%
	% of sidewalks in fair or better condition	Walkways & Paths (Sidewalks)	100%
	% of walkways in fair or better condition	Walkways & Paths (Walkways)	99%
	% of multi-use pathways within the right of way in fair or better condition	Walkways & Paths (Multi-Use Pathways)	99%
	% of traffic signals in fair or better condition, (condition is based on age)	Traffic (Signals)	94%
	% of traffic lighting in fair or better condition (condition is based on age)	Traffic (Lighting)	74%
	% of traffic signage in fair or better condition	Traffic (Signage)	99%
Maintenance Retain asset condition to provide services	Rated performance based on outstanding maintenance work orders	All Assets	G
Operations Regular activities to provide services	Rated performance based on outstanding operation work orders	All Assets	G

*Based on 2016 Transportation Tomorrow Survey

**Note: Referenced for a proposed TLOS

3.5 Proposed Levels of Service

The O.Reg 588/17 requires AMP to document the proposed levels of service by July 2025 for all asset classes. This AMP documents the first generation proposed levels of service for the transportation service delivered by the City. The Proposed Level of Service (LOS) service standards are service objectives that are the future target state, in 10 years' time. The target is to achieve "good" performance across all customer levels of service. To support this the Transportation Service Area has developed Technical Level of Service benchmarks to articulate the desired future performance and a proposed target, which relates to the customer and technical levels of service. This also allows for performance tracking of these metrics. These are presented in the table below.

Table 3.7 Proposed (2029) Transportation Technical Levels of Service

TLOS Category	Technical Levels of Service (TLOS) service standard	Asset Type L1 (L2)	Desired Target Perform-ance	Current Perfor m-ance	Service Level Benchmarks				
					VG	G	F	P	VP
Growth & Utilization Provide a new asset that did not exist previously	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 (lane-km/km2) (O.Reg.588)	Roadways (Arterial)	NA	**2.9**	Mandatory O Reg. LOS Service Standards no benchmark set				
		Roadways (Collector)		**1.9**					
		Roadways (Local)		**7.3**					
	% modal share of auto passenger during the PM peak period (2016)	Roadway Network	>26%	**15%**	28%	26%	24%	22%	20%
	% modal share of transit trips during the PM peak period (2016)	Roadway Network	>14%	**10%**	16%	14%	12%	10%	8%
	% modal share of walking and cycling during the PM peak period (2016)	Roadway Network	>8%	**2%**	10%	8%	7%	6%	5%
	% roadway bridges and structural culverts with loading restriction (# with restriction / total #) (O.Reg.588)	Structures (Roadway Bridges & Culverts)	<2%	**1.5%**	1%	2%	3%	4%	5%
	% roadway bridges and structural culverts with dimensional restriction - vertical clearance (# with restriction / total #) (O.Reg.588)	Structures (Roadway Bridges & Culverts)	<4%	**2.0 %**	2%	4%	6%	8%	10%
	Rated performance of sidewalk along roadway network	Walkways & Paths	G	**G**	Improvement Initiative				
	Rated performance of bicycle facility along the roadway network	Walkways & Paths	G	**F**	Improvement Initiative				
Upgrade Improve an asset to provide a higher level of service	Rated performance related to compliance with legislation or Brampton standard whichever is higher	All Assets	G	**VG**	Improvement Initiative				
	Rated performance of safety measured as availability of protective barriers to avoid vehicle collision with piers on roadway bridges	Structures (Roadway Bridges & Culverts)	G	**G**	Improvement Initiative				
	% of roadway bridges & culverts that have sidewalks and railings	Structures (Roadway Bridges & Culverts)	>95%	**95%**	100 %	95%	90%	85%	80%
	% of roadway bridges that have parapet walls with end protection (e.g., guiderails)	Structures (Roadway Bridges & Culverts)	>75%	**66%**	85%	75%	65%	60%	50%
	% of pedestrian bridges with railings	Structures (Pedestrian Bridges)	>95%	**95%**	100 %	95%	90%	85%	80%
	% of pedestrian bridges or underpasses including rails lit at night	Structures (Pedestrian Bridges & Underpasses)	>95%	**100%**	100 %	95%	90%	85%	80%

TLOS Category	Technical Levels of Service (TLOS) service standard	Asset Type L1 (L2)	Desired Target Perform-ance	Current Perfor m-ance	Service Level Benchmarks				
					VG	G	F	P	VP
	Rated Performance of automated speed enforcement cameras implemented as per plan within the community safety zones	Traffic Services	75%	**G**	90%	75%	60%	45%	30%
	% of streetlights retrofitted with LED lights for more efficient energy consumption (percentage is overall city owned)	Traffic Services	>95%	**57%**	98%	95%	85%	75%	65%
Renewal Return the service capability of an asset up to that which it had originally	For paved roads in the City, the average pavement condition index (PCI) value (PCI) (O.Reg. 588)	Roadway Network	>7.5	**8.3**	8	7.5	7	6.5	6
	% of roadways in fair or better condition	Roadway Network (Arterials)	>90%	**93%**	95%	90%	85%	80%	75%
	For bridges in the City, the average bridge condition index value (O.Reg. 588)	Structures (Roadway Bridges)	>75	**78**	78	75	74	72	70
	For structural culverts in the City, the average bridge condition index value (O.Reg. 588)	Structures (Roadway Bridges)	>75	**75**	78	75	74	72	70
	% of roadway and pedestrian bridges and structural culverts in fair or better condition (with a BCI of 60 or greater)	Structures (Roadway Bridges & Culverts)	>90%	**99%**	95%	90%	85%	80%	75%
	% of Gateway Features in fair or better condition (with a BCI of 60 or greater)	Structures (Gateway Features)	>90%	**99%**	95%	90%	85%	80%	75%
	% of retaining walls in fair or better condition	Structures (Retaining Walls)	>90%	**100%**	95%	90%	85%	80%	75%
	% of noise walls in fair or better condition	Structures (Noise Walls)	>90%	**96%**	95%	90%	85%	80%	75%
	% of fences in fair or better condition	Structures (Fences)	>90%	**95%**	95%	90%	85%	80%	75%
	% of guiderails in fair or better condition	Structures (Guiderails)	>90%	**100%**	95%	90%	85%	80%	75%
	% of handrails in fair or better condition	Structures (Handrails)	>90%	**100%**	95%	90%	85%	80%	75%
	% of steps in fair or better condition	Structures (Steps)	>90%	**100%**	95%	90%	85%	80%	75%
	% of sidewalks in fair or better condition	Walkways & Paths (Sidewalks)	>90%	**100%**	95%	90%	85%	80%	75%
	% of walkways in fair or better condition	Walkways & Paths (Walkways)	>90%	**99%**	95%	90%	85%	80%	75%
	% of multi-use pathways within the right of way in fair or better condition	Walkways & Paths (Multi-Use Pathways)	>90%	**99%**	95%	90%	85%	80%	75%
	% of traffic signals in fair or better condition, (condition is based on age)	Traffic (Signals)	>90%	**94%**	95%	90%	85%	80%	75%
	% of traffic lighting in fair or better condition (condition is based on age)	Traffic (Lighting)	>90%	**74%**	95%	90%	85%	80%	75%
	% of traffic signage in fair or better condition	Traffic (Signage)	>90%	**99%**	95%	90%	85%	80%	75%
Maintenance Retain asset condition to provide services	Rated performance based on outstanding maintenance work orders	All Assets	G	**G**	Improvement initiative				
Operations Regular activities to provide services	Rated performance based on outstanding operation work orders	All assets	G	**G**	Improvement initiative				

Those service standards that do not have future levels of service are expected to be phased out or replaced with a LOS indicator which better reflects the vision for the City's future.

Establishing LOS targets is an iterative process. The subject matter experts within the Transportation Service Area have nominated targets for the proposed levels of service based on balancing both public (community) expectations, the City's objectives, risk and affordability. These are expected to require further refinement over time with additional consideration of the public expectations against constraints such as affordability. After accounting for these constraints, it will be determined whether public expectations can in fact be approved as the expected target LOS for the Transportation assets management process.

3.6 Interdependencies

As with any entity, the Transportation Service Area does not deliver service in isolation and hence is reliant on other Service Areas, Departments, and external stakeholders to support the delivery of the LOS detailed above. Similarly, Transportation Service Area supports other internal stakeholders.

As an example, major refurbishment or replacement for core assets (roads and bridges) is coordinated with other service areas such as Stormwater and external stakeholders, such as the Region of Peel. Although project funding is kept separate, project coordination is essential to maximize customer value. This communication is essential to ensure that refurbishment or replacement projects don't conflict with planned activities, by other stakeholders. This is typically managed through consultation with stakeholders during annual planning periods. For example, capital coordination is required with the Region of Peel before any necessary work is conducted on water mains, situated under the roadways.

A summary of the interdependencies is summarized in the **Dependent** – Stakeholders upon whom the Transportation Service Area is dependent to deliver its level of service objectives.

– **Contributor** – Stakeholders who are supported by the Transportation Service Area to deliver that stakeholder's level of service objectives.

Table 3.8. Each stakeholder is defined as

– **Dependent** – Stakeholders upon whom the Transportation Service Area is dependent to deliver its level of service objectives.
– **Contributor** – Stakeholders who are supported by the Transportation Service Area to deliver that stakeholder's level of service objectives.

Table 3.8 Summary of Interdependencies

Stakeholder	Inter-dependency Type	Relationship Context	Governed By
Development Engineering (Internal)	Dependent	**Growth** – Development Engineering is responsible for overseeing design, construction and the quality of the Transportation assets before they are transferred to the Transportation Service Area	Managed informally
Transportation Planning (Internal)	Dependent	**Growth –** Responsible for developing the Master Plans and city transportation planning. This determines the quantity and increase in the Transportation Asset inventory.	Managed informally

Stakeholder	Inter-dependency Type	Relationship Context	Governed By
Digital Innovation and IT(Internal)	Dependent	**All – P**rovides IT infrastructure (network, software and system support) and maintains asset data (citywide) which forms the collective understanding of the assets. They also manage the procurement of digital management systems on behalf of the Transportation Service Area	Issues managed 'by request' and formal procurement process for new systems
Environment Section - includes SW programs (Internal)	Contributor	**O&M** – Responsible for operations, planning and project services to maintain SW assets such as street sweeping, Storm Sewer flushing. clean out Oil &Grid Separator and ditches maintenance.	Managed informally
	Contributor	**Renewal & Upgrade** - Responsible for renewal, replacement, and expansion of the SW system in the Road right-of-way.	Managed informally
	Dependent	**O&M** - Stormwater ponds are dredged and maintained, allowing enough capacity for the roads to drain into them.	Managed informally
	Dependent	**All -** Oversee SW assets database in right-of-way to inform work on roads.	Managed informally
	Dependent	**Growth –** Advise on SW management plans for infill development areas (road replacement and expansion)	Managed informally
Parks (Internal)	Contributor	**O&M –** Provide reliable and safe access to the service. Renewal– Lighting at the Parks	Managed informally
Recreation, Cultural Services, Brampton Library and Animal Services (Internal)	Contributor	**O&M –** Provide reliable and safe access to the service.	Managed informally
Fleet (Internal)	Dependent	**O&M** – Provides the right type, quality and quantity of vehicles to enable effective winter and summer operation and maintenance services	Issues managed by formal request'
	Contributor	**Growth** - Support with identification of the type and quantity of vehicles to enable timely procurement and LOS provision	Formal asset procurement process through finance
Facilities (Internal)	Dependent	**O&M** - Provide quality, well maintained facilities to enable the Transportation Service Area with working spaces and storage	Service Level Agreement (SLA)
	Contributor	**Renewal, O & M** – Rebuild the parking lots (outdoor surface lots) owned by facilities	Managed informally
Region of Peel, **City of Mississauga,**	Dependent	**Renewal or upgrade -** Coordinate Transportation renewal projects with water and waste-water regional or	Annual meeting with all parties to mutually agree to the

Stakeholder	Inter-dependency Type	Relationship Context	Governed By
Town of Caledon (External)		neighbouring authorities. Coordination occurs to ensure that water and wastewater projects are conducted prior to road constructions, renewals or upgrades.	refurbishment projects schedule list for next 3 years.
Public Utilities Coordinating Committee (PUCC) (External)	Dependent and Contributor	**All –** Jointly coordinate activities in the road right of way or associated with shared infrastructure (i.e. support poles).	Transportation Service Area representation and attendance at quarterly coordination meetings
Transit (Internal)	Contributor	**Growth –** Consult with Transit on decisions related to transit 'pad' locations and need for designated lane or infrastructure support during new construction. **O&M -** Provide summer and winter clearing of transit stop locations. Align the Traffic Service assets with Transit to provide signal priorities at intersections (buses). **Upgrade –** Provide **t**emporary route signage and add new pads to our road routes if needed based on route review.	Managed informally
Fire and Emergency services (Internal)	Contributor	**All –** Reliant on Traffic Service assets to prioritize emergency services movements through the city.	Managed informally

3.7 Improvements

The Transportation Service Area has some improvement opportunities associated with its delivery of services to the community. These include:

– Opportunities to continue to improve coordination and management of service delivery with its partners. This is particularly applicable to the coordination with the Region of Peel and the Utility Companies through increased frequency of engagement and data sharing to promote better planning between the stakeholders.

– During the development of the Levels of Service the Transportation Service Area identified few service standards that need further discussions to be appropriately considered in future. These are noted below:

- Asset performance measure which can directly reflect community safety
- Asset performance measure which reflects accessibility in relation to Active Transportation
- Asset performance measure that reflects Minimum Maintenance Standards (MMS).

4. Demand Management Strategy

Asset management helps the City manage change and business transformation challenges. These challenges are recognized in the form of demand drivers. Services are delivered to the residents of Brampton based upon the requirements and defined capacities, available funding, and allocated resources. The levels of service (LOS) provided is intended to meet the demands for services. Therefore, understanding changes in demand placed on services is advantageous in the planning of affordable, sustainable, and desirable community services.

External trends and demand drivers may affect LOS or the City's ability to meet the proposed LOS in the future. This chapter discusses the:

- **Demand Drivers** – challenges, trends and drivers which may affect current services.
- **Demand Impact or Forecast** – outlines the impact of the demand drivers and forecasts the changes to the transportation assets.
- **Demand Management Strategies** - sets out the City's lifecycle management strategies (maintenance and renewal strategies), or additional infrastructure in response to the demand.
- **Emerging Drivers** – Those challenges, trends and drivers which may affect current services in the future (next 10 years)

The demand drivers and service needs discussed in this chapter, plus the lifecycle responses are recognized within the service delivery framework (see section 2.3.5). The pressures on services generated by changing demand usually required a change to the asset activities in order to respond to the changes. As a guide the Transportation Service Area, the City's planning teams issue documents such as the Transportation Master Plan.

4.1 Current Demand Drivers

Demand drivers can create positive or negative service needs and/or enable or constrain the LOS the City of Brampton can effectively and affordably deliver to its communities. For example, the development of new communities places a growth and expansion demand on transportation infrastructure networks.

This section summarizes those demand drives already considered and included as part of the City's current Transportation Master Plan.

4.1.1 Population and Employment Growth

The City of Brampton utilizes the population forecasts detailed in the Growth Plan for the Greater Golden Horseshoe (GPGGH) 2017, for planning and managing growth to 2041. The City's Total Population in 2016 was 613,600 and, the total population figures projected are 812,000 and 890,000 by 2031 and 2041, respectively. This is illustrated in Figure 4.1 [2].

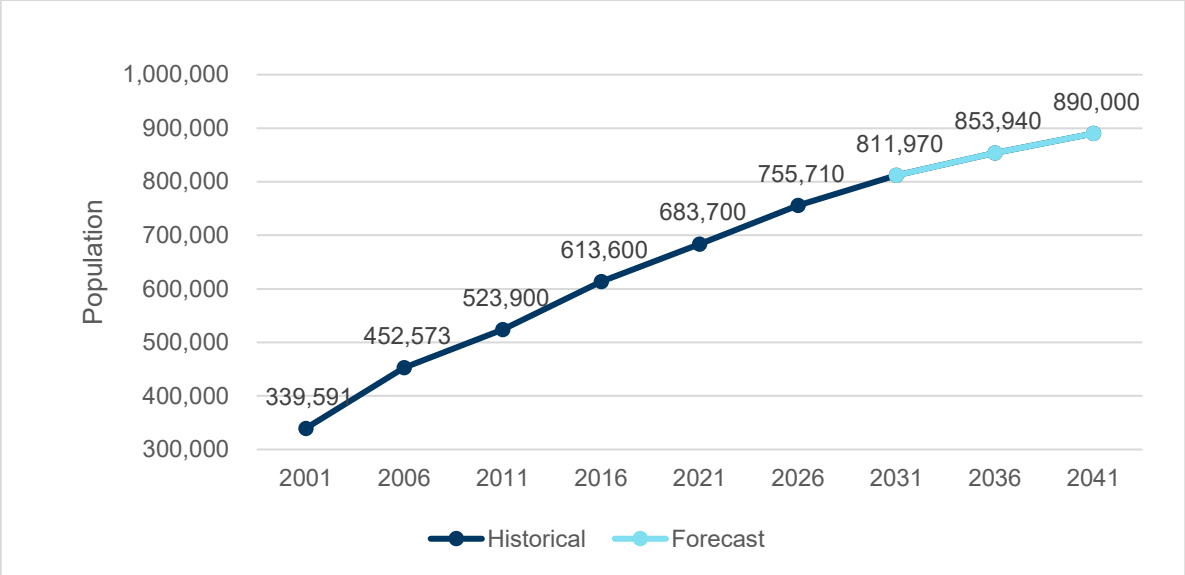


Figure 4.1 Historical and Forecast Population Growth [3] [4]

These projections indicate that the City's population is expected to increase from 2016 to 2031 approximately 1.8 % average annual population growth from 2011 until 2031, with this diminishing slightly to a 1.5% increase over the 2041 horizon

Employment is also set to increase with employment increasing from 2016, 191,390 jobs, to 277,430 (2.3% increase) in 2031 and 324,910 (1.9%) in 2041 over their respective periods [2] [5]. New Regional MCR numbers have been developed but not formally approved by the council (at the time of this report).

The growth in population can have several impacts on the demand for transportation infrastructure. Some examples of this:

- Increased vehicles on the road and hence increased congestion
- Increased deterioration rates for road through greater ridership
- Increased need for new roads and transit routes
- Greater fuel taxation revenues
- Additional transit requirements including higher order transit such as LRT/BRT
- Increased number of accidents
- Increased costs (capital, renewal, O&M)
- Increased demand for Active Transportation.

4.1.2 Urbanization

In response to the population and employment growth there is a corresponding increase in urban growth. Brampton is planning for intensified urban development as a result of the planning and development of provincial and local rapid transit along major travel corridors such as Hurontario/Main Street, Queen Street, Steeles Avenue and Bovaird Drive [5]. These areas are opportunities for more sustainable development, with enhanced roles for pedestrian, cycling and transit mobility.

4.1.3 Sustainable Carbon Strategies

There is a growing demand from the City and its communities to achieve more sustainable carbon strategies through adaptive response and mitigation planning. This demand is created through the need

to address climate change and the associated Green House Gas (GHG) emissions as well as maintaining important livability metrics (such as air quality). Transportation networks are facing increasing demands for adaptive responses, for example, fast charging stations for electric vehicles which create demand for new services.

The City of Brampton Community Energy & Emissions Reduction Plan (CEERP) 2019 has set a goal "to reduce community-wide emissions by 50% from 2016 levels by 2041". This objective has significant consequences for the City's transportation usage which accounts for the majority of the GHG emissions at approximately 60% of the City's total emissions [6]. An adjustment in the City's usage has significant implication for it's transportation infrastructure needs. These may include:

- Increased investment in sustainable infrastructure (carpooling, active transportation, and public transit)
- Travel Demand Management (TDM)
- Alternate charging and fueling infrastructure
- Changes to transportation fleet, with a shift to hybrid or electric vehicles

4.1.4 Transportation Safety

The Vision 2040 for the City of Brampton is underpinned by the Region of Peel's Vision Zero Road Safety plan. This states the "Vision Zero Road Safety Strategic Plan's goal is to reduce – and finally end – injuries or deaths caused by motor vehicle collisions". The Transportation Service area is responsible for meeting this objective through the provision of suitably designed, constructed, maintained and operated assets to maximize user safety.

As Brampton continues to evolve towards a more equitable transportation network that enables everyone to move safely in their community and prioritizes sustainable modes, an increased deployment of safety measures and traffic management infrastructure, and adoption of a "complete streets" road design philosophy will be required. This will minimize (and ultimately eliminate) fatal and severe traffic collisions, particularly between motorized and non-motorized users.

In addition to population and employment growth the City of Brampton is continuing to become more diverse. According to the 2016 census data, more than 52% of the City's population was born outside of Canada [7]. This trend is expected to continue as governments continue to encourage immigration to help support economic growth. It is important to ensure that the City has efficient communication and signage for all road users, to help enhance safety and participation, particularly as there is an increase in language diversity, and varying user experience and comprehension.

4.1.5 Movement of Goods and Economic Impact on Traffic

As the population increases, the usage of infrastructure by the transport sectors for movement of goods is also expected to grow considerably. The City expects that the freight demand will almost triple by 2050, while aviation demand will likely double [3].

As traffic increases in the City, it could create congestion and affect the City's attractiveness for business and could negatively impact the goods movement industry. Select road links and intersections are already approaching capacity, with congestion experienced at several intersections in the peak commuter periods. Focusing utilization of heavy vehicles on specific road segments may also require additional design and maintenance consideration to accommodate the increased heavy vehicle traffic.

4.1.6 Connected Vehicles

Connected Vehicles with Vehicle to Vehicle (V2V) and Vehicle to Infrastructure (V2I) connections are digitally enabled vehicles which can communicate and send data between each other and the transportation infrastructure (such as roadway and traffic signals). Connected vehicles use different types of wireless communications technologies to communicate with their surroundings [8]. This presents a significant opportunity to improve safety and mobility but will likely require the City to invest in digitally enabled and networked infrastructure, data management and security.

The City of Brampton's Transit and Emergency Services are already undertaking steps to enable their fleet of ZUM (zoom) buses and emergency response vehicles, respectively, with Automatic Vehicle Location (AVL), a type of Connected Vehicle technology. This system would enable the vehicles to be connected to Intelligent Transport System (ITS) and hence allow for the prioritization of traffic services to support better movement of these vehicles based on their 'real time location'.

Based on the current needs, the Transportation Assets do not require significant physical or asset upgrades to incorporate this functionality and this will largely be programming changes to the software utilized at the traffic control center. However, given the rapid advancement in these technologies and the need to continue to support investments being made in other areas, it is expected that the Transportation Service Area may be required to provide functional upgrades as this occurs.

4.2 Demand Impact

4.2.1 Forecast

Based on the discussion above, the expected demand changes on the Transportation Assets are summarized in Table 4.1. The demand is expressed in two methods:

1. The expected net demand direction – is the overall change in the size in the asset category
2. The relative demand direction- attempts to highlight the relative growth expectations between the asset categories in the portfolio (i.e. those that will see the greatest change).

Both are expressed visually using arrows to indicate their expected demand (Increasing ↑, Decreasing ↓ or Static →).

Table 4.1 Asset Category Demand Summary

Asset Categories	Sub Asset Category	Net Demand Direction	Demand Driver	Relative Demand Direction	Comment
Roadway Network	All	↑	Sustainable Carbon Strategies	→	Investment is expected to shift to repurposing the roadway network to support sustainable transportation. However, road network growth is expected to continue as greenfield development continues.
Structures	Bridges & Culverts	↑	Urbanization	→	Investment is expected to shift to repurposing the bridges and culverts network to support sustainable transportation. However, the number of bridges and culverts are expected to grow as the City continues to grow.
	Other	↑	Sustainable Carbon Strategies	↑	Investment is expected to increase due to increased urbanization which will likely require greater safety and 'wellness' infrastructure
Sidewalks/ Walkways	All	↑	Urbanization	↑	Mode shift to sustainable infrastructure will require increased investment in paths for walking and cycling
Traffic	All	↑	Urbanization and Active Transportation	↑	Increased traffic and increased modes are expected to require additional traffic signals, lighting, and signage infrastructure.

4.3 Demand Management Strategy

Demand changes for services within the City (positive or negative) will necessarily require an adjustment to the way services are delivered. The way services are delivered to our community, within the Transportation Service Area, is through our assets and the lifecycle activities undertaken. These lifecycle activities have to be adapted to ensure service is maintain the desired level..

Current asset lifecycle strategies (as aligned through the service delivery framework Section 3.3.5). Typical options available to address changes in demand which can be employed include:

- **Non-asset solutions** are actions or policies that do not necessarily relate to direct work on assets and can increase the efficiency and effectiveness of the Transportation infrastructure (e.g., education, demand reduction and balancing usage, etc.)
- **Asset expansion (Growth & Upgrade)** needs that increase service potential, performance capability or capacity as are typically outlined in the Master Plans,
- **Asset renewal** includes rehabilitation, disposal and replacement, typically based on condition assessment programs, and
- **Operations and Maintenance** need based on analysis of known historical and forecasted future costs.

4.3.1 Non-Asset Solutions

Transportation Demand Management is a multi-faceted and multi-modal approach to reducing and managing travel demand using sustainable modes and the distribution of trips beyond traditional peak travel periods. This increases the efficiency and effectiveness of the available transportation infrastructure, through the implementation of strategies that influence travel choice and behaviour to reduce reliance on the single occupant vehicle trips [9].

The City of Brampton has set ambitious goals related to shifting the City's transportation usage away from single occupant travel to more "sustainable" modes including cycling, walking, public transit and carpooling. The City's objective is to at least 50% of travel peak PM trips to be using sustainable modes by 2041. This would require a 100% increase in local transit mode, a 100% increase in walking and cycling, and a 56% increase in carpooling by the year 2041 [9]. A summary of the desired transportation modal share of trips during PM peak period is summarized in Table 4.2 [5].

Table 4.2 Current and Target Future Transportation Mode Splits during PM Peak Period

Mode	2016	2021	2026	2031	2041
Car, truck, van - as a passenger	20%	22%	24%	26%	28%
Public transit	8 %	10%	12%	14%	16%
Walked & Bicycle	5%	6%	7%	8%	10%
Car, truck, van - as a driver*	67%	62%	57%	52%	46%

**Calculated as the remaining mode of transportation measured*

Although this shift is underway, according to the 2016 Transportation Tomorrow Survey (TTS) the shift to sustainable modes is still lagging behind its 2016 goals in all areas except for transit, as shown in the figure.

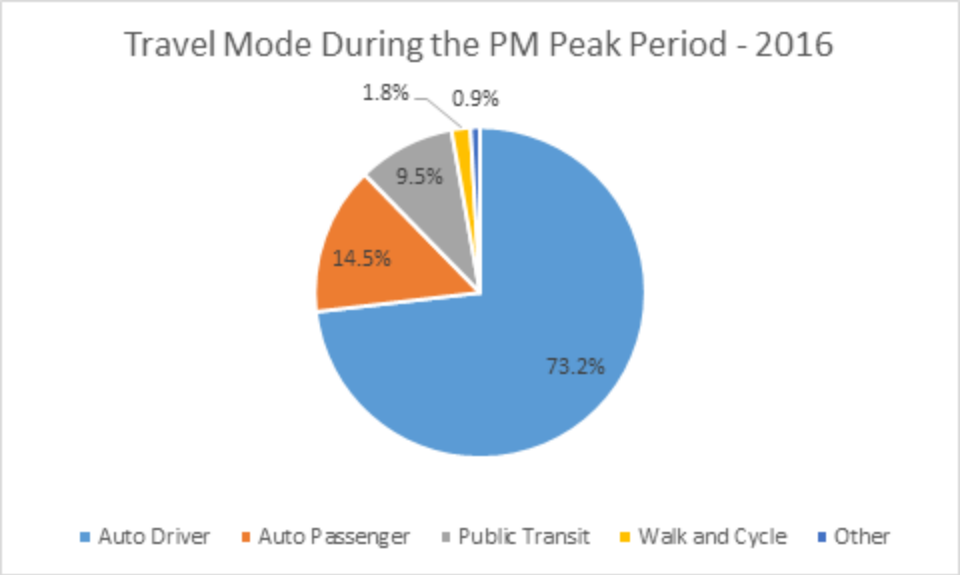


Figure 4.2 Transportation Mode Split during PM Peak Periods in 2016

The identified changes are unlikely to reduce the need for demand in transportation infrastructure, however, it may change the areas in which the City plans to invest.

4.3.2 Asset expansion (Growth & Upgrade)

This level of population growth will place significant pressure on the capacity of existing infrastructure and create demand for new infrastructure. Based on the expected average annual population growth outlined above, the City's asset portfolio is estimated to grow by approximately 1.8% annually from now until 2031, as determined in section 4.1.1.

Additionally, this growth may be required to be deployed with a greater focus on active transportation, carpooling programs and public transit with lesser emphasis on new roads. For example, the Brampton Transportation Master Plan Update (2015) and Active Transportation Master Plan (2019) highlight some identified future investments associated with the Transportation Asset portfolio.

Active Transportation [10]

- Provide dedicated annual capital funding of $1.25 million to accelerate the installation of missing sidewalks on arterial roadways and address challenging corridors.
- Allocate an annual budget of $4 Million towards implementing the short-term (2025) priorities identified in the ATMP "Infill" program.
- Allocate an annual budget of $1 million over the next 5 years to address the gaps identified in the ATMP "Fix-it" program.

Roads [5]

- The plan has identified approximately 13 capital road projects which total $210 million implemented in the medium-term horizon by year the 2031. These road projects include road widening and a number of new road constructions.
- The plan highlights the intention to repurpose existing roads to serve a more strategic use including creating alternate routes to remove vehicles from congesting the downtown.

Transit [11]

– Recognizing the rapid growth of the City by 2031, the plan includes the early implementation of Bus Rapid Transit (BRT) and Light Rail Transit (LRT) and expansion of the ZUM network (in line with Metrolinx' 'Frequent Rapid Transit Network' projects). In particular, the plan includes the following:
    - Hurontario-Main Street LRT: from southernly boundary to Downtown Brampton
    - Hurontario-Main Street Rapid Transit: from Downtown Brampton to Mayfield Road
    - Queen Street BRT: from Mississauga Road to Highway 50
    - Bramalea ZUM: from Steeles Avenue to Bovaird Drive

Although the transit assets are not within the scope of the Transportation AM, the deployment of transit infrastructure has a link to the demand for additional transportation infrastructure. The increased transit vehicles will inherently increase and change the demand for transportation infrastructure, particularly along transit routes. Additionally, the City is hoping to shift a notable percentage of single occupant vehicles to other more sustainable modes of transportation, which will also help to reduce the demand on critical and constrained road networks, particularly during peak periods.

4.3.3 Asset Renewal Requirements

Asset renewal requirements are currently based on the strategies outlined in section 8. Increased demand does not inherently change the frequency of refurbishment activities or reduce the service life achieved by the asset. However, it may increase the asset's utilization. The renewal requirements will continue to be monitored as part of the current asset management practices.

4.3.4 Operations and Maintenance

The level of transportation portfolio growth will also place significant pressure on the capacity of existing operations and maintenance. Incremental expenditure is the operations and maintenance cost associated with new assets.

For most assets, a good estimate of the incremental operational expenditure required to operate and maintain the new assets is simply the existing operations and maintenance cost multiplied by the growth factor. Based on the expected average annual population growth outlined above, the City's operations and maintenance activities and associated costs could be assumed to grow by approximately 1.8% from now until 2031 prorated based on the historic road development data and subject matter expert's input.

4.4 Emerging Trends

These trends are currently evolving, typically in terms of technology, availability, or customer adoption, hence the emerging trends are still not completely understood. While the direction of the impact on the transportation assets is thought to be understood, the magnitude of the impact and the urgency to the City is unclear. These have been captured for completion and should be monitored in future planning works.

4.4.1 COVID-19

As described above, COVID-19 has notably and dramatically changed commuters' habits, as illustrated in the comparison between daily commute by mode of transportation pre-pandemic and during COIVD-19.

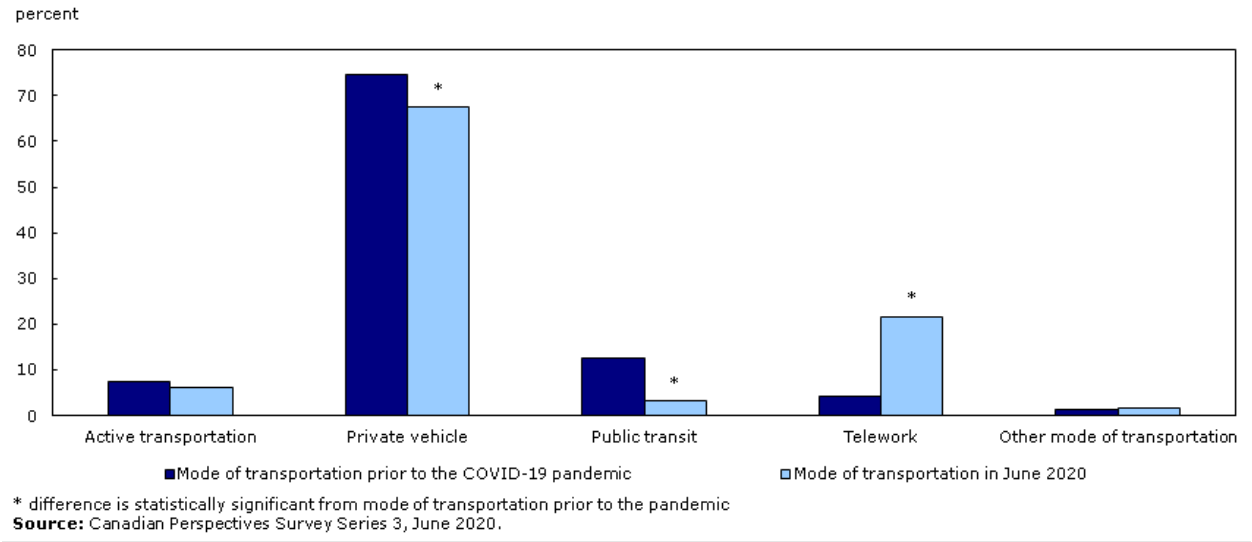


Figure 4.3 Daily Commute Pre and During COVID-19

As is evident from the Figure 4.3, teleworking and public transit were the most significantly affected by Covid-19 while private vehicles and active transportation were relatively unchanged. See Section 4.4.1 for a detailed discussion of remote work.

Public transit usage was notably affected, which was reported primarily due to safety concerns associated with the virus. Prior to the Covid-19 pandemic, approximately 13% of the surveyed group used public transit which dropped to only 3% in June of 2020. Conversely, only 4% of Canadian workers were previously teleworking which jumped to 22% during the same period. Private vehicles also noted an approximate 10% decrease in usage while active transport and other modes remained relatively unchanged [8].

The impact of Covid-19 is evolving and its long-term implications on Transportation infrastructure assets are currently unknown.

4.4.2 Remote Work

Working or studying remotely (i.e., somewhere else than the office or school) has become increasingly popular due to the proliferation of remote working tools, high speed internet and social changes [12]. At the same time, education is moving to online platforms; university courses, and even primary school classes, are being taught over the internet. Remote work and distance education will increasingly affect transportation needs, reducing the number of commuters, particularly during peak times.

The recent COVID-19 pandemic has accelerated this trend, with an estimated 4% of the population in Canada teleworking pre-pandemic. This increased significantly to approximately 22% in June 2020. It is unclear whether this will revert to pre-pandemic levels in a post COVID-19 world, however, current statistics suggest that 82% of companies' CEOs intend to allow remote working part of the time and nearly 47% suggested that they would allow employees to work remotely full time going forward [13].

Canadian study estimates that only 39% of jobs are compatible with telecommuting [14]. It should be noted that, the option to telework is not evenly distributed across society. Remote work disproportionately favors higher educated and higher salary positions. “Front line workers” or “essential workers” can only conduct their jobs when physically present for work. Hence, the commute to the construction site, factory, hospital, warehouse, or store is still required.

4.4.3 Autonomous Vehicles

Autonomous vehicles are self-driving vehicles that sense the roadway environment and drive themselves at some level of automation. Autonomous driving offers significant benefits such as increased safety, time savings, mobility for non-drivers, decreased environmental harm, and reduced transportation costs. Although automated vehicles themselves will not have a significant impact on technology or infrastructure demand, it is expected to have a notable policy and design implications.

4.4.4 Shared Vehicles

Shared Vehicles are the concept of distributed vehicles across a network where members can access the vehicles at any time with a reservation and are charged by either time or distance. Shared vehicles themselves will not have a significant impact on technology nor have direct implications on the City’s revenues. However, an increase in shared vehicles may indirectly impact the City’s revenues through Provincial and Federal gas tax funds and parking revenue by changing the vehicle usage and composition.

4.4.5 Mobility as a Service (MaaS)

MaaS enables users to book various transportation services from apps, choosing e-bikes, e-scooters, taxis, or public transportation services in various combinations throughout their journey [15]. MaaS has emerged as a viable alternative to personal vehicle ownership, and in many cases, it facilitates mobility across cities with subpar incumbent public transportation options. This is likely to reduce demand for personal transportation and increase the demand for public transportation and other services like car-sharing, walking, and cycling.

4.4.6 Micromobility

Micromobility is the collective definition for electric scooters, docked and dockless shared bikes, and other vehicle types which typically have a small physical footprint and are light weight (less than 500lb). They are typically utilized to travel short distances (less than 5km) [16]. It is expected that demand for active transport infrastructures such as bike lanes, footpaths and pedestrian bridges is likely to support this technology. It is also likely that demand for passenger vehicles and hence roads would decrease. This demand change is expected to be most notable in urbanized areas of the City. Technology companies that operate Micromobility firms are in discussion with Brampton Council (August 2020) about the viability of introducing these services to the City of Brampton [14].

4.4.7 Alternative Drive Trains Vehicles

Alternative Drive Trains Vehicles or Alternative Fuel Vehicles are vehicles powered by electricity or hydrogen. McKinsey forecasts the adoption of EV vehicles as a percentage of total vehicles as shown in

Figure 4.4 Percentage of Electric compared to Internal Combustion Engine Vehicles by Year

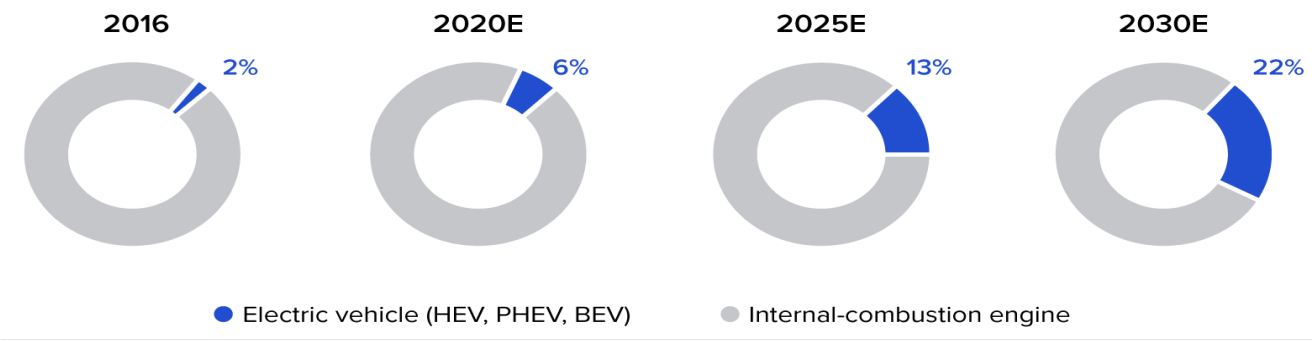


Figure 4.4 Percentage of Electric compared to Internal Combustion Engine Vehicles by Year

This change may occur even faster than predicted in the figure above, particularly if regulatory legislation is introduced. The province of Quebec said on the 14th of November 2020, it will ban the sale of new gasoline-powered passenger cars from 2035 which is only expected to speed this transition [17].

The City of Brampton will need to consider the deployment of alternative fueling and charging stations at the City controlled and metered parking areas, as a minimum. Based on the current taxation model this would adversely impact the federal and provincial fuel taxation revenues which the City of Brampton indirectly relies on.

4.4.8 Climate Change

Brampton City Council voted unanimously to declare a climate emergency and acknowledged the role of Green House Gases (GHG) and set a reduction target within the City of 80 percent by 2050 [18]. This is a clear declaration, from the City's leadership team, that the climate is changing which would result in significant risks, pressures and changes in demand in the future.

At the time of this report, the City is preparing a Climate Change Adaptation Plan, however, this had not been finalized. A high-level assessment of the change in demand, which could be expected includes:

- A greater number of hot days (over 30C) which have the potential to impact the performance of assets, particularly those aging assets that were likely never designed with such conditions being a possibility.
- Increases in the number of days of heavy precipitation. This may manifest in higher short term snow management needs and increased importance or capacity of stormwater supporting assets (bridge and culverts)
- A greater number of freeze thaw cycles which have the potential to adversely affect asset durability and performance.

Despite this initial assessment, the Transportation is awaiting the guidance from the City's Climate Change Adaptation Plan prior to completing a comprehensive assessment of service and infrastructure demand changes within this services area.

4.4.9 Summary

In an attempt to quantify the demand impact, the emerging trends have been risk ranked. This is intended to inform those responsible for the management of the transportation portfolio of the potential impacts on the transportation assets. The assessment process has been conducted in accordance with the City of Brampton Corporate Risk Framework which is discussed in Section 5. The likelihood is assessed by considering the probability of the trend actualizing in the next 5 years. It should be noted that some of these trends are likely to intensify beyond the nominated 5 years however the window and the risk will be updated in future iterations of the plan. The demand is expressed as the expected net demand direction (Increasing ↑, Decreasing ↓ or Static →). The emerging trends risk assessment is summarized in Table 4.3.

Table 4.3 Emerging Trends Risk Assessment Summary

Emerging Trend	Likelihood	Consequence		Risk	Demand Impact
	Score	Description	Score	Score	
Remote Work	4	Less commuters	4	High (16)	Road Network: ↓ Structures: → Walkways: → Traffic →
Autonomous Vehicles	3	Need to modernize transportation infrastructure	3	Medium (9)	Road Network: → Traffic →
Shared Vehicles	4	Reduced single occupant vehicles	3	Medium (12)	Road Network: → Traffic →
Mobility as a Service (MaaS)	3	Reduced single occupant vehicles Increase utilization of other transport modes	3	Medium (9)	Road Network: ↓ Structures: → Walkways: ↑ Traffic ↑
Micromobility	4	Bike/scooter usage in urbanized areas	3	Medium (12)	Road Network: → Walkways: ↑ Facilities: ↑
Alternative Drive Trains Vehicles	4	Fuel Taxation & Revenue	2	Medium (8)	All → Fuel Taxation Revenue which supports transportation assets may be adversely affected
Climate Change	3	Greater need for performance	4	Medium (12)	Road Network: ↑ Structures: ↑ Walkways: ↑ Traffic ↑

5. Risk Management Strategy

5.1 Introduction

Management of Risks is a critical component of the Transportation Service Area asset management principle, to meet service levels and manage risk while minimizing lifecycle costs. Risk events are events that may compromise the delivery of the City's strategic objectives and services. Some illustrative examples included asset failures, climate events, emergencies, and insufficient technical expertise or resources. These can occur at any level of the organization, at the:

– Enterprise Level
– Service Area Level; or
– Technical (or Asset) Level.

This section is structured to describe the Risk Framework utilized to identify, analyze, evaluate, mitigate, and monitor the risks and summaries how it is applied at each level of the organization and what the key risks are associated with the Service Area and at the Technical Level (as these are the only levels within the scope of the AMP).

5.2 Risk Framework

The Transportation Portfolio follows the corporate Enterprise Risk Management approach toward risk assessment. The risk assessment is described in the following section and the approach has been consistently applied to other assets within the Public Works and Engineering Department.

5.2.1 Consequence

An outcome of an event affecting (city, department, or asset) objectives. Consequences can be expressed qualitatively or quantitatively. It can be certain or uncertain and can have positive or negative effects on the objectives.

The consequence of failure is determined based on the degree to which a risk event would impact the following five considerations:

– **Health & Safety** impact considerations such as the ability to meet health and safety related regulatory requirements and the degree and extent of injury, from negligible injuries to multiple loss of life.
– **Reputational** impact is the change in public perception that varies from no community concern to international media coverage.
– **Service** delivery considerations such as the lack of sufficient service capacity to meet demand or loss of existing service, expressed as degree and duration of impact from minimal localized short-term disruption of nonessential service to widespread and long-term disruption of essential service.
– **Financial** impact considerations such as damages to the City or private property and infrastructure, loss of revenue, and fines.
– **Environmental** impact considerations such as the extent of damage to the environment and the time within which the impact would be reversible.

The scoring of the Consequence, for each of the categories, is determined based on a comparison with the description in Table 5.1.

Table 5.1 Consequence Matrix

Impacts	Consequence of Failure (CoF)				
	C1 Insignificant	**C2 Minor**	**C3 Moderate**	**C4 Major**	**C5 Catastrophic**
Health & Safety	Negligible injuries	Minor injuries, medical attention required	Serious injuries, multiple minor injuries	Multiple serious injuries, loss of life	Multiple loss of life or City-wide epidemic
Reputational	Event only of interest internally. No community concerns.	Minor community interest. Local media report.	Public Community Discussion. Broad adverse media coverage.	Loss of confidence in Council. National publicity. Public agitation for action.	Public investigation. International coverage. Management changes are demanded.
Service	Service not affected or minimal impact	Localized disruption of non-essential service	Localized disruption of essential service	Widespread short-term disruption or localized long-term disruption of essential service	Widespread and long-term disruption of essential service
Economic	Damages, losses or fines <$10,000	Damages, losses or fines $10,000 to $200,000	Damages, losses or fines $200,000 to $2,000,000	Damages, losses or fines $2,000,000 to $10,000,000	Damages, losses or fines >$10,000,000
Environmental	Negligible impact is fully reversible within 1 week.	Material damage of local importance. Prosecution possible. Impact is fully reversible within 3 months.	Serious damage of local importance. Prosecution is probably. Impact is fully reversible within 1 year.	Serious damage of national importance. Prosecution expected. Impact is fully reversible within 5 years.	Serious damage of national importance. Prosecution likely. Long term study required. Impact is not fully reversible.

This AMP assumes the overall consequence of failure for each asset class within the transportation service area by using the maximum applicable consequence score out of the five impacts (health & safety, reputational, service, environment, and economic).

5.2.2 Likelihood

The likelihood of a risk event is the probability of its occurrence that would compromise the delivery of the City's strategic objectives and levels of service. It may be determined objectively or subjectively and measured qualitatively or quantitatively. It can also be expressed as the probability or a frequency over a given period. The scoring of the Likelihood is described in Table 5.2.

Table 5.2 Likelihood Matrix

PoF	Title	Probability	Description
P1	Rare	< 0.05	Event could occur very infrequently or only in exceptional circumstances, but is not expected
P2	Unlikely	>= 0.05 & < 0.3	Event could occur infrequently
P3	Moderate	>= 0.3 & < 0.7	Event should occur at some time
P4	Probable	>= 0.7 & < 0.9	Event will probably occur regularly or in most circumstances
P5	Almost Certain	>= 0.9	Event is expected to occur very frequently or in most circumstances

5.2.3 Risk Map

Risk mapping is used by the City to determine the significance of a perceived transportation risk. A risk map represents a graphic representation of the magnitude of risk, or combination of risks, expressed in terms of the product of the consequence and likelihood of the risk. The Risk Map utilized is shown in Table 5-3.

Table 5-3 Risk Map

		Consequence				
		C1	**C2**	**C3**	**C4**	**C5**
Likelihood	P5	Medium	Medium	High	High	Extreme
	P4	Low	Medium	Medium	High	High
	P3	Low	Low	Medium	Medium	High
	P2	Insignificant	Low	Low	Medium	Medium
	P1	Insignificant	Insignificant	Low	Low	Medium

Using The ERM system indicates that all risks in the City must be evaluated in terms of the potential impact on the City of Brampton, including both positive and negative aspects of risks, at all levels of the organization. It also states that all risks should be measured in terms of probability and consequence. ERM framework acknowledges that implementation of this standard and development of a cohesive set of risk categories and associated risk criteria for measurement purposes are required. A draft risk map is shown in Table 4.3.

As a guide, the following understanding of risk mitigation thresholds has been adopted. The risk level and the required response is summarized as follows:

– **Insignificant** – No action required
– **Low** – May be acceptable but monitoring may be required
– **Medium** – Requires consideration by management with necessary risk management and monitoring adopted, as required
– **High** – Requires consideration by management. Risk management and monitoring is required
– **Extreme** – Requires extensive management input. Risk mitigation to reduce to an acceptable level is essential

5.3 Enterprise Risk Management (ERM) Framework

5.3.1 General

The City of Brampton is currently implementing an Enterprise Level Risk Management framework based on the ISO 31000 Standard. This roll out of an ERM based on the ISO standard will enable consistent identification and evaluation of risks leading to standardized understanding, management and monitoring of key risks across the City.

Risk identification and evaluation sit within business verticals aligned to departments and teams. The duplication of risk processes within the department represents an inefficiency in resource allocation and duplication of effort, the siloed risk process is also bounded to the departmental boundaries and represents a blinkered view of risk.

Risk Management activities currently occur at the division or department level rather than the enterprise level as we have only achieved a “Fragmented” level of maturity as shown in the City’s own Risk Maturity Model (RMM), shown in Figure 5.1. Although many departments are practicing risk management activities on a frequent and consistent basis, there are other departments that have not yet engaged in these activities. The City is actively trying to migrate to a more strategic risk management system.

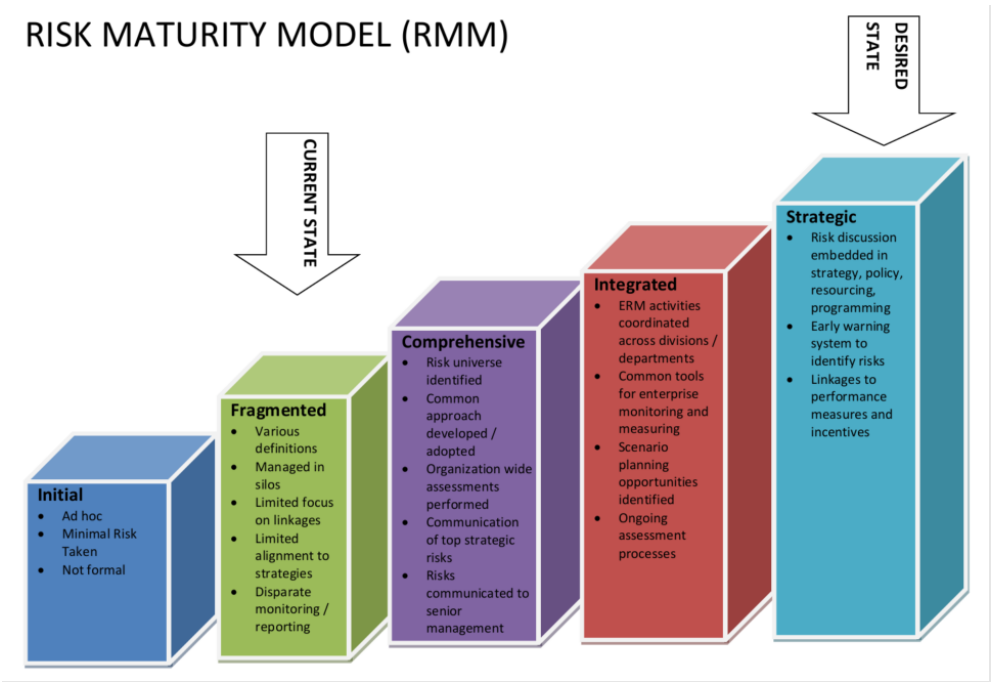


Figure 5.1 Risk Maturity Model

5.3.2 Principles

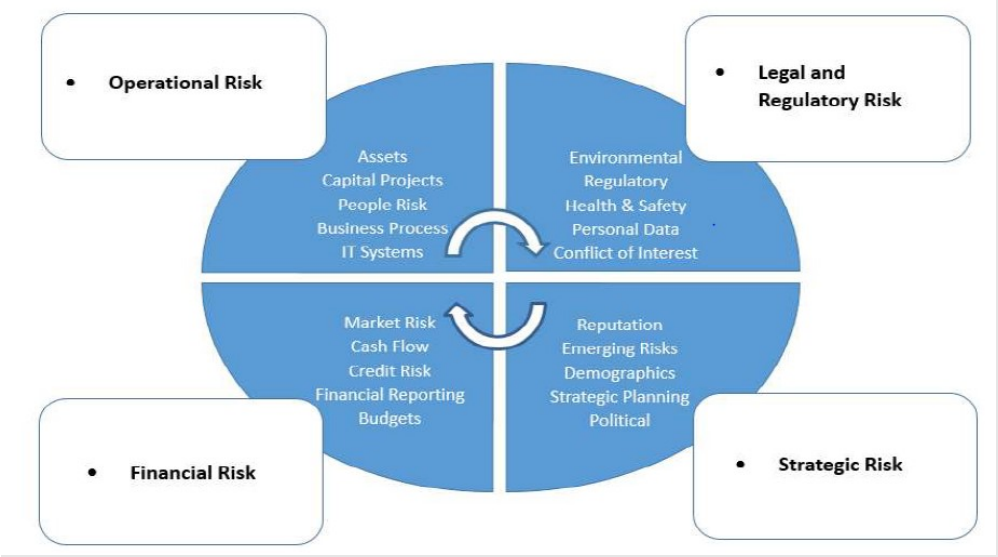
The ERM system indicates that all risks in the City must be evaluated in terms of the potential impact on the City of Brampton, including both positive and negative aspects of risks, at all levels of the organization. It also states that all risks should be measured in terms of probability and consequence. ERM framework acknowledges that implementation of this standard and development of a cohesive set of risk categories and associated risk criteria for measurement purposes are required. A draft risk map is shown in Table 4.3.

Table 5.3 ERM Risk Matrix

		Consequence		
		Minor	Moderate	Significant
Probability	High	Manage and Monitor Risks	Management Effort Required	Extensive Management Effort Essential
	Medium	Accept but Monitor Risks	Management Effort Worthwhile	Must Manage and Monitor the Risk
	Low	Accept Risks	May Accept Risks with Monitoring	Consideration by Management Required

The ERM framework sets out and categorizes the risks into four broad categories, which are intended to help support the identification and classification of the types of risks and their impact on the organization. This is as shown in Figure 5.2. The figure illustrates the concept that risk can be categorized into one of 4 groups but also highlights there are often interdependencies that exist between the categories.

Figure 5.2 Risk Quadrants



5.3.3 City of Brampton Risk Definitions

The framework for Enterprise Risk Management includes some definitions. These have been adopted for the Transportation Portfolio and are summarized below:

- ***Risk -*** The effect of uncertainty on objectives, positive and/or negative. (Risk is often expressed in terms of a combination of the severity and associated consequences of an event and the associated likelihood or frequency of an occurrence taking place.)
- ***Risk Tolerance -*** The willingness of the corporation to accept or reject a given level of residual risk (exposure). Clarity on risk tolerance at all levels is necessary to support risk-informed decision-making and will foster risk-informed approaches. Risk Tolerance is different from Risk Appetite as tolerance is specific to a business unit, a particular risk category or a specific initiative whereas Risk Appetite is applicable to the corporation as an entity.
- ***Consequence*** *(see Section 5.5.1)*
- ***Likelihood*** *(see Section 5.5.2)*
- ***Risk Maps*** *(see Section 5.5.3)*
- The key elements of this framework's application are presented in the following sections.

5.4 Transportation Service Area Risk Assessment

Risk assessments have been completed for both customer and technical levels of service. Table 5.4 represents the identified and assessed risks for the Transportation Service Area. The risk information has been used to prioritize organizational changes and service area improvements.

Table 5.4 Summary of Top Service Area Risks

Risk	Risk Description	Category	Likelihood	Consequence	Risk Score	Mitigation	Mitigation Cost	Residual Risk
Personnel Sickness	Risk of loss of winter service personnel due to widespread infection	Operational Risk	Moderate (3)	Major (4)	Moderate (12)	Run separated teams for summer/winter maintenance.to minimize interactions. Implement procedures for sanitizing special equipment.	120k per year for duration of widespread infection event	Low (4)
Asset Construction Quality	The quality of infrastructure assumed by the City is subpar quality. This might create the need for earlier than anticipated asset intervention (replacement or major refurbishment)	Financial risk	Moderate (3)	Major (4)	Moderate (12)	Propose to review the current procedures and process for providing feedback. Develop or update current Handover Standard Operating procedures with the Development Engineering department to formalize feedback processes.	Internal review costs	Moderate (8)
Data inadequacy	The data quality and completeness are not consistent, which compromises the decision making for the asset life cycle planning process.	Operational Risk	Probable (4)	Major (4)	High (16)	Develop a project to address data gaps & implement those identified in Asset Information Framework	200k for 5 years for external projects and one FTE at 100k per year (ongoing)	Moderate (8)
Asset Handover	Maintenance staff are often left with	Operational Risk	Probable (4)	Major (4)	High (16)	Propose development of standards and handover documentation	50k for handover process development	Moderate (8)

Risk	Risk Description	Category	Likelihood	Consequence	Risk Score	Mitigation	Mitigation Cost	Residual Risk
	insufficient asset information for example asset attributes like, CAD information; Historic data; Future lifecycle costs					checklists to ensure that files are received in the correct formats prior to asset acquisition	and improvement procedures 0.1 FTE to enforce and maintain (~10 k per year ongoing)	
O & M Staffing Levels	Rapid growth in asset portfolio and limited increase in O&M personnel to deliver services resulting in personnel constraints	Operational Risk	Moderate (3)	Major (4)	Moderate (12)	Improvement of AM understanding and expression of both $ and FTE per asset per type required. This will enable linkage of personnel growth to # of assets. (See Improvement Section)	Internal Review of personnel training and development	Low (4)

5.5 Technical Level Risk Assessment

Risk assessment associated with the City's assets is essential to meet service levels and manage risk while minimizing life cycle costs. Risk events, such as an asset failure, may compromise the delivery of the City's strategic objectives and Levels of Service (LOS). The risk assessment was determined for each of the LOS "Customer Attributes":

– Capacity and Use
– Functionality; and
– Quality.

The process of assessing and evaluating the risks associated with the City's assets allows a systematic process with which to identify high risk assets that can then be prioritized for Asset Management activities.

5.5.1 Criticality or Consequence of Failure

All assets are scored in accordance with Table 5.1 and hence an asset consequence of failure is determined based on the degree to which a potential failure to provide levels of service impacts the health and safety of its customers, delivery of service, organization's reputation, the city's financial position and the environment. The following table provides a summary of the consequence for each asset category, on each customer LOS attribute

Table 5.5 Consequence Matrix

Asset	Asset Category	Capacity and Use	Functionality	Quality	Overall
Road Network	Arterial	4	4	4	4
	Collector	3	3	3	3
	Local	3	3	3	3
Structures	Bridges	3	4	4	4
	Culverts	3	4	4	4
	Gateway Features	2	2	2	2
	Noise Walls	2	2	2	2
	Retaining Walls	2	2	2	2
	Fences	1	2	2	2
	Guiderails	1	3	3	3
	Handrails	1	3	3	3
	Steps	2	2	2	2
Sidewalks/ Walkways	Sidewalks	3	3	3	3
	Walkways	3	3	3	3
	Multi-Use Paths	3	3	3	3
Traffic Services	Street Lightings	3	3	3	3
	Signals	3	3	3	3
	Signs	3	3	3	3

The Transportation Service Area has historically utilized individual subject matter experts' experience to assess the risks and prioritize investment. This has not previously been documented. The historic approach does not imply a lack of rigour but rather implies a lack of transparency and reproducibility. The process outlined in this AMP establishes a documented understanding of the consequence of asset failure and enables effective management of assets – the "right" management strategy (e.g., do nothing, proactive maintenance, rehabilitate, replace). The degree to which an asset's failure can affect the City's ability to achieve its objectives is also referred to as its criticality.

Asset criticality reflects the importance of an asset to the City's objectives or, in technical terms, the potential consequences of the asset failing to provide the required LOS. The higher the criticality of an asset, the lower the City's risk tolerance for that asset. Conversely, the City will tolerate greater risk in relation to less critical assets.

5.5.2 Likelihood or Probability of Failure

Understanding the probability of asset failure further enables effective management of assets – the "right" management strategy for every asset should depend on its criticality to achieve the City's objectives and then on the likelihood of a failure that would trigger the impact. A summary of the likelihood for each asset category, on each customer LOS attribute is shown in Table 5.6.

Table 5.6 Likelihood Matrix

Asset	Asset Category	Capacity and Use	Functionality	Quality
Road Network	Arterial	2	1	Based on Asset Condition
	Collector	2	1	
	Local	2	1	
Structures	Bridges	2	1	
	Culverts	2	1	
	Gateway Features	1	1	
	Noise Walls	1	1	
	Retaining Walls	1	1	
	Fences	1	1	
	Guiderails	1	1	
	Handrails	1	1	
	Steps	1	1	
Sidewalks/ Walkways	Sidewalks	2	1	
	Walkways	2	1	
	Multi-Use Paths	2	1	
Traffic Services	Street Lightings	1	1	
	Signals	1	1	
	Signs	1	1	

The maximum score across the attributes is used to evaluate the asset likelihood or probability of failure. Even though the likelihood of failure could be due to any of the attributes, in the case that likelihood of failure is due to the poor asset condition then "quality" becomes the primary attribute that contributes to the maximum score. This is illustrated by mapping the 5-point condition rating scale to the Probability of Failure score as shown in Figure 5.3. It should be noted that this has been applied to a generic deterioration curve for illustrative purposes.

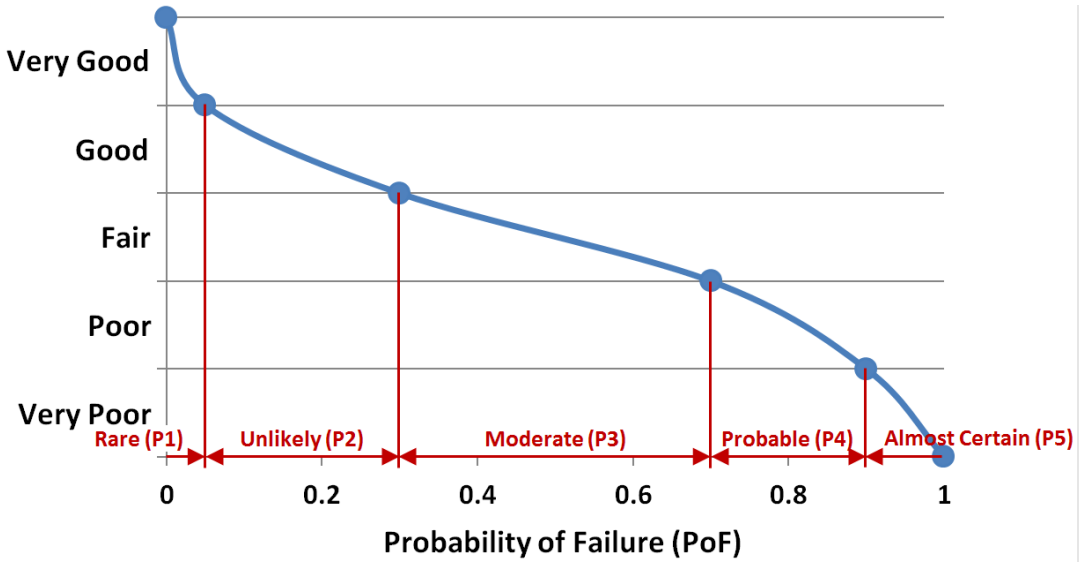


Figure 5.3 Condition Rating to Probability of Failure (PoF) Graph

5.5.3 Risk Maps

A risk map for the Transportation asset portfolio has been developed in Table 5.7. This shows the highest risk calculated across any of the customer LOS attributes. The risk map is expressed in terms of the asset replacement value, in 2019-dollar value, corresponding to the risk of failure score:

- Extreme (red),
- High (orange),
- Moderate (yellow),
- Low (green), and
- Insignificant (grey).

Table 5.7 Overview of Transportation Asset Portfolio Risk Summary

		Consequence				
		C1	**C2**	**C3**	**C4**	**C5**
Likelihood	P5	$-	$0.40	$35.81	$2.27	$-
	P4	$-	$0.18	$72.79	$25.63	$-
	P3	$-	$0.62	$247.45	$160.67	$-
	P2	$-	$20.08	$809.58	$1,452.38	$-
	P1	$-	$12.38	$147.71	$-	$-

Assets falling in the higher risk categories are those assets that are an investment priority for the City (have a high consequence of failure and highest probability of failure).

- Assets that appear in the extreme (red) zone are critical to the City and are performing poorly, and therefore need to be actively monitored and managed in a more comprehensive manner than other assets. This may include immediate inspection and stop gap measures (e.g., emergency plan in case of asset failure or emergency rehabilitation or replacement) to ensure that the asset does not fail.
- Assets that appear in the high (orange) and moderate (yellow) zones will also be actively monitored and managed depending on their criticality.
- Assets that appear in the low (green) and insignificant (grey) zone are generally accepted without significant mitigation strategies being implemented, although monitoring may still occur in some form.

This assessment allows for the identification and prioritization of high-risk assets that require closer inspection (to verify if they truly are high risk), preventive maintenance activities, and short- and medium-term capital renewal

works, including possible transition out of service. It should be noted that this process is intended to be used as a support tool for screening the asset inventory for potential risks which required greater consideration. This tool can be developed further to provide additional decision-making support in the future (e.g. return on investment). However, regardless of the tools deployed the final decision on the risk treatment and or lifecycle activity intervention should be made in consultation with the SMEs.

The City has **no assets in the extreme risk category**. It currently has **$63.7 million (2.1%) assets in the high risk** (orange) category**,** $2.3 million of these assets are in "Very Poor" condition and the "Major" consequence of failure category. The assets that comprise the current High (orange) risk assets are summarized in Table 5.8.

Table 5.8 Summary of 'High' Risk Assets (2019 SOLI condition rating)

Asset Category	Asset Type	Name	Segment
Road Network	Arterial	Bramalea Rd	Peter Robertson Bv to Sandalwood Py
		Chinguacousy Rd	Flowertown Av to Major Wm. Sharpe Dr
		Goreway Dr	C.N.R. Tracks to Steeles Av
			Humberwest Py to Castlemore Rd
		Heart Lake Rd (N)	Sandalwood Py to Countryside Dr
			Bovaid DR to 230m S. Of Copperfield Rd
			230m S. of Copperfield Rd to Sandlewood Py
		Torbram Rd	15m S.OF C.N. TRACKS to Steeles Av
			Steeles Av to Walker Dr
			Balmoral Rd to Clark Bv
		Williams Py	Humberwest Py to Edvac Dr
			Torbram Rd to Grenoble Bv
			Kennedy Rd to Centre St
			Centre St to Main St
			Mclaughlin Rd to Fletchers Creek Bv
		Mcvean Dr	Countryside Dr to Mayfield Rd
		Queen Street[1]	McMurchy AV to George St
			George St to Main St
			Main St to Scott St
	Collector	McMurchy Av	Railroad St to Queen St
			Parkend Av to Charolais Bv
	Local	Nelson-West Ln	
		Gorewood Dr	
		Handel Ct	
		Hannibal Sq	
		Hero Sq	
		Herron Pl	
		Juniper Cr	
		Maitland St	
Structures	Pedestrian Bridge	Manitou Park South	

	Culvert	Sheffield Park South	
Walkways and Paths	Walkway	Heritage Over Credit River Tr	
		Madison St	
Traffic Services	Lighting[4]	10,166 lighting assets[3]	
	Signals[4]	Ray Lawson Boulevard at Cherrytree Drive / Malta Avenue	
		Torbram Road at Balmoral Drive / Bramhurst Avenue	
		Torbram Road at Clark Boulevard	
		Clark Boulevard at Briar Path Entrance / BCC	
		Queen Street at George Street	
		Williams Parkway at Grenoble Boulevard / Jordan Boulevard	
		McLaughlin Road at Flowertown Avenue	
		Williams Parkway at Murray Street	
	Signage	133 signage assets[3]	

Note Since the completion of the risk analysis the nominated assets have been addressed. These include:

– Road - Burbank Ct, Hannah St, Pleasant Rd, Volens Ct

– Pedestrian Bridge - Ped Bridge, Maitland Park NW of Williams Pkwy & Mackay

– Culvert - Countryside Over West Humber Tr., Marycroft ct. South

Note 1. "Queen St" is under regional jurisdiction and requires capital coordination with the region.

Note 2. Scott St bridge (Road Bridge) is currently closed for vehicular traffic following the original assessment as the inspection had not occurred during the 2019 SOLI.

Note 3. Although the Transportation Service area has developed a complete list of the individual Lighting and Signage assets which are high risk this has not been provided, in the summary table, for readability reasons.

Note 4. Street Lighting and Signals condition is based on age. The condition of Street Lighting identified as very poor, has since been addressed based on the condition assessment.

Further breakdown of the risk scoring associated with each asset category has been provided in Table 5.9 to. Each table provides a summary of the total replacement value of asset in each risk category, the percentage of the overall replacement value for the asset category and the number of units in that risk category.

Table 5.9 Roadway Network (excluding roadway islands)

Risk Category	Percentage of Transportation Portfolio	Replacement Value (2019$ Millions)	Units (Lane Km)
Insignificant	0.0%	$-	-
Low	53.3%	$573.2	1,919
Moderate	44.5%	$479.2	1,347
High	2.2%	$23.4	59
Extreme	0.0%	$-	-

Table 5.10 Bridges and Culverts

Risk Category	Percentage of Transportation Portfolio	Replacement Value (2019$ Millions)	Units (m)
Insignificant	0.0%	$-	-
Low	0.0%	$-	-
Moderate	99.4%	$678.0	9,778
High	0.6%	$4.1	78
Extreme	0.0%	$-	-

Table 5.11 Structures (excl. Bridges & Culverts)

Risk Category	Percentage of Transportation Portfolio	Replacement Value (2019$ Millions)	Units (m)
Insignificant	31.9%	$12.4	5,161
Low	65.6%	$25.4	76,977
Moderate	2.4%	$0.9	3,555
High	0.0%	$-	-
Extreme	0.0%	$-	-

Table 5.12 Sidewalks/Walkways

Risk Category	Percentage of Transportation Portfolio	Replacement Value (2019$ Millions)	Units (Km)
Insignificant	0.0%	$-	-
Low	55.4%	$154.5	63.1
Moderate	33.1%	$92.3	14.4
High	11.5%	$32.0	10.3
Extreme	0.0%	$-	-

Table 5.13 Traffic Services

Risk Category	Percentage of Transportation Portfolio	Replacement Value (2019$ Millions)	Units (Each)
Insignificant	0.0%	$-	-
Low	97.6%	$224.8	1,902,763
Moderate	2.4%	$5.5	46,027
High	0.0%	$0.1	626
Extreme	0.0%	$-	-

Managing risk is achieved in large part by optimizing the timing and type of maintenance and renewal interventions. To provide guidance for asset maintenance and renewal decision-making, the City's tolerance for risk arising from the deterioration and failure of assets has been defined based on asset criticality.

6. Governance

For an efficient asset management planning process, it is essential that a clear structure, with appropriate authority, roles and responsibilities is in place. This allows individuals within the organization to understand their role, take ownership and effectively support AM objectives.

The purpose of this section is to further develop the roles and responsibilities outlined in the *Strategic Asset Management Policy* as it relates to the Transportation Assets. The City has recognized the importance of an effective AM Governance structure in contributing to the successful delivery of services and in achieving goals. This AMP builds on the significant recent advancement in AM governance in the identification and documentation of AM roles and responsibilities.

6.1 Corporate Roles & Responsibilities

The Strategic Asset Management Policy (8.2.6-7) effective July 1, 2019 outlines the governance practices associated with the Asset Management planning and implementation at the City of Brampton. Section 7 of the policy defines the roles and responsibilities in relation to the development of all the Asset Management Plans within the City and are stated below:

- The Council will:
  a. Approve by resolution the Asset Management Plan and its updates every five years.
  b. Review progress on the implementation of the Asset Management framework and roadmap on an annual basis; and,
  c. Support the implementation of the Asset Management Plan and ongoing efforts to improve the Plan and ensure it includes changes necessitated by the updates to other strategic documents.
- Senior Leadership Team (SLT) will:
  a. Endorse the Strategic Asset Management Policy and the Corporate Asset Management Plan; and,
  b. Maintain compliance with the Asset Management Policy and Ontario Regulation 588/17: Asset Management Planning for Municipal Infrastructure.
- The Treasurer and Manager, Corporate Asset Management have been endorsed by Council as Executive Co-Leads. They will:
  a. Develop the Corporate Asset Management Plan for Council's consideration.
  b. Lead and coordinate efforts to implement Corporate Asset Management strategy, roadmap and supporting strategies.
  c. Collaborate and endorse Service Area Asset Management Plans for Council approval; and
  d. Collaborate with the Asset Management Steering Committee in providing strategic advice to the Senior Leadership Team.
- Asset Management Steering Committee is a staff committee of service area directors or designates that will:
  a. Provide executive direction and advice and ensure compliance with the regulatory requirements.
  b. Sponsor the implementation of the Corporate Asset Management Strategy and Roadmap and supporting strategies; and,
  c. Represent departments in providing overall guidance and approval of Service Area Asset Management Plans.
- Corporate Asset Management Unit, under the leadership of the Treasurer and Manager, Corporate Asset Management, the Corporate Asset Management Unit will:
  a. Develop and implement the Corporate Asset Management Roadmap and supporting strategies.
  b. Ensure coordination and a standardized approach among asset management related initiatives across service areas; and,
  c. Collaborate with the Asset Management Technical Leads in the preparation of Service Area Asset Management Plans.

– Asset Management Technical Leads and Asset Management Network
    a. This group consists of service area subject matter experts and supervisors that will: Develop, administer, and support asset management activities that fall within their service area, including the development of service area asset management plans.

6.1.1 Corporate Asset Management Office (CAMO)

The Corporate Asset Management Unit (as per policy) or referenced internally as the Corporate Asset Management Office (CAMO) is central to the delivery of Asset Management services at the City. CAMO is intentionally separate from any specific Service Area and reports directly to the Treasurer. The unit comprises of Asset Management professionals who coordinate Asset Management activities across the organization regardless of asset or Service Area, including the Transportation Service Area. The goal of CAMO is to create consistent implementation, promote and provide education on best practices, facilitate knowledge sharing and encourage a culture of continuous improvement across the Service Areas, including Transportation.

6.2 Transportation Service Area

The Transportation Service Area (TSA) is a specific subset of the City of Brampton responsible for the management of the Transportation assets. It includes individuals from different divisions within the organization who are all connected by their involvement in supporting asset management of the Transportation Asset Portfolio.

6.2.1 Organizational Chart

The key positions within the Service Area, and associated reporting and relational hierarchy are shown in Figure 6.1. The organizational chart identifies individuals and roles within the department or division within the TSA. The roles and responsibilities outlined in the Strategic Asset Management Policy have also been mapped in the organizational chart to show how the corporate AM governance structure is reflected and applied within the Transportation Service Area. The AM Policy roles and responsibilities captured in the organization chart include:

– Council
– Senior Leadership Team (SLT)
– The Treasurer
– Asset Management Steering Committee
– Corporate Asset Management Office
– Asset Management Technical Leads and Asset Management Network

For simplicity, the Senior Leadership Team and the Asset Management Steering Committee have not been shown as the individuals within these groups exist outside the organizational chart shown in Figure 6.1.

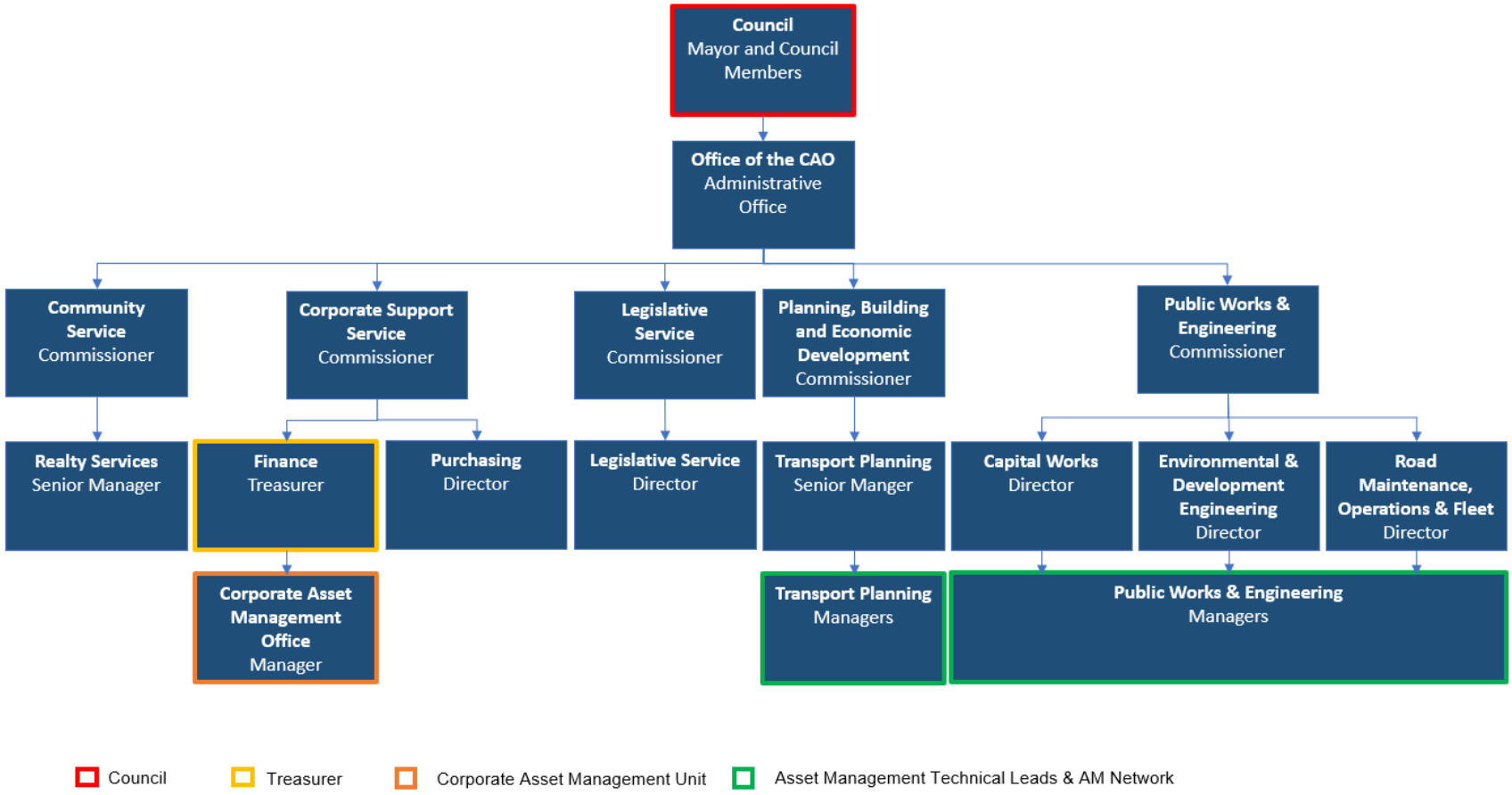


Figure 6.1 Transportation Service Area - AM Governance Structure

6.2.2 Responsibility Assignment Matrix

The RACI or Responsibility Assignment matrix indicates those roles, within the City of Brampton that are involved in the asset management of the Transportation Assets. The involvement is broken up into four categories depending on their level of responsibility:

- **Responsible (R)** –The individual responsible for the project delivery or completing the task
- **Accountable (A)** - The individual who is the approver or ultimately answerable for the correct and thorough completion of the deliverables
- **Consulted (C)** - Those whose opinions, knowledge, or coordination of tasks is required to support the development of the necessary deliverable or task (ie two-way knowledge exchange).
- **Informed (I)** - Those who are kept up to date on progress or updated as a matter of courtesy but not required to contribute to the deliverable. Often these individuals are only notified at the completion of the task or deliverable.

The Responsibility Assignment matrix maps out the key Asset Management activities and the typical Transportation Asset life cycle, and who is required to lead and be engaged in each activity. This is summarized in Table 6.1.

Table 6.1 Transportation Service Area - RACI Matrix

Key Lifecycle Activity	Asset Class	Council	PWE Commissioner	Environment & Development Eng. Director	Environment & Development Eng. Managers	Community Service (Reality Services Manager)	Capital Works - Director	Capital Works - Managers	Infrastructure Planning	Road Maintenance, Ops. & Fleet - Director	Road Maintenance, Ops & Fleet – Managers	Planning, Building & EcDev Director/ Managers	Transportation Planning	Corporate Support Services (CAMO, Finance and	Legislative Services (Legal Services)
Demand Development & Master Planning	All Assets	A	C	C	C		C	C	C	C	C		R		
Design review (includes: * 1 - subdivisions and site plans * 2 – Capital works EA & Design	Roads	I	A	C(1)	R(1)	R(2)	C(2)	R(2)	C	C	C	C	C	I	
	Structures														
	Walkway & Paths														
	Traffic	I	A	I	C	C	C	C	C	C	R	R(1), C(2)	C	I	
Construction (includes: * 1 - Development inspection and as built * 2 - Capital Construction Administration and as built)	Roads	I	A	C(1)	R(1)		C(2)	R(2)	C	C	C	C	I	I	
	Structures														
	Walkway & Paths														
	Traffic	I	A	I	C		C	C/R	C	C	R/C	R(1), C(2)	C	I	
Asset Assumptions/Handover * 1 - Development inspection and as built * 2 - Capital Construction Administration and as built)	Roads	A(1) I(2)	A	C	R(1)		C	R(2) C(1)	I	C	C	I	I	I	I
	Structures														
	Walkway & Paths														
	Traffic	I	A	C	R(1)		C	C	I	C	C	I	I	I	I
Maintenance Planning	Roads	A	C		C		C	R	R	C	R		C	I	C
	Structures														

	Walkway & Paths														
	Traffic	A	C		C		C	C		C	R		C	I	
Operation & Maintenance	Roads (includes winter maintenance)	I	I				C	C	I	A	R	C (Winter maint.)	I	I	
	Structures														
	Walkway & Paths														
	Traffic	I	I				C	C	I	A	R	I	I	I	
Renewal & Replacement Planning	Roads	A	C	C	C		A	R	R	A	R	C	C	C	
	Structures														
	Walkway & Paths														
	Traffic	A	C					C	I	A	R		I	C	I
Asset Disposal	All Assets	A	C	C	C		C	R	R	C	R	C	C	I	
Development of the AMP (a support activity)		A	C	C	C		C	C	C	C	C	C	C	R	

6.2.3 Gaps and Improvements

The Strategic Asset Management Policy governs the way Asset Management is delivered in the City of Brampton and came into effect in 2019. Given its relatively recent implementation, the City's Service Areas, and specifically the Transportation Service Area, is continuing to implement and extend the prescribed governance structure to their Service Area. As a result, there are some aspects of the governance system which have been effectively implemented and some which require additional attention.

To support the identification of areas of improvement, a Transportation Asset Management Maturity Assessment (2020) was conducted. This report included a section specifically on the AM governance implementation within the Transportation Service Area. The assessment helped inform the below key recommendations:

- Develop, test, and refine the responsibility (RACI) matrix presented in section 6.2.2. Although developed based on the current practice, it is recommended that:
  - The matrix continues to be developed (include more detail) and reviewed for the next 12 months to confirm its effectiveness
  - Engage with Senior Leadership, Asset Management Steering Committee and CAMO and secure the necessary endorsement or approval
- Nominate a Project Co-Manager from the Transportation Service Area (along side the CAMO Project Manager). This will ensure the necessary representation of the Transportation Service Area during the development of Asset Management initiatives and changes to Asset Management delivery at the City.
- Develop AM Job descriptions and incorporate these into the Service Area roles, described within section 6.2.2. It is understood that these are still being developed to meet the intent of the policy and the needs of the Service Area. It is understood that Job descriptions for the Corporate Asset Management Team have been implemented; and
- Advance Asset Management practices in a manner that supports consistent implementation at the Corporate level. Where challenges exist, caused by the absence of standard policies or practices the Transportation Service Area has an opportunity to lead the organization through a coordinated pilot program with the Corporate Asset Management Office and Asset Management Steering Committee.

The suggested recommendations arising from the maturity assessment continue the governance framework building process. The City recognizes that future delivery of transportation services will be dependent on planning and investment based on the direction and decision outputs from effective governance. The advancement of the governance model will be a key step toward achieving this goal.

7. Asset Information

7.1 Introduction

Asset information is a key enabler for effective asset decision-making and essential to good Asset Management practices. As with the physical assets, asset information itself must be managed effectively, throughout the asset lifecycle, to maximize its value. The management of asset information begins when it is first created at the asset conceptualization phase and continues until the information is no longer required and is either deleted or archived.

7.2 Business Needs

The practice of asset information management supports asset management planning, service delivery and performance management. This creates a common need to have complete and accurate asset data that supports evidence-based decision-making, when considering each of the fundamental attributes of asset management, including:

- **State of Local Infrastructure** - Provides information on a municipality's asset inventory, location, and attributes, accounting or historical valuations, current valuations, condition assessments and fundamental relationships to other assets. This information is the foundation for other sections of an Asset Management Plan. Asset level information is core to effective asset management and the planning for future services.
- **Levels of Service** - Provides a municipality's customer service and technical asset standards (also known as targets or desired levels of service) related to capacity and use, functionality, reliability, and responsiveness. Provides information on current performance on identified measures or indicators and predicted or expected levels of service based on planned operating and capital investments over the next ten years. Level of service information is essential for creating a line of sight through the transportation business on performance.
- **Lifecycle Management Strategy** - The optimal lifecycle management strategy is the set of planned activities that will enable the assets to provide the desired levels of service, in a sustainable way, while managing risk, at the lowest lifecycle cost. Lifecycle activities include non-infrastructure solutions, expansion, upgrade, maintenance, operations, rehabilitation, disposal, and replacement. Asset information includes the likelihood and consequence of an asset's failure, predictions of future behaviour of assets (deterioration, triggers, and treatment effect details), work activities completed and planned for assets with associated costs. This data helps to support lifecycle optimization.
- **Financing Strategy** – The financing strategy identifies concepts and strategies for short- and long-term funding plans for the lifecycle management strategies. Includes consideration of rate impacts, available funding sources, infrastructure funding deficits/shortfalls, performance, and sustainability measures, reporting options.

Ensuring that asset information is appropriate, consistent, and traceable, and to reflect the technical and operational reality of the assets is a challenge. However, it is a powerful tool to enable the organization to make effective and efficient decisions and is the foundation for successfully adopting asset management practices.

7.3 Corporate Information Governance

7.3.1 General

Currently, there is no corporate level framework that governs asset information. Each group, within the city, is responsible for creating and managing the relevant information associated with their specific role within the organization. This includes those responsible for the management of the Transportation assets.

7.3.2 Asset Information Management Strategy

An Asset Information Management Strategy (AIMS), completed in March 2021, sets out the implementation framework to enable the City to mature its asset information management practices throughout the City, over the

next three to five years. The AIMS also supports the City's endeavours to be following O.Reg. 588/17, while incorporating ISO 55000 standards. It covers asset information details including:

– Asset Data Requirements
– Asset Data Gap Assessment
– Asset Information Standards
– Asset Information Systems
– Continuous Improvement and Governance

Once implemented, the framework will ensure that the information about the City's assets, including Transportation Assets, is accurate and properly maintained throughout their lifecycle.

The AIMS primarily focuses on the corporate strategies and implementation "roadmap" however section 1.2.2 of the AIMS report also provides some recommendations which are specific to the Transportation Service Area. These are discussed in more detail in section 0.

7.4 Transportation Service Area

7.4.1 Information Management Support Tools

7.4.1.1 General

To support the management of the City's Transportation assets, the City uses several databases and software tools. The Asset Information Ecosystem which relates to the Transportation Assets is shown in Figure 7.1.

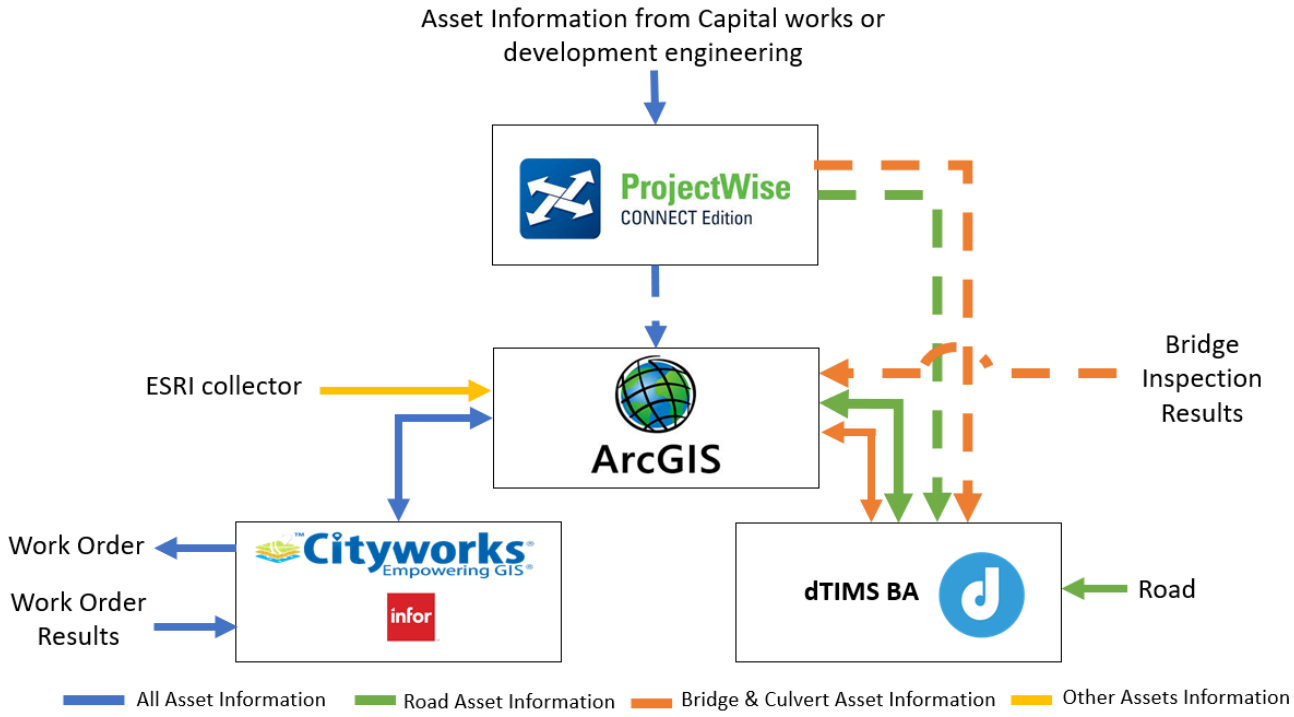


Figure 7.1 Asset Information Ecosystem

Note: *Solid lines indicates the data transfer process is automated or semi-automated (batched transfers) and the dashed lines indicate that this is a manual data exchange (requireing manual data entry)*

The software discussed in the following sections is central to the management of the Transportation Assets. However, the software is administrated, supported, and upgraded by Digital Innovation and Information Technology (IT), a division of the Corporate Support Services department. Integration between different digital tools is also facilitated by IT, at the request of the Transportation Service Area. A user's access privileges and

ability to upload, modify and download information from these packages is determined by IT using a predetermined rule-based system linked to a user's role or position.

While most of the Transportation assets information is now stored within the City's management tools, there remains some legacy documentation that is not yet uploaded to these tools or digitized, including street lighting and traffic signal information. However, the Service Area has plans to address the remaining data migration in the next 2-3 years.

7.4.1.2 ProjectWise

ProjectWise acts as the central digital repository for all original construction documents, including specifications, and design/as-built drawings from which all SOLI asset information is developed.

When a development or capital project is complete, all data provided to the City is saved in this system. The files are stored in the native file format (ie PDF, AutoCAD or MicroStation), as provided by the consultant or construction contractor or manufacturer. Once the asset information is within ProjectWise, the relevant asset information is then manually transcribed or transferred to the relevant asset management tool (GIS, dTIMS BA, CityWorks). Currently, the City lacks the ability to automate this process. The choice of the management tool depends on the asset class within the Transportation hierarchy as these are not all managed under a single database.

Restrictions arising from product licensing mean not all the City of Brampton employees can access ProjectWise. For that reason, the City continues to utilize and duplicate the asset information on its enterprise-wide cloud based system called SharePoint which is accessed through Engineering Design Drawing Index (EDDI) application. This challenge is addressed as an information governance/management improvement. Information for capital projects related to Roadway Assets has been successfully migrated to ProjectWise and the transition of the remaining Transportation Assets is ongoing.

7.4.1.3 Esri (ArcGIS)

Esri ArcGIS is the City's Transportation asset's Geospatial Information System (GIS) database. It is the Transportation Services Areas' primary repository for SOLI asset information.

The Esri ArcGIS system includes the following Linear and Vertical Transportation Assets:

– Roads (center line details)
– Structures
– Walkways, Sidewalks and Multiuse paths; and
– Traffic

While the GIS asset information is largely complete, the City has identified some additional details, such as subcomponents related to the traffic signals which will be added to the GIS database in the future.

The information stored within the GIS database is linked to two other asset information systems: dTIMS BA and CityWorks. The level of information and system data that is linked depends on the asset class (see the explanation of individual systems for more details). The GIS information is duplicated in a few other systems including "Infor", even though these systems are legacy systems and are being phased out.

ArcGIS Collector is a mobile app which enables inspection/maintenance crews (only enabled for internal personnel-) to digitally record and report the findings of their physical inspection. The City of Brampton uses this Esri tool to support their physical inspection program, including sidewalks and ancillary structures (i.e., fences and retaining walls). This tool is not currently utilized for work associated with pavement, bridge and culvert assets, or any structure requiring an OSIM inspection.

7.4.1.4 dTIMS BA

The primary function of dTIMS is to allow for analysis of the roads and bridges asset data in order to optimize the rehabilitation programs. This system is linked to Esri GIS to enable the asset information and features to be utilized within dTIMS. This system is also used to track the condition of assets and work history. Typically completed work orders, such as rehabilitations or inspections are uploaded directly into dTIMS BA, however,

information such as bridge details are uploaded to GIS. Due to the digital connection between these two databases, this information can be easily transferred between the two systems.

Plans to develop a risk-based life-cycle cost optimization tool within dTIMS BA is also underway. Once implemented the asset information within this system will improve the Transportation Service Areas' ability to make decisions relating to Lifecycle Management Strategy for Bridge and Pavement assets.

7.4.1.5 Cityworks

Cityworks is regarded as the primary work, inspection and service request management tool for the majority of the Transportation Assets information, including:

– Structures (excluding Bridges and culverts)
– Traffic (Signals, Signs and Lighting)
– Walkways, Sidewalks and Multiuse Paths

All maintenance (preventative and corrective) is programmed, assigned and monitored within this system and is used by both 'in house' and external maintenance teams. The Cityworks system is also setup to allow for the digital collection of asset information and "live" completion of work orders using the mobile Cityworks application. This enables the automation of digital recording, reporting and processing of contractor payments thereby improving the efficiency and accuracy compared to paper-based systems.

Cityworks is a dynamic tool that manages a combination of SOLI, Lifecycle Strategy and Financial asset information. Although Cityworks allows for asset information to be updated and managed, based on the completion of work orders, Esri GIS serves as the central store for this data.

7.4.1.6 Other

Transportation asset information is also stored and managed in three other locations. These include:

– Infor – replaced by Cityworks
– Excel spreadsheets – used for uploading data into Cityworks
– SharePoint – Document management and cloud-based storage system used as a collaborative platform

Information stored in legacy systems such as Infor or Excel spreadsheets is currently being migrated to one of the primary Information Management Support tools described in the earlier sections. SharePoint will continue to be used by the corporation. However, as more people get access to Information Management Support tools, there will be lesser need to duplicate the information in SharePoint.

7.5 Gaps and Improvements

Through internal reviews and the AIMS project (see Section 7.3.2), the City of Brampton has identified gaps in their asset information practices related to the Transportation Service Area and these are summarized in Table 7.1. These generally can be broken down into three categories:

– **Information adequacy** – the improvement is associated with the detail and type of information being collected.
– **Information accuracy** – the improvement is associated with the level of accuracy of the information currently captured and stored in the systems; and
– **Information governance/management** – the improvement is associated with system integration and the way data is being managed between different software systems, groups or individuals.
–

Table 7.1 Information Gaps and Improvements

Challenge or Gap	Deficiency Type	Business Need	Improvement Actions
Road class is based on functional classification which no longer aligns with the definitions stated in Minimum Maintenance Standards (MMS).	Information Adequacy	State of Infrastructure Lifecycle Management Strategy	Develop road data to enable the classification of roads in accordance with the classes prescribed in the MMS. This is currently underway. 2.
The City continues to utilize and duplicate the asset information on its enterprise-wide cloud based system called SharePoint which is accessed through Engineering Design Drawing Index (EDDI) application.	Information Governance/ Management	State of Infrastructure Lifecycle Management Strategy	Appropriate information management solution needs to be developed either to provide a lighter version of Projectwise or provide a compatible EDDI that can access base data directly from Projectwise on real-time basis without duplication.
In-service dates are missing or need to be added for some structures.	Information Accuracy	State of Infrastructure	Audit and correction program to fill gaps.
No Work Management activities are recorded for some structures' assets and sidewalks.	Information Adequacy	State of Infrastructure Lifecycle Management Strategy	Develop systems, tools and processes to enable all asset lifecycle information to be captured and be available for analysis by SMEs
Only high visibility LOS metrics are available and tracked by the city (those made available to the Public)	Information Adequacy	LOS Lifecycle Management Strategy Data Management	Improving data tracking and analysis related to all LOS KPIs
Risk predominantly missing across all asset classes.	Information Adequacy	Lifecycle Management Strategy Data Management	Improving data related to risk assessment Risk data models are being developed for bridges and roads which will be further deployed to other assets in the future.
Expenditure forecasts and funding gaps are developed for some asset classes. However, this analysis is not done at an advanced level.	Information Adequacy	Financing Strategy	Expand current expenditure data capture and planning, related to lifecycle activities. Currently, the financial expenses are determined based on a known cost and inventory. Greater maturity can be achieved through the development of these costs at a sub-asset level and provide greater confidence in developing investment needs.

Challenge or Gap	Deficiency Type	Business Need	Improvement Actions
Asset information transfer following asset creation often occurs without complete information relating to the asset.	Information Governance/Management	State of Infrastructure Lifecycle Management Strategy	Implementation of a working group comprising Development Engineering, Capital Works and Operations to establish Asset Information standards for each asset type. This would ensure that assets are transferred with all available and necessary asset information. This would also provide an opportunity for feedback to support efficient asset management practices. This links with the developing system, tools and process identified above to improve Information Adequacy.
Currently, no maintenance or work order records are being collated against assets within dTIMS.	Information Adequacy	Lifecycle Management Strategy Financial Strategy	Asset maintenance information collected through Cityworks be transferred to GIS and eventually to dTIMS to utilize for analysis.
Asset information process between systems particularly related to GIS, are not fully automated, requiring manual process...	Information Accuracy and Adequacy	State of Infrastructure	Work with IT to improve data standards and business processes.

The ability to collate and analyze quality, relevant data is essential to improving asset management maturity and delivery. By identifying and addressing the asset information issues, such as those identified in Table 7.1, the City will improve its ability to deliver effective evidence-based decision-making for asset management.

8. Asset Lifecycle Strategies

8.1 Introduction

This section describes the strategies and practices undertaken by the Transportation Service Area to actively manage the transportation asset portfolio throughout the asset's lifecycle which is categorized into five different activities. These activities include:

11. Expansion (Growth and Upgrade)
12. Operations
13. Maintenance
14. Renewal (Rehabilitation and Replacement)
15. Disposal

Each of these asset management activities has an inherent cost associated with performing the work. The accumulative cost of all the activities required throughout an asset's lifecycle is referred to as the asset's lifecycle cost. A visual representation of a theoretical asset's lifecycle and the accumulative lifecycle cost or cost of ownership is shown in Figure 8.1.

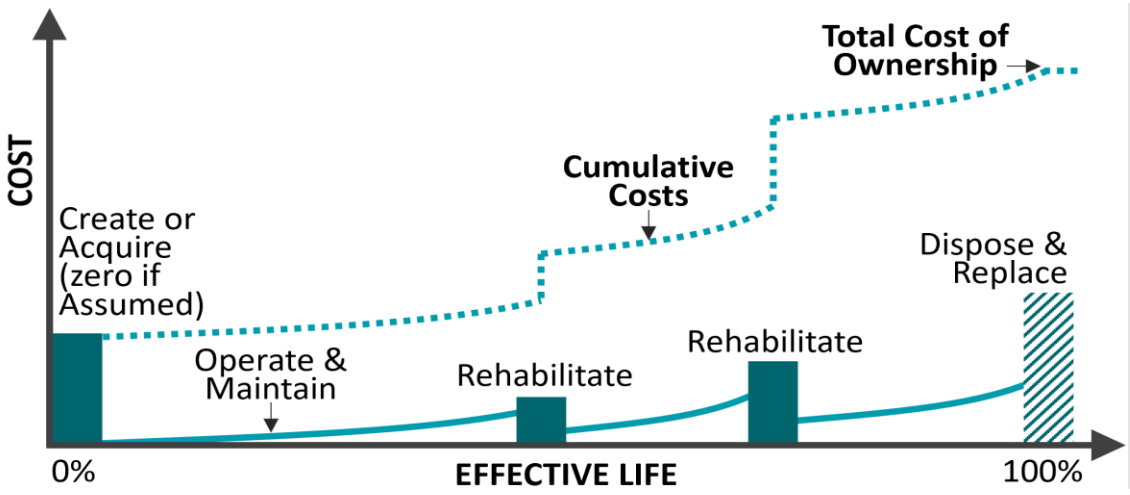


Figure 8.1: Illustrative example of asset's lifecycle and the accumulative lifecycle cost

A key objective of the Transportation Service Area is to effectively deliver the Levels of Service at the lowest lifecycle cost while managing the risk and maximizing the useful life of the asset. The following sections summarize the strategies and activities which the City of Brampton undertakes to achieve the lowest lifecycle cost.

8.2 Expansion (Growth and Upgrade)

The Transportation Service Area acquires or grows its Transportation Asset Portfolio in two distinct ways: through the identification, planning, construction and implementation of Capital projects by the City of Brampton or through the acquisition of new assets created by the developers.

The City has a planning department that is responsible for supporting and identifying future projects that are required to manage the demand for services. These projects are typically identified and recorded in the transportation related master planning documents. Once a project is approved, the Public Works and

Engineering Department, an internal department within the City, is then engaged internally to provide delivery of the selected Capital projects. This activity is often supported by external consultants and contractors, however, not always.

The other primary mechanism through which the City acquires assets is through the transfer of asset ownership from private developers. When the City approves a land area for development or changes the zoning, private companies can apply to develop the land. These developments usually include the construction of new public infrastructure assets (i.e., roads, bridges, streetlights, etc.). These assets are built by the developers based on the needs of the development area and standards set by the City.

In both instances, the construction or acquisition of new Transportation Assets is usually managed by the Development Engineering group which handles asset handover, quality control and release of the contractor at completion of the project

Once the asset has been created and the associated warranty periods have expired, the Environment and Development Engineering Division transfers the completed asset or land area to the Transportation Service Area who then assumes responsibility for the continued lifecycle management of the acquired Transportation Asset(s).

8.3 Operations

Asset operations activities are those that are regularly planned activities (and costs) and are required to support the delivery of service to the City's residents. For municipalities this is generally governed by the applicable local and provincial standards to ensure that consistent minimum service levels are provided. For the Transportation Service Area, asset operations are typically delivered in accordance with the provincial Minimum Maintenance Standard, or the City's own internal standards, whichever is more stringent.

Table 8.1 summarizes the cost associated with delivery of Asset Operations by asset class. These costs have been determined through a review of the past 5 years of financial information and averaged to provide a representative annual investment.

Table 8.1: Summary of Planned Operations Activities

ID	Asset Class	Activity Description	Operation Costs (2019 $M)	Total (2019 $M)
Roadway				
1.1	Arterial Roads	Road patrolling, winter control (operating, standby, sand, salt, brine), AVL/GPS units, leaf vacuum service, special events clean-up Every 4 years automated surface condition survey (whole system) which is completed by an external consultant	$6.2	$22.5
1.2	Collector Roads		$3.9	
1.3	Local Roads		$11.5	
1.4	Islands		$0.9	
Structures				
2.1	Roadway Bridges	Physical Inspection of bridges in accordance with Ontario Structure Inspection Manual (OSIM) every 2 years	$0.42	$1.11
	Pedestrian Bridges		$0.09	
2.2	Roadway Culverts		$0.54	
2.3	Gateway Features		$0.02	

2.4	Noise Walls	Power washing, graffiti removal, visual inspection every 2 years excluding guiderails and handrails which are annual.	$0.02	
2.5	Retaining Walls*		$0.01	
2.6	Fences		$0.00	
2.7	Guiderails		$0.01	
2.8	Handrails		$0.00	
Sidewalks/Walkways				
3.1	Sidewalks	Snow clearing services. Annual visual patrols and temporary repairs.	$8.30	$8.87
3.2	Walkways		$0.15	
3.3	Multi-Use Paths		$0.42	
Traffic Services				
4.1	Street Lighting	Streetlight locates and electricity costs	$6.11	$7.65
4.2	Traffic Signals	Energy costs, communication systems costs, signal locates and inspection and testing which occurs semi-annually (2 times a year) and conducted by external contractor or consultant	$1.37	
4.3	Traffic Signs	Traffic counting, annual retro-reflectivity and positioning in accordance with regulatory and warning signs requirements of the Ontario Traffic Manual	$0.17	

**Retaining Walls greater than 2m in height or those that potentially can impact road performance are inspected in accordance with OSIM and performed by external contractors.*

Operations activities are completed by a combination of Transportation Service Area operations personnel and external contractors

8.4 Maintenance

When a Transportation asset experiences a defect, which impacts its LOS (capacity, function, or quality), the activity that is required to restore it to its original operational condition is defined as maintenance. At the City, maintenance is usually triggered based on findings of a physical inspection, customer complaints, or adverse weather events (snow or storm events).

Once a corrective maintenance work order is created, it is assigned to an ‘inhouse maintenance crew’ or an external contractor that is administrated using standing maintenance contracts. The maintenance work order is also assigned an expected completion time/date to ensure that maintenance tasks are prioritized appropriately. Priority and projected completion time/date are assigned based on the Transportation asset class and sub-asset category. In case of a safety issue, the work is usually governed by the LOS requirements in accordance with the Ontario Regulations for Minimum Maintenance Standards (MMS).

Once a corrective maintenance work order is complete, it is closed. Details captured as part of work order completion include task completed, contractor or internal staff responsible for the work, payment processing details, finance codes and equipment and staff utilized to complete the work.

The cost breakdown for maintenance activities, by asset class, is summarized in Table 8.2. These costs have been determined through a review of the past 5 years of financial information and averaged to provide a representative annual investment.

Table 8.2: Summary of Planned Maintenance Activities

Asset Class	Activity Description	Maintenance Costs (2019 $M)	Total (2019 $M)
Arterial Roads	In-house maintenance, Public Works repair contract, crack sealing, Rail signal & crossing maintenance, utility restoration, Hwy 407 maintenance agreement*	$0.40	$1.49
Collector Roads		$0.26	
Local Roads		$0.76	
Islands		$0.06	
Roadway Bridges	Currently no major maintenance activities	$0.15	$0.4
Pedestrian Bridges		$0.03	
Roadway Culverts		$0.19	
Gateway Features	Addressing minor infrastructure damages	$0.007	
Noise Walls		$0.01	
Retaining Walls		$0.00	
Fences		$0.00	
Guiderails		$0.00	
Handrails		$0.00	
Steps		$0.00	
Sidewalks	Sidewalk repair and mud-jacking repair program	$1.25	$1.33
Walkways		$0.02	
Multi-Use Paths		$0.06	
Street Lighting	Streetlight pole inspection & maintenance, pole replacement, re-lamping, maintenance contract, Hydro One contract*, park pathway lighting	$2.71	$6.71
Traffic Signals	Spring & fall routine maintenance, Annual EVP range testing, signal maintenance.	$1.36	
Traffic Signs	Pavement markings, retro reflectivity	$2.64	

**In some instances, activities have been reported, however, the cost of these services is not incurred by the City. These activities are typically those that the City conducts for another stakeholder on their behalf and are completely reimbursed. These items have been reported for completeness as the City has agreed to perform this work and supply the necessary resources to complete them. These costs have been omitted in the calculation of the Maintenance Costs, as these are recovered and hence not required and considered as part of the Financial Strategy analysis (section 9). An example of this is the maintenance work the City of Brampton conducts on behalf of Highway 407 ETR.*

8.5 Renewal (Rehabilitation and Replacement)

All assets physically deteriorate at different rates. When an asset degrades sufficiently to where the asset's ability to deliver the required LOS is affected, the asset is required to be refurbished/rehabilitated or replaced. Asset condition is a measured assessment of an asset's current position or place on the

asset “decay” or “deterioration” curve. Asset lifecycles can be modelled to show the relationship between the condition and effective life (i.e., age), a representative lifecycle curve is reproduced in Figure 8.2. A key observation is that it is far more cost effective to maintain and rehabilitate assets before they reach a condition where the only option is costly reconstruction or replacement. For assets where preventive maintenance and rehabilitation activities are technically feasible, understanding the asset’s current condition and place on the asset decay curve enables forecasts of future conditions and determination of optimal treatment type and timing – key aspects of lowest lifecycle cost renewal decision-making. The City invests in condition assessments to gain the critical knowledge needed to determine the lowest lifecycle strategies.

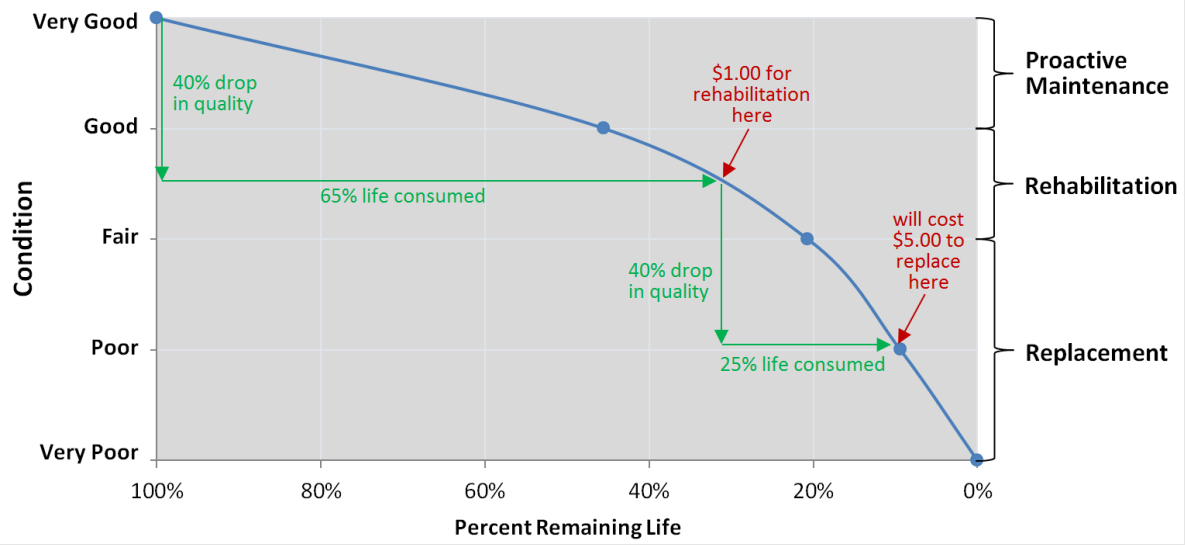


Figure 8.2 Typical Asset Decay Curve

The rehabilitation and replacement schedules for Transportation assets used to develop this Plan are summarized in Table 8.3. The renewal strategy uses a combination of preventative maintenance, refurbishments, and replacements to ensure cost-effective asset management.

Table 8.3: Summary of Renewal Strategy

Asset Class	Useful Life	Rehabilitation Frequency (before replacement)	Approx. Cost (% of CRV)	Activity Description	Renewal Costs (2019 $M)	Total (2019 $M)
Roadway Network						
Arterial Roads	45	2	30%	Resurface every 15 years	$5.70	$21.02
Collector Roads	50	2	34%	Resurface every 17 years	$3.58	
Local Roads	60	2	41%	Resurface every 20 years	$10.63	
Islands	45	2	30%	Resurface every 15 years	$0.24	
Structures						
Roadway Bridges	75	2	30%	Minor and major refurbishments every 25 years	$3.00	$7.94

Asset Class	Useful Life	Rehabilitation Frequency (before replacement)	Approx. Cost (% of CRV)	Activity Description	Renewal Costs (2019 $M)	Total (2019 $M)
Pedestrian Bridges	25	1	20%	Minor refurbishment 15 years	$0.65	
Roadway Culverts	75	2	20%	Minor and major refurbishments every 25 years	$3.86	
Gateway Features	25	None	None	None	$0.14	
Noise Walls	25	None	None	None	$0.11	
Retaining Walls	25	None	None	None	$0.09	
Fences	30	None	None	None	$0.03	
Guiderails	20	None	None	None	$0.05	
Handrails	25	None	None	None	$0.01	
Steps	25	1	30%	Minor refurbishment 15 years	$0.01	
Sidewalks/Walkways						
Sidewalks	50	2	25%	Refurbishments every 15 years	$0.49	$0.52
Walkways	30	None	None	None	$0.01	
Multi-Use Paths	20	None	None	None	$0.02	
Traffic Services						
Street Lighting	37*	1	5%	Major refurbishment of brackets at 20 years. *Life has been averaged based on weighted replacement value. 25 years life for the lighting unit and 40 years for the bracket/pole.	$3.69	$4.68
Traffic Signals	25	1	30%	None	$0.97	
Traffic Signs	NA	None	None	Managed through maintenance as signs are replaced as part of maintenance.		

The current renewal strategy (Table 8.3) is applied consistently across the asset portfolio with limited adjustment, at the individual asset level. The strategy does not reflect other parameters such as criticality, utilization and redundancy, condition, or performance. This is primarily because of the City of Brampton's rapid growth in the last 20 years. This growth means that a notable portion of the Transportation Assets has not yet required replacement or any major maintenance. As such the institutional knowledge of the factors that may accelerate an individual asset's deterioration is still being developed. The City is aware of this and is actively testing and monitoring its strategy to enable future refinement.

When major refurbishment or asset replacement is identified, renewals for core assets (roads and bridges) are often coordinated with internal departments (e.g., stormwater) and other stakeholders, such as the Region of Peel. Although project funding is kept separate for projects in the same area, project coordination is essential to maximize customer value. This communication is essential to ensure that

refurbishment or replacement projects don't conflict with planned activities, by other stakeholders. A common example is to schedule road refurbishment activities after the Region of Peel has conducted any necessary work on water mains, situated under the roadway. This is typically managed through consultation with stakeholders during annual planning periods. More details are provided in section 0.

8.6 Disposal

The Transportation Service Area will recommend asset disposal where, in the broadest terms, assets have ceased to meet the service performance requirements and the required maintenance or measures to rehabilitate or modify the assets are less beneficial than disposal and replacement options. Obsolescence is a potential trigger for recommending asset disposal and replacement.

No formal procedure is currently implemented. This is identified as a potential improvement covered in Section 10. For the purposes of the following financial analysis, the cost associated with asset disposal is incorporated into the asset replacement program.

8.7 Other Assets

Although the assets detailed within this section are primarily utilized by the Transportation Service Areas to support the delivery of the required LOS, some assets are managed centrally by separate Service Areas or Departments. These Service Areas include:

- **Facilities:** Assets used to support the asset management of the Transportation Assets and delivery of services by providing physical space for personnel and support equipment (e.g., snow clearing equipment).
- **Fleet**: Assets include licensed vehicles, off road vehicles and equipment which are utilized to support the inspection, snow clearing and maintenance of Transportation Assets.
- **IT:** Assets include information software which are utilized to support informed decision making in order to accurately and effectively execute asset management activities These assets are managed by separate specialty departments. The financial and personnel costs for administrating the maintenance and operation of these assets are absorbed by the relevant support department and not transferred to the Transportation Service Area. The Transportation Service Area is consulted regarding the changing demand for these types of assets, as they directly affect the Transportation Asset's LOS. These relationships are discussed further in Section 0.

8.8 Conclusion and Recommendation

A key objective of the Transportation Service Area is to effectively deliver the Levels of Service at the lowest lifecycle cost while managing the risk and maximizing the useful life of the asset. To do this the Transportation Service Area aims to invest and conduct the assets activities in the most efficient manner. Lifecycle strategies to achieve this are summarized in Table 8.4.

Table 8.4: Summary of Lifecycle Strategy

Asset Class	Operation & Maintenance	Rehabilitation		Replacement	
	Avg. Unit Cost (2019 $)	# Rehabs. Over lifecycle	Avg. Unit Cost (2019 $)	Useful Life	Avg. Unit Cost (2019 $)

Roadway Network					
Arterial Roads	$8,338.1	2	$156,513	45	$391,282
Collector Roads	$7,882.1	2	$147,954	50	$369,884
Local Roads	$6,215.9	2	$116,679	60	$291,697
Islands	$1.7	2	$33	45	$82
Structures					
Roadway Bridges	$271.0	2	$38,944	75	$129,815
Pedestrian Bridges	$71.7	1	$6,870	25	$34,348
Roadway Culverts	$121.0	2	$11,595	75	$57,975
Gateway Features	$10.0	None	-	25	$4,790
Noise walls	$4.2	None	-	25	$1,997
Retaining Walls	$3.4	None	-	25	$1,647
Fences	$0.2	None	-	30	$111
Guiderails	$0.3	None	-	20	$146
Handrails	$0.3	None	-	25	$153
Steps	$26.1	1	$3,750	25	$12,500
Sidewalks/Walkways					
Sidewalks	$5,255	2	$30	50	$119,000
Walkways	$12,255	None	-	30	$277,000
Multi-Use Paths	$4,087	None	-	20	$92,000
Traffic Services					
Street Lighting	$210.9	1	$263	37*	$5,251
Traffic Signals	$6,893.2	1	$43,899	25	$146,329
Traffic Signs	$61.67	None	-	NA	-

**Life has been averaged based on weighted replacement value. 25 years life for the lighting unit and 40 years for the bracket/pole.*

Using the City's current modelling, it is predicted that investing at the frequencies and levels described in the table above will result in the best use of City resources and produces the lowest asset life cycle costs. It is however acknowledged that this is not always practical and deviating from this is expected to incur additional costs to the City.

Although the current lifecycle modelling represents the most up to date lifecycle strategy, the following areas of improvement have been identified by the Services Area.

– The replacement of assets has not historically been a common event at the city and hence the establishment of replacement costs data requires attention to help in the refinement of the forecast replacement need.

- Some asset costs are determined based on asset categories and not based on individual or historical asset expenditure. Tracking these costs at a greater level of detail is expected to generate greater insights into the variations between different assets.
- The frequency for renewals has been implemented recently. Continued monitoring and testing of these frequencies is required and should be reconfirmed during the next revision of the AM plan.
- Currently, the City has no formal asset disposal procedure which is deployed within the Service Area. This may be useful in supporting decisions around when assets are needed to be replaced to avoid unwarranted investment.

The Transportation Service Area has implemented plans to address the improvements identified, these are discussed further in Section 10.

9. Financing Strategy

9.1 Introduction

This section integrates asset management planning with financial planning and budgeting. Allocating costs between lifecycle activities such as expansion (also known as growth), upgrade, renewal, operations and maintenance is complex due to the interconnection between the activities and an array of possible solutions to address the needs.

The Transportation Services Area is an asset-intensive part of the organization'. To accurately capture the financial commitment of the department it is important to recognize the consumption of an asset, categorize expenditure by lifecycle activity, allocate costs to assets, prepare long term forecasts, consider available revenue sources, and report financial performance.

One of the City of Brampton's strategic goals, as articulated in the Term of Council Priorities, is to be "a well-run city" which includes an objective to ensure "Stewardship of assets and services".

Transportation Asset Management Plan directly links to this strategic goal by actively managing the City's Transportation infrastructure assets and supports inter-generational equity by apportioning the investment needs over the long term.

Note that facilities, City-support fleet and software have been excluded from this analysis as they are managed centrally by a designated department and hence the costs associated with these assets will be captured in their respective Asset Management Plans.

9.2 Lifecycle Activities

As described in the Asset Lifecycle strategy chapter of this AMP, all asset management lifecycle activities have been categorized as one of the following:

- Expansion and Upgrade Investment
  - Expansion or Growth investments provide a new asset that did not exist previously or an expansion to the capacity of an existing asset
  - Upgrade investments increase the service potential of an existing asset by enhancing its functionality.
- Renewal investments reinstate an asset to its original service capability or condition (through asset replacement or rehabilitation)
- Operations and maintenance
  - Operations investments ensure the asset delivers expected levels of service to the community (inspections, energy, winter 'maintenance', etc.).
  - Maintenance investments support retaining the asset condition in order to fully realize the original service potential (minor repairs, etc.).

9.3 Expenditure Forecast

The forecasted expenditure is the investment required to achieve the City's Level of Service based on the lifecycle activities identified for each asset category within the asset hierarchy. This section is broken as follows:

- **Current Levels of Service** – Expenditure required to provide the current levels of service which has historically been provided or agreed.

– **Proposed Levels of Service** –Expenditure required (positive and negative) to adjust the current levels of service to achieve a future target performance, in 10 years' time.

9.3.1 Current Levels of Service

9.3.1.1 Expansion and Upgrade Investment

To maintain the current levels of service, the City has planned expansion and upgrade works until 2041 and outlined the costs of providing these activities in the *2019 DC Project List*. The list details planned growth and upgrade investments, which average an annual investment of approximately **$80.0 million** over the projected period. In addition, the City expects that investment, in the form of assets acquired from the developers will occur at a rate of approximately 1.8% per year (compounding) of the current asset inventory value which equates to **$42.4 million** per year. Therefore, the combined expansion and upgrade average investment is projected to be **$122.4 million** annually. This corresponds to a total investment of **$1.2 billion** over the next 10 years.

The following table summarizes the 10-year capital growth and upgrades program, the current replacement value (based on SOLI 2019), the forecast replacement value (2029), and the forecast Growth & Upgrade increase over the next 10 years.

Table 9.1 Expansion and Upgrade Investment

Service Area	Forecast Capital Growth & Upgrade Program ($M (1)	Current Replacement Value ($M) (2)	Forecast Replacement Value ($M) (sum of 1 & 2)
	Sum 2020-29	**2019**	**2029**
Roadways	$584	$1,125	$1,709
Structures	$375	$722	$1,097
Sidewalks/Walkways	$120	$230	$350
Traffic Services	$145	$279	$423
Totals	**$1,224**	**$2,356**	**$3,579**

It should be noted that an assumption, related to the expansion and upgrade, has been made that the assets created or upgraded retain the proportion of the asset category within the Transportation asset portfolio.

The City's Transportation Master Plan is in the process of being updated. The updated Transportation Master Plan will reflect the City's 2040 Vision that emphasizes the need for active transportation improvements and creating complete streets. As a result, some of the currently planned upgrades and expansions are expected to change. The future iteration of the Transportation Asset Management Plan will capture any changes to the Transportation Master Plan and will have validated information on the expansion projects and their cost allocation by asset category. This has been identified as a future improvement.

9.3.1.2 Renewal Investments

The Asset Management Plan forecasts long-term asset renewal needs (both replacement and refurbishment activities) based on current asset performance and the identified AM lifecycle strategies to reinstate the asset practically to its original service capability or condition. The average long-term (50-year) investment needs are considered the optimal level of annual investment required to maintain

current levels of service. Based on current estimates in the Asset Management Plan, the optimal level of annual renewal investment is approximately **$69.9 million**.

Table 5-2 below provides a summary of the following by asset category:

- **Current level of investment**: the 10-year average annual capital renewal program
- **Optimal level of investment**: the average annual capital renewal forecast needs that are determined by applying the asset renewal strategies over the lifecycle
- **Infrastructure surplus or (gap):** the difference between the current and optimal levels of investment
- **Asset Renewal Programming Ratio**: current investment per capital program as a percentage of optimal investment according to asset management plan needs.

Table 9.2 Renewal Investments ($M)

Asset Category	Current Level of Investment*	Optimal Level of Investment (based on ave. annual capital renewal forecast needs over the lifecycle)			Infrastructure surplus (gap, if negative)	Asset Renewal Programming Ratio (Current / Optimal, %)
		Replacement (1)	Rehabilitation (2)	Renewal (1+2)		
Roadways	$21.0	$21.4	$15.5	$36.9	($15.9)	57%
Structures	$7.9	$12.2	$4.5	$16.7	($8.8)	47%
Sidewalks/ Walkways	$0.5	$5.0	$2.1	$7.1	($6.6)	7%
Traffic Services	$4.7	$8.2	$1.0	$9.2	($4.5)	51%
Totals	$34.1	$46.8	$23.1	$69.9	($35.8)	49%

* This represents the combined renewal (refurbishment and replacement) calculated by averaging the annual Capital Expenditure budgeted for 2020-2024 and then extrapolating this amount over the required 10 years period of interest.

For contrast, Pavement Management Update dated 2016-08-08 indicated that, *based on the current condition assessment method there is a gap of an average of $20.0 million over the next 10 years and that the current average funding of $12 million annually for resurfacing (renewal) will result in deterioration of the road network over time*. These numbers are consistent with the current analysis (particularly with the growth in the inventory factored in) and support the need for greater investment.

The difference between the current level of investment as reflected in the City's 10-year capital program and the optimal level of investment is referred to as the infrastructure gap. Based on these longer-term asset renewal needs, the infrastructure gap is approximately **$35.8 million** per year. Figure 9.1 shows the complete needs, including the renewal costs forecast over the next 10 years which are slated to increase proportionately with growth and upgrade of the asset portfolio as outlined in section 9.3.1.1.

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 over the next ten years against a target of 1.0. As is evident from Table 9.2, the City is only investing 49% of the identified renewal need. The Transportation Service Area has identified that the difference is likely due to the absence of planned allocations for future replacement activities. Instead of building up a dedicated replacement reserve for these activities, this has historically been more reactive. Although it is acknowledged that to date, this approach may represent a funding challenge for the City, it should also be recognized that the City is relatively "young" and has only recently undergone a period of rapid growth and investment. As the average asset age continues to increase, the replacement burden will continue to

grow. To prevent the City from facing an unmanageable financial commitment, it is necessary to invest in renewal programs, particularly replacement, at a level that is closer to a 1.0 funding ratio. The Transportation Service Area acknowledges that this is an area where additional associated work is required to improve understanding of the replacement need. This is discussed further in 9.5.1.

Further, to the development of the 'optimal' renewal investments (see section 8) the Transportation Service Area has identified a replacement and rehabilitation 'backlog'. This 'backlog' refers to renewal activities that are overdue and relate to assets that are considered to be in service beyond their useful life or refurbishment schedule. This has been estimated by assessing the average annual need required over the next 10 years and comparing it to the amount required in the first year (i.e. 2020) of the 10 year cycle. The difference between these amounts represents a historical shortfall or backlog which is required to be cleared to 'reinstate' the target level of service. After considering the backlog, the renewal investments are summarized in Table 9.3.

Table 9.3 Renewal Investments and Backlog ($M)

Asset Category	Additional Renewal 'Backlog' ($M)	Average Annual 10 year Additional Renewal ($M)	Optimal Level of Investment (from Table 9.2) ($M)	Total Annual Renewal Investment (2 +3)
Roadways	$87.2	$8.7	$36.9	$45.6
Structures	$0.0	$0.0	$16.7	$16.7
Sidewalks/Walkways	$0.1	$0.0	$7.1	$7.1
Traffic Services	$18.9	$1.9	$9.2	$11.1
Totals	$106.2	$10.6	$69.9	$80.5

Based on 2019 SOLI data of the Transportation infrastructure, the backlog equates to an additional investment need of **$106.2 million**, creating an additional renewal investment need of **$10.6 million** annually over the next 10 years to achieve the levels of service objectives.

9.3.1.3 Operations and Maintenance Expenditures

To maintain the current levels of service, the City includes planned maintenance and operations activities in its annual operating budget. The following table outlines the average annual maintenance and operations budget based on the historical expenditure by asset category.

Table 9.4 Operations and Maintenance Investments ($M)

Asset Category	Operations(M$)	Maintenance (M$)	Total (M$)
Roadways	$22.5	$1.5	$24.0
Structures	$1.1	$0.4	$1.5
Sidewalks/Walkways	$8.9	$1.3	$10.2
Traffic Services	$7.6	$6.8	$14.4
Totals	$40.1	$10.0	$50.1

The subtotal of operating costs from the above table, which represents the cost of operating and maintaining assets to deliver current levels of service, is in the range of $50.1 million annually.

9.3.1.4 Summary

Table 9.5 summarizes the completed need associated with achieving the current Level of Service.

Table 9.5 Current Levels of Service Investments Summary ($M)

Service	Lifecycle	Lifecycle Activity		Current Annual Needs Forecasts ($M)		
		Objectives	Average Annual Budget	Average Annual Needs	Average Annual Funding Shortfall	Funding Ratio (Target = 1.0)
Capacity, Use and Function	Growth and upgrade [Note 1]	*Developer constructed assets to facilitate greenfield land development*	-	$42.4*	-	-
		City constructed assets to increase capacity and enhance function	-	$80.0*	-	-
Note 1: The capital needs required to fund the Growth and Upgrade is met through DC funding and/or contractor.						
Quality and Reliability	Renewal	City activities to bring assets up to a state of good repair (1)	$34.1	$80.5	$46.4	0.42
	Maintenance	City activities to maintain assets at a state of good repair (2)	$10.0	$10.0	$0.0	1.00
	Operations	City activities that use assets to achieve agreed levels of service (3)	$40.1	$40.1	$0.0	1.00
Total (1+2+3)			$84.2	$130.6	$46.4	0.64

Figure 9.1 shows the complete needs, including operations, maintenance and renewal costs forecast over the next 10 years which are slated to increase proportionately with the growth and upgrade of the asset portfolio as outlined in section 9.3.1.1.

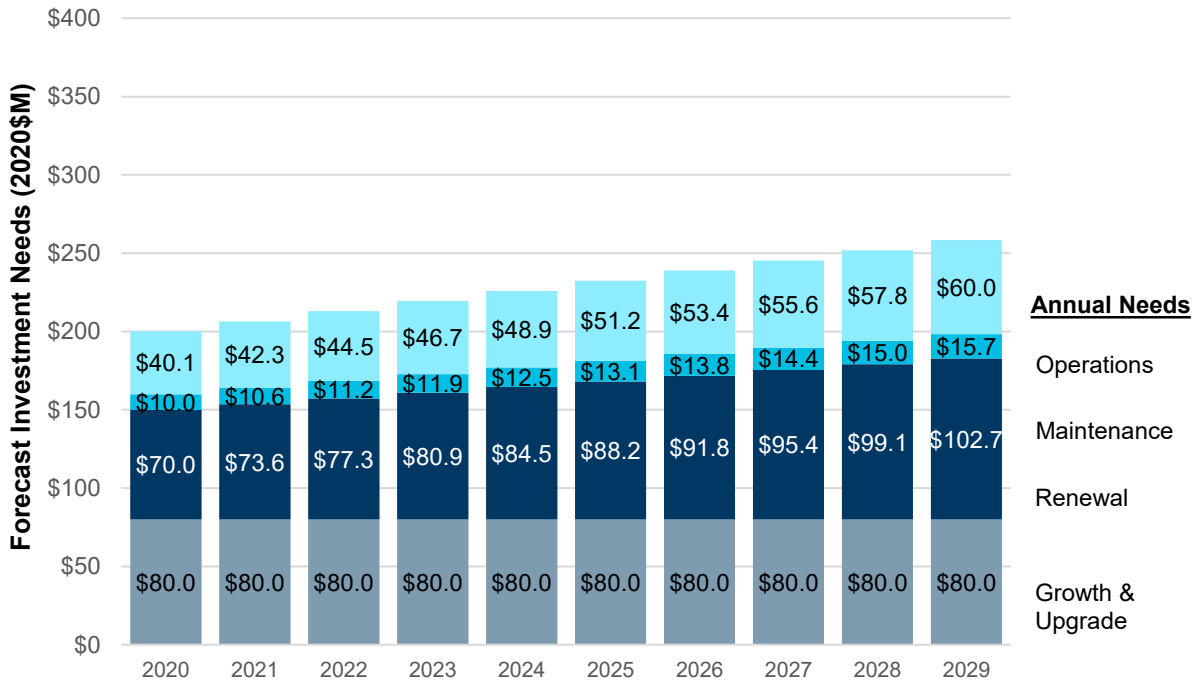


Figure 9.1 Forecast Combined Current of LOS Needs

9.3.2 Proposed Level of Service

The Transportation Service Area has identified several Levels of Service metrics that are required to be brought up to a higher performance standard, to meet future demand (e.g. increased active transportation). The 'target' level of service, which provides higher levels of services to the community compared to the current levels, is referred to as the Proposed Levels of Service (see Section 3). To achieve the Proposed Levels of Service, the Transportation Service Area has identified supplementary financial needs in addition to those outlined in the Current Levels of Service section.

In order to achieve the Proposed Levels of Service, no additional expansion and upgrade or renewal investment needs were identified, as the LOS targets are the same for both.

9.3.2.1 Operations and Maintenance Expenditures

Changes to user expectations, regulations and operational issues, over the next 10 years, are expected to demand greater investment to achieve the proposed levels of service. These needs are summarized in Table 9.6.

Table 9.6 Proposed level of Service Operations Investments ($M)

Asset Category	Operations Need			
	Current Need	% Increase	Total Need	Comment
Roadways	$22.5	7%	$24.1	Increase expected due to increased demand for road and bike lanes separations (to meet Active Transportation objectives). This will create operational challenges for summer/winter clearing (more obstacles).

				User needs that are associated with ensuring 'year-round' bike lane operations (greater clearing) are also expected. Further, as the urbanization of the City continues, it is expected that land use restrictions will limit space to store snow (removal and melting).
Structures	$1.1	0%	$1.1	Significant change not expected
Sidewalks/ Walkways	$8.9	10%	$9.8	Increased LOS related to sidewalk summer/winter clearing (By-law). Regulatory changes will increase the sidewalks from 1.5m to 1.8m requiring new equipment and additional time. Feature sidewalks (increased areas and greater aesthetic appeal) and higher LOS needs are also expected for integrated pavements (e.g., Dixie, Inspire) due to alternative operations needs
Traffic Services	$7.6	0%	$7.6	Significant change not expected
Totals	**$40.1**	**6%**	**$42.6**	

Including the current levels of service needs, a total of **$42.6 million** or a 6% increase on the current investment has been estimated to achieve the proposed levels of service needs.

Similarly, maintenance investment needs are also expected to require some adjustment over the next 10 years to meet the proposed levels of service objectives. These will primarily be driven by changes in asset inventory, technology, and regulations.

Table 9.7 Proposed level of Service Maintenance Investments ($M)

Asset Category		Maintenance Need		
	Current Need	% Increase	Total Need	Comment
Roadways	$1.5	0%	$1.5	Significant change not expected
Structures	$0.4	28%	$0.5	Increased costs associated with unique precast "theme" assets such as noise walls, retaining walls, fences and gateway features -
Sidewalks/ Walkways	$1.3	50%	$2.0	Sidewalks –maintenance backlog which needs to be addressed over the next 10 years. New technology needs are also expected to grow (e.g., permeable pavement, feature or coloured pavements). Legislative changes associated with a mandate to widen arterials sidewalks from 1.5m to 1.8m and installation of tactile plates at intersections (growth and functional upgrade).
Traffic Services	$6.8	20%	$8.2	Traffic Signals – increased investment to engage larger contract support resulting from growing Active transportation needs. Traffic Signs – - . An additional need to accommodate new reflectivity testing.
Totals	**$10.0**	**21%**	**$12.2**	

The Transportation Service Area has identified an investment 'need' of **$12.2 million** or a 21% increase, over the current levels of service, in order to achieve the proposed levels of service.

9.3.2.2 Summary

The total required to achieve the proposed Levels of Service as identified by the Transportation Service Areas is provided in Table 9.8.

Table 9.8 Proposed levels of Service Investments Summary ($M)

Service	Lifecycle	Lifecycle Activity		Future Annual Needs Forecasts ($M)		
		Objectives	Average Annual Budget	Average Annual Needs	Average Annual Funding Shortfall	Funding Ratio (Target = 1.0)
Capacity, Use and Function	Growth and upgrade [Note 1]	*Developer constructed assets to facilitate greenfield land development*	-	$42.4*	-	-
		City constructed assets to increase capacity and enhance function	-	$80.0*	-	-
Note 1: The capital needs required to fund the Growth and Upgrade is met through DC funding and/or contractor.						
Quality and Reliability	Renewal	City activities to bring assets up to a state of good repair (1)	$34.1	$80.5	$46.4	0.42
	Maintenance	City activities to maintain assets at a state of good repair (2)	$10.0	$12.2	$2.2	0.82
	Operations	City activities that use assets to achieve agreed levels of service (3)	$40.1	$42.6	$2.5	0.94
Total (1+2+3)			$84.2	$135.3	$51.1	0.62

Figure 9.2 shows the complete needs, including operations, maintenance and renewal costs forecast over the next 10 years which are slated to, increase proportionately with the growth and upgrade of the asset portfolio as outlined in section 9.3.1.1.

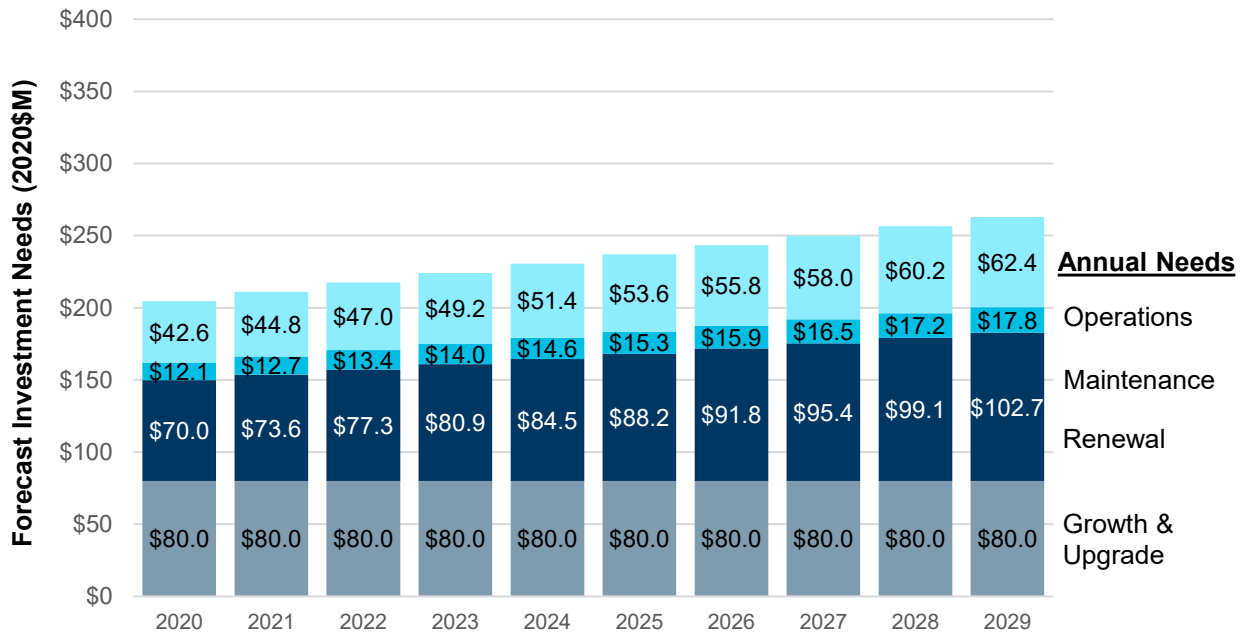


Figure 9.2 Forecast Combined Proposed of LOS Needs

9.4 Funding Forecast

9.4.1 Funding Sources

Through the annual budget process, capital and operational project information are gathered from service areas, including investment needs, trends and priorities to prepare the five-year capital program. The five-year capital program includes the current year budget and a four-year forecast. Once the expenditure plan for the five-year capital program is finalized, a funding plan for the proposed expenditure is developed. To forecast the budget allocations over a 10 year period (as required by the O.Reg588/17), the planned budget investments level has been averaged and extrapolated E-1. The plan includes several key sources of funding and financing as outlined in the table below:

Table 9.9 Key Sources of Funding and Financing

Funding Source	Examples	Financing Use
Property taxes	NA	Operations, Maintenance and in some instances renewal (e.g., road resurfacing and rehabilitation)
Development Charges	NA	Restricted to Growth or Upgrade Activities (no replacement activities)
Grants and subsidies	Provincial Gas Tax Federal Gas Tax	External grants which usually come linked with some funding constraints
Special Purpose Levy	Infrastructure Levy	No restrictions on investment related to the Transportation assets

Unlike some Service Areas within the City, the Transportation Service Area does not receive any direct user-pay charges to support funding of levels of service objectives.

The City of Brampton has instituted development charges to pay for off-site, development-related infrastructure. The Development Charges Act provides the authority to impose these charges and provides strict limitations on their calculation. Development charges are generally based on the benefits principle, as increases in the need for services necessitated by development are estimated, all or a portion of the net capital cost (gross cost less other contributions such as grants or subsidies) of providing the services are recovered through the levy paid by the benefiting development. These are collected by the City from developers and 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 residential and non-residential development.

Grants from the Province or the Federal Government are also used to finance the City's capital program. Most grants are a result of stimulus or other one-time funding that may be more difficult to forecast. Most grants are included in the budget forecast when confirmed.

However, the City recognizes the Federal Gas Tax revenue as a stable source of funding due to its historical consistent allocation. While this may not always remain the case, it has been assumed to be stable until greater certainty exists about how this may be impacted. These contributions, which are distributed to municipalities based on population, are now indexed annually for inflation. Unlike Provincial Gas Tax funds, Federal Gas Tax funds may be applied to most services. The City of Brampton has typically used Federal Gas Tax funds for Transit and Transportation projects in recent years. In this AMP, the allocation of the Federal Gas Tax funds to the Transportation Assets is assumed to be 60% based on historical budgets.

The remaining funding needs inform the property tax levy requirement. Property assessment changes and assessment growth, both residential and non-residential, will impact the amount of property taxes that each property owner will pay. In addition to the property taxes, the City of Brampton has also adopted an "infrastructure levy" which is specifically designed to collect tax revenue to ensure that infrastructure (which does not receive user-pay fees) is managed effectively. The annual 2% infrastructure levy, as recommended in the Long-Term Financial Master Plan, supports the repair and replacement of City assets. In any given year, the Council may reduce the infrastructure levy to appropriately respond to the economic environment, However, the long-term forecast in this Asset Management Plan assumes a 2% levy and its allocation to Transportation assets at 20%.

All Transportation asset management programs are supported by a combination of revenue sources. During budget development, estimates are made with respect to program expenditure requirements, which are then offset by anticipated federal/provincial subsidies and user fee revenues. The summary of the funding sources is presented in Figure 9.3 and Table 9.10.

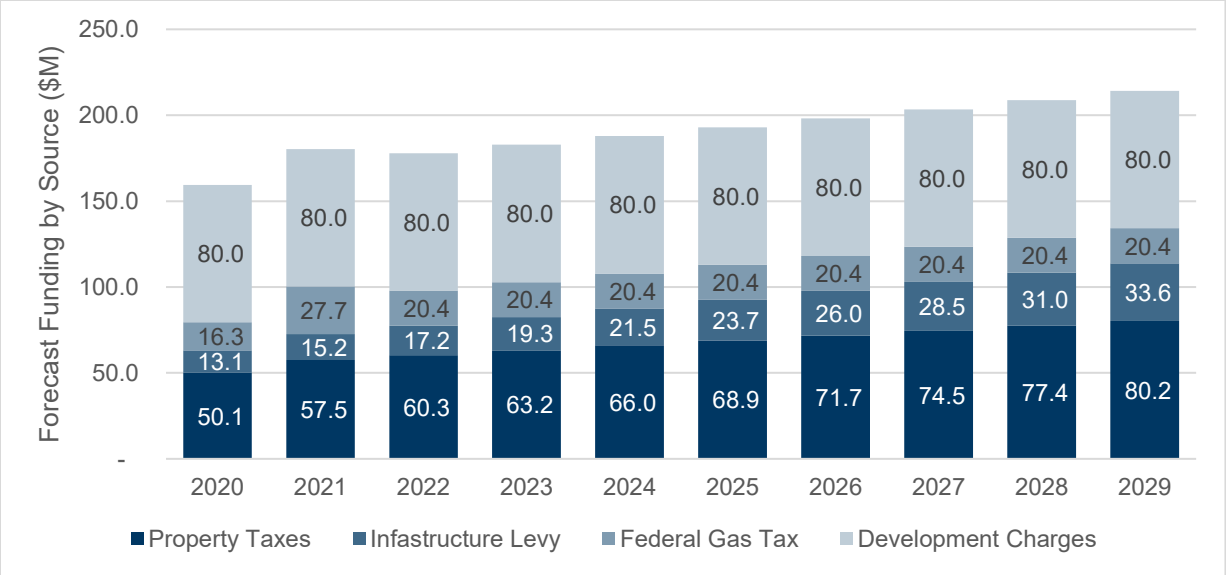


Figure 9.3 Revenue Forecast ($M)

Table 9.10 Summary of Forecast Transportation Service Area Funding

Funding Source	Forecast Transportation Funding (2019 $M)										10 Year avg.
	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
Property Taxes	50.1	57.5	60.3	63.2	66.0	68.9	71.7	74.5	77.4	80.2	67.0
Res#4 - Infrastructure Levy	13.1	15.2	17.2	19.3	21.5	23.7	26.0	28.5	31.0	33.6	22.9
Res#91 - Federal Gas Tax	16.3	27.7	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.7
Development Charges	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
Total	**159.5**	**180.3**	**177.9**	**182.9**	**187.9**	**192.9**	**198.1**	**203.4**	**208.7**	**214.2**	190.6

Reserve 4 represents the City's most utilized asset replacement reserve for Transportation Assets. Given the "2 percent infrastructure levy", the annual contribution to Reserve 4 is expected to increase by approximately $10 million per year (between 2020 to 2029) of which Transportation Service Area receives 20% (ie $2M). Funds in Reserve 4 tend to be spent quickly; as a result, only small balances are carried forward from one year to the next. Similarly, Reserve 91 represents the Federal Gas Tax which is also expected to be a consistent funding source with the Transportation Service Areas allocation remaining at approximate 60%.

9.4.2 Financing

Other than the above funding sources, discretionary Reserves funds and Debt are two other financing instruments that could be used to support the management of infrastructure. Capital reserves are established as a method of saving or allocating funding for the City of Brampton's future capital program. Funding for these reserves is obtained annually through contributions from property tax supported and user rate budgets. The annual reserve contributions are based on forecasted financing requirements to address infrastructure replacement costs in the future and smoothen the inherent uncertainties in capital

funding needs and its impact on the City's annual budget. This practice can help to stabilize any annual fluctuations in funding requirements, plan for any major long-term infrastructure investments, and prevent sudden spikes in property taxes, rates, and debt levels.

Tax and rate supported external debt is also an available tool that can be used to fund growth, replacement, and enhancement projects. To sustain intergenerational equity, debt is typically used for projects that provide benefits over a longer timeframe so that the burden of the capital cost is distributed between the current taxpayer and future rate payers.

9.5 Financial Summary

By comparing the Expenditure Forecast and the Forecast Funding, it allows the Transportation Service Area to understand whether there is sufficient investment available to pay for the expected Levels of Service to its residents. This understanding is the first step in developing a program which can be fully funded to provided long-term financial sustainability of City's Transportation Infrastructure, which is a requirement of the O. Reg 588/17. Financial sustainability is the ability for a municipality, such as the City of Brampton, to be able to afford to deliver the levels of service by balancing the Expenditure and Funding, now and into the future. Table 9.11 shows that the City expenditure needs and the funding available and presents the gap between that currently exists over the next 10 years (O. Reg mandates this window). This is also shown visually in Figure 9.4.

Table 9.11 Projected Funding Gap

Service Attributes	Lifecycle Activity	Lifecycle Activity Objectives	Projected Average Annual Current Needs (2019$M)										Annual Average (over 10 years)
			2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
Capacity, Use and Function	Growth and upgrade	City constructed assets to increase capacity and enhance function **(1)**	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
Quality and Reliability	Renewal (Replacement Component)	City activities to bring assets up to a state of good repair **(2)**	47.4	49.6	51.7	53.9	56	58.1	60.3	62.4	64.6	66.7	57.1
	Renewal (Refurbishment Component)	City activities to bring assets up to a state of good repair **(3)**	33.2	34.7	36.2	37.7	39.2	40.7	42.2	43.7	45.2	46.6	39.9
	Maintenance	City activities to maintain assets at a state of good repair **(4)**	12.1	12.7	13.4	14.0	14.6	15.3	15.9	16.5	17.2	17.8	14.9
	Operations	Routine City activities that help assets to achieve agreed levels of service **(5)**	42.6	44.8	47.0	49.2	51.4	53.6	55.8	58.0	60.2	62.4	52.5
Annual Projected 'needs' (1+2+3+4+5) **(6)**			215.3	221.7	228.2	234.7	241.2	247.6	254.1	260.6	267.1	273.5	244.4
Annual Projected Funding (total from Table 9.10) **(7)**			159.5	180.3	177.9	182.9	187.9	192.9	198.1	203.4	208.7	214.2	190.6
Funding ratio (6/7)			**0.741**	**0.813**	**0.780**	**0.779**	**0.779**	**0.779**	**0.780**	**0.781**	**0.781**	**0.783**	**0.780**
Funding Gap (6 - 7)			**(55.8)**	**(41.4)**	**(50.3)**	**(51.8)**	**(53.3)**	**(54.7)**	**(56.0)**	**(57.2)**	**(58.3)**	**(59.4)**	**(53.8)**

Note: The Developed constructed assets and City Constructed assets are assumed to be fully funded.

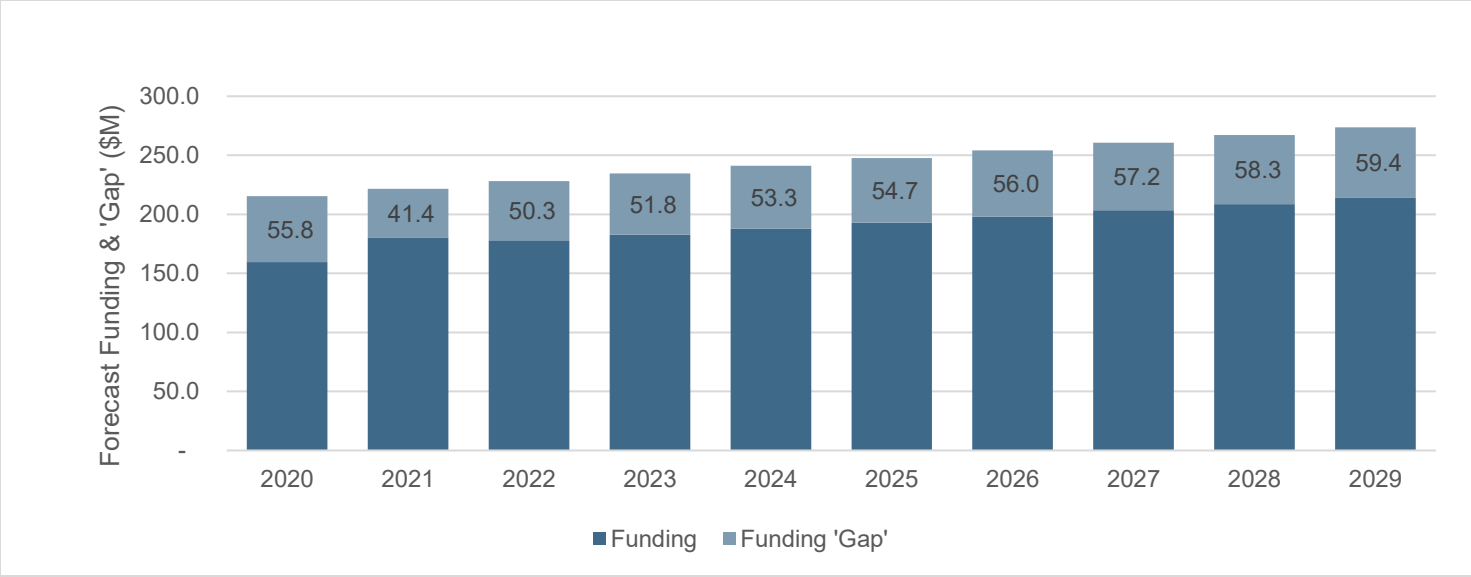


Figure 9.4 *Visual Representation of the Funding and the 'Gap'*

The average annual cost of the forecast needed lifecycle activities as **$244.4M** and the projected average annual funding as **$190.6 M per year**. Since the expenditure "needs" exceed the "funding", the City has an average annual infrastructure "gap" of **$53.8 M per year or a Funding Ratio of 0.78**.

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 over the next ten years against a target of 1.0. To close the financial 'gap' there are numerous methods available. For example, the City may choose to increase or decrease the needed infrastructure investment for a time due to factors such as the age of the infrastructure, accumulated backlog of work, risk tolerance, and available infrastructure renewal funding. **However, eventually, asset operations, maintenance and renewal must be undertaken to avoid accumulation of large backlogs of work overtime and manage associated risk to service delivery**. These options are discussed in detail in Section 9.6.

This analysis is limited to consideration of the financial need. However, an escalation of other resources (i.e., staffing level), may also be necessary to ensure effective asset management of the growing infrastructure over the next 10 years.

9.5.1 Opportunities and Uncertainty

As described, in section 9.3.1.2, the replacement program for the Transportation assets is not fully mature and has not been formally considered in the past. Historically this has not been a large component of the asset management activities required because the City's infrastructure is relatively young. As such it was possible to allocate funds in a more reactive way. However, it is acknowledged that as the city ages this needs to be done purposefully over time. Thus, the needs arising from the future replacement activities is a major contributor to the infrastructure gap.

Some of the assumptions have been made that to enable the completion of this analysis and as such there remains some uncertainty. Based on the SME's understanding of their assets it is estimated that the 'true' replacement need is likely to be within the range of 25%- 100% of the need identified in the previous section. As such for comparison three different scenarios have been provided for illustrative purpose only. These include:

- Scenario A: 100% of the forecast Replacement Need (base case which has been calculated)
- Scenario B: 50% of the forecast Replacement Need
- Scenario C: 25% of the forecast Replacement Need

Table 9.12 Summary of Scenarios

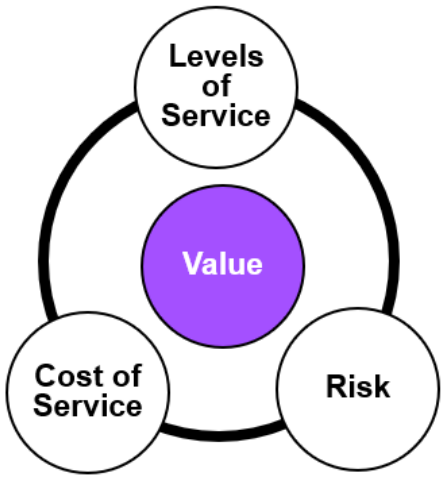
Scenario	Annual Replacement Need ($M)	Need Excluding Replacement ($M)	Adjusted Total Need ($M)	Total Funding ($M)	Total Gap for each Scenario
Scenario A	57.1	186.8	243.9	190.6	(53.8)
Scenario B	28.6	186.8	215.4	190.6	(24.8)
Scenario C	14.3	186.8	201.1	190.6	(10.5)

The Transportation Service Area is aware of some data gaps associated with asset replacement. To address this deficiency an action in the improvement plan has been added, which will help to reduce the uncertainty due to the data gaps. It is expected through these improvements, by the next iteration of this plan, that greater confidence in the reported infrastructure gap will be possible.

9.6 Financial Sustainability Options

One of the key drivers of the Ontario Regulation 588/17 is to help ensure that all municipalities are actively managing assets in a way that achieves "financial sustainability". Based on current calculation of the 'infrastructure gap' it is evident that Transportation Service Area, and the City, need to focus on closing this gap. Typically, this is achieved through:

- Seek additional funding
- Accepting Higher level of Risk
- Accepting Lower Levels of Service



These options are discussed further below. It should be noted that there is no singular method for addressing the 'infrastructure gap'. Often this is an iterative process to balance cost, risk, and LOS, through consultation with the

community, particularly in relation to ‘willingness to pay’ for services.

9.6.1 Option 1: Seek additional funding

Increasing the revenue or funding provided to the Transportation Service Area is a method of reducing the infrastructure gap. As one of the major infrastructure-based Services Areas which are not completely funded by “user pays” model (like other utilities like water and wastewater services) it is important that funding allocated to Transportation is actively managed.

One of the primary sources of funding for the Transportation Service Area, which the City has control over, is the Infrastructure Levy. This could be increased to help reduce the rate of widening of the gap or to help close it. Alternatively, it may be necessary to reallocate some funding, from other projects funded from the infrastructure levy towards the Transportation Services Area. Currently the Transportation Service Area receives 20% of the Infrastructure Levy. Additional allocation to the Transportation group would help to reduce the gap each year. Should the allocation be increased to a value greater than the current gap this would then not only prevent the ‘cumulative gap’ from increasing it would over time close the gap completely.

Alternatively, the city has identified opportunities to continue to build on the existing relationships with stakeholder to improve the coordination of asset activities with other stakeholders (such as the Region) to maximize the value created through joint capital expenditure programs.

Finally, another option would be to continue to lobby higher levels of government for a greater share of the collective taxation revenue. It is well documented by organizations such as the Federation of Canadian Municipalities (FCM) that local Governments have a disproportionate share of total infrastructure ownership (approximately 60%) compared to the total tax revenue received (between 8 - 10%).

9.6.2 Option 2: Accepting higher level of Risk

Although not always desirable, it may be possible to accept a higher degree of asset risk at the City to help lower ongoing asset costs. It should be noted that increased risk is of failure to meet our levels of services, it doesn’t necessarily translate asset failure. An example may be that we don’t get to inspect our less critical assets as regularly i.e., signs and as a result there may be higher level of complaints about damaged signage. As illustrated in the example a higher level of risk may reduce the City’s reliability service standards and may increase the asset lifecycle ownership cost.

9.6.3 Option 3: Accepting Lower Levels of Service

Establishing Levels of Service (LOS) targets is an iterative process. They must balance both public (community) expectations, the City’s objectives, risk and affordability. If the City is not able to sustainably fund the current LOS it may be beneficial to seek opportunities for adjustment through public consultation. It is critical in this process to link consideration of the public expectations with the understanding of the constraints such as affordability and the options for addressing these (higher taxes). Only after considering these constraints can the public expectations and their willingness to pay for these services be determined.

For example, the City may hypothetically nominate to lower the threshold for snow clearing from 7.5 cm accumulation to 5 cm at a cost saving of $100 per resident. This may be accepted by the community, or they may nominate to uphold the current LOS based on the understanding that their taxes would need to increase.

10. Monitoring and Improvement Plan

10.1 Status of Asset Management Practices

The Transportation Service Area is currently operating a functioning Asset Management System. The asset management system has been implemented for all transportation assets and includes processes and tools required to effectively manage the City's assets, in accordance with the necessary legislation. However, some aspects of the Asset Management System have only recently been deployed and operationalized. Additionally, the City has identified opportunities for improvement, beyond the requirements for compliance with the regulation. These improvements are expected to provide greater context, detail and certainty to improve evidence-based asset management decision making.

10.1.1 Ontario Regulation 588/17

The development of AMPs 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 AMP with Ontario Regulation 588/17 for "current levels of service" and the compliance with Regulation 588/17 for "proposed levels of service" by July 1, 2025. A summary of compliance is presented in Table 10.1.

Table 10.1 Status of O.Reg. 588/17 Compliance for AMPs

Plan Section	Compli-ance	O.Reg. 588/17 Compliance Practices (Current LOS)	O.Reg. 588/17 Compliance Improvements (Proposed LOS)
State of Local Infrastructure	Yes	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 assets.	Continue to improve knowledge of asset replacement costs and the current condition of the assets based on asset criticality.
Levels of Service	Yes	For each asset category, the AM plan provides the current LOS. For core assets, the AM plan 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 for the next 10 years. An explanation of why the proposed LOS is 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.
Asset Management Strategy	Yes	The AMP provides the population and employment forecasts as set out in Schedule 3 of the *2017 Growth Plan for the Greater Golden Horseshoe.* For each asset category, the AM plan provides the lifecycle activities that would need to be undertaken to maintain the current LOS for each of the next 10 years, based on risk and lifecycle cost analysis.	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 analysis.
Expenditure Forecasts and Financing Strategy	Yes	The AMP 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 *2017 Growth Plan for the Greater Golden Horseshoe.* 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 and financing strategy that sets out the following for the 10-year period: 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.
Other	Yes	Public availability: The AMP indicates how the background information and reports upon which the state of infrastructure section within AMP is based will be made available to the public.	The risk associated with AMP implementation: Provide an overview of the risks associated with the implementation of the AMP 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.

10.2 Monitoring and Review Procedures

It is important to note that achieving compliance is not a singular event. It requires regular monitoring, maintenance and adjustment of the system to ensure continuous compliance.

This AMP will be reviewed during annual budget planning processes and amended to show any material changes in service levels and/or resources available to provide those services because of budget decisions.

The AMP will be updated every four 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.

10.3 Performance Measures

Although the system is operational and foundational elements of asset management have been implemented it is acknowledged that additional improvements to the system are required. The effectiveness of the asset management plan can be measured in the following ways:

– Independent assessment of the current Asset Management program maturity against the desired target
– The degree to which the required projected expenditures identified in this asset management plan is incorporated into the long-term financial plan
– The degree to which 1–5-year detailed works programs, budgets, business plans and corporate structures consider the 'global' work program trends provided by the AMP
– The degree to which the existing and projected service levels and service consequences (what we cannot do), risks and residual risks are incorporated into the Strategic Plan and associated plans
– The Asset Renewal Funding Ratio achieving the target of 1.0.

10.3.1 Asset Management Improvement Plan

The Transportation AMP has identified initiatives to improve the asset management program, some of which have been launched, while others are under development. Table 10.2 summarizes the key improvements actions. Additional details associated with the action, outcome, timeline and priority are provided in Table 10.2. The timeline is broken into three categories:

– Short (1-2 years)
– Medium (3 – 5 years) and
– Long (greater than 5 years).

The owners and nominated leads for delivering each improvement action remain to be confirmed in most cases.

Table 10.2 Improvement Plan

Area of Improvement	Action	Outcome	Timeline	Priority
Asset inventory	For those assets where the ownership or responsibility is in question, this should be addressed. An example of this is the sidewalks associated with the regional roads.	A clear understanding of the Service Area's liability and responsibility will help in the delivery of the levels of service associated with the assets where ownership is overlapping.	Short	High

	Continue to refine asset hierarchy. As an example, reclassifying roads as per new guidelines. An initiative has been identified to split the road and pedestrian bridges which are currently treated as a single asset class.	Creation of distinct asset classes with unique lifecycle activities will provide greater clarity around asset governance and asset planning.	Short	Medium
	Continue to improve knowledge of asset renewal costs.	Improved asset renewal cost knowledge help to get accurate reporting of the City's financial needs.	Medium	High
	Continue to improve knowledge on the useful life of the assets.	Improving asset data helps to refine the City's financial needs	Short	Medium
	Continue to improve knowledge of the current condition of the assets.	Improving asset data State of Local Infrastructure reporting (eg signals)	Short	Medium
Level of Service	Assign and track the performance metric that best indicates the Technical Level of Service (LOS). In many cases, the TLOS is currently captured qualitatively.	Tracking, recording and assessing the performance data will support the evidence-based input to gauge the performance of our customer LOS and the organization's expectations.	Short	High
	Develop a program to engage the community in recalibrating the established level of service standards and confirming the community's willingness to pay.	This action will support the Transportation Service Area and Council in confirming that standards are set correctly and consideration is given to community's affordability.	Long	Medium
	Continue to improve planning and coordination efforts with strategic partners who support delivery of services (eg Region of Peel and Utility companies).	Through continued improvement in the coordination of capital planning programs the Transportation Service Area will be able to improve efficiency, reduce waste and maximize community value when it delivers capital projects with its partners.	Long	Medium
Demand	Update asset management plan once the latest Transportation Master Plan has been completed.	Recalibration with the Transportation Master Plan will enable the service area to better align its strategic activities and understand the changes in the demand expectations.	Medium	Medium

Asset information	Improve data adequacy, accuracy, and governance (see Section 7.5)	Asset data is an essential enabling tool to promote effective asset management. Improvements in this area will ensure that the service area has the necessary information to make the 'right' asset management decision.	Short - Long	High
Governance	Continue to support CAMO and clarify the roles and responsibilities with further refinement of asset management governance structure (see Section 6)	Effective governance ensures that all asset management activities are adequately delivered with appropriate accountability and in coordination with the necessary support.	Medium	Medium
Risk	Continue to work with the CAMO team to develop and deploy a standardized Enterprise Risk Management (ERM) framework which is consistent across the organization.	Standardize process for assessing and mitigating risk will help prioritize the City's investment by direct comparison between different assets, and service areas.	Long	Medium
	Continue to implement mitigation measures to address top Transportation Service Areas risks identified (see Section 5.4)	Investment in these mitigation measure will help to mitigate any disruption to the level of services.	Medium	High
	Continue to develop decision support tool to evaluate other prioritization lenses (e.g. return on investment)	These tools will support SME's in evaluation of prioritize and investment strategies.	Medium	High
Lifecycle Strategy	Formalize renewal programs to include budget allocations for replacement activities.	Historically this has not been formally budgeted and as a result notable funding gap in this area was identified. Outlining this investment need will help fund this program effectively.	Medium	High
Financial Strategy	Educate the City stakeholders on the funding gap and the lifecycle activities that are funded, and the risk associated with the once that are not.	Understanding of the funding gap and its contributing factors will allow the Transportation Service Area to prioritize investments, close the gap and support financial sustainability.	Medium	Medium
Climate Change Strategy	Following the issue of the City's Climate Change Adaptation Plan the Transportation team will review and apply the plan to the Service Areas asset portfolio.	By deploying the City level plan for assessing and mitigating the risks associated with Climate Change.	Medium	High

Appendices

Appendix A

Asset Maturity Assessment Executive Summary

1. Executive Summary

An Asset Management Maturity assessment was conducted the Transportation Services Department as part of the Transportation AM Plan project. The maturity assessment was based on the ISO 55000 AM Standard and the IAM Framework using a standard maturity assessment tool based on relevant best in class practices. The assessment included key stakeholders across the City from the Transportation Services Department, Corporate Asset Management, Senior Management and Supporting Groups (e.g. IT, Risk Management). Each element of the IAM Framework was evaluated based on business process effectiveness (i.e. AM Capability and how well it was being Executed). The consulting team captured and analysed these findings and assigned a maturity rating on the scale of 0-5 (Innocence to Excellence) for the current situation. In addition, the team assigned potential future ratings assuming that the Department take the necessary action to close the opportunity gaps identified.

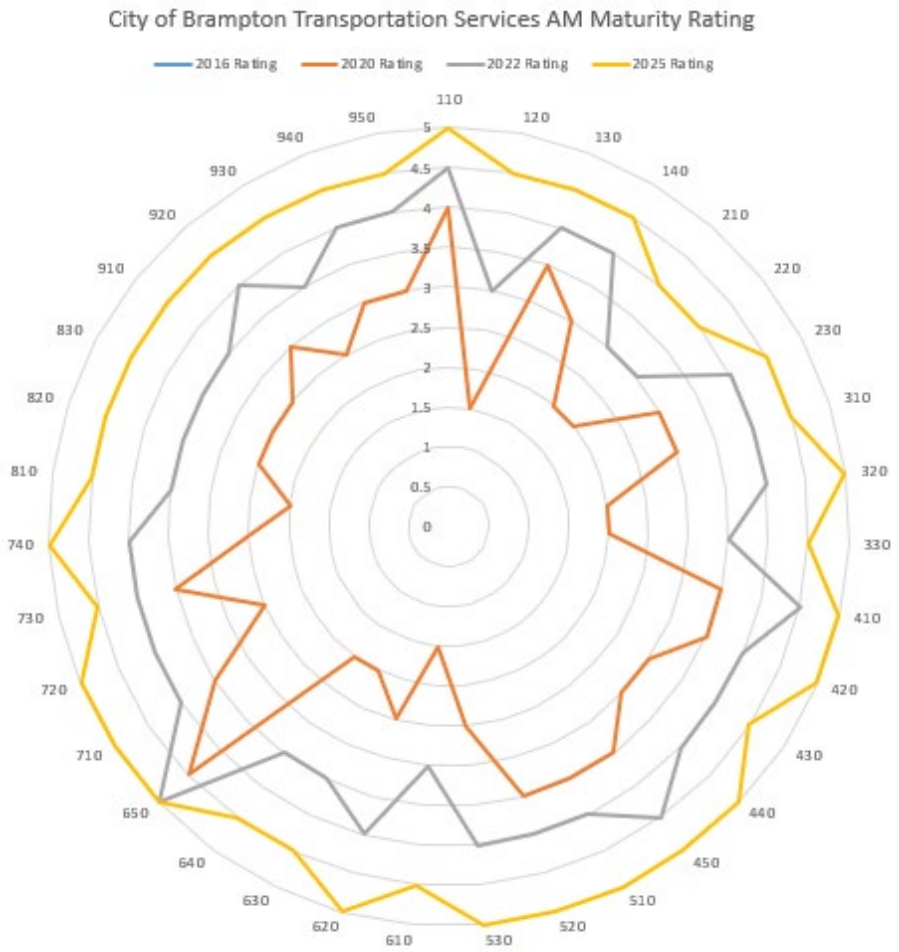
Overall, the Transportation Services Department has an average AM maturity Rating in the rage of establishing (2.5) to competent (3). The consulting team believes that the Department can achieve A maturity rating of enterprising (4) in the next five years if opportunity gaps are closed by implementation of appropriate best in class improvement initiatives. The detailed ratings are provided in Figure 1 below. In addition, the detailed outcomes of the AM maturity assessment workshops are provided in Appendix 1 showing the relevant best in class practice, the Transportation department's current situation and the consulting team ISO maturity rating

It is recommended that the Department builds on this understanding of the Asset Management Current Situation to inform its overall AM Program development in concert with the Corporate AM Team as follows:

1. Communicate and validate the Current Assessment and future AM Maturity ratings with Key Stakeholder
2. Develop detailed opportunity gaps for each of the AM elements assessed
3. Develop detailed improvement initiatives based on best in class practices to close the identified opportunity gaps
4. Develop a detailed 5-year AM Roadmap of these improvement initiatives with appropriate priorities and sequencing and the supporting Implementation Plan
5. Develop a detailed Stakeholder Engagement Plan.

Figure 1: Transportation Services AM Maturity Ratings

Focus Area		AM Element No	2020	2022	2025
100 Setting Direction	110 Asset Management Policy	110	4	4.5	5
	120 Asset Management Strategy	120	1.5	3	4.5
	130 Demand Analysis	130	3.5	4	4.5
	140 Setting Asset Management Objectives	140	3	4	4.5
200 Programming	210 Accounting and Costing	210	2	3	4
	220 Strategic Planning	220	2	3	4
	230 Capital Expenditure Evaluation	230	3	4	4.5
300 Preparation	310 Maintenance Decision Making	310	3	4	4.5
	320 Asset Management Plans	320	2	4	5
	330 Implementation of Asset Management Plans	330	2	3.5	4.5
400 Implementation	410 Operations	410	3.5	4.5	5
	420 Creation & Acquisition	420	3.5	4	5
	430 Maintenance	430	3	4	4.5
	440 Work and Resource Management	440	3	4	5
	450 Rationalisation and Disposal	450	3.5	4.5	5
500 Asset Monitoring	510 Asset Condition Monitoring	510	3.5	4	5
	520 Asset Performance Monitoring	520	3.5	4	5
	530 Asset Investigation	530	2.5	4	5
600 Management System Review	610 Management System	610	1.5	3	4.5
	620 Business Risk Management	620	2.5	4	5
	630 Asset Risk Management	630	2	3.5	4.5
	640 Continuous Improvement	640	2	3.5	4.5
	650 Legal, Regulatory and Other Requirements	650	4.5	5	5
700 People & Organisation	710 Organisational Issues	710	3.5	4	5
	720 People Issues	720	2.5	4	5
	730 Commercial	730	3.5	4	4.5
	740 Communication	740	2.5	4	5
800 Data & Information	810 Processes for Managing Asset Know ledge	810	2	3.5	4.5
	820 Asset Data and Know ledge	820	2.5	3.5	4.5
	830 Activity Data and Know ledge	830	2.5	3.5	4.5
900 Technology	910 Information System Issues	910	2.5	3.5	4.5
	920 Financial and HR Information Systems	920	3	4	4.5
	930 Asset and Work Management Information Systems	930	2.5	3.5	4.5
	940 Supply and Logistic Management Information Systems	940	3	4	4.5
	950 Advanced Information Systems	950	3	4	4.5



Appendix B

Transportation Services Asset Hierarchy

Transportation Services

Phas

Level 2 Services Areas	FLOWER CITY BRAMPTON.CA — **Public Works & Engineering**
Level 3 Services	**Transportation Services**
Level 4 Linear vs. Discrete	Roadway Network; Structures; Traffic Services; Sidewalks/ Walkways; Transportation Fleet; Transportation IT (software); Transportation Facility
	Responsibility of Other service areas: Refer to Fleet, IT and Facility asset hierarchy
Level 5 Geographic Area	
Level 6 Types of Assets	Arterial; Collector; Local; Bridges; Culverts; Walls; Rails; Gateway Features; Steps; Traffic Signals; Street Lighting; Traffic Signs; Parking Services; Sidewalks; Walkways; Multi-use Paths
Level 7 Disciplines	Roadway Bridges; Pedestrian Bridges; Noise Walls; Retaining Walls; Fences; Guiderails; Handrails
Level 8 Classification Level (Equipment)	
Level 9 Component	
Level 10 Subcomponent	

Appendix C

State of Local Infrastructure

C-1 Asset Class: Roadway Network

C-1-1 Condition Summary:

Table C.1: Asset Condition by Replacement Value

Rating	$2019 Value ($M)	Allocation
Very Poor	$ 5.2	0.5%
Poor	$ 75.7	6.7%
Fair	$ 245.1	21.8%
Good	$ 515.0	45.8%
Very Good	$ 283.9	25.2%
Total	**$1,124.8**	**100.0%**

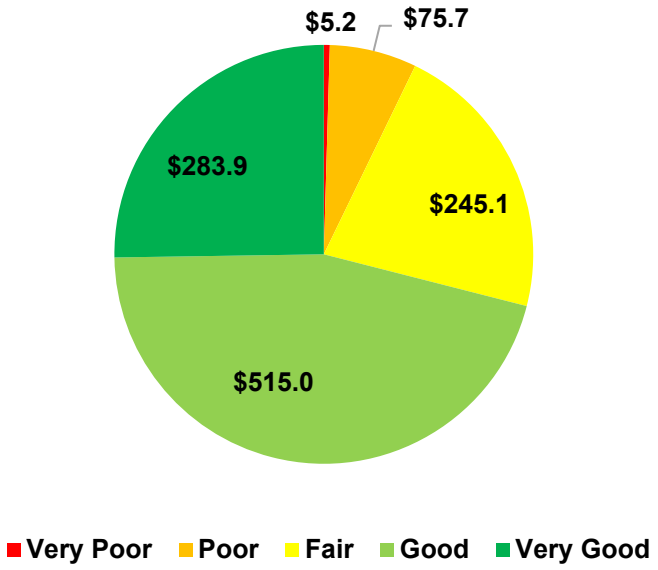


Figure C.1: Asset Condition by Replacement Value (Roadway Network)

– Notable assets in Poor or Very Poor Condition (with their associated Replacement Values) include:
– Arterial Road: BRAMALEA RD, from PETER ROBERTSON BV to SANDALWOOD PY ($1,918,256);
– Arterial Road: HEART LAKE RD (N), from BOVAIRD DR to S. to COPPERFIELD RD ($1,927,811);
– Arterial Road: HEART LAKE RD (N) from COPPERFIELD RD to SANDALWOOD PY ($2,666,600);
– Arterial Road: TORBRAM RD from C.N. TRACKS to STEELES AV ($1,609,292); and,
– Arterial Road: TORBRAM RD from BALMORAL RD to CLARK ($1,827,720)

C-1-2 Age Summary:

Age Analysis is not available for the City's Roadway network due to data gaps in segment installation years. The useful life of the City's road network (local, arterial, collector and partial roads) is shown in Figure C.2.

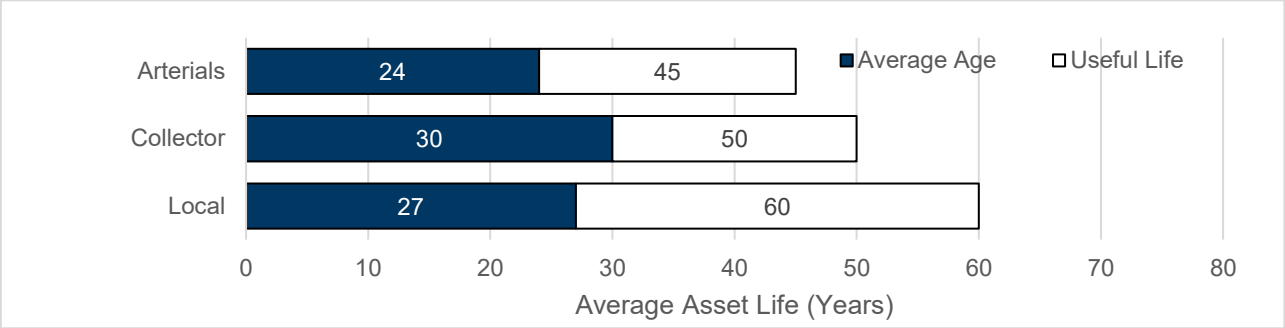


Figure C.2: Asset Age by Sub Asset Class (Roadways)

C-2 Asset Class: Structures

C-2-1 Condition Summary:

Table C.2: Asset Condition by Replacement Value

Rating	$2019 Value ($M)	Allocation
Very Poor	$ 1.0	0.1%
Poor	$ 4.9	0.7%
Fair	$ 50.4	7.0%
Good	$ 584.7	81.1%
Very Good	$ 79.8	11.1%
Total	**$ 720.8**	**100.0%**

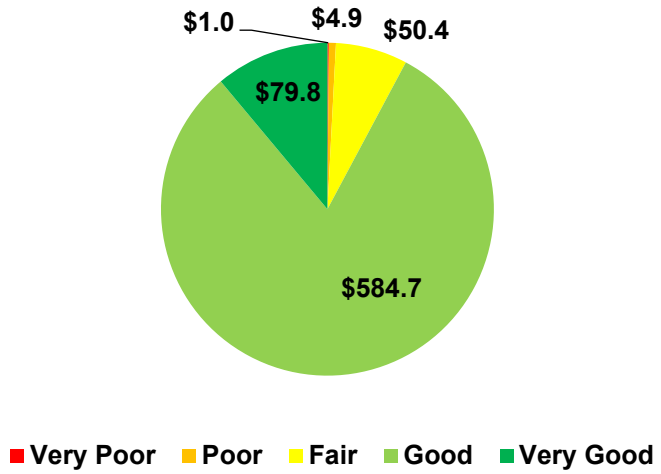


Figure C.3: Asset Condition by Replacement Value (Structures)

Notable assets in Poor or Very Poor Condition (with their associated Replacement Values) include:

- Bridge: Sheffield Park South ($139,887)
- Noisewall: Pennyroyal Crescent ($398,956)
- Fence: Eastside of Humberwest Pky, N of Goreway Dr ($57,927.60)
- Fence: Eastside of Humberwest Pky, S of Williams Pky ($95,284.49)
- Guiderail: Heritage Road 0.8 km South of Embleton Road ($7,692.00)
- Handrail: Bovaird Drive ($1,200.00)

C-2-2 Age Summary:

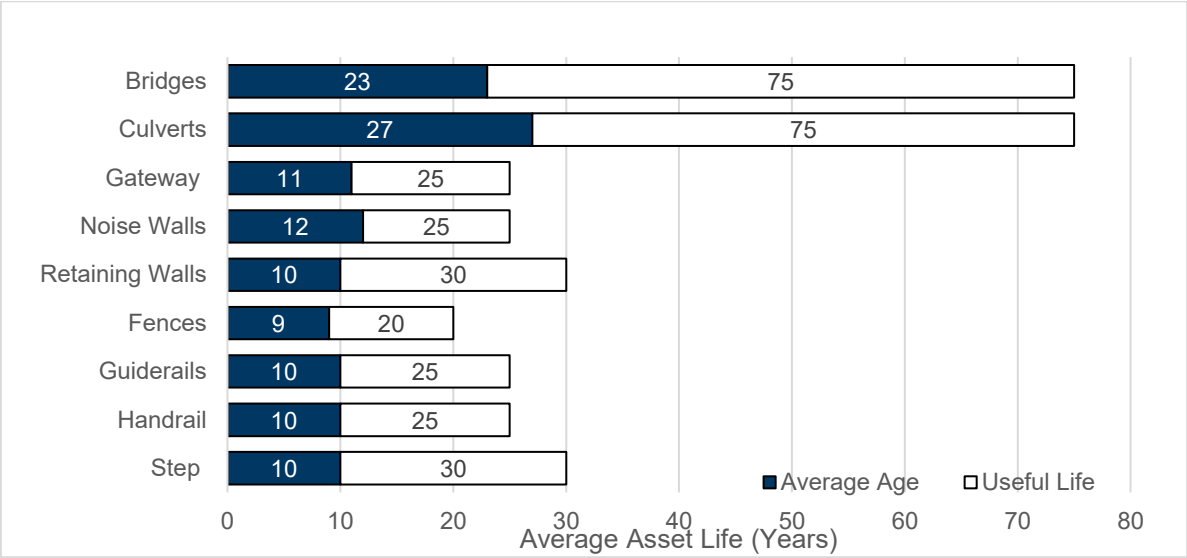


Figure C.4: Asset Age by Sub Asset Class (Structures)

C-3 Asset Class: Sidewalks/Walkways

C-3-1 Condition Summary:

Table C.3: Asset Condition by Replacement Value

Rating	$2019 Value ($M)	Allocation
Very Poor	$ 0.0	0.0%
Poor	$ 0.3	0.2%
Fair	$ 5.2	2.2%
Good	$ 79.4	34.5%
Very Good	$ 145.4	63.1%
Total	**$ 230.4**	**100.0%**

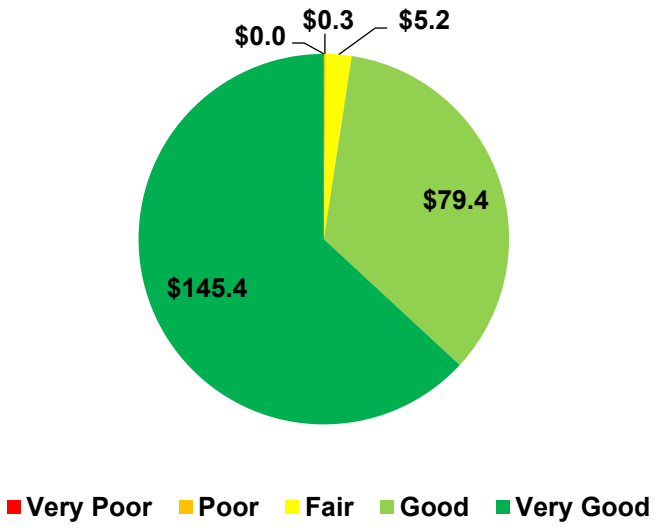


Figure C.5: Asset Condition by Replacement Value (Sidewalks/Walkways)

– Notable assets in Poor or Very Poor Condition (with their associated Replacement Values) include:
– Sidewalk: WILLIAMS PKY, from Centre St N to Kennedy Rd N ($82,032)
– Sidewalk: STEELES AVE E ($91,849)
– Walkway: MADISON ST from MADISON ST to KHALSA COMMUNITY SCHOOL ($9,727)
– Multi-Use Path: BRAMALEA RD from Peter Roberton Blvd, Larkspur Rd ($37,152)
– Multi-Use Path: Bramalea Rd from Sandalwood Pky to Black Forest Dr ($34,644)
– Multi-Use Path: Steeles Avenue E to Tobram Rd ($32,012)
– Multi-Use Path: Bovaird Dr from Nasmith St ($27,196)
– Multi-Use Path: Bovaird Dr from Fernforest Dr ($21,612)

C-3-2 Age Summary:

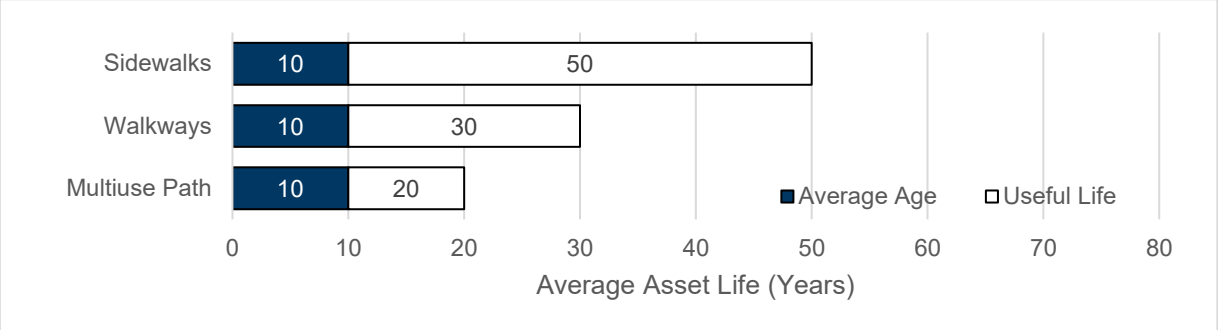


Figure C.6: Asset Age by Sub Asset Class (Sidewalks/Walkways)

C-4 Asset Class: Traffic Services

C-4-1 Condition Summary:

Table C.4: Asset Condition by Replacement Value

Rating	$2019 Value ($M)	Allocation
Very Poor	$ 36.6	13.1%
Poor	$ 23.1	8.3%
Fair	$ 71.1	25.4%
Good	$ 78.6	28.1%
Very Good	$ 70.2	25.1%
Total	**$ 279.7**	**100.0%**

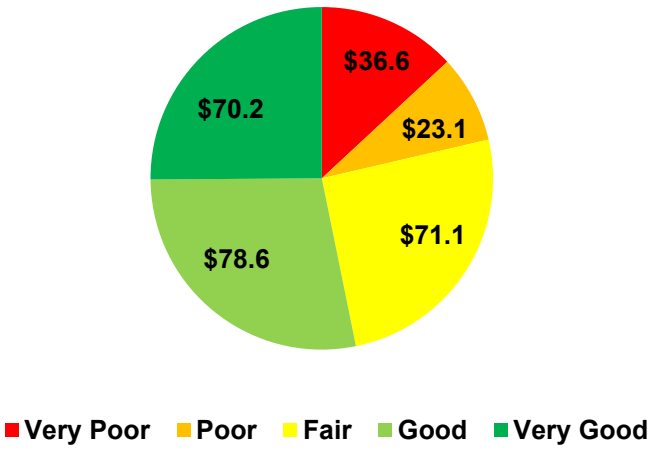


Figure C.7: Asset Condition by Replacement Value (Traffic Services)

Notable assets in Poor or Very Poor Condition (with their associated Replacement Values) include:

– Poor: 9933 Poles and Brackets and 13 Traffic Signals ($23.1M) [Note 1] and,

– Very Poor: 16440 Poles and Brackets, 09 Traffic Signals, and 134 Signs ($36.6M).

– Calculated using Age for Street Lighting and Signals.

Note 1: The condition of the Traffic Signals and Street Lighting based on age not though direct condition assessment

C-4-2 Age Summary:

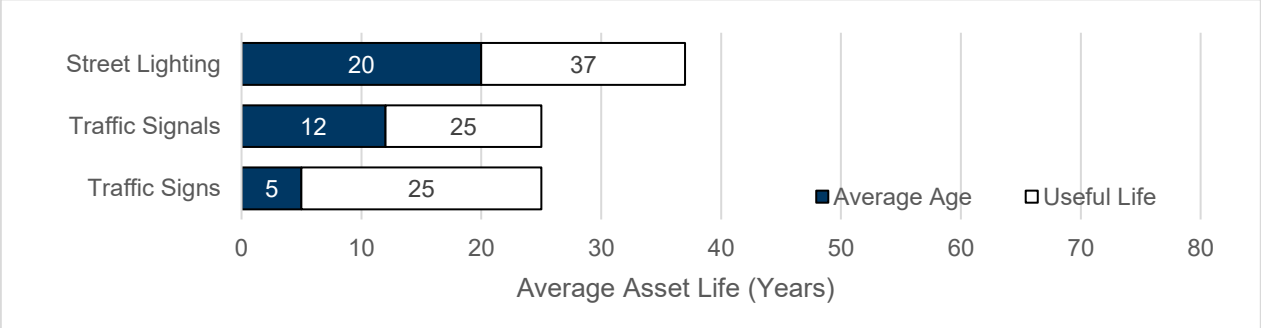


Figure C.8: Asset Age by Sub Asset Class (Traffic Services)

Appendix D

Levels of Service

D-1 O.Reg. Community LOS

D-1-1 Roads

The following map of the road network shows its level of connectivity with the community.

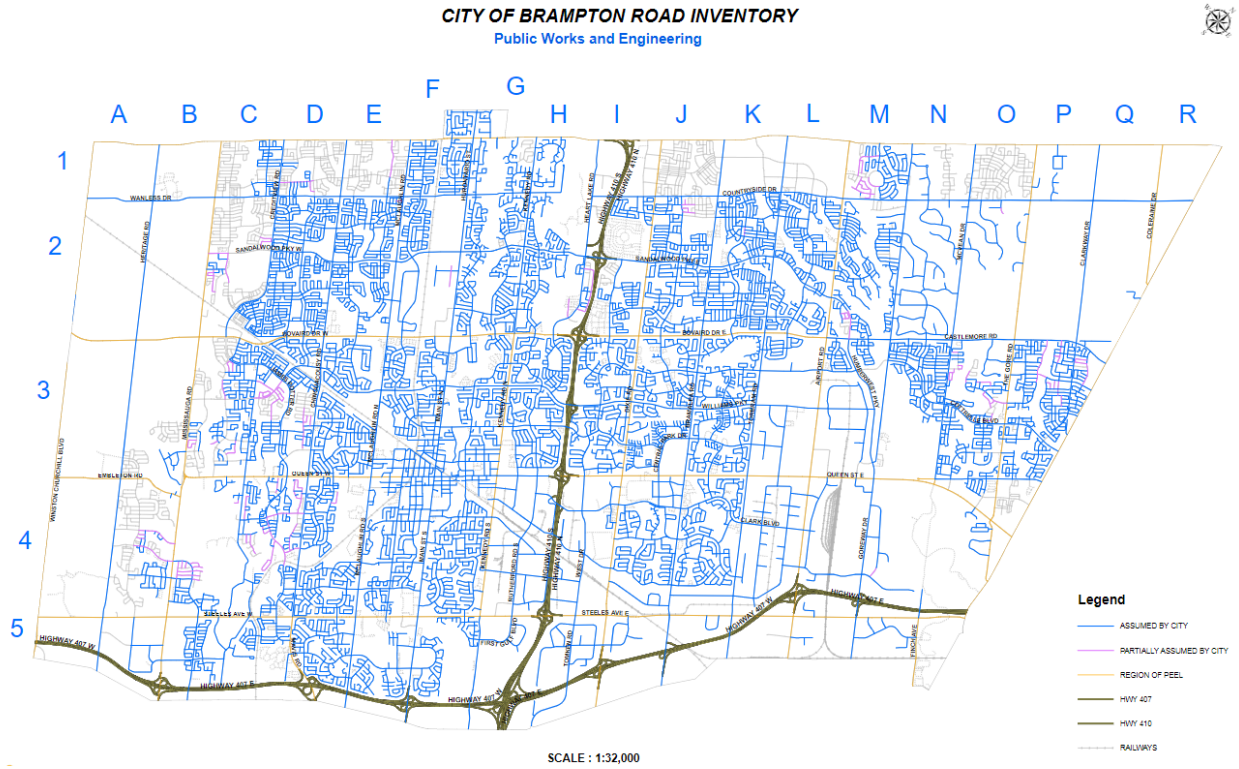


Figure D.10.1 Road Network

The condition of the Arterial, Collector and Local Roads is shown in Figure D.10.2 and Figure D.10.4.

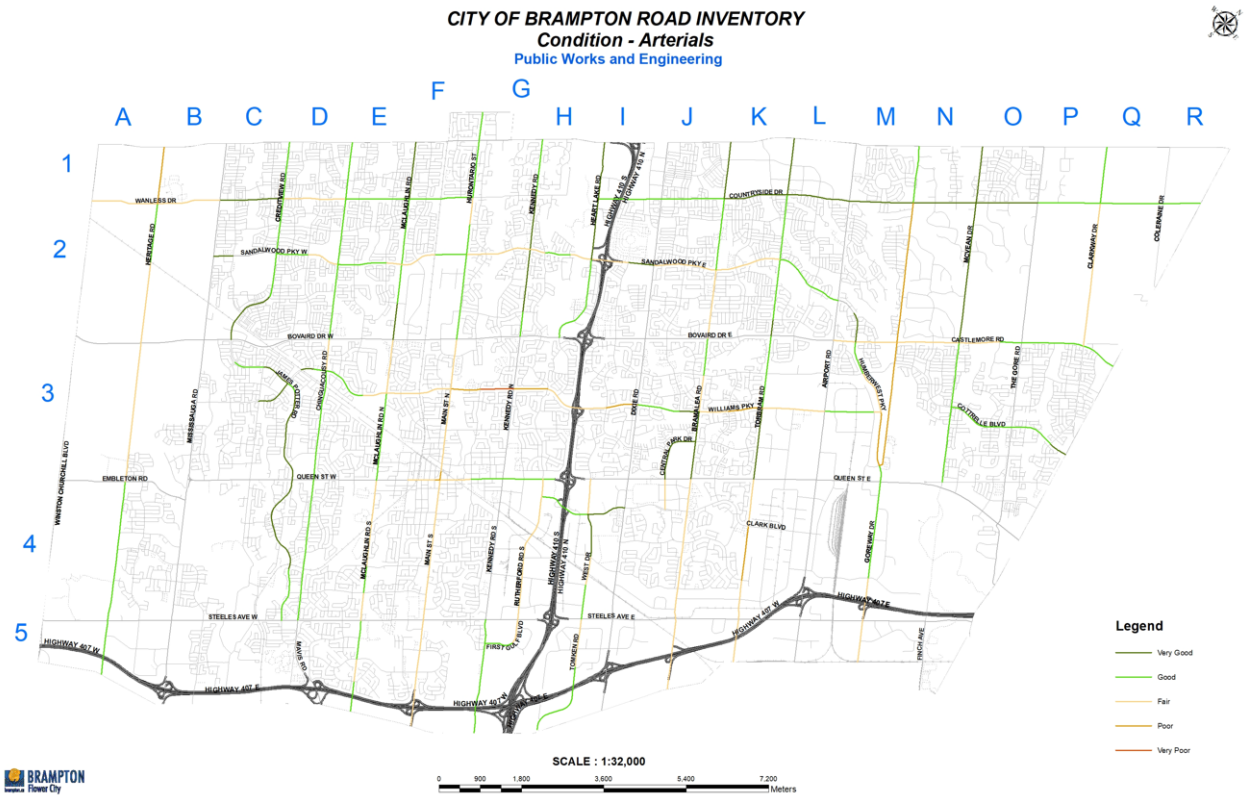


Figure D.10.2 Arterial Road Network

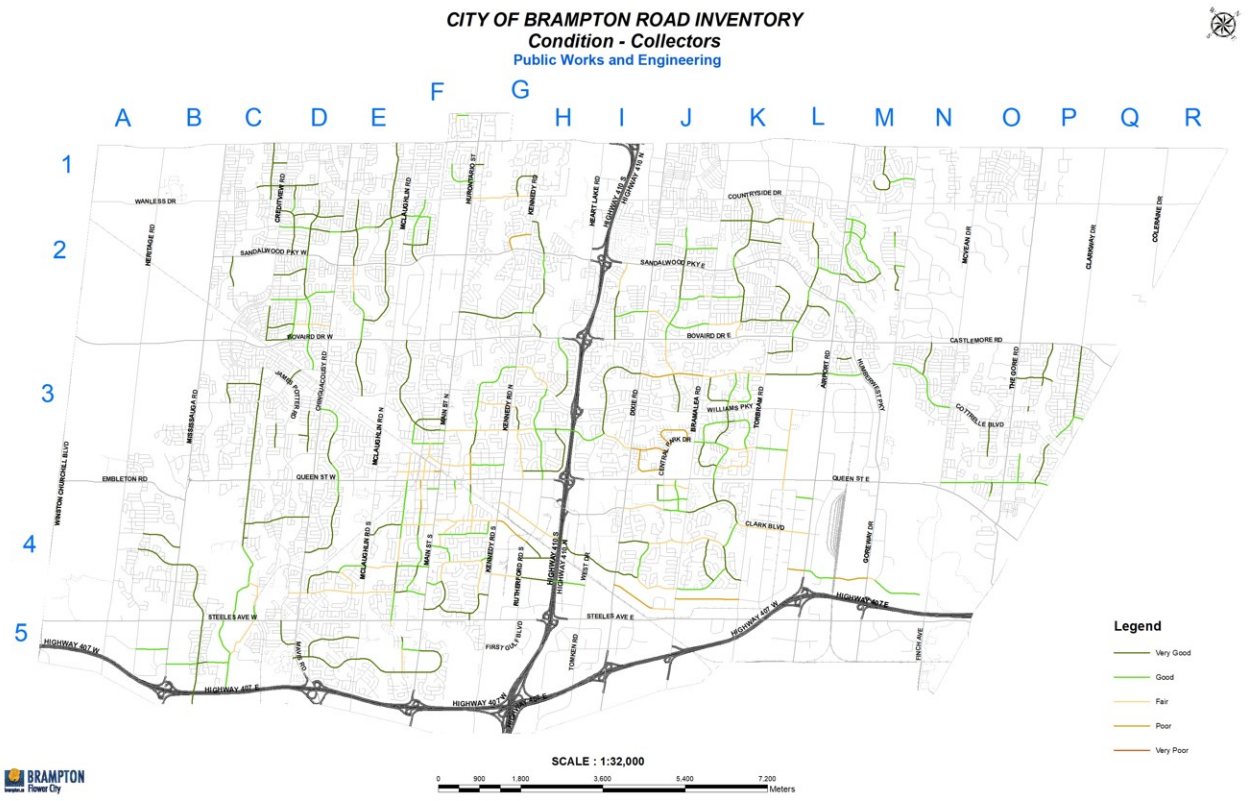


Figure D.10.3 Collector Roads

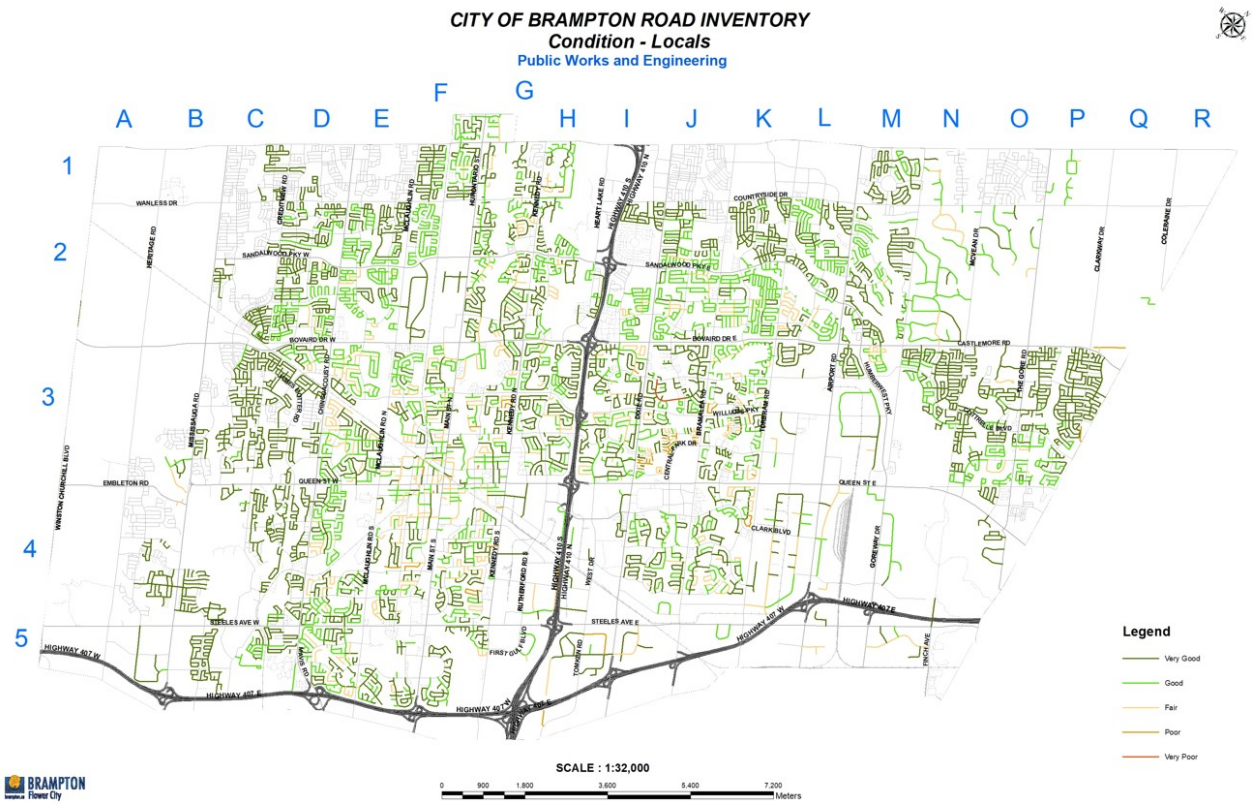
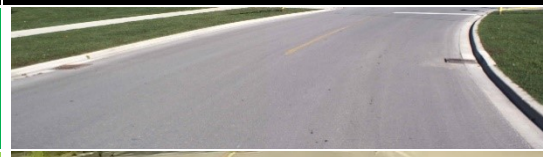
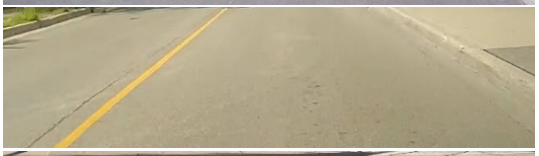
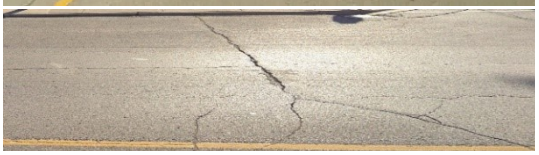
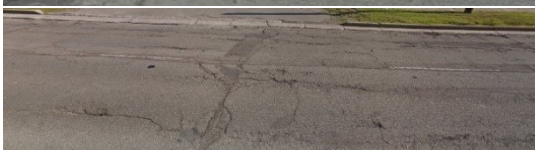


Figure D.10.4 Local Roads

Pavement condition data is collected on the entire road network every four years. Data collected includes the type, extent and severity of distresses (cracks and rutting) and smoothness or ride comfort of the road. An overall PCI is calculated from all collected data and is used as input into the annual road resurfacing and reconstruction program. The index is scaled from 0 to 10 and has been divided into ranges to assess condition. Examples of roads in each of the PCI rating categories are provided in the following table:

Condition Grade	Urban Road Example
Very Good (PCI = 8 to 10)	
Good (PCI = 7 to 8)	
Fair (PCI = 6 to 7)	

Condition Grade	Urban Road Example
Poor (PCI = 5 to 6)	
Very Poor (PCI < 5)	

D-1-2 Bridges and Culverts

The need for mobility requires that the City's roadway system be kept in a state of good repair. Structures are a vital part of this system. An effective structure management system involving the systematic inspection of the structures on the roadway network is required to maintain structures in a state of good repair. In accordance with O. Reg. 104/97 Standards for Bridges, the City conducts detailed inspections of all its bridges every two years. All inspections are supervised by a trained, professional engineer following the guidelines in Ontario's Structure Inspection Manual (OSIM) which sets standards for the visual inspection and condition rating of bridges and their elements. The inspector assesses each bridge element and records the condition in each of Five condition states: Very Good, Good, Fair, Poor, and Very Poor. The inspector also records suspected performance deficiencies and recommends maintenance and renewal activities, with costs. The typical follow-up action for a suspected load carrying capacity deficiency would be to carry out a strength evaluation of the structure (or element) to determine the load carrying capacity in accordance with the requirements of the Canadian Highway Bridge Design Code.

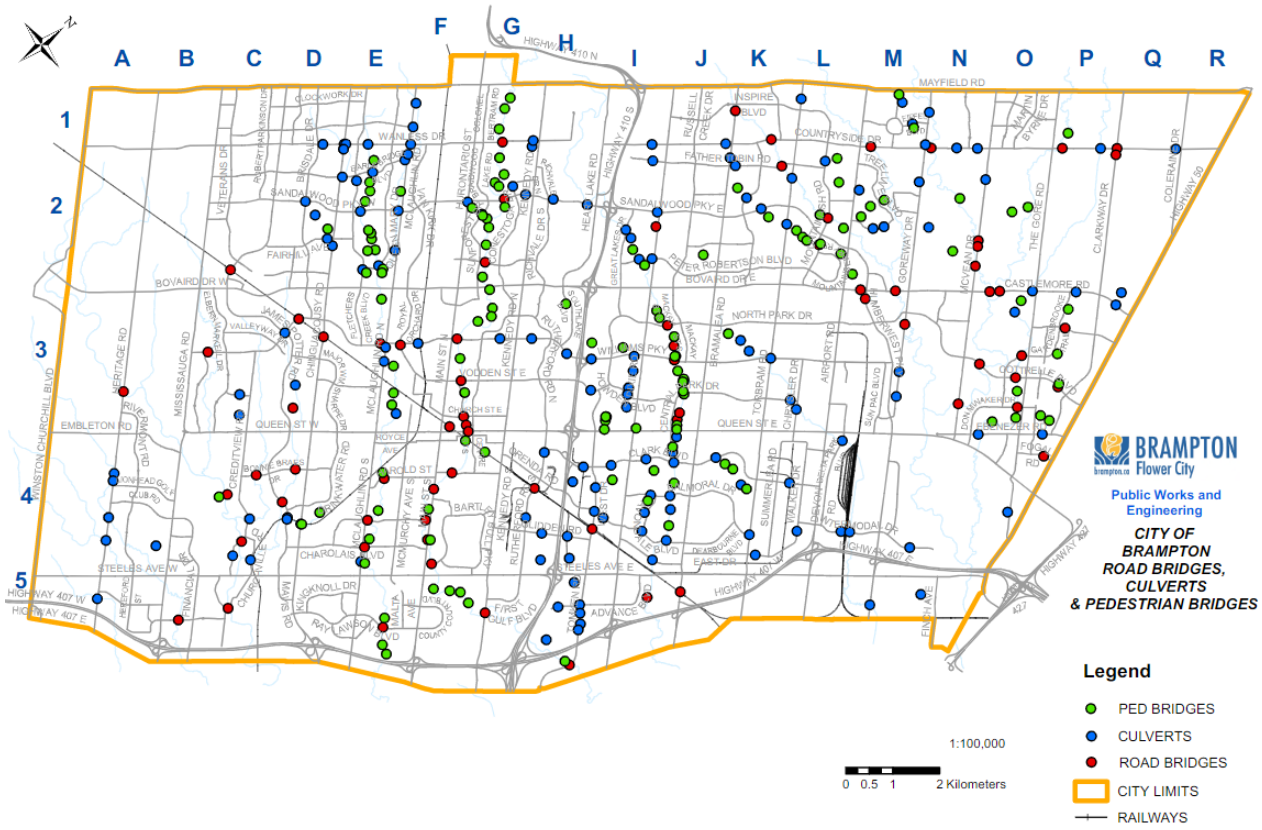


Figure D.10.5 Bridges and Culverts

An overall Bridge Condition Index (BCI) is calculated from all collected data and informs the annual bridge and structural culvert rehabilitation and reconstruction program. The index is scaled from 0 to 100 and has been divided into ranges to assess condition. The BCI is not used to rate or indicate the safety of a bridge or structural culvert. Any safety issues are immediately reported by the inspector to supervising engineers and maintenance crews. Condition grade examples are provided in the following table:

Table 10.3 Bridge Condition Grade Scale

Condition Grade	Bridge Examples	Culvert Examples
Very Good BCI >90	 J3RBPKE387 – Chinguacousy Park road bridge over pond (2019 BCI = 99)	 L1RCNTH386 – Torbram Rd over Humber Tributary (2019 BCI = 96)
Good BCI >70 to 90	 B3RBNTC001 – Heritage Rd over Credit River (2019 BCI = 74)	 E2RCNTF244 – Lormel Gate over McLaughlin Rd (2019 BCI = 76.5)

Condition Grade	Bridge Examples	Culvert Examples
Fair BCI >60 to => 70	 G4RBWTE085 – Bartley Bull Pkwy over Etobicoke Creek (2019 BCI = 67.8)	 I3RCNTE109 – Hazelwood Dr over Etobicoke Creek (2020 BCI = 67)
Poor BCI >50 to =>60	 G3RBNTE075 – Scott St over Etobicoke Creek div. channel (2020 BCI = 59.0)	 B4RCNTC005 – Heritage Rd over Credit River Tributary (2019 BCI = 56.9)
Very Poor BCI < 50	 TRCA bridge as an example: Wylie bridge (2020 BCI = 49)	 No culvert in Very Poor Condition

D-2 Winter Snow Clearing LOS

D-2-1 Roads

The City of Brampton services its roads on a priority system, with the order outlined below:

– **Arterial roads** (e.g., Bramalea Road, McLaughlin Road):
  - Major traffic corridors for traffic, transit, and emergency services
  - The first to be cleared when it snows
  - Pre-treated and plowed continuously during any snowfall

– **Collector roads** (e.g., Centre Street, Professor's Lake Parkway):
  - Collect and distribute traffic between arterial and local roads
  - Receive second priority during snow clearing operations
  - Include Brampton Transit routes and streets where Peel District schools are located

– **Local roads** (the streets and courts in your neighbourhood):
  - Maintained once arterial and collector routes are cleared
  - Treated with salt (sand may be used during extreme cold weather)
  - Plowed when at least 5 cm of snow falls in a single storm

– Each road type has different level of service objectives. The desired for each road category is summarized as follows and in figure
  - Arterials – Bare pavement, completely clear of ice and snow. May be wet or dry
  - Collectors – Conditions range from bare to track bare pavement (snow covered except for wheel tracks)

- Locals – Roads can be track bare or snow-covered

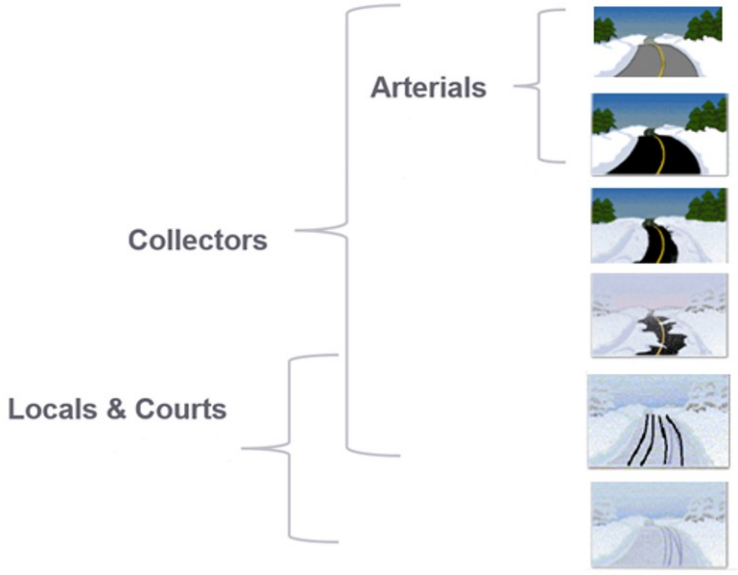


Figure 10.6 Visual Representation of winter LOS for each road classification

D-3 Sidewalks/Walkways

D-3-1 Sidewalks

Sidewalks are maintained by the City if they are:

– On arterial roads like Queen Street or Bramalea Road
– In front of City parks and recreation facilities
– Curb-faced (no grass boulevard)
– Behind a property (reverse frontage)
– On a road with Brampton Transit/Züm bus stop locations

All other sidewalks are the responsibility of the property owner and must be cleared by 11 am the day after a snowfall. Failure to do so could result in a fine from By-law Enforcement.

D-3-2 Walkways and Multi-use Paths

Street-to-street walkways and multi-use paths are plowed and salted during sidewalk plowing.

Street-to-park walkways are maintained once recreation facility parking lots are complete. They are plowed when at least 5cm of snow has fallen.

School crossings are hand-cleared and salted as required throughout a snowfall

D-3-3 Brampton Transit Stops

Stops and shelter pads are cleared and salted

Terminals are salted as required throughout a snowfall, and plowed when snow accumulation reaches 4.5 cm

Appendix E

Financing Strategy Assumptions

E-1 Assumptions

As the Transportation Service Area matures the Asset Management Program, there continues to be improvements in the confidence of data, which will improve the accuracy of calculating sustainable funding targets.

The following assumptions have been made to support the development of the financing strategy section.

1. 1.8% developer's asset contribution of current asset value based on a historical average (last 5 years).
2. Asset expansion (growth) will occur at a rate which will keep the current asset proportions of assets within the asset portfolio consistent.
3. Assume Federal Gas Tax will remain at a consistent total of $34M to the City and the proportion of which is delegated to Transportation Assets remains consistent at 60% based on historical allocations.
4. Infrastructure levy annual increase is assumed to be 2%. Transportation Assets will continue to receive approximately 20% of the total infrastructure levy based on its historical allocation.
5. Expansion and upgrade contributions, from both, the developers' contributions and the City triggered assets are both assumed to be fully funded. This is based on the understanding that developers will be responsible for the capital cost of the asset they create.
6. Proportions of growth funding will be consistent with that assumed in the 2019 DC project list. It should be noted that the William's parkway road widening has been removed from this list due to the current (at the time of this report) council decision not to proceed with this project.
7. 'Current funding' is determined based on the projected capital expenditure over the next 5 years (2020 to 2024). To determine the 10-year projection for the 'current funding' 5-year average is applied to the 10-year period.
8. Operations and Maintenance funding will be prioritized over the renewal activities to manage financial/budget constraints.
9. All financial costs are based on 2020 budgets and estimates and stated in 2019 dollars.

Appendix F

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ghd.com

The Power of Commitment