

D

Appendix D: Operations and Maintenance Supporting Technical Paper



City of Vaughan

Pedestrian and Cycling Master Plan

Operations and Maintenance of Active Transportation Facilities

Report No. E02
February 11, 2019

B000773

SUBMITTED BY CIMA CANADA INC.

400-3027 Harvester Road
Burlington, ON L7N 3G7
T 289 288-0287 F 289 288-0285

cima.ca

CONTACT

Jaime Garcia, P.Eng., Ph.D.
Jaime.Garcia@cima.ca
T 289 288-0287, 6814

City of Vaughan

Pedestrian and Cycling Strategy

Operations and Maintenance of Active Transportation Facilities

PREPARED BY:

Alessandra Massaro, EIT

Peter Brocks, M.L.Arch

VERIFIED BY:

Jaime Garcia, P.Eng., Ph.D.

CIMA+

400 – 3027 Harvester Road
Burlington, ON. L7N 3G7

Table of Contents

- 1. Introduction 1**
- 2. Background 1**
 - 2.1. Provincial Legislation 1**
 - 2.2. City of Vaughan - Current State of Practice 4**
 - 2.2.1. Sidewalks (and In-boulevard Multi-use Paths)..... 4
 - 2.2.2. Cycling Facilities..... 6
 - 2.2.3. Multi-Use Recreational Trails (MURTs) 7
 - 2.2.4. Asset Management..... 7
- 3. Best Practices..... 8**
 - 3.1. City of Markham 8**
 - 3.1.1. Sidewalks 8
 - 3.1.2. Cycling Facilities – Highway 7 9
 - 3.1.3. Multi-use Recreational Trails 10
 - 3.2. Town of Oakville..... 10**
 - 3.2.1. Sidewalks 10
 - 3.2.2. Cycling Facilities..... 10
 - 3.2.3. Multi-use Recreational Trails (MURTs)..... 11
 - 3.3. City of Mississauga..... 11**
 - 3.3.1. Sidewalks (and In-boulevard Multi-use Paths)..... 11
 - 3.3.2. Cycling Facilities..... 12
 - 3.3.3. Multi-use Recreational Trails 12
 - 3.4. City of Ottawa 12**
 - 3.4.1. Sidewalks 12
 - 3.4.2. Cycling Facilities..... 13
 - 3.4.3. Multi-use Recreational Trails 15
 - 3.4.4. Asset Management..... 15
 - 3.5. City of Kingston..... 15**
 - 3.5.1. Sidewalks 16
 - 3.5.2. Cycling Facilities..... 17

3.5.3. Multi-use Recreational Trails 17

4. Future Considerations 18

4.1. Maintenance and Operations Program..... 18

 4.1.1. Sidewalk Facilities 18

 4.1.2. Cycling Facilities 19

 4.1.3. Multi-Use Recreational Trails..... 19

4.2. Designing for Maintenance 20

4.3. Asset Management Strategy 20

4.4. Maintenance and Operations Funding 21

List of Tables

Table 2-1: Snow Accumulation – Bicycle Lanes 2

Table 2-2: Ice Formation Prevention..... 2

Table 3-1:Mississauga Winter Service Levels 12

Table 3-2: Ottawa Road Classification Winter Treatment 14

Table 3-3: City of Kingston Sidewalk and Pathway Snow Maintenance..... 16

List of Figures

Figure 3-1 City of Markham - Maintenance Responsibility – Highway 7 9

1. Introduction

The appropriate maintenance of active transportation facilities can help protect capital investments by maintaining the lifespan of the infrastructure. Achieving standards of excellence for the construction and maintenance of active transportation facilities also promotes the use by meeting standards for safety, comfort, and aesthetics.

Operations and maintenance requirements should be established and included in annual operational budgets and considered during the design process. Successful cycling and trail function will rely on a continued and regular program of maintenance of cycling facilities, multi-use recreational trails and associated support facilities. A Maintenance Program will not only ensure a quality recreational or travel experience for the cyclist but is also an essential ingredient of a risk management plan for the City. The City should dedicate sufficient staffing and resources to a regular maintenance schedule to meet these goals.

As the cycling and trail network develops, the maintenance practices and level of service will need to be adjusted to address new facilities, expectations of the public, and minimum standards. Priority should be given to the Primary Cycling Network and Multi-use Recreational Trail Network The Vaughan Super Trail and other routes where there is a high volume of pedestrian and cyclist traffic. Allocating the necessary funds to provide a consistent timely maintenance practice is a critical strategic direction to ensure a successful high-quality cycling and trail network.

The information and recommendations contained in this report regarding Operations and Maintenance has been developed based on consultation with staff of City of Vaughan and other municipalities as well as available documents, including best practices and lessons learned.

2. Background

Operations and maintenance of active transportation facilities are often addressed in transportation studies and master plans as separate chapters complementing the implementation process. For example, the Active Transportation Planning Guide developed by the Province of Manitoba refers to Operations as *“the means to ensure safe and efficient use of the network including the consistent application of pavement markings, signage and crossing treatments”*, and in a form similar to the current version of the Ontario Traffic Manual Book 18, Cycling Facilities, the Guide includes several maintenance strategies and recommendations that could be included as part of the implementation process.

As the network expands and best practices emerge, the maintenance practices and level of service limits will need to be adapted to address the existing and new cycling facilities, expectations of the public and new minimum maintenance standards.

Currently the operation and maintenance of active transportation facilities in the City of Vaughan are covered as part of the activities conducted by the Transportation Services, Parks and Forestry Operations and addressed by the following provincial guidelines, municipal policies and by-laws.

2.1. Provincial Legislation

Ontario’s Municipal Act, O. Reg. 239/02: Minimum Maintenance Standards (MMS) for Municipal Highways

O. Reg. 239/02: Minimum Maintenance Standards for Municipal Highways (MMS) provides a set of minimum standards for road and highway maintenance including sidewalks that should be

followed by all municipalities with respect to items such as the frequency of inspections, weather monitoring, ice formation, snow accumulation, trip hazards, etc. In 2018, O. Reg. 239/02 was amended and for the first time now also includes minimum maintenance for bicycle lanes effective as of May 3, 2018. The MMS use Ontario Traffic Manual (OTM) Book 18's definition for Bicycle Lane and define it as "a portion of a roadway that has been designated by pavement markings or signage for the preferential or exclusive use of cyclists, or a portion of roadway that has been designed for the exclusive use of cyclists by signage and a physical or marked buffer." Bicycles have a lower threshold for conditions and deficiencies (i.e. they are vulnerable to potholes and cracks), and therefore cyclists need additional consideration.

As per the amendment 366/18, the following elements shall be addressed. For the purposes of this section, addressing snow accumulation on a bicycle lane or sidewalk includes:

1. Plowing;
2. Salting;
3. Applying abrasive materials;
4. Applying other chemical or organic agents;
5. Sweeping; or
6. Any combination of the methods described in 1 to 5.

Section 4.2 – Snow accumulation on bicycle lanes. After becoming aware that snow accumulation occurs, as established in the corresponding table, the municipality will deploy resources as soon as it is practicable to provide a minimum bicycle lane width of one metre. Depths and timeframe differs depending on the class of highway or adjacent highway.

Table 2-1: Snow Accumulation – Bicycle Lanes¹

Class of Highway	Depth	Time
1	2.5 cm	8 hours
2	5 cm	12 hours
3	8 cm	24 hours
4	8 cm	24 hours
5	10 cm	24 hours

Section 5 (5) - Ice Formation on roadways. This section includes a provision for the prevention on bicycle lanes on a roadway, but does not apply to other types of bicycle facilities. Ice formation, ice prevention and timeframes differ depending on the class of highway.

Table 2-2: Ice Formation Prevention²

Class of Highway	Time
1	6 hours
2	8 hours
3	16 hours

¹ As per Reg. 366/18, s.7.

² As per Reg. 266/18, s.8.

Class of Highway	Time
4	24 hours
5	24 hours

Section 16.3 – Snow accumulation on a sidewalk. After the snow accumulation has ended, reduced to an accumulation of 8 cm or less within 48 hours, provide a minimum sidewalk width of 1 m. This is not dictated by classification of road.

Section 16.5 – Prevention of ice formation on sidewalks and icy sidewalks. The municipality should monitor the weather and if there is a substantial probability of ice forming, treat the sidewalk, if practicable, to prevent ice formation or improve traction within 48 hours of determination to deploy resources. The standard to treat ice on a sidewalk is 48 hours.

Section 16.7 – Winter sidewalk patrol. The municipality should monitor the weather. If there is a substantial probability of snow accumulation in excess of 8 cm, ice formation or icy sidewalks, the standard requires the municipality to patrol (representative) sidewalks. The patrol can be done by walk, driving or electronic monitoring by a patroller or by personal performing maintenance.

For full regulations visit: <https://www.ontario.ca/laws/regulation/020239>

Ontario Traffic Manual (OTM) Book 15 – Pedestrian Crossing Treatments (2016)

Provides guidance specific to pedestrian facilities operations, including pavement marking and signs for several types of crossing treatments from fully signalized intersections to uncontrolled crossings.

Ontario Traffic Manual (OTM) Book 12 – Traffic Signals Training Guide (2007) and Book 12A – Bicycle Traffic Signals (2018)

Provides information, guidance and direction regarding the implementation and operation of traffic signals or special signal phasing for cycling facilities.

The OTM Book 12A, which was recently approved by the Ministry of Transportation, provides guidance and application information on the planning, design and operation of intersections under traffic signal control through which bicycle traffic operates. Book 12A supplements information contained in OTM Book 12 and should be used in conjunction with OTM Book 18.

Ontario Traffic Manual (OTM) Book 18- Cycling Facilities (2013)

OTM Book 18 includes selected general guidance specific to winter maintenance of bicycle facilities, such as:

- Clear on-road bicycle facilities of snow at the same time as vehicle travel lanes;
- Ice conditions. Treat at the local road authority quality standards, or at the earliest opportunity;
- Reduce or remove snow banks where they restrict widths or sight lines;
- Where abrasives are used, sweep specially after a major storm event; and
- Snow storage melt drain away from bike facility to prevent freeze-thaw cycles and ice formation.

Accessibility for Ontarians with Disabilities Act, O. Reg. 191/11: Integrated Accessibility Standards

In this regulation, section 80.6 applies to newly constructed or redeveloped trails that an organization intends to maintain.

Section 80.6 provides the requirements for the slope of the trail and the need for, and location of, ramps on the trail that are mandatory for the accessible operation of trails, such as:

- Minimum clear width,
- Minimum head room clearance,
- Surface type and conditions,
- Edge protection,
- Entrance design and trail head signage, and
- Boardwalks and ramps.

Section 80.21 applies to newly constructed and redeveloped exterior paths of travel that are outdoor sidewalks or walkways designed and constructed for pedestrian travel and are intended to serve a functional purpose, and not to provide a recreational experience. Section 80.21 provides the requirements for the following operational elements of a pedestrian walkway:

- Sidewalks,
- Curb ramps,
- Depressed curbs, and
- Accessible pedestrian control signals.

2.2. City of Vaughan - Current State of Practice

Transportation Services, Parks and Forestry Operations Staff are responsible for the operations and regular maintenance of municipal assets including active transportation facilities such as sidewalks, in-boulevard multi-use pathways, cycling facilities and multi-use recreational trails and associated infrastructure such as traffic signals, flashing warning beacons, signage and pavement markings. In order to manage risk and liability the City has the following main tools to identify, document, and prioritize maintenance activities as well as inform citizens:

- Access Vaughan: a general contact centre for the City of Vaughan. Access Vaughan can track and flag for public works inquiries and issue work orders
- Public Works Report A Problem Program: an online reporting tool that allows citizens to report Public Works issues (<http://pwreportaproblem.vaughan.ca/>)
- Where's My Snowplow: an online mapping tool that uses GPS technology to track the location and progress of the City's plows
- Social media (Facebook and Twitter): is used to monitored and flag issues as they arise, as well as provide real time maintenance updates to citizens

2.2.1. Sidewalks (and In-boulevard Multi-use Paths)

The following provides an overview of the City's current state of practice as it relates to the maintenance of sidewalks. Multi-use Paths within the road right-of-way (In-boulevard Multi-use Paths) are maintained the same as a sidewalk.

Sidewalk Regular Maintenance Program

City staff conduct a regular sidewalk maintenance program composed by the following elements:

- An annual review of all the sidewalks composing the pedestrian network servicing the City. The review's purpose is to identify any defects that may be considered potentially dangerous;
- A prioritization of the identified defects based on severity; and
- Scheduling of repairs, ranging from saw cutting to the complete removal and replacement of the defective section of the sidewalk.

Sidewalk Pre-Winter Operation & Maintenance

Prior to winter season City Staff conducts the following activities:

- City staff identifies all routes considered for review and assign a specific operator for each section.
- The operator assigned to that route drives the sidewalk routes at least twice. On a copy of the route map, the operator identifies, any low branches, obstructions, or trip and report it to the Supervisor for removal/repair.
- All facility hand crew staff are required to inspect all assigned areas and identify on the facility sheets, any obstructions to their supervisor (i.e. potholes, raised manholes, cracked concrete or pavement, broken or moved curbs or other hazards).
- Supervisors will ensure that the operators report these deficiencies to the appropriate Forestry / Works Supervisor for action before November 15th.

Sidewalk and Facilities Snow Clearing and Salting Operations

The City defines sidewalk snow plowing as the removal of snow and ice on sidewalks on both City and Regional road allowances and on some predetermined park pathways using specialized equipment. Under the current operation and maintenance process conducted by the City of Vaughan, sidewalks considered for snow clearing and salting operations are defined as follow:

- Primary sidewalk is a municipally owned sidewalk on a street serviced by York Region Transit within the City of Vaughan, as well as sidewalks adjacent to or leading to schools or places of worship.
- Secondary sidewalks are defined as all other municipally owned sidewalks and pathways including municipal parks

Sidewalk plowing begins with five centimetres of snow accumulation with sidewalks on main roads serviced first, then sidewalks in residential communities and after that paths and walkways within parks and private roads.

With respect to snow clearing around municipal facilities, the City conducts the removal of snow and ice from doorways, entrances, fire exits, sidewalks, pathways, parking lots at all City operated building and facilities, including fire halls and libraries. Primary areas for snow clearing and salting include main entrances, fire exits from building and facilities, fire routes to and from public buildings and fire halls, and parking adjacent to main entrances.

Sidewalk Winter Maintenance Level of Service

As stated in By-Law 300-93 and 56-96, the City delegates the responsibility of cleaning and removal of snow and ice from residential sidewalks to the owner of the adjacent properties, whether the properties are occupied or unoccupied. The standard requires this done within 24 hours after snowfall.

With respect of primary and secondary sidewalks the City developed the following service levels:

Service Level:

- Primary sidewalk. Circumstances permitting, operators shall do one complete pass of primary sidewalk routes/facility areas within 8 hours of commencing operations when snow accumulation has reached 5cm or more.
- Secondary sidewalk. An operator will do all secondary routes/areas only after all primaries are complete, if circumstances permit. All secondary routes/areas will be completed with 16 hours after starting secondary sidewalk & facility snow operations.
- Facilities. Circumstances permitting, staff will be deployed to facilitate snow clearing and salting of the primary areas, prior to scheduled opening times of all facilities, or when asked to accommodate a special meeting or event. With snowfalls of less than 5cm, the supervisor will direct the action.
- In-boulevard multi-use pathways within the road right-of-way are maintained the same as a sidewalk.

If compared with the winter maintenance practices for sidewalks presented in the Provincial Minimum Maintenance Standards, the City's current standard practice for sidewalk clearing exceeds these standards.

2.2.2. Cycling Facilities

The following provides an overview of the City's current state of practice at the time of writing this report as it relates to the maintenance of cycling facilities.

Maintenance of Cycling Facilities

Cycling facilities that are on the road such as Signed Bike Route with Edgelines and Bicycle Lanes are maintained to the same standard as municipal roadways. Regular maintenance includes the following activities:

- An annual pavement marking program to refresh all existing on-road pavement markings on City owned streets.
- A sign inspection once a year to test retro-reflectivity of all regulatory signs.
- All traffic signals are inspected twice a year. It is expected that bicycle signals will be included as part of this annual inspection.
- Street-sweeping program usually begins in April/May and takes four to five weeks to complete. After initial spring cleaning, street sweeping continues throughout the summer and into the fall on a four to five-week rotation

Cycling Facilities Snow Clearing and Salting Operations

Winter maintenance of cycling facilities includes the following activities:

Salting/Sanding

- Main roads - begins as soon as ice or snow forms on the roads, first round of salting completed within four hours
- Residential roads - are salted after main roads are complete, first round of salting completed within 12 hours
- Narrow streets (rear laneways) - are salted after main roads are complete, first round of salting completed within 12 hours

Plowing

- Main roads - plowing begins as soon as five centimetres (two inches) of snow accumulates, completed within four hours after snowfall has ended
- Residential roads - plowing begins as soon as five centimetres (two inches) of snow accumulates, completed within 16 hours after snowfall has ended
- Narrow streets (rear laneways) - plowing begins as soon as five centimetres (two inches) of snow accumulates, completed within 16 hours after snowfall has ended

2.2.3. Multi-Use Recreational Trails (MURTs)

Winter Maintenance of Multi-Use Recreational Trails

Currently the City of Vaughan does not maintain MURTs outside of the road right-of-way (ROW) in winter. As the City expands the MURTs network, the City may consider identifying a winter-maintained network to provide pedestrians and cyclists with year-round active transportation and recreational opportunities.

Available budget will affect the extent of winter-maintained MURTs. The City should give priority to proposed linkages that provide direct access to major destinations such as the VMC, connections to the City of Toronto's trail network, and the following existing MURT segments of the Vaughan Super Trail:

- The Barley Smith Greenway along the West Don River, and
- The William Granger Greenway along the Humber River.

2.2.4. Asset Management

City of Vaughan Corporate Asset Management Strategy

According to a report to City of Vaughan Council on May 16, 2017, staff have been working on three key elements of the Corporate Asset Management Strategy:

- Data collection and storage,
- Computerize Work Management System (CWMS), and
- Asset Management Planning System (AMPS) implementation.

The report indicates that it is expected that roads and traffic areas will be included as part of the second phase of the CWMS and that the AMPS will be used to forecast asset deterioration and prioritization of capital investments across all asset types.

3. Best Practices

Operations and maintenance best practices from other regions and municipalities presented in this document consider the important benefits that efficient operations and timely maintenance provide to the comfort and safety of all users, the dependability of the active transportation infrastructure, and the consequent increase in facility utilization. The information was gathered through consultation with these municipalities as well as a review of their Transportation, Cycling, Active Transportation, Multi-use Recreational Trail or similar master plans.

The main priorities observed in the best practices of the active transportation facilities in other municipalities were:

1. Surface Conditions, and
2. Winter Maintenance.

Surface conditions

Operation and maintenance requirements and recommendations related to surfacing of sidewalks, cycling facilities and MURTs will be identified based on current practices and the information collected as part of the sidewalk maintenance program such as surface defects, cracking or potholes issues, or to be included as part of the AMPS.

Winter maintenance

Recommendations for operation and maintenance of active transportation facilities during winter will have to consider the potential implications to changes to the Minimum Municipal Standards, as well as the type of equipment (currently used or to be used) by the municipality for winter maintenance operations.

3.1. City of Markham

The City of Markham has a similar geographic size and population to Vaughan (just over 300,000 in 2016) and, therefore, will have similar transportation needs and issues facing their citizens. The following sections detail Markham's current and proposed Operations and Maintenance service levels and policies as we understand them at the time of this report.

3.1.1. Sidewalks

Sidewalk Cleaning and Repairs

To ensure safe pedestrian movement along sidewalks and paved boulevards, the City of Markham removes accumulated winter materials (sand/salt) along sidewalks, paved boulevards, curbs and road islands and conduct any necessary repairs.

Winter Maintenance

City Staff plows all sidewalks (including residential sidewalks) within 24 hours of the end of a snowfall when accumulations reach 5cm or more. They provide priority service according to the road classification, beginning with sidewalks along arterial and primary roads, followed by secondary and residential sidewalks. Markham gives special attention to sidewalks near schools and bus stops. Plowing and subsequent sanding could take up to 14 hours to complete.

3.1.2. Cycling Facilities – Highway 7

Markham made special efforts in working with York Region to design and build the cycle tracks and enhanced streetscaping elements along sections of Highway 7.

Staff recommended entering into an agreement with York Region on shared operations and maintenance, capital funding, operating & life cycle costs of infrastructure within the Highway 7 Boulevard between Town Centre Boulevard and Sciberras Road.

Under the terms of the proposed agreement, the City will be fully responsible for the operation and maintenance of the in-boulevard Cycle Tracks and York Region is responsible for the maintenance and operations of streetscaping infrastructure adjacent to the curb, approximately shown in Figure 3-1 (in addition to the sidewalks that the City already maintains).

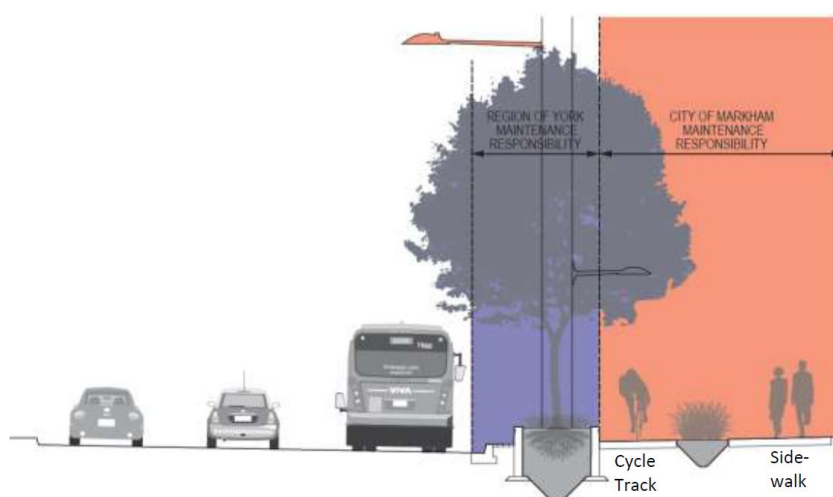


Figure 3-1 City of Markham - Maintenance Responsibility – Highway 7

Markham's proposed level of service/Operations and Maintenance responsibilities for the cycle tracks includes:

- Annual inspection;
- Repair of minor cracks and blemishes to match paving surface material;
- Replacement of sections/ members when necessary;
- Sweeping, cleaning and debris removal;
- Maintain in a passable and safe condition during spring, summer and fall;
- Leveling of sections as necessary;
- Graffiti removal; and
- Plowing of all sidewalks and cycle tracks within 6 hours of the end of a snowfall when accumulations reach 5cm or more.

The following key factors generally determine annual operations and maintenance costs of the Cycle Tracks:

1. Level of service during winter conditions and the rest of the year

2. Snow storage room for winter maintenance of the cycle tracks.

3.1.3. Multi-use Recreational Trails

The City of Markham offers winter maintenance on their Multi-Use Pathways (MUPs), located next to a roadway (i.e. within the road right-of-way), such as the one on Major Mackenzie Drive. The City maintains them with the same level of service as sidewalks during the winter season. The City does not maintain the MUPs located within parks with no destination, and only for recreational purposes, in the winter.

3.2. Town of Oakville

According to the Town of Oakville's 2017 Active Transportation Master Plan, the town's current maintenance practices are consistent with the provincial Minimum Maintenance Standards at that time. With the anticipated amendment to include bicycle lanes in the MMS, the ATMP recommended that the Town consider developing a level of service standard specifically related to active transportation.

3.2.1. Sidewalks

Summer Maintenance

Candidates for the Road Resurfacing and Preservation Program are selected as part of a process approved by Council. When the Town selects a street for repairs, the contractor will first complete all necessary concrete curb and sidewalk repairs. Repairs address drainage issues, tripping hazards and to improve accessibility. The Town does not repair curb and sidewalks to correct aesthetic issues such as minor cracking.

Winter Maintenance

The Town clears sidewalks after snow accumulates in excess of 5 centimetres and only after clearing roads. Operators plow sidewalks located on primary and secondary roads with schools first, followed by residential sidewalks. They complete sidewalk salting and sanding only on primary and secondary sidewalks when extremely slippery conditions exist. The Town has 3 tracking tools to monitor areas requiring maintenance and to manage risk and liability:

- Report a Program (by phone or online) for regular public works requests
- PlowOakville – an online mapping tool that uses GPS technology to track the progress of the town's plows
- Social media (Facebook and Twitter) – is monitored to track and flag issues as they arrive. Updates are also shared via social media.

3.2.2. Cycling Facilities

There are currently no formal maintenance standards specific in the Town of Oakville. However, they currently maintain snow clearing from all town-owned roads from curb to curb (includes on-road bike lanes) after 5cm of accumulated snow. Similar to Vaughan, the level of service applied in Oakville is categorized into three classes: Primary Roads, Secondary Roads and Residential Roads. Primary and secondary roads are typically cleared first to ensure that residents and emergency vehicles can safely travel to hospitals, schools and workplaces, and access public transportation.

3.2.3. Multi-use Recreational Trails (MURTs)

The Park Operations department manages the operations and maintenance of the MURTs in Oakville. Generally, they do not maintain MURTs in the winter; however, active MURTs connecting to parks are winter-maintained and illuminated.

3.3. City of Mississauga

The City of Mississauga has a much larger area and population than Vaughan, with a population of over 700,000 (2016). However, the design and layout of the City is similar to Vaughan and given that Mississauga is a leader in active transportation, their operations and maintenance practices can be used to inform recommendations and a future maintenance program. Mississauga's 2018 Cycling Master Plan recommends expansion of current practices formalized in a maintenance program that specified maintenance activities, and establishes cycling route classifications for levels of service including priority routes. The plan also recommends the establishment of a winter cycling network, the development of a program to manage the repair of damaged bicycle racks and mandatory accommodations for cyclists in work zones, including requirements for temporary routes and detours.

3.3.1. Sidewalks (and In-boulevard Multi-use Paths)

Summer Maintenance

The City of Mississauga begins its spring street sweeping and clean-up program after the winter season. The City's Transportation and Works Department clears debris left behind after the winter season from roads, sidewalks, traffic islands, hard-surfaced boulevards and curbside gutters.

The City begins the sweeping of all roads in mid-April, followed in May by cleaning of hard-surfaced boulevards, sidewalks that are directly adjacent to the curb, curbside gutters and traffic islands. Then, they repair damaged sections of existing roadways, sidewalks and curbs on a priority basis as part of the Engineering and Works Division's maintenance program. Mississauga has dedicated phone lines for taking requests. Mississauga is also responsible for the maintenance of sidewalks on roads under the jurisdiction of the Region of Peel as per the Municipal Act.

Winter Maintenance

The City plows and salts priority sidewalks when snowfall exceeds 8 centimetres. Priority sidewalks are located on major roads or bus routes, or provide access to hospitals, schools or long-term care homes. These sidewalks are:

- Either blanket salted, or spot salted as conditions warrant when snowfalls are less than 8 centimetres (3"); or
- Plowed and blanket salted when snowfall exceeds 8 centimetres (3") cleared within 36 hours of the end of a winter storm.
- Property owners are responsible for cleaning sidewalks adjacent to residential property.

In-boulevard Multi-use Paths are maintained to the same standards as sidewalks.

3.3.2. Cycling Facilities

Much of Mississauga’s existing cycling network is on road. The City maintains existing on-road bike lanes at the same standard as their roads shown in **Table 3-1**.

Table 3-1: Mississauga Winter Service Levels

Snowfall Accumulation of:	Less than 8 cm (3")	8 cm (3") to 15 cm (6")	15 cm to 30 cm (6"-12")	More than 30 cm (12") or Back to Back Storms
Major/Priority Road	Salting Only	Plowing and salting Cleared within 12 hrs after the end of a snowfall	Plowing and salting Cleared within 24 hrs after the end of a snowfall	Plowing and salting More than 24 hrs after the end of a snowfall
Residential/Secondary Roads Priority Sidewalks Bus Stops Pedestrian Crossings	Salting Only	Plowing and salting Cleared within 24 hrs after the end of a snowfall	Plowing and salting Cleared within 36 hrs after the end of a snowfall	Plowing and salting More than 36 hrs after the end of a snowfall

3.3.3. Multi-use Recreational Trails

City of Mississauga has an extensive Multi-use Recreational Trails system which is managed by the Park and Forestry departments. Some MURTs are maintained during the winter months, depending on usage, district and cost.

3.4. City of Ottawa

The City of Ottawa has a population of just over 900,000 (2016). Though the City completed its cycling plan in 2013, it was and still is very progressive in all aspects including level of service standards for the City’s active transportation network.

3.4.1. Sidewalks

Winter Maintenance

The City plows sidewalks after a snow event as per the following timelines:

- Sidewalks in the downtown core: Within 6 hours,
- Downtown residential sidewalks: Within 12 hours,
- Residential sidewalks: Within 16 hours,
- Intersections and pedestrian crossings: Within 16 hours, and
- Bus stops: Within 24 hours after cleanup

While residents do not have to clear snow from their adjacent sidewalks (the municipality is responsible for this), they are encouraged to spread grit on problem areas using available grit from publicly supplied boxes.

Standard

Various classes of sidewalks and pathways use bare surface and snow packed treatment standards as follow:

- Bare Surface - requires the controlling of snow and ice, cleared and/or prevented for the full travelled width; and
- Snow-Packed - requires the clearing of snow and ice and the levelling of ruts.

During weather periods subject to freeze-thaw cycles, the City monitors the conditions of sidewalks and pathways and provide spot application of abrasives or de-icing materials.

Service Level

For treating icy sidewalks and pathways, resource deployment happens as soon as practicable, and after the City becomes aware of the icy conditions.

For snow clearing, the City deploys resources and completes snow clearing as described above. If the depth of snow accumulation is less than the minimum for deployment, then the City may deploy resources subject to sidewalk and pathway conditions resulting from previous snow accumulations, or from forecasted weather conditions. The City clears bus stops located along roads within 24 hours after the snow accumulation has ended. Windrows across sidewalks at intersections and at pedestrian crossings that operators leave after road-plowing operations are to be removed within 16 hours after the end of the storm.

3.4.2. Cycling Facilities

Summer Maintenance

This standard applies to distortions on paved and treated road surfaces, including cycling lanes, paved and gravel shoulders, that could pose a risk to cyclists and motorists, and/or that could accelerate the deterioration of the road structure

The City selects the type of treatment for these surface distortions in accordance with the type and extent of the distortion, prevalent weather conditions and scheduled infrastructure rehabilitation programs.

If it is not possible to carry out some operations between November 15th and April 15th due to temperature limitations, interim/temporary measures will be required if conditions create a safety hazard to the users.

Standard

The following criteria are used as maximums for allowable surface distortions along designated City cycling routes – within designated cycling lanes or within 1.5 m from the edge of road (or parking lanes) along shared use lanes (May – November):

- Longitudinal cracks equal to or greater than 2.5 cm in width.
- Potholes and bridge deck spalls greater than 10 cm in diameter.
- Vertical pavement discontinuities equal to or greater than 2 cm.

Service Level

Surface distortions along designated city cycling routes are to be repaired within 7 days (May – November). Priority attention is to be given to distortions located at intersections and hills. Repairs may be temporary to eliminate the hazard until more permanent repairs can be undertaken.

Winter Maintenance

The City has an interactive map called GeoOttawa which shows existing bicycle network as well as the winter network which shows where city staff will be clearing the snow. The City wishes to provide connectivity for the winter users and therefore focuses on the core area where bicycle usage is the highest in Ottawa.

Snow removal:

- The City aims to distribute snow on both sides of the road. Snow banks are removed or reduced in size when they begin to restrict sightlines, travel widths, and pedestrian and cycling traffic.
- After the spring thaw, seasonal load restrictions are put into effect on some city roads. Seasonal load restrictions are authorized and supported by Infrastructure Services department.
- During this time, the City improves road conditions and reduces potential flooding by:
 - Using hot and cold mix asphalt to patch potholes during the winter and in early spring.
 - Clearing snow from the ends of culverts and using steam to thaw frozen catch basins to allow maximum water flow and reduce potential flooding.
 - Conducting a street sweeping blitz throughout Ottawa and concentrated street sweeping in neighbourhoods where there is continuous on-street parking.
 - Grading gravel roads and shoulders to re-establish an even road surface

This standard applies to winter snow and ice control operations for City-owned sidewalks, pathways, bus stops and pedestrian malls designated for winter usage. Snow and ice control operations can be carried out 24/7 subject to weather conditions and in a manner that will enable the City to achieve this standard with available resources. Under extreme winter storm conditions (i.e. those that exceed normal conditions), snow and ice control operations will be carried out based on the capacity of resources in as continuous a manner as practicable, consistent with the classes of sidewalks and pathways as detailed in **Table 3-2**.

Table 3-2: Ottawa Road Classification Winter Treatment

Road Maintenance Class	Road Type	Minimum Depth of Snow Accumulation for Deployment of Resources	Time to Clear Snow Accumulation or Time to Treat Icy Conditions	Treatment Standard			
				Bare Pavement	Centre Bare	Snow Packed	
1	A	High Priority Roads	2 h (3-4 h)	√			
	B			√			
2	A	Most Arterials	3 h (3-6 h)	√			
	B			√			
3	A	Most Major Collectors	4 h (8-12 h)	√			
	B			√			
4	A	Most Minor Collectors	6 h (12-16 h)	√			
	B				√		
	C					√	
5	A, C		7 cm (10 cm)	10 h (16-24 h)			√

Road Maintenance Class	Road Type	Minimum Depth of Snow Accumulation for Deployment of Resources	Time to Clear Snow Accumulation or Time to Treat Icy Conditions	Treatment Standard		
				Bare Pavement	Centre Bare	Snow Packed
B	Residential Roads and Lanes	10 cm (<i>not defined</i>)	16 h (<i>not defined</i>)			√

Safety is imperative for them and they have installed sideguards on all snow plows to protect cyclists and pedestrians.

3.4.3. Multi-use Recreational Trails

City of Ottawa refers to their MURTs as Multi-Use Pathways (MUP) and are considered to service both cycling and pedestrian linkages along major arterials.

Both multi-use pathways and cycle tracks are constructed over a road base that is less extensive, and therefore less expensive than on-street roadway bases. They are therefore more subject to root damage from nearby vegetation and root-barriers are recommended where needed during design to reduce life cycle costs. Only designated major MUPs are maintained to the same standards of sidewalks during winter maintenance, while others are not maintained in the winter.

3.4.4. Asset Management

In 2012 Council approved a Comprehensive Asset Management (CAM) Program. The intent of the CAM Program is to ensure that City assets are maintained in a state of good repair and managed in the most effective manner, to support the delivery of services to the community (including cycling facilities). CAM identifies the need to document levels of service from a customer perspective. The intent is to develop the customer level for cycling as a separate service. This will then inform how the assets supporting that service will be managed in a manner that is affordable and sustainable.

3.5. City of Kingston

As per the City's updated Active Transportation Master Plan completed in May of 2018, the City's current maintenance practises are consistent with the provincial Minimum Maintenance Standards. To maintain the transportation infrastructure in a good state of repair, the City undertakes a variety of activities including patching and paving the boulevard, crack sealing, sweeping and flushing, curb and gutter repair, bridge and culvert repair, sidewalk and pathway repair/cleaning. During the winter months the City also provides snow plowing, salting and sanding services.

The updated Master Plan identifies a number of strategies that the City may consider to achieve the greatest benefit from resources that are available for maintenance including:

- Winter Network: The City may consider identifying a core network to maintain during the winter and concentrate winter maintenance resources to this network

- Spine Network: The same principle can be applied to other maintenance procedures, with more resources invested into the core network with the highest ridership.
- Facility Design: City staff should consult with maintenance and operations staff during the design process for any new facilities.
- Best Practices: City staff should engage with maintenance and operations staff from other municipalities to exchange ideas, best practices and innovations.

Maintenance Standards: Ensure the City practices are consistent with the Province’s Minimum Maintenance Standards.

3.5.1. Sidewalks

Summer Maintenance

The main identification of sidewalk defects happens during the spring “Street Sweeping” cleanup where typically sidewalks on either side of the roadway is swept first.

Other than during these annual cleanups, Kingston has developed the “Sidewalker Inspection Program” which maps sidewalk defects and other trip hazards using a Windows-based tablet computer with a GPS system. It provides an effective identification and prioritization of sidewalk deficiencies by City staff and allows for the development of a “Planned Maintenance Program”.

There is also the “Step Safe Program” which encourages residents to report sidewalk hazards so that they can be assessed and fixed, and/or marked with fluorescent paint to visually warn pedestrians of the hazard. There is a call-in number for residents.

Winter Maintenance

The snow clearing on sidewalks is triggered by a certain level of accumulation described in **Table 3-3**.

The service levels are:

- Arterial: For sidewalks and walkways adjacent to high-volume roadways and/or with high pedestrian volumes, the target is to make them safe and passable within 24 hours after the snowfall ends when possible.
- Residential: For the balance of sidewalks and walkways that can be cleared with mechanized equipment, the target is to make them safe and passable, within 48 hours after the snowfall ends when possible.

Sidewalks and pathways are designated into four categories according to their associated pedestrian and cycling traffic, proximity to high volume roadways and the ease with which they can be cleared as shown in **Table 3-3**.

Table 3-3: City of Kingston Sidewalk and Pathway Snow Maintenance

Designation	Description	Snow Clearing
1	Sidewalks / pathways adjacent to high volume roadways and/or sidewalks / pathways with high pedestrian and cyclist volumes	When accumulation is less than or equal to 2.5 cm

Designation	Description	Snow Clearing
2	Balance of sidewalk / pathways that can be cleared with mechanized plow equipment	When accumulation is less than or equal to 5 cm
3	Sidewalks / pathways that require a blower or hand shovelling to clear	When accumulation is less than or equal to 5 cm
4	Sidewalks that will not be cleared due to their destination	Will not be cleared.

3.5.2. Cycling Facilities

Summer Maintenance

City staff will work three shifts per day (24 hours per day) until all streets have been swept. The main roads are done first. After that it takes approximately eight weeks to complete the residential street schedule below.

High volume and high speed arterial streets are addressed first, as the potential for dust on these streets is the greatest and typically these arterials also have designated cycle lanes, followed by transit routes and collector streets again because of the traffic volumes, the high potential for dust and also as these collector's streets often have designated cycle lanes.

Once the arterials and collectors have been addressed, the program moves to the urban/suburban residential phase. Typically, this phase is expected to take seven weeks, but with the heavy residual winter sand load being experienced, this phase may take longer.

Winter Maintenance

Bicycle lanes follow the same maintenance standards as the roads. The road plowing priorities and standards during normal winter conditions are as follows:

- Arterial: For major and collector roads and major rural roads, the centre of road will be essentially clear as soon as possible after snowfall ends and, normally, within four hours.
- Collector and transit routes: For secondary collector roads and transit routes, the centre of road will be essentially clear as soon as possible after snowfall ends and, normally, within six hours.
- Residential: Local residential and minor hard-surfaced rural roads will be essentially cleared as soon as possible after snowfall ends and, normally, within 16 hours.

When not addressing winter plowing and salting/sanding needs, the City's Public Works staff use 'cold patch' to try to maintain potholes until more permanent repairs can be carried out.

3.5.3. Multi-use Recreational Trails

City of Kingston refers to these as Multi-Use Pathways (MUP) and are considered to service both cycling and pedestrian linkages along major arterials. Maintenance of MUP follows the same approach as sidewalks as identified in Table 3-3.

4. Future Considerations

4.1. Maintenance and Operations Program

It is recommended that the City of Vaughan develop a formal Active Transportation Maintenance & Operations Program, creating a requirement for funding commitments during capital planning process, asset management and maintenance designing.

The following section identifies level of service and standards for active transportation facilities that staff at the City of Vaughan may consider in developing a formal maintenance program for the pedestrian, cycling, shared-use and multi-use recreational trail networks. This program would need to assess the impact to operating budgets, equipment needs and resources and should:

- specify maintenance activities and assess the impact to operating budgets, equipment requirements and staffing needs;
- address seasonal maintenance requirements (winter versus spring/summer versus fall);
- outline procedures for pavement marking renewal;
- outline procedures for public requests; and
- outline procedures for effective documentation and tracking of maintenance practices as a means of managing risk and liability.

It will require funding commitments during capital planning processes, as well as asset management considerations.

- As the City expands its Active Transportation Network, Operation and Maintenance will increase in importance;
- Minimum Maintenance Standards for Municipal Highways (MMS) under the Municipal Act apply to pedestrian and bicycle facilities;
- Accessibility for Ontarians with Disabilities Act (AODA) legislation requirements must be met through maintenance activities;
- City by-laws related to Operation and Maintenance will have to be rewritten to recognize these changes

The following subsections outline specific level of service standards that may be considered by the City when developing a formal operations and maintenance program. These are based on current best practices and adjacent municipality efforts.

4.1.1. Sidewalk Facilities

- Sidewalk Maintenance Program: It is recommended that repairing sidewalks adjacent to roadways when they are resurfaced is included as part of the maintenance program.
- Sidewalk Winter Maintenance: It should be noted that, based on the changes to the Minimum Municipal Standards recently approved, the current by-law may be required to be updated.
- Designing for Maintenance: new sidewalk facilities should include planning for maintenance and AODA standards, also having cycling facilities at the same grade as sidewalks can also help make maintenance easier and sidewalk and cycle tracks are typically cleared to the same service level.

4.1.2. Cycling Facilities

As part of the last amendment of the MMS (May 3, 2018) winter maintenance of bicycle facilities (separated and conventional bike lanes) are now also covered by the minimum maintenance standard. For the purposes of this section, addressing snow accumulation on a bicycle lane includes:

1. Plowing the bicycle lane;
2. Salting the bicycle lane;
3. Applying abrasive materials to the bicycle lane;
4. Applying other chemical or organic agents to the bicycle lane;
5. Sweeping the bicycle lane; or
6. Any combination of the methods described in 1 to 5.

Summer Maintenance: The City may consider a pothole and surface defects program specific for cycling facilities as they are much more dangerous to cyclists and can cause serious injuries, leading to expensive lawsuits. Typically cycling facilities will require more frequent street sweeping and inspection for defects than a road would require.

Further to this, on the City of Vaughan Public Works Online and Reporting Tool should include “cycling facilities” and “recreational trails” as well as other active transportation assets in their reporting types. Access Vaughan should be informed of these established service levels.

Winter Maintenance: With the recent changes to O. Reg. 239/02 Minimum Maintenance Standards (MMS) for Municipal Highways, the City should ensure current practices as they relate to winter maintenance of cycling facilities are consistent with the MMS.

Design for Maintenance: If cycling facilities are physically separated from roadway, they will need to have a minimum width to allow for a maintenance vehicle to pass. Cycling facilities that are not physically separated from the roadway can be plowed regularly, however, they need to be maintained to a higher standard to typical roadways and this should be taken into consideration.

4.1.3. Multi-Use Recreational Trails

Among the factors determining maintenance requirements are existing landscape character and the extent and type of capital improvements. All trails should be inspected regularly to identify any needed repairs and maintenance.

Effective vegetation management is a critical dimension of the maintenance program. It is necessary to preserve and enhance the natural and scenic interest of the trail network and is an important component of trail safety. Adequate sight lines along the trail should be maintained as recommended through Crime Prevention Through Environmental Design (CPTED) principles. Accessibility for Ontarians with Disabilities Act (AODA) clearance requirements for outdoor public spaces must be met.

The City should develop a multi-use recreational trail maintenance program, where the following may be considered:

- Maintain trails by sweeping and clearing vegetation debris and silt that may have accumulated over the winter, or after significant weather events.
- Inspect and clean drainage structures and swales to prevent buildup of debris that could cause significant erosion damage.

- Inspect and maintain bridges and other structures associated with the trail network to ensure structural integrity. Bridges associated with public roads are already on a regular inspection schedule.
- Inspect trail surface and repair asphalt edges, cracks, and surface as required, including re-application of line painting and symbols where applicable.
- Inspect and maintain directional and informational signs along trail corridors.
- Provide trash receptacles to allow for efficient litter pickup. Encourage a "carry-in, carry-out" approach to litter control.
- Monitor potential maintenance concerns following significant storm events
- Inspect trails at regular intervals to identify safety concerns and maintenance requirements related to snow and ice buildup, erosion, tree damage, etc.
- Mowing requirements should include recommendation on minimum mowing distance from trail edge, and recommendation on mowing frequency.
- Potentially hazardous tree limbs and trail obstructions should be identified during regular inspections and promptly removed as required.
- Include recommendations on frequency of vegetation removal along trails, and where the clear zones need to be in relation to horizontal and vertical clearance requirements. Clear zones should be established to meet AODA requirements and respect CPTED principles.
- Control of invasive vegetation (such as invasive plant species that could cause health concerns (ex. poison ivy) or damage to the trail structure (ex. Japanese knotweed) should be considered as part of the multi-use recreational trail maintenance program.

Another key element of the maintenance and management system of the trail revolves around communication and information that allows trail users to provide feedback and report on issues concerning trail maintenance and safety issues. Currently the City does this through their Public Works Report A Problem Program: an online reporting tool that allows citizens to report Public Works issues (<http://pwreportaproblem.vaughan.ca/>). The City should expand the drop-down list of problem type to include multi-use recreational trails and cycling facilities. This component of maintenance could be supported through the establishment of a trail users' organization as well as through effective signage throughout the trail providing users with information on who to contact regarding such matters.

4.2. Designing for Maintenance

Operations and Maintenance staff should be a key stakeholder during the design and approval process for any new active transportation facilities including sidewalks, cycling facilities and multi-use recreational trails as part of both projects being delivered through development and internally through capital programming. The City should integrate facility maintenance access requirements into open space systems which may dually serve as local trail connections.

4.3. Asset Management Strategy

Corporate Asset Management (CAM) is in the process of finalizing a strategic asset management policy and developing asset management plans for all municipal infrastructure assets by 2023 as mandated by O. Reg. 588/17: Asset Management Planning for Municipal Infrastructure. The City should continue its effort to develop a comprehensive inventory of all pedestrian, cycling, shared-

use and multi-use recreational trails (official and unofficial) infrastructure including key attributes to support the planning, design and renewal of these facilities. Including existing publicly accessible bicycle parking locations in the City's asset management database. Continuously update as new infrastructure and facilities are implemented or upgraded.

4.4. Maintenance and Operations Funding

Operating and maintaining the active transportation network and protecting the municipal assets will require a service level and financial commitment from the City and should be embedded into the asset management protocol. The City should adjust, and review maintenance costs and impacts to operating budgets, equipment needs and resources on an annual basis. In a future report, a budget for maintenance and operations will be included. The City should undertake a corporate-wide review and identify mechanisms to link operation and maintenance budget needs associated with capital infrastructure and development projects prior to project budget approval.

The City's existing City-Wide Streetscape Implementation Manual and Financial Strategy is a comprehensive design, construction and financial framework used to manage the design, construction and costing of streetscapes in Intensification Areas and Heritage Conservation Districts in the City. The manual aims to develop streetscapes for all modes of transportation. The next update should consider including cycling as one of the streetscape zones in the Level of Service definitions and financial model for both capital and operating/maintenance costs. The city should review the potential to apply a similar model city-wide (i.e. in areas outside of the Intensification Areas and Heritage Conservation Districts), with consideration for appropriate Level of Service reviews through the Corporate Asset Management Strategy.

SUBMITTED BY CIMA CANADA INC.

400-3027 Harvester Road

Burlington, ON L7N 3G7

T: 289 288-0287 F: 289 288-0285

cima.ca

