



MISSISSAUGA

# Cycling Master Plan



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# 1 | Executive Summary

## Introduction

The number of people riding bicycles for transportation in Mississauga is on the rise. According to Transportation Tomorrow Survey data, between 2011 and 2016 the number of bicycle trips on an average weekday in the city doubled from 0.3% to 0.6% of all trips. Cycling is also an important recreational activity in the city, with thousands of residents and visitors participating in annual cycling events like the Tour de Mississauga and local community rides, as well as using mobile apps to map their rides along Mississauga's roads and trails.

The 2010 Mississauga Cycling Master Plan recommended a bicycle route network and supporting programs to create a multi-modal transportation system. That plan built upon existing trails and bicycle facilities to propose an expanded and connected bicycle network to provide access to key destinations. As a result of that plan and those that came before it, Mississauga has a developing cycling network composed of shared roadways (signed bicycle routes and sharrows), conventional bicycle lanes, boulevard multi-use trails, and off-road trails. The table below shows the kilometres of cycling facilities that were in place before the 2010 plan and at the beginning of 2017, when this update was initiated.

**Lengths of Existing Cycling Network Facilities in Mississauga**

Cycling Facility Type	Constructed before 2010 (km)	Constructed from 2010 to 2016 (km)	Total (km)
Bicycle Lanes	29	25	54
Boulevard Multi-Use Trails	61	27	88
Off-Road Multi-Use Trails	205	16	221
Shared Routes	79	12	91
<b>Total</b>	<b>374</b>	<b>80</b>	<b>454</b>

In January 2017, City of Mississauga staff initiated a project to update the 2010 Cycling Master Plan. Evolving best practices in cycling infrastructure design and new thinking on network planning principles necessitated the update of the plan. This work is now completed and the resulting 2018 Cycling Master Plan is being brought forward in this report to present how it was developed, its findings and refreshed goals, its recommended cycling network and supporting programs, and its recommended implementation and monitoring plans.

## Vision, Goals and Recommendations

The 2018 Cycling Master Plan (2018 CMP) is organized by the vision for cycling in Mississauga, the four goals that work together to realize the vision, and the specific recommendations and actions that will enable the city to achieve those goals.

### Vision

The City of Mississauga will be a place where people choose to cycle for recreation, fitness and daily transportation needs. Cycling will become a way of life that supports vibrant, safe and connected communities and enhances our overall health and quality of life.

### Goals

The four goals of the 2018 CMP are to:

1. Improve safety for cycling;
2. Build a connected, convenient and comfortable bicycle network;
3. Increase the number of cycling trips in Mississauga; and
4. Foster a culture of cycling.

### Recommendations and Actions

The 2018 CMP's recommendations and actions are aimed at achieving its four overarching goals. They have been divided into the seven categories of project implementation to illustrate their key functions in delivering the 2018 CMP, as summarized in the table to the right.

## Summary of Recommended Actions of the 2018 CMP

Category	Recommended Action
1. Planning	Coordinate with partner agencies to implement the 2018 CMP.
	Examine the feasibility of a bike share system in Mississauga.
	Integrate cycling network and supporting facilities into all city planning and capital improvement projects.
	Expand the city's bicycle parking supply, including short-term and long-term facilities on commercial, residential, and city-owned properties.
	Establish programs for routine collection, maintenance, and publication of cycling data.
2. Design	Design a comfortable (low stress) cycling network that is suitable for "Interested but Concerned" cyclists, providing cycling opportunities to people of all ages and abilities.
3. Funding	Increase the city's annual budget allocated to implementing the 2018 Cycling Master Plan.
	Leverage all available funding to expedite project delivery.
4. Project Delivery	Use all available internal and external resources to implement 2018 Cycling Master Plan projects.
5. Promotion and Education	Use targeted marketing and promotion to increase bicycle use.
	Encourage school-based cycling education and promotion.
	Provide education opportunities to cyclists and motorists about bicycle safety, and the opportunities for, and benefits of, cycling.
	Support police enforcement for cyclists and motorists to educate about, and reinforce, safe cycling and driving practices.
6. Operations and Maintenance	Maintain cycling routes so that they are comfortable and free of hazards.
	Maintain bicycle parking.
	Accommodate cyclists in construction/work zones.
7. Evaluation	Develop a monitoring program to evaluate the impacts of new cycling facilities.
	Produce annual report on the progress of the 2018 CMP.

## “Connected, Convenient and Comfortable”

Mississauga residents that participated in the project have indicated that the most significant barrier to cycling is feeling unsafe or uncomfortable. This reported stress most often occurs when cyclists must share space on the road with motor vehicles. Many studies have shown a similar impact of “traffic stress” on cyclists in cities worldwide.

Roadways provide direct access to people’s homes and destinations, and they are the main routes for all travel modes including walking and cycling. Providing comfortable bicycle facilities within the road rights-of-way is necessary to encourage more people to cycle, and increasing the number of cyclists using a roadway network is one of the most effective ways to improve overall cyclist safety.

A successful cycling network is one that makes it possible for people to get to where they want to go (**Connected**) without significant detours (**Convenient**) and without exposing cyclists to conditions that are beyond their tolerance for traffic stress (**Comfortable**). Therefore, bicycle network planning and implementation must consider cyclists’ tolerance for traffic stress, and work to reduce that stress so that the network will function as intended and achieve the 2018 CMP goals.

## Types of Bicycle Route Facilities

Facility	Description
Conventional Bicycle Lane	Signs and pavement markings. Reserved for bicycle use only.
Buffered Bicycle Lane	Bicycle lanes that have a painted buffer to provide extra space between cyclists and other traffic lanes. Reserved for bicycle use only.
Separated Bicycle Lane	Bicycle lanes that are physically separated from other traffic lanes by flexible posts, planters, parking stalls, curbs, or other barriers. Reserved for bicycle use only.
Raised Cycle Track	Bicycle lanes that are physically separated by a curb and raised higher than the street, either to sidewalk level or slightly lower. Reserved for bicycle use only.
Park Multi-Use Trail	Paved trails in park lands, shared by cyclists and pedestrians.
Boulevard Multi-Use Trail	Paved trails in the boulevard beside major roadways, shared by cyclists and pedestrians.
Paved Shoulders	On rural roads, paved shoulders provide a designated space for cyclists to ride.
Signed Bicycle Route	A route shared between cyclists and motorists on local streets with slower speeds and less traffic. May also include traffic calming and design elements to prioritize bicycles.
Sharrows and Signs	A route shared between cyclists and motorists. Includes signs and sharrow pavement markings. May also include traffic calming, low speed limits and design elements to prioritize bicycles.
Advisory Bike Lanes	On narrow roads with low traffic volumes and slow speeds, advisory bike lanes show the preferred space for cyclists on routes shared between cyclists and motorists.



Building a safe and comfortable cycling network means choosing the right type of bicycle facility for each location. Bicycle facilities are chosen based on the goal of reducing the exposure of cyclists to traffic stress and conflict. As illustrated in the table on the previous page, there is a range of bicycle facility types that provide more or less separation between motorists and cyclists. In principle, greater separation should be provided where traffic volumes and operating speeds are higher. There are three types of separation that can be used:

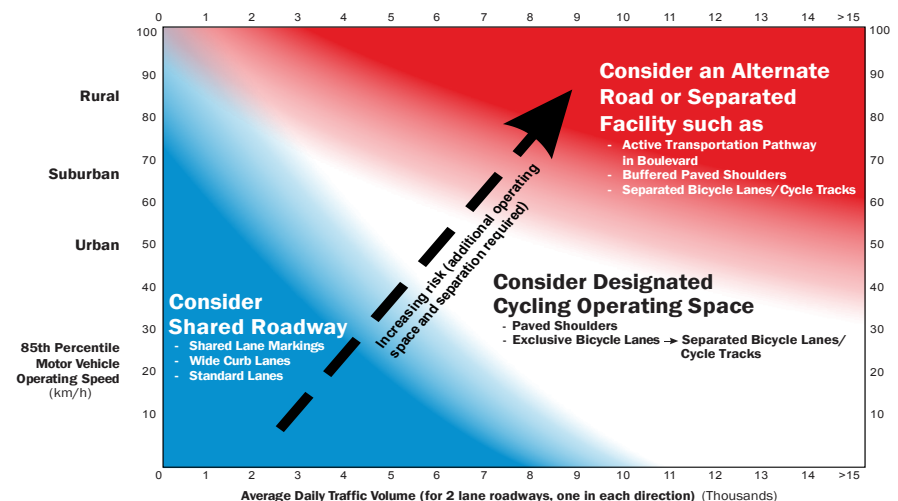
1. Spatial (dedicated space for bicycles separated by a painted line);
2. Physical (physical barriers between the cycling facility and other motor vehicles like bollards, curbs, planters, or parked cars); and
3. Time (stop controls or traffic signals that separate bicycle movements from turning motor vehicles).

One or more of these kinds of separation may be used depending on the facility type and the surrounding environment. However, a context sensitive approach to identifying appropriate bicycle facility types is critical. Many factors must be taken into account such as:

- the frequency of intersections and driveways;
- the visibility of cyclists particularly when separated from, or set back from, the roadway;
- an increased potential for conflict at intersections and driveways that is introduced by two-way cycling facilities; and
- potential conflict between cyclists and pedestrians on mixed-use facilities.

This project followed the bicycle facility type selection process, outlined in *Ontario Traffic Manual Book 18* (2013). This is a three-step process that begins by selecting a facility type based on motor vehicle speeds and volumes as shown in the figure below, followed by a detailed look at other traffic and site specific characteristics to determine the most suitable kind of facility.

### OTM Book 18—Cycling Facility Pre-Selection Tool (Image Credit: MMM 2013)



### Developing the Recommended Network

To understand the needs and opportunities to improve cycling in Mississauga, development of the 2018 CMP included a detailed review of all available cycling-related data and consultation with Mississauga residents and other stakeholders.

## Public and Stakeholder Outreach

A thorough public engagement process was undertaken in the development of the 2018 CMP, including two public open houses, regular meetings with a working group of the Mississauga Cycling Advisory Committee, information tables at five local community events, and information tables at community centres and libraries in all 11 city wards. In addition to social media, print and digital advertising efforts, project staff also reached out to citizen committees, residents' associations, business improvement associations and Smart Commute members to encourage participation in the project. Along with the public outreach efforts, the project team engaged with technical stakeholders including internal and external partners. A full list of events and organizations that were consulted is available in **Appendix VII**.

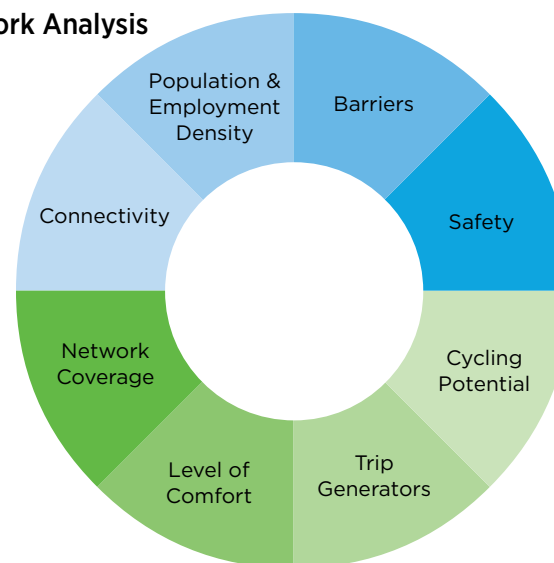
## Planning the Cycling Network

Cycling network planning was guided by the vision and goals of the 2018 CMP, and informed by an analysis of the existing conditions, needs and opportunities research, and input from technical stakeholders and the community. Six route selection principles were developed during this process, which were used to review the existing cycling network plan and to guide recommended changes.

### Route Selection Principles:

- Integrate new facilities with the existing cycling network
- Provide continuous and barrier-free routes
- Provide connections to key destinations
- Prioritize connections to public transit
- Provide access to all neighborhoods
- Provide safe and comfortable routes

## Cycling Network Analysis



Data analysis tools were developed using available cycling-related data to evaluate and update the proposed cycling network from the 2010 plan. Data categories are illustrated in the figure above and include:

- **Population and Employment Density**—Canada Census data;
- **Connectivity**—gap analysis of the existing and proposed network;
- **Network Coverage**—proximity of residences and businesses to the cycling network;
- **Level of Comfort**—traffic stress analysis of the existing and proposed cycling routes;
- **Trip Generators**—proximity of the bicycle network to community facilities, transit, and other important destinations;
- **Cycling Potential**—location of short auto trips (5 km or less) that could potentially be converted to cycling trips—Transportation Tomorrow Survey data (2011);

- **Safety**—Peel Regional Police collision data; and
- **Barriers**—location of geographical and human-made barriers (rivers, ravines, highways, rail corridors).

## Proposed Cycling Network

The 2018 Cycling Master Plan envisions a comfortable, connected and convenient cycling network that includes separated bike lanes, cycle tracks, multi-use trails, conventional bike lanes and shared routes. Once implemented, these facilities will create a cycling network that Mississauga residents and visitors of all ages and abilities will feel comfortable using.

The approximate lengths of each facility type to be built or upgraded, including the approximate cost, are summarized in the table below.

**Summary of proposed cycling network upgrades, additions and costs**

Facility Type	Existing Length (km)	Upgrade Length (km)	Additional Length (km)	Total Length (km)	Total Cost (\$ million)
Cycle Tracks/Separated Bike Lanes	0	20	150	170	106.8
Bike Lanes	51	1	56	108	12.4
Multi-Use Trails (Boulevard)	68	15	125	208	40.8
Shared Routes	87	0	131	218	6.6
Multi-Use Trails (Parks)	70	34	89	193	67.3
<b>Totals</b>	<b>276</b>	<b>70</b>	<b>551</b>	<b>897</b>	<b>233.9</b>

Note: Lengths may differ from other sources due to the measuring methodology used. Parkland multi-use trail lengths only include major trails, and minor trails that connect cycling facilities.



## Implementing the 2018 CMP

### Next Steps

The 2018 Cycling Master Plan is a long-term plan that, when fully implemented, will improve safety for cycling; provide a connected, convenient and comfortable bicycle network; increase the number of cycling trips in Mississauga; and foster a culture of cycling. It is a plan that belongs to Mississauga residents and will continue to be guided by the community. As each cycling network project is implemented, community members and other stakeholders will have the opportunity to provide input. For the cycling network to achieve the goals of the 2018 CMP, it must be complete with no gaps. Completing the cycling network is a key priority to meeting the City of Mississauga's Official Plan, Strategic Plan and Climate Strategy goals.

Ideally, the entire proposed cycling network should be built within a 20-year timeframe. The 2018 CMP aims to coordinate the construction of new infrastructure with scheduled road rehabilitation and major road construction projects, where possible. It takes into account the different funding streams for facilities along roadways and those on parklands, as well as notes where facilities can be funded by other parties, such as Metrolinx or a private developer.

The City of Mississauga currently funds its cycling infrastructure through two departmental budgets: Transportation and Works, within road rights-of-way (ROWs); and Community Services, within parkland. The total estimated costs of the 2018 CMP, provided in the table to the right, are based on stand-alone construction of all cycling facilities and upgrades.

### Total Cost of Network and Structures

Network Components	Cost
Primary Network	\$134,000,000
Secondary Network	\$34,000,000
Off-Road Trail Network (Community Services)	\$38,000,000
Off-Road Trail Road Crossings (Transportation & Works)	\$18,000,000
Major Crossing Structures	\$43,000,000
<b>Total Network and Structures Cost</b>	<b>\$267,000,000</b>

### Funding Scenarios

The Active Transportation Office (within the Transportation and Works Department) programs the capital plan for cycling infrastructure on Mississauga-owned road rights-of-way (ROWs). Capital planning for off-road trails outside of road ROWs is led by the Community Services Department. As a result, there are two funding recommendations, one for Roads Service Area and a second for the Parks and Forestry Service Area.

#### Funding Scenarios—Roads Service Area

Four capital funding scenarios were developed for the cycling infrastructure to be planned, budgeted and constructed by the Roads Service Area. Each scenario would require a different number of years to complete the network. This represents the primary and secondary on-road networks, which make up the bulk of the total cycling network.

## Roads Service Area Funding Scenarios

Scenarios	A (current)	B	C	D
Yearly funding allotment	\$1,450,000	\$3,575,000	\$5,262,500	\$6,950,000
Length constructed per year (km)	5	12	18	25
Years to complete network	95	40	27	20

Major crossings require more detailed design work to determine budget estimates; that is beyond the scope of this plan. These structures are typically funded on a project-to-project basis, and thus not included in the funding scenarios.

## Funding—Parks and Forestry Service Area

Trails through parklands are planned, budgeted and built by the Community Services Department, in coordination with the Active Transportation Office. Trail construction and rehabilitation has been consistent, and major network pieces are funded and under construction. Funding from the Region of Peel and Ontario Municipal Commuter Cycling program has been fairly consistent. Community Services funds construction on a project-to-project basis. This is considered adequate at current levels. Following approval of the 2018 Cycling Master Plan, project prioritization will be undertaken by the Community Services Department, in consultation with the Active Transportation Office.

## Conclusion

The 2018 Cycling Master Plan is a long-term plan that will be implemented over many years. It is a plan that belongs to Mississauga residents and will continue to be guided by the community. As each cycling network project is implemented, community members and other stakeholders will have the opportunity to provide input. For the cycling network to achieve the goals of the 2018 CMP, it must be complete with no gaps. Completing the cycling network is a key priority to meet the City of Mississauga's Official Plan, Strategic Plan and Climate Strategy goals.



## 2 | Introduction

The number of people riding bicycles for transportation in Mississauga is on the rise. According to Transportation Tomorrow Survey data, between 2011 and 2016 the number of bicycle trips on an average weekday in the city doubled from 0.3% to 0.6% of all trips. Cycling is also an important recreational activity in the city, with thousands of residents and visitors participating in annual cycling events like the Tour de Mississauga and local community rides, and using mobile apps to map their rides along Mississauga's roads and trails.

Beginning with the first boulevard multi-use trail on Rathburn Road in 1985, the City of Mississauga has been working to include bicycles in the city's transportation and trail networks so that more people choose to ride bicycles for all kinds of trips—to work, to school, to run an errand, go out to dinner or a show, meet a friend at the mall, or just to get some exercise.

Cycling is an environmentally responsible way to travel, and it is also a healthy and economically smart choice. Choosing to ride a bicycle regularly can reduce the costs of owning a car and can help to reduce the risk of many chronic diseases that cost our health care system billions of dollars a year. When included as part of the transportation system, cycling, along with public transit, can help to reduce traffic congestion. 82% of all trips in Mississauga on an average weekday that are 5 km or less are completed in cars. Many of these trips could feasibly be converted to cycling if connected, convenient, safe and comfortable cycling routes were available.

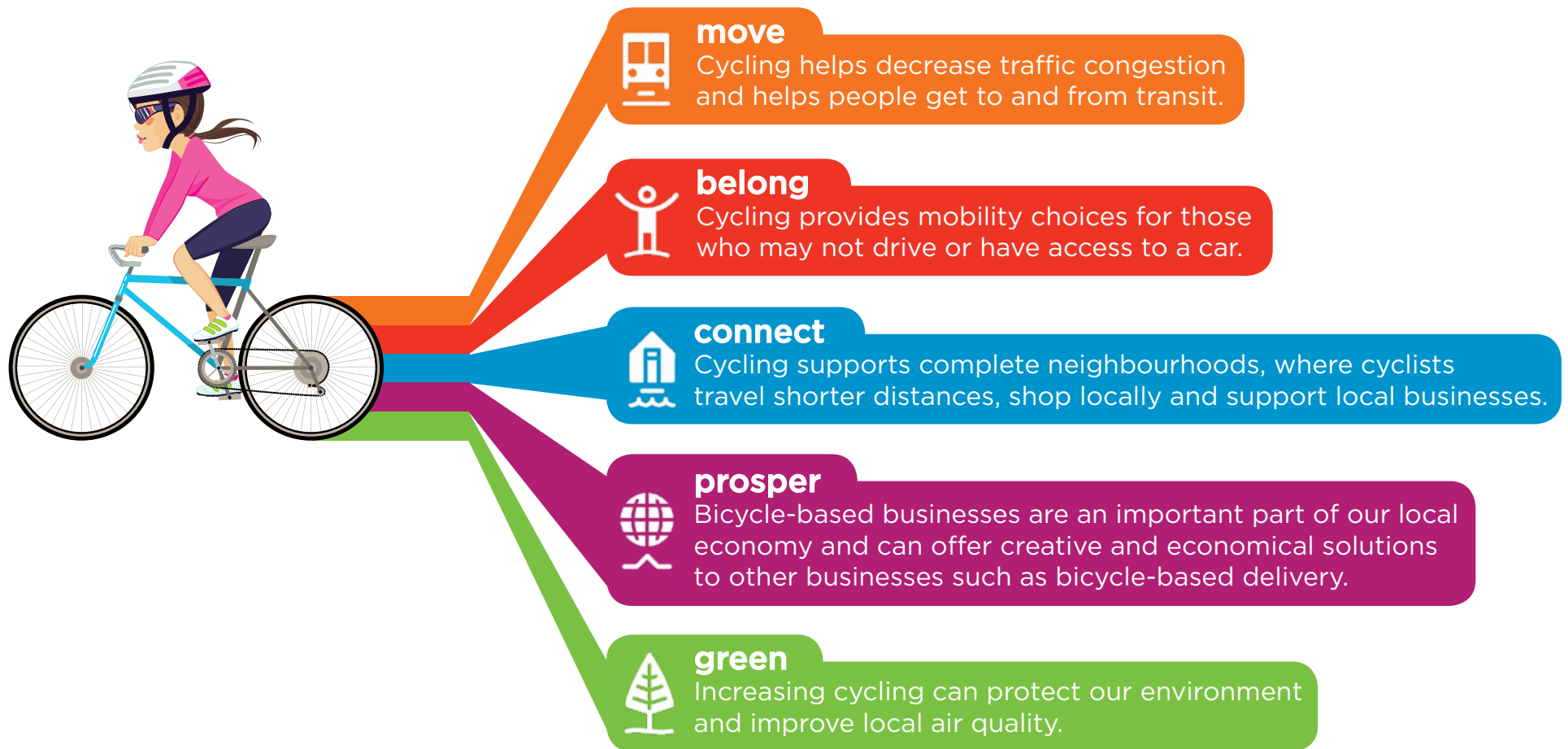
Mississauga's 2010 Cycling Master Plan recommended a cycling network and supporting programs to create a multi-modal transportation system. As a result of that plan and those that came before it, Mississauga has a developing cycling network composed of shared roadways (signed bicycle routes and sharrows), conventional bicycle lanes, boulevard multi-use trails, and off-road trails.

The purpose of the 2018 Cycling Master Plan is to transform Mississauga into a bicycle-friendly city, where people will choose to cycle for recreation, fitness and daily transportation needs. This plan is focused on making cycling more comfortable, convenient, and fun so that it is a viable means of achieving many of the city's Strategic Plan goals.



As such, this plan recommends a network of connected cycling facilities that are comfortable for cyclists of all ages and abilities. It also recommends policies and programs that will support cycling by all types of cyclists.

**Figure 1:** Connection between cycling and Mississauga's strategic plan goals



The rest of the 2018 Cycling Master Plan is divided into the following chapters:

- **Chapter 3: Goals and Recommendations**  
This chapter outlines the vision, goals and recommendations for the 2018 CMP. It lists all the recommendations and actions required to move the plan forward, and describes the policy documents which support the plan.
- **Chapter 4: Existing Cycling Network**  
Chapter 4 is a snapshot of the cycling facilities implemented as of the end of 2016. It provides a picture of progress to date and sets the stage for Chapter 5.
- **Chapter 5: Needs and Opportunities**  
Chapter 5 provides a summary of cycling data collected in Mississauga since the 2010 Cycling Master Plan. This information gives us a clearer picture of the impacts of the cycling network development outlined in Chapter 4, and the issues that need to be addressed to achieve the 2018 CMP's vision.
- **Chapter 6: Recommended Cycling Network**  
This chapter outlines a recommended cycling network that will meet the needs of cyclists of all ages and abilities. It includes information on the planning process that was used, the recommended routes and types of facilities, and how these will create a connected, comfortable and convenient network for travelling by bicycle.
- **Chapter 7: Recommended Supporting Programs**  
Chapter 7 discusses the programs that are needed to help support more people cycling for recreation and for transportation—programs like bicycle parking, education and promotion.
- **Chapter 8: Implementing the Plan**  
Chapter 8 outlines the funding needed to implement this plan, and how long the build-out would take under various funding scenarios. It also outlines the recommended five-year network implementation plan.
- **Chapter 9: Evaluating the Plan's Success**  
Tracking the progress of a plan is necessary to measure its success. This chapter provides a framework of measurable objectives and data sources that will be collected over time and used to evaluate the 2018 CMP step by step.
- **Chapter 10: Next Steps**  
The 2018 Cycling Master Plan is a long-term plan that will be implemented over the next 20+ years. Chapter 10 outlines the process that cycling projects follow, how decisions are made and where there are opportunities for the public to help shape those projects.
- **Chapter 11: Appendices**  
A list of appendices (that are available online) is provided at the end of this document. These contain additional supporting research and more detailed information that contributed to the development of this plan.



## 3 Goals and Recommendations

This chapter outlines the vision for cycling in Mississauga, the four goals that work together to realize the vision, and the specific recommendations and actions that will enable us to achieve those goals.

### 3.1 Vision

The City of Mississauga will be a place where people choose to cycle for recreation, fitness and daily transportation needs. Cycling will become a way of life that supports vibrant, safe and connected communities and enhances our overall health and quality of life.

### 3.2 Goals

The four goals of the 2018 Cycling Master Plan are:

1. Improve safety for cycling.
2. Build a connected, convenient and comfortable cycling network.
3. Increase the number of cycling trips in Mississauga.
4. Foster a culture of cycling.



### 3.3 Recommendations and Actions

The 2018 CMP's recommendations and actions are aimed at achieving the four overarching goals. They have been divided into the seven categories of project implementation to illustrate their key functions in delivering the 2018 CMP.

**Table 1:** Recommendations and actions

1.0 Planning	
<b>1.1 Coordinate with partner agencies to implement the 2018 Cycling Master Plan.</b>	1.1.1 Work with regional, provincial and federal governments, partner agencies, transit authorities, major landowners, property managers, employers and institutions to ensure that Cycling Master Plan recommendations are incorporated into their planning and areas of responsibility.
	1.1.2 Work with regional, provincial and federal governments, partner agencies, transit authorities, major landowners, property managers, employers and institutions to incorporate their plans and programs into the funding, study, design, and construction of Cycling Master Plan projects, whenever project scope allows.
	1.1.3 Work with MiWay, Metrolinx/GO Transit to improve bicycle access to transit stations and stops, and on transit vehicles, including during peak hours.
	1.1.4 Work with MiWay, Metrolinx/GO Transit to provide and maintain secure bicycle parking at transit stations and stops.
<b>1.2 Examine the feasibility of a bike share system in Mississauga.</b>	1.2.1 Undertake a feasibility study to examine the potential for a bike share system; for example in the downtown, Port Credit, and/or combined areas that would support the Hurontario LRT project, anticipated to be completed in 2022.
	1.2.2 Examine opportunities to implement a pilot bike share project in Mississauga in the short-term to inform feasibility analyses.
<b>1.3 Integrate cycling network and supporting facilities into all city planning and capital improvement projects.</b>	1.3.1 Update Official Plan Schedule 7 Long-Term Cycling Routes to include recommended updates to primary on-road and off-road cycling routes and ensure alignment with provincial and regional cycling network plans.
	1.3.2 Examine opportunities to prioritize shared cycling routes in the city's traffic calming policy.
	1.3.3 Coordinate traffic calming plans on designated cycling routes with the Active Transportation Office to ensure bicycle-friendly designs.
	1.3.4 Include consideration of cycling access and safety in Transportation Impact Assessments of new developments.
	1.3.5 Work with the Community Services Department to establish a prioritization matrix for implementation of off-road trails which includes consideration of cycling network, connectivity and coordination opportunities.

<b>1.4 Expand the city's bicycle parking supply, including short-term and long-term facilities on commercial, residential, and city-owned properties.</b>	1.4.1 Launch a comprehensive bicycle parking program to be managed by the Active Transportation Office with a dedicated staff lead and consistent funding.
	1.4.2 Include bicycle parking standards for new developments in the Zoning By-Law as recommended through the Transportation Demand Management Strategy.
	1.4.3 Produce bicycle parking design guidelines to support implementation of bike parking on private property as recommended through the Transportation Demand Management Strategy.
	1.4.4 Conduct a bike parking audit of all city-owned buildings and parks, and establish priorities for expanding bicycle parking supply at these city facilities.
	1.4.5 Research enhanced bicycle parking facilities and develop demonstration projects for facilities such as bicycle lockers, bike corrals and sheltered bicycle parking.
	1.4.6 In cooperation with MiWay, and other potential partners, determine the viability of implementing a bike station/bike room at the City Centre Transit Terminal.
	1.4.7 Review city special event procedures and policies for bicycle parking and update to include bicycle parking requirements.
<b>1.5 Establish programs for routine collection, maintenance, and publication of cycling data.</b>	1.5.1 Develop a bicycle counting program that integrates with the city's traffic data management system, and includes annual or bi-annual city-wide cycling counts.
	1.5.2 Routinely post up-to-date cycling network and bicycle parking information on the city's open data portal.
	1.5.3 Collect cycling facility maintenance, repair and upgrade information, and include cycling facility condition data in the city's asset management system.
	1.5.4 Provide access to bicycle count data on the city's open data portal.
	1.5.5 Expand the number of automated bicycle counters at key locations across the city.
	1.5.6 Work with Region of Peel to identify opportunities for improving cycling data collection through the Region of Peel Cordon Count Program and other monitoring programs.

## 2.0 Design

### 2.1 Design a comfortable (low stress) cycling network that is suitable for “interested but concerned” cyclists, providing cycling opportunities to people of all ages and abilities.

- 2.1.1 Design a connected and comfortable network of cycling facilities as recommended in **Figure 15**.
- 2.1.2 Develop a bicycle facility design guide that would include: all types of on-road and off-road bicycle facilities recommended in the cycling network, and a toolbox of context sensitive intersection crossing treatments tailored to the Mississauga context.
- 2.1.3 Update Mississauga Roadway Engineering Standards and Guidelines to improve safety for cyclists and all road users, including identification of appropriate design and control vehicles, and updated guidance on curb radii.
- 2.1.4 Develop a plan to retrofit intersections along existing bicycle facilities that will, wherever technically possible, include bicycle-integrated designs and remove barriers such as dismount and walk requirements, and obstacles including traffic light standards, P-gates and bollards.
- 2.1.5 Develop a program to enhance existing on-road and off-road cycling facilities identified for upgrade in the Cycling Master Plan to ensure the design of cycling facilities is consistent with best practices and achieves the design quality that will be recommended in the Mississauga bicycle facility design guide.
- 2.1.6 Provide intersection treatments on all future bicycle facilities to clearly indicate the correct positioning and right of way for cyclists and motorists, and improve safety for all road users.
- 2.1.7 Request authorization from the Province of Ontario to implement a pilot project to test bicycle crossings at mid-block and roundabout locations where pedestrian crossovers are warranted by current provincial guidance.
- 2.1.8 Investigate opportunities to engage with experts in the field of cycling, e.g., convening design workshops with international experts and city planning and design staff to address challenging cycling facility design problems and tailor them to the Mississauga context.
- 2.1.9 Design and construct primary boulevard trails and primary off-road trails with consideration for separating cyclists and pedestrians, or protecting for future separation wherever appropriate.
- 2.1.10 Implement a pilot project to install and evaluate a protected intersection.
- 2.1.11 Coordinate the design of all cycling facilities with operations staff to identify potential maintenance issues and design strategies to help mitigate these issues.
- 2.1.12 Continue to implement the city’s wayfinding program across the cycling network.



3.0 Funding	
3.1 Increase the city's annual budget allocated to implementing the 2018 Cycling Master Plan.	3.1.1 Through the city budget planning process, increase the annual cycling budget to implement the recommended actions in this Cycling Master Plan Update.
	3.1.2 Through the city budget planning process, assess and prepare for future staffing, consultant, and capital funding needs as projects arise.
3.2 Leverage all available funding to expedite project delivery.	3.2.1 Pursue funding from all available grant sources and use existing cycling budget to match grant funding as needed.
	3.2.2 Actively develop Cycling Master Plan projects to ensure the city is in the best position to compete for available grants.
4.0 Project Delivery	
4.1 Expand internal and external human resources to implement 2018 Cycling Master Plan projects.	4.1.1 Over the short-term, create a minimum of two new staff positions in the Active Transportation Office to support the planning, consultation, engineering and evaluation of cycling facilities.
	4.1.2 Develop and execute a long-term staffing plan that includes city staff and consultant support and is sufficient to implement recommended cycling network projects including all internal and external consultation and engagement activities.
	4.1.3 Expand staff capabilities in the Active Transportation Office to include full-time staff with GIS expertise and provide access to city data.
5.0 Promotion and Education	
<i>Encouragement</i>	
5.1 Use targeted marketing and promotion to increase bicycle use.	5.1.1 Develop a public brand to represent cycling infrastructure, and initiatives that promote Mississauga as a "bicycle-friendly city."
	5.1.2 Create public communication channels for the Active Transportation Office, including a website, e-mail newsletters and social media.
	5.1.3 Provide up-to-date, convenient information about the cycling network, cycling programs and bicycle parking through the online public communication channels and published cycling maps.
	5.1.4 Celebrate and promote the opening of new bicycle facilities.
	5.1.5 Support TDM Plan initiatives for Smart Commute members and other major employers that promote cycling among employees, through marketing, promotion, incentives and infrastructure like bike parking and employee bike share.

	5.1.6 Work with Metrolinx/GO Transit and MiWay to promote the use of bicycle parking on transit properties, and combined cycling-transit commuting as part of a multi-modal transportation system.
	5.1.7 Support community organizations and other third parties that are delivering community cycling events.
<i>Education</i>	
<b>5.2 Encourage school-based cycling education and promotion.</b>	5.2.1 Promote and support Region of Peel's School Travel Planning, Bike to School Week, and the school bike rack program.
<b>5.3 Provide education opportunities to cyclists and motorists about bicycle safety, the opportunities for, and benefits of, cycling.</b>	5.3.1 Work with partners to develop education campaigns, resources and content that teach about cycling safety on different types of cycling facilities. This will help drivers and cyclists become more familiar with how cycling facilities operate and shift public perceptions to better reflect empirical evidence on bicycle facility safety.
	5.3.2 Continue the Cycling Ambassador Program to promote safe cycling and support public engagement.
	5.3.3 Provide and promote bicycle skills training programs for cyclists of all ages and abilities.
<i>Enforcement</i>	
<b>5.4 Support police enforcement for cyclists and motorists to educate about, and reinforce, safe cycling and driving practices.</b>	5.4.1 Collaborate with Peel Regional Police to support focused enforcement of road safety laws in areas with the greatest cycling crash risk/injury severity. Also collaborate with them to encourage cycling.
<b>6.0 Operations and Maintenance</b>	
<b>6.1 Maintain cycling routes so that they are comfortable and free of hazards.</b>	6.1.1 Develop a maintenance program for the cycling network that specifies maintenance activities, and establishes cycling route classifications for levels of service including priority routes.
	6.1.2 Update 311 information categories to better promote the collection of information specific to cycling through 311 and the Pingstreet mobile app.
	6.1.3 Promote Pingstreet to cyclists and use this tool to solicit maintenance-related feedback on the cycling network.
	6.1.4 Establish a winter cycling network with priority snow-clearing, and promote winter cycling in coordination with the Region of Peel.

<b>6.2 Maintain bicycle parking.</b>	6.2.1 Develop a program to manage the repair of damaged bicycle racks and the removal of abandoned bicycles from city-owned bicycle parking.
	6.2.2 Include existing and future bicycle parking locations in the city's asset management database.
<b>6.3 Accommodate cyclists in construction/work zones.</b>	6.3.1 Develop mandatory accommodations for bicycles in work zones, including requirements for temporary routes and detours.
<b>7.0 Evaluation</b>	
<b>7.1 Develop a monitoring program to evaluate the impacts of new cycling facilities.</b>	7.1.1 Collect before and after data on new cycling facilities to evaluate the impact on all road users, e.g., bicycle and motor vehicle volumes, travel time and speed analyses, and intercept survey data.
<b>7.2 Produce an annual report on the progress of the 2018 Cycling Master Plan.</b>	7.2.1 Prepare an annual report on cyclist count data and its relation to Cycling Master Plan goals and recommendations.
	7.2.2 Prepare and present a report to the Mississauga Cycling Advisory Committee and City Council outlining the progress in achieving the goals of the 2018 Cycling Master Plan based on the Performance Monitoring Framework.



### 3.4 Policy Context

Many local, regional and provincial policies provide context for this Plan and have informed the planning process. A full list of the plans, policies and other resource documents that provided the background policy framework for this project is included in **Appendix IV**.

#### 3.4.1 Official Plan and Strategic Plan

Mississauga's Official Plan envisions a city where integrated land use and transportation planning will create an environment of "distinct, complete communities" that support many different options for moving safely and conveniently around the city. The city's Strategic Plan vision of vibrant, safe and connected communities is supported by five strategic pillars of change: move, belong, connect, prosper, and green. The 2018 Cycling Master Plan goals and recommendations contribute to each of these pillars, and are specifically aligned with Strategic Plan goals to develop a transit-oriented city and connected communities with more mobility choices.

Both the Official Plan and Strategic Plan position cycling as a key part of a multi-modal transportation system that also includes walking, public transit, shared mobility, personal motor vehicles and goods movement. The 2018 Cycling Master Plan goals and recommendations are consistent with this vision and together with the Transportation Master Plan, Transportation Demand Management Strategy and Implementation Plan, and Parking Master Plan, outline the actions needed to achieve it.

#### 3.4.2 New and Developing Transportation Policies

##### Transportation Safety and Vision Zero

In December 2017, the Council of the Region of Peel adopted the framework of *Vision Zero* to reduce the number of injuries and fatalities on regional roads. *Vision Zero*, a concept that originated in Sweden in 1997, is a framework that coordinates efforts and resources among agencies and stakeholders to prevent fatal and serious injuries from motor vehicle collisions. The framework derives its name from the principle that no loss of life is acceptable, and therefore life and health should never be exchanged for other benefits in society. The Vision Zero framework acknowledges that the way the transportation system is designed, built and operated must be changed, because it is not realistic to expect that people will not make mistakes. This means that safety should be prioritized over speed, convenience or cost, and the transportation system should be forgiving of human error.

To realize this vision, the Region of Peel has developed a Transportation Safety Strategic and Operational Plan in cooperation with the City of Mississauga and other major stakeholders. The long-term goal for the 2018 CMP is zero fatal and injury collisions, with a near-term goal of 10% reduction in fatal and injury collisions by 2022 on regional roads. By adopting the Vision Zero framework, the Region of Peel has committed to working collaboratively with partner agencies, including the City of Mississauga, to develop new programs and enhance existing programs to promote road safety.

In February 2018, Mississauga City Council also passed a resolution to adopt Vision Zero. An operational plan is under development and near-term goals for the reduction of fatal and injury collisions are under consideration.

The 2018 Cycling Master Plan goals and recommendations are closely aligned with the concept of Vision Zero. Designing a comfortable cycling network that is suitable for “interested but concerned” cyclists will provide cycling opportunities to people of all ages and abilities. It will also help to improve safety for all road users by including design features that will improve visibility, reduce conflicts, and slow traffic speeds at potential conflict points. Similarly, promotion and education, operations and maintenance, and evaluation recommendations all strive to achieve a safe cycling environment that is a critical part of a Vision Zero framework.

#### Transportation Master Plan

The city’s first Transportation Master Plan (TMP) is being developed to provide a strategic, long-term planning framework to guide transportation decision-making for all travel modes, including cycling, until 2041. The TMP will set priorities in support of the city’s Strategic Plan, and will be designed to work in tandem with the city’s Official Plan to realize the vision of a multi-modal transportation system in Mississauga.

The 2018 Cycling Master Plan was developed in close coordination with the developing TMP. The 2018 Cycling Master Plan goals and recommendations will help to achieve the TMP vision and goals, and will directly support the TMP’s recommended action items.

#### Transportation Demand Management Strategy and Implementation Plan

The Transportation Demand Management (TDM) Strategy and Implementation Plan highlights the importance of multi-modal transportation to a rapidly growing, urbanizing city like Mississauga. The TDM Strategy’s objectives include more efficient use of existing transportation infrastructure and shifting travel behaviour away from personal motor vehicles to other more sustainable modes including cycling. The Strategy frames cycling in the broader context of TDM and demonstrates the important role that cycling plays in an efficient, effective and sustainable transportation system.

The 2018 Cycling Master Plan goals and recommendations will help to realize the TDM Strategy’s objectives by guiding implementation of the cycling network and supporting programs needed to increase the attractiveness of cycling in Mississauga.

#### Parking Master Plan

The Parking Master Plan and Implementation Strategy will guide future decisions regarding the provision and management of automobile parking in Mississauga. Similar to the TMP, this plan has been under development at the same time as the Cycling Master Plan update. The Parking Master Plan recognizes the importance of parking to the transportation system and recommends a strategic approach to parking provision and management that will support the city’s vision of a multi-modal transportation system for people of all ages and abilities that does not require dependence on personal automobiles for travel. The Parking

Master Plan acknowledges that the Cycling Master Plan and TDM Strategy and Implementation Plan have both analyzed and provided recommendations with regard to the supply and management of bike parking on public and private property. Parking Master Plan recommendations include incorporating bicycle parking rates in the city's Zoning By-Law, developing bicycle parking design guidelines and incorporating this guidance into the city's Urban Design Guidelines and Standards.

### Region of Peel Sustainable Transportation Strategy

The Region of Peel Sustainable Transportation Strategy (STS) is a component of the region's Long Range Transportation Plan (LRTP) which outlines the region's strategy for addressing long-term transportation and growth-related issues. The STS emphasizes the need to plan for environmental, social, and economic sustainability and identifies the region's roles and responsibilities relating to sustainable transportation modes: walking, cycling, carpooling, transit and teleworking. The STS envisions a transportation network where 50% of peak period trips are taken by sustainable modes by 2041. Recommended actions regarding cycling aim to provide comfortable, continuous cycling facilities, improve year-round maintenance of cycling facilities, expand bicycle parking and other end-of-trip facilities, and promote cycling across the region. A regional cycling network has been identified as a key component of the STS. This regional cycling network was closely coordinated with the Cycling Master Plan update so the recommendations at both the regional and city levels align with one another.

### Provincial Cycling Network Plans

#### *Metrolinx 2041 Regional Transportation Plan (RTP)*

In September 2017, Metrolinx—the province's transportation agency—officially released the draft version of its 2041 Regional Transportation Plan for the Greater Toronto and Hamilton Area (GTHA). The RTP's vision is for a sustainable transportation system that is aligned with land use, and supports healthy and complete communities. The RTP identifies a regional cycling network that will grow from the existing 990 km today to 2,000 km of connected cycling facilities. It also aims to double the number of walking and cycling trips and sees 60% of school trips being made by walking or cycling in the GTHA by 2041. Regional cycling network development was undertaken in consultation with the City of Mississauga and is reflected in 2018 Cycling Master Plan recommendations.

#### *Ontario Ministry of Transportation Cycling Strategy: CycleON*

Ontario's cycling strategy envisions a future where Ontario is recognized as the best Canadian province for cycling and ranked among the top 10 jurisdictions worldwide for cycling. This includes a built environment that supports and promotes safe cycling for people of all ages and provides an interconnected cycling network across the province.

The Strategy's second Action Plan proposal (Action Plan 2.0) was released for public comment in February 2018. Proposed actions include sustained investment in new cycling infrastructure through the Climate Change Action Plan 2017–2021, developing a long-term implementation plan for the recommended province-wide cycling network, providing public education and support for safety and promotional initiatives, improving cycling safety and increasing opportunities for cycling tourism.

### 3.4.3 Provincial Legislation

There have also been important changes to provincial legislation in the last few years that aim to improve safety for all road users including cyclists. Some of these changes create opportunities for municipalities to improve conditions for cycling. Recent changes include:

- Allowing bicycle traffic signals to be used to direct bicycle traffic at intersections;
- Requiring cyclists to obey bicycle traffic signals where they exist;
- Requiring motorists to leave a one-metre distance between themselves and cyclists when passing;
- Increased penalties for opening a vehicle door into the path of a cyclist or any other road user; and
- Increased fines for cyclists who don't comply with the requirements for lights, reflectors and reflective material.

New provincial legislation has been developed to introduce new and harsher penalties for distracted driving, careless driving, driving under the influence of alcohol or drugs, and failing to yield to pedestrians at pedestrian crossings.

### 3.5 Evolving Design Guidance

Bicycle facility design in North America is a field that is rapidly changing and evolving. Design guidance is regularly updated as design solutions are reviewed and adapted to improve cycling safety and comfort, encourage cycling for a variety of trip purposes, and support people of all ages and abilities to ride bicycles. Several bicycle facility design manuals have been developed and updated since Mississauga's first Cycling Master Plan and have informed the direction and recommendations of this 2018 plan including the Transportation Association of Canada *Geometric Design Guide for Canadian Roads* (June 2017), *Ontario Traffic Manual Book 18* (2013), which is on schedule for update in 2018, and other local and regional design guidance being developed and tested in the GTHA, across Canada and throughout the United States. A list of current design guides reviewed for this project are included in **Appendix V**. These and other international sources should be taken into consideration for current cycling network projects and to provide context for Recommendation 2.1: Design a comfortable (low stress) cycling network that is suitable for "interested but concerned" cyclists, providing cycling opportunities to people of all ages and abilities.



## 4 Existing Cycling Network

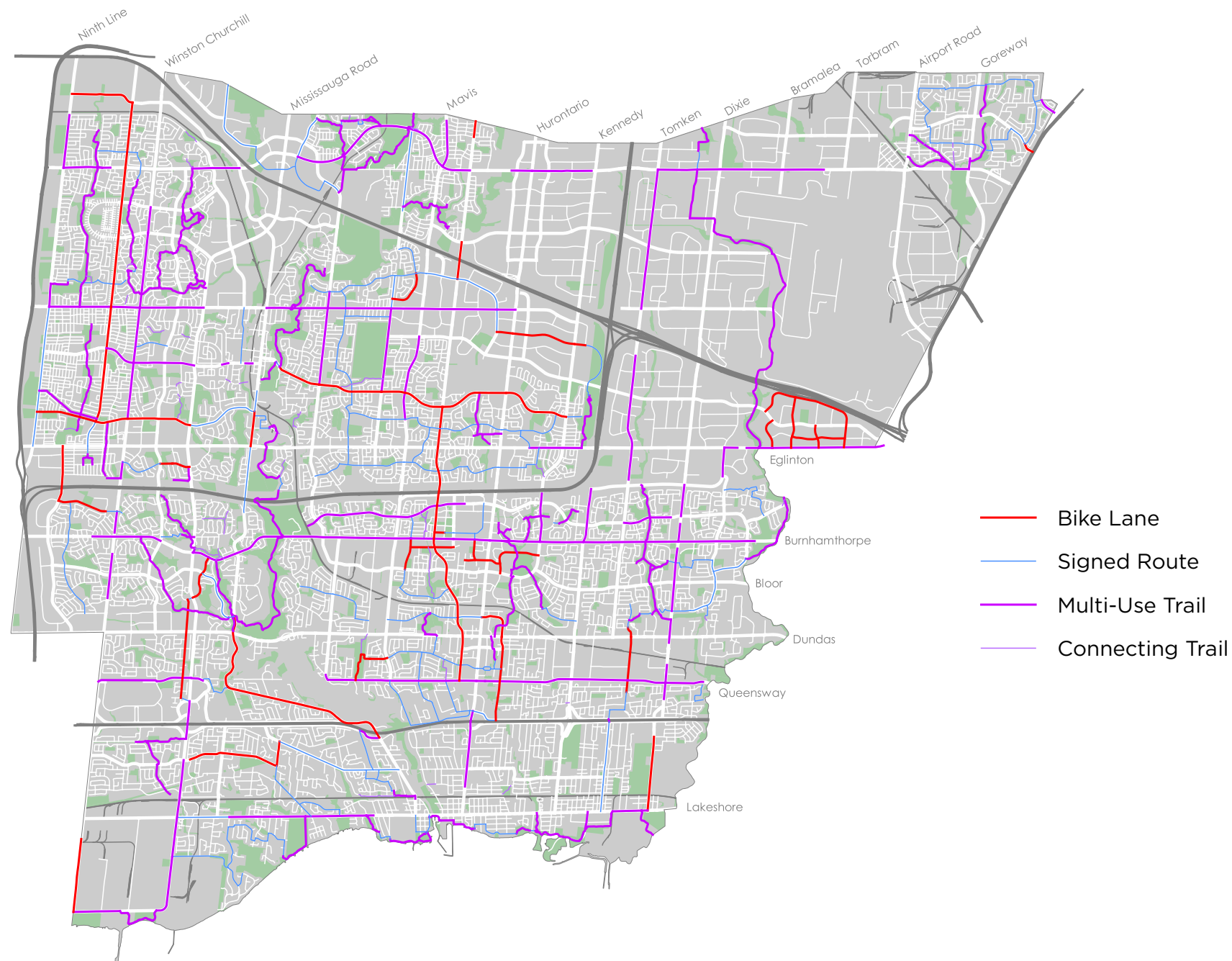
The City of Mississauga has a developing cycling network composed of shared roadways (signed bicycle routes and sharrows), conventional bicycle lanes, boulevard multi-use trails, and off-road trails in parks.

**Figure 2** shows the existing cycling network. In 2010, the city's Cycling Master Plan built upon existing trails and bicycle facilities to propose an expanded and connected cycling network that provides access to key destinations. **Table 2** shows the kilometres of cycling facilities that were in place before the 2010 plan and up to the time this project was initiated.

**Table 2:** Lengths of existing cycling network facilities in Mississauga

Cycling Facility Type	Constructed before 2010 (km)	Constructed from 2010 to 2016 (km)	Total (km)
Bicycle Lanes	29	25	54
Boulevard Multi-Use Trails	61	27	88
Off-Road Multi-Use Trails	205	16	221
Shared Routes	79	12	91
<b>TOTAL</b>	<b>374</b>	<b>80</b>	<b>454</b>

**Figure 2: Existing cycling network**







## 5 Needs and Opportunities

To understand the needs and opportunities to improve cycling in Mississauga, this project included a detailed review of all available cycling-related data and consultation with Mississauga residents and other stakeholders. The results of this review are summarized in this chapter. An existing conditions assessment completed in Phase 1 of the project is provided in **Appendix VI**.

### 5.1 Bicycle Trips

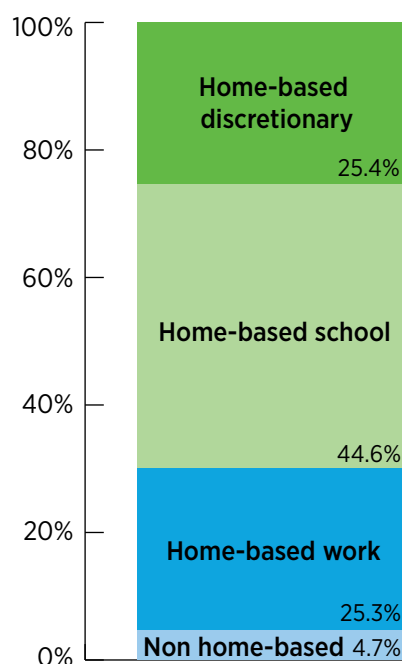
Once every five years, the Canada Census Survey collects data on how people are travelling for work-related trips. Canada Census data from 2011 and 2016 both showed that 0.3% of Mississauga residents reported that they use cycling as their main mode of commuting to work.

The Transportation Tomorrow Survey (TTS) is a randomized telephone survey about how, why, and where residents travel on a typical day in the Greater Toronto Area (GTA). This includes work-related trips and other kinds of trips. 2011 TTS data showed 0.3% of all trips in Mississauga were by bicycle during a typical day. 2016 TTS data showed an increase in bicycle mode share to 0.6% of all trips.

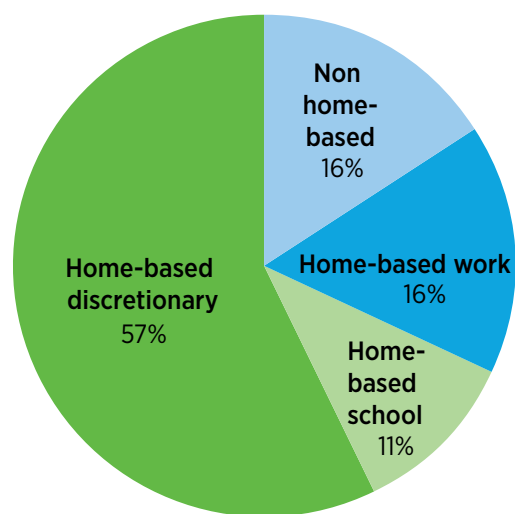
According to the TTS surveys, bicycle use in Mississauga has seen growth over the last few years. However, it is important to remember that these surveys collect information from a very small sample size of cyclists; they do not count all types of bicycle trips (e.g., recreational bicycle trips). In addition, some past surveys have been administered by landline phone which may have excluded younger and middle aged residents who are less likely to have a landline phone but may be more likely to use bicycles. As a result, it is possible that the amount of cycling in Mississauga is underrepresented by these surveys.

TTS data may be useful in helping to indicate potential for cycling. According to the 2016 TTS, 87% of bicycle trips in Mississauga are 5 km long or less. On a typical weekday, approximately 82% of all trips in Mississauga that are 5 km or less are completed in a car. Many of these trips could feasibly be taken by bicycle.

**Figure 3:** Purpose of *current* bicycle trips (Source: TTS 2016)



**Figure 4:** Purpose of *potential* bicycle trips\* (Source: TTS 2016)



\* non-cycling, non-walking trips 5 km or less

Workplace commute data is also collected by the local Transportation Management Association (TMA): Smart Commute Mississauga, also known as SustainMobility. Annual surveys of all Smart Commute member businesses ask employees about how they travel to work. The most recent survey data shows 7% of Smart Commute members in Mississauga cycle to work but only 2% commute by bicycle regularly. Reported barriers to cycling for Smart Commute members included the absence of cycling facilities especially on busy arterial roads and through highway interchanges, a lack of secure bicycle parking at many workplaces, and long commute distances.

## 5.2 Region of Peel Cordon Count

The Region of Peel, in partnership with other municipalities in the GTA and the Ontario Ministry of Transportation, delivers a cordon count program. The program counts vehicles that pass counting stations which are grouped together to form a screenline. Counts take place over a 15-hour period from 5:30 a.m. to 8:30 p.m. with full counts (all stations) done once every five years and partial counts in between.

Bicycle counts from the 2006, 2011 and 2016 Cordon Count Program are shown in **Table 3**. Counts show a moderate increase in total numbers of bicycles passing the count stations in Mississauga over 11 years.



**Table 3:** Total number of cyclists captured through the Cordon Count Program

(Source: Region of Peel Cordon Count Program, full count years)

Year	Total cyclist counts
2006	7,028
2011	9,862
2016	13,359

Partial counts taken in 2009 and 2014 showed more cyclists passing the Lakeshore Road West and Credit River counting station than the other stations. This station is consistently in the top five busiest stations for all count years, showing that this is an important location for cycling activity.

### 5.3 School-Based Travel

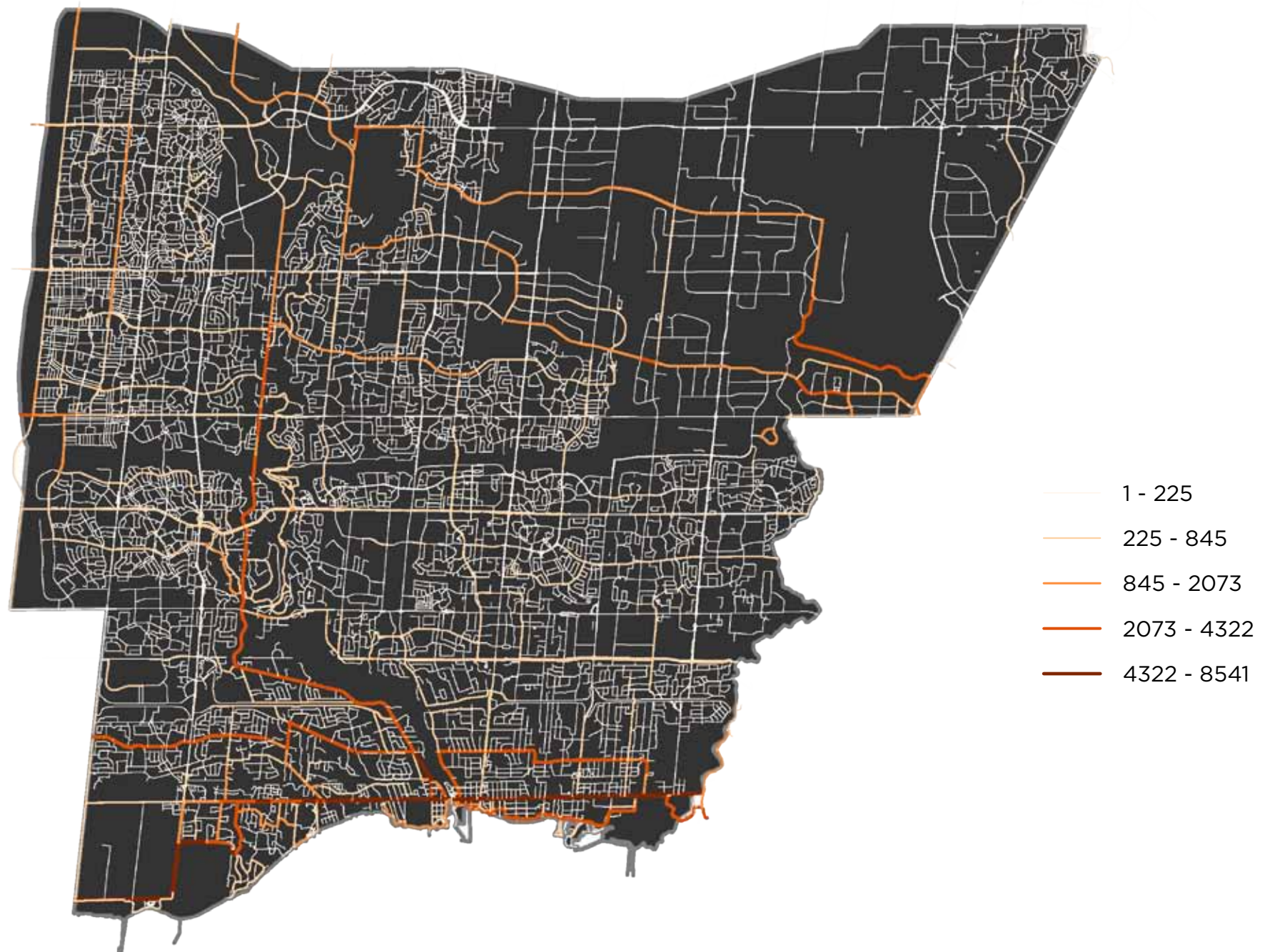
Region of Peel's School Travel Planning (STP) program gathers data on school travel through surveys and traffic counts at participating schools. Preliminary traffic counts and family travel surveys show that cycling activity to schools is relatively low: 1-2% of students at participating schools biked to school on their own; and less than 1% of students cycled with an adult. The feeling among parents that cycling is not safe is a significant barrier to having more children travel by bicycle. However, this feeling varies depending on the location of the school and whether there are comfortable cycling facilities available. When asked about specific safety issues, parents noted high volumes and speeds of traffic and bad driver behaviour like illegal parking and failing to stop at intersections.

### 5.4 Recreational Cycling

People in Mississauga do not only ride bicycles for transportation. Cycling is an important recreational activity. Many successful recreational cycling events are hosted by city staff and the Mississauga Cycling Advisory Committee, a volunteer, citizen-led committee working to support cycling in Mississauga. In 2017, the committee hosted 24 community rides in different neighbourhoods across the city and the 2017 Tour de Mississauga hosted 1,690 cyclists of all ages on rides of various distances around the city.

Mobile apps that record the distance, time and route of cycling trips provide some information about recreational cycling in Mississauga. Strava is one app that is popular among recreational cyclists. 2016 Strava data recorded approximately 80,000 cycling trips in the City of Mississauga. However, this information relies on people downloading and using the app, and users tend to be heavily skewed toward male cyclists. 85% of users cycling in Mississauga in 2016 identified as male. But even though it is only a partial picture, the information shown in **Figure 5** tells us that recreational cycling is occurring all across the city on roadways as well as trails.

**Figure 5:** Recreational cycling trips recorded on Strava in 2016



## 5.5 Bicycle Collisions

Over a four-year period from 2010–2013 there were 473 reported collisions involving bicycles in Mississauga. Of these, 380 collisions occurred on Mississauga roads and 93 collisions on Region of Peel roads. **Figure 6** shows the location of bicycle-related collisions during this four-year period. A detailed analysis of these collisions showed the following trends:

- Half of all bicycle collisions in Mississauga from 2010–2013 resulted in injury, 3% were major injuries and 1% fatal.
- 60% of bicycle collisions that occurred on Region of Peel roads within the City of Mississauga resulted in injury. These are wider, busier roadways.
- Turning movements at intersections pose a key safety risk to cyclists. 90% of all collisions in the four-year period occurred at or near an intersection. Improvements to intersection design to increase the visibility of cycling activity and limit motor vehicle turning speeds will help to improve safety and comfort for all road users.
- Most collisions happened during the morning and evening peak traffic periods when roads are very busy.
- More than half (61%) of all collisions involved a cyclist riding on the sidewalk. Sidewalk riding is illegal, except for bikes with wheels 50 cm or less in diameter, because sidewalks are not designed for bicycle use and riding on them is a risk to safety. However, a significant number of cyclists seen riding on sidewalks supports 2017 Cycling Survey results showing that the majority of cyclists or non-cyclists who would like to cycle are not comfortable sharing the road with motor vehicle traffic. Bicycle

facilities that provide separation from motor vehicle traffic are needed in certain locations to provide a safer alternative to sidewalk riding.

- 32% of drivers failed to yield the right of way to cyclists and 9% of cyclists failed to yield the right of way to motor vehicles. In many cases, conventional road designs do not communicate the presence, correct location and right of way for cyclists. Roadway designs that include clearly marked facilities for cyclists, accompanied by driver and cyclist education, are needed to improve safety and communicate the rights and responsibilities of all road users.
- 47% of all collisions included cyclists under the age of 25.
- 5% of drivers and 8% of cyclists disobeyed traffic control.

**From 2010 to 2013, there were:**

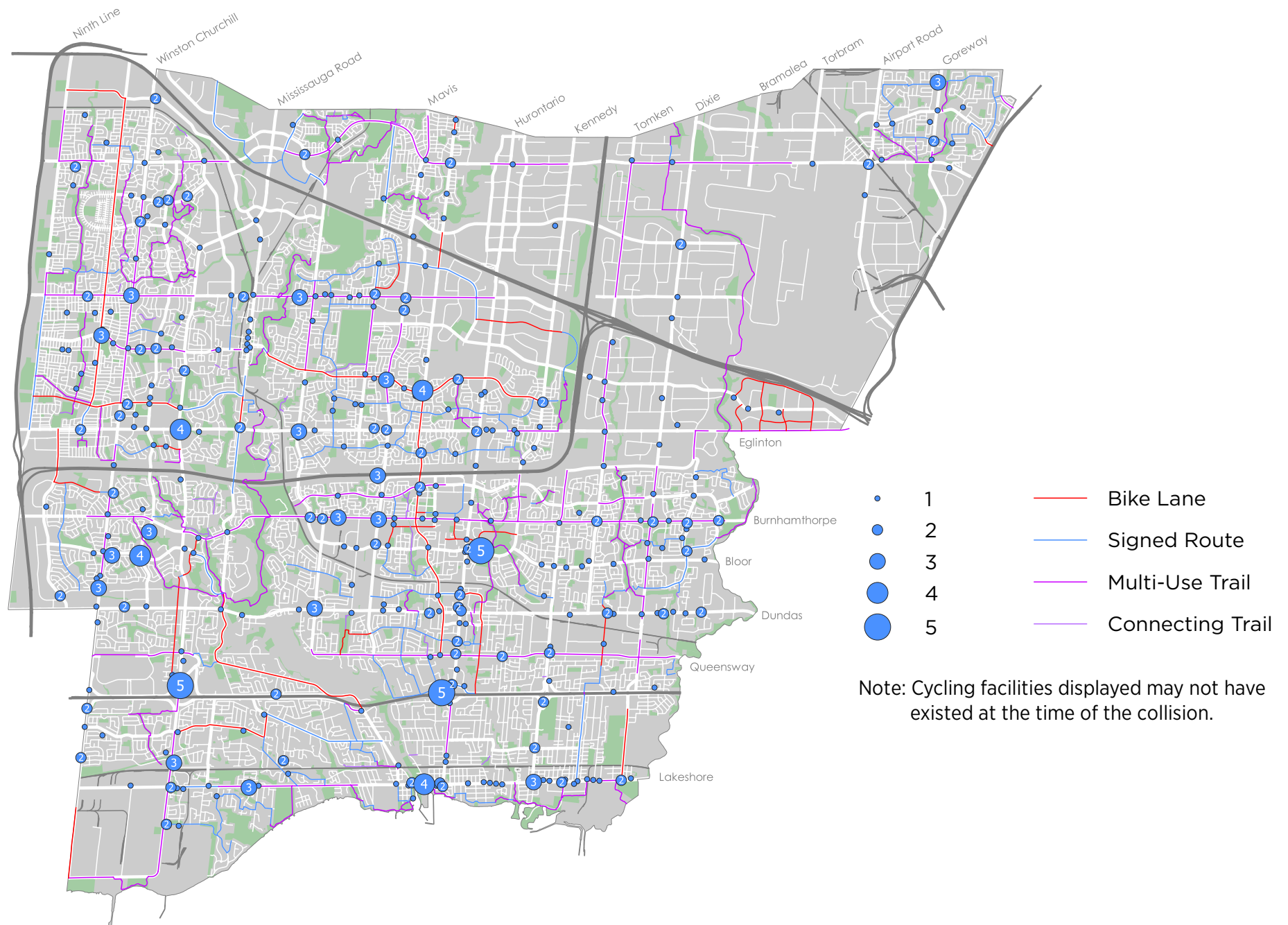
**473** collisions involving bicycles in Mississauga.

**10** of these collisions resulted in major injuries to the cyclist, and **4** were fatal.

The long-term goal for the 2018 CMP is **0** fatalities and injuries.



**Figure 6:** Collisions involving bicycles 2010–2013



## 5.6 Public and Stakeholder Outreach

This project incorporated a thorough public engagement process that involved several public outreach events including two public open houses, regular meetings with a working group of the Mississauga Cycling Advisory Committee, information tables at five local community events, and information tables at community centres and libraries in all 11 city wards. In addition to social media, print and digital advertising efforts, project staff also reached out to citizen committees, residents' associations, business improvement areas (BIAs), and Smart Commute members to encourage participation in the project. Along with the public outreach, the project team engaged with technical stakeholders including internal and external partners. A full list of events and organizations that were consulted is available in **Appendix VII**.

### 5.6.1 Project Website

The project website, *DoesCyclingMoveYou.ca*, was the primary source of all project information for the public. The website included links to the 2016–17 Mississauga Cycling Survey, an interactive map of the cycling network, quick polls, and opportunities for review and comment on project materials during all phases of the work. Over 3,500 people participated in the project by visiting the website, filling out one or more surveys or speaking with the project team at events. Input was received from the public and stakeholders through all four phases of the project from establishing existing conditions to reviewing the draft plan.

The central themes that were communicated through public engagement include:

- Building a network of connected cycling facilities;
- Physically separated bicycle facilities along busy streets;

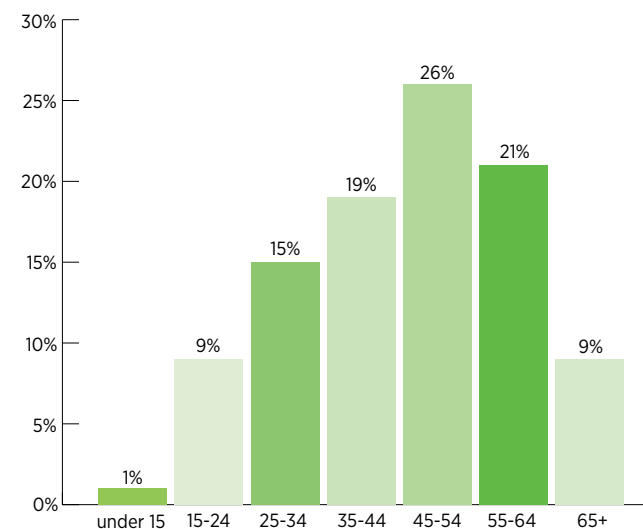
- Protected crossings where trails intersect with roadways;
- Separating pedestrians and cyclists on busy trails;
- Improving surface conditions on unpaved trails; and
- Designing intersections to include bicycle facilities

### 5.6.2 Mississauga Cycling Survey

From October 2016 to October 2017, a Cycling Survey was available online and was offered in-person at Celebration Square over two days in December 2016. The survey was promoted using the city's social media channels and through the *Does Cycling Move You?* website. A copy of the survey and a detailed summary of survey results is available in **Appendix VII**.

There was broad participation in the survey by people between the ages of 25 and 64 as shown in **Figure 7**. As detailed in **Appendix VII**, focused outreach to youth and elderly residents through community events helped to boost participation by these age groups.

**Figure 7:** Age of 2016-17 cycling survey participants

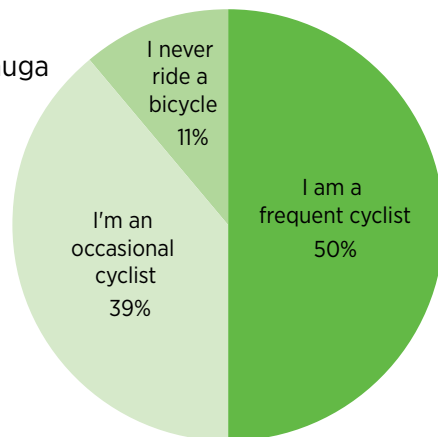




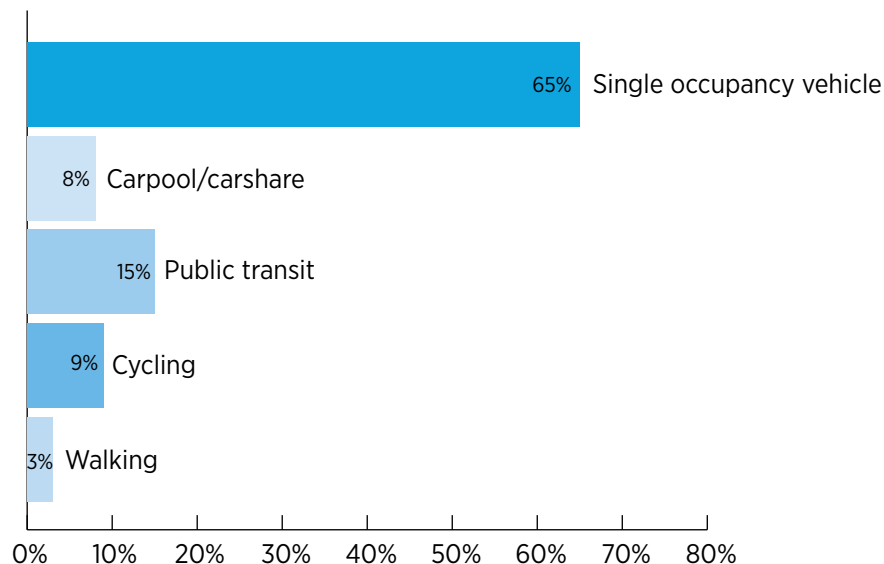
## Bicycle usage & regular mode of transportation

As shown in **Figures 8 and 9**, out of 2,170 participants, a strong majority identified as frequent or occasional cyclists, but less than 10% said they used cycling as their main mode of transportation. 11% of participants said they never use bicycles.

**Figure 8: Bicycle usage**  
(Source: 2016-17 Mississauga Cycling Survey)



**Figure 9: Regular mode of transportation**  
(Source: 2016-17 Mississauga Cycling Survey)



## Reasons people don't ride bicycles more often

When asked why they do not cycle more often, over half of cyclists chose a response related to feeling uncomfortable sharing the roadway with motor vehicles. "Feel unsafe on the road" was chosen by 31% of cyclists followed by "lack of bike lanes/off-road trails," chosen by 29%.

Just under a third of non-cyclists (29%) chose "feel unsafe on the road" as their number one reason for not cycling, while another third (32%) said "I don't have a bicycle." (60% of non-cyclists surveyed do not own a bicycle.)

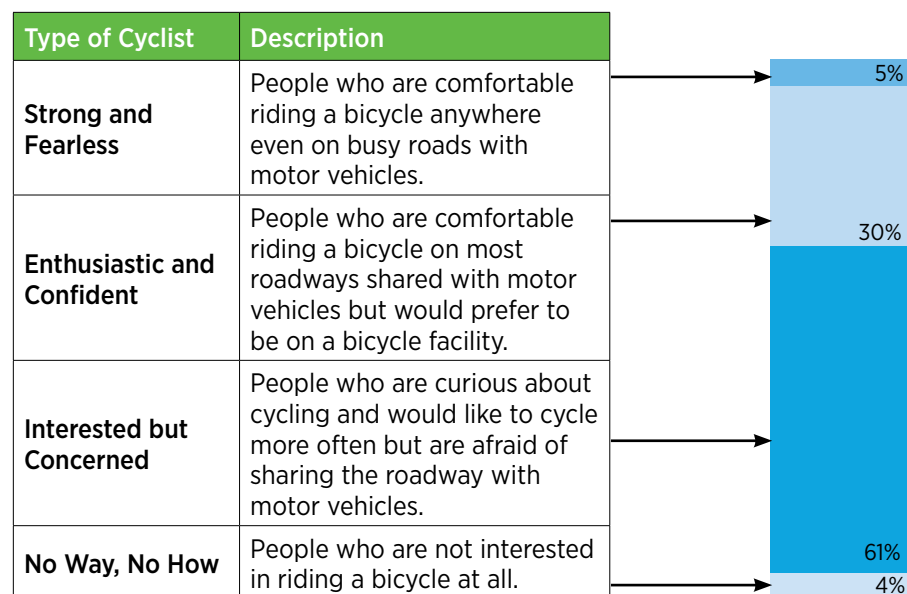
65% of cyclists and 26% of non-cyclists said that more protected cycling facilities would encourage them to cycle more often.

Although weather and distance are often perceived as being significant deterrents to cycling, less than a quarter of cyclists (18%) said that distance was their number one reason for not cycling more often. And an equal proportion of cyclists said that weather was the primary reason for not cycling more often. Similarly, among non-cyclists, only 18% identified weather as their number one reason for not cycling.

## Level of Comfort

Survey participants were asked to report their level of comfort when cycling on different types of bicycle facilities. Based on these results, survey participants were divided into four types of cyclists. These types were originally developed for a 2006 study by Roger Geller, a city planner from Portland, Oregon. Since this first study, the categories continue to be used by many US and Canadian cities to better understand the market for increasing cycling for transportation, and what is needed to accommodate that market. These categories are described in the table section of **Figure 10**.

**Figure 10:** Types of cyclists & percentage of each type  
(Source: Mississauga Cycling Survey)



The Mississauga Cycling Survey showed that most survey participants are “Interested but Concerned” about cycling in Mississauga as shown in the bar graph section of **Figure 10**. These numbers show that 96% of survey participants would continue to cycle, cycle more often, or start cycling if more comfortable bicycle facilities were in place.

## 5.7 Levels of Traffic Stress

Mississauga residents that participated in the project said that the most significant barrier to cycling is feeling unsafe or uncomfortable. This reported stress most often occurs when cyclists must share space on the road with motor vehicles. Many studies have shown a similar impact of “traffic stress” on cyclists in cities worldwide.

Roadways provide direct access to people’s homes and destinations and they are the main routes for all travel modes including walking and cycling. Providing comfortable bicycle facilities on roadways is necessary to encourage more people to cycle, and increasing the number of cyclists using a roadway network is one of the most effective ways to improve overall cyclist safety.<sup>1,2</sup>

A successful cycling network is one that makes it possible for people to get to where they want to go (connected) without significant detours (convenient) and without exposing cyclists to conditions that are beyond their tolerance for traffic stress (comfortable). Therefore, cycling network planning and implementation must consider cyclists’ tolerance for traffic stress and work to reduce that stress so that the network will function as intended and achieve the 2018 CMP goals.

1. *Ontario Traffic Manual Book 18*. Dec 2013. p.25.
2. Jacobsen, P.L. “Safety in numbers: more walkers and bicyclists, safer walking and bicycling.” *Injury Prevention*. 2003, Issue 9, pp.205-209.

Bicycle facilities that require very little interaction with motor vehicles are low stress. The level of traffic stress is typically related to the speed and the volume of motor vehicle traffic and the amount of separation between cyclists and motor vehicles. For example, a local neighbourhood street with low traffic volumes and speeds is low stress, but a busy roadway that provides physical separation between cyclists and motor vehicles can also be considered low stress. Different people will tolerate different levels of traffic stress; a strong and fearless cyclist will feel less stress than an interested but concerned cyclist.

As described in section 5.6.2, the majority of people who participated in this project identified themselves as “interested but concerned” cyclists. A level of traffic stress (LTS) analysis was completed for the existing cycling network and an LTS rating was provided for each segment of the existing cycling network. The LTS ratings illustrate the experience for the majority of cyclists or would-be cyclists, i.e., those who identify as “interested but concerned” when cycling on the existing cycling network. The traffic stress analysis is an objective evaluation based on available traffic data. The definitions of the levels of traffic stress are described in **Table 4** and a discussion of the methodology used to develop the LTS analysis is provided in **Appendix VIII**.

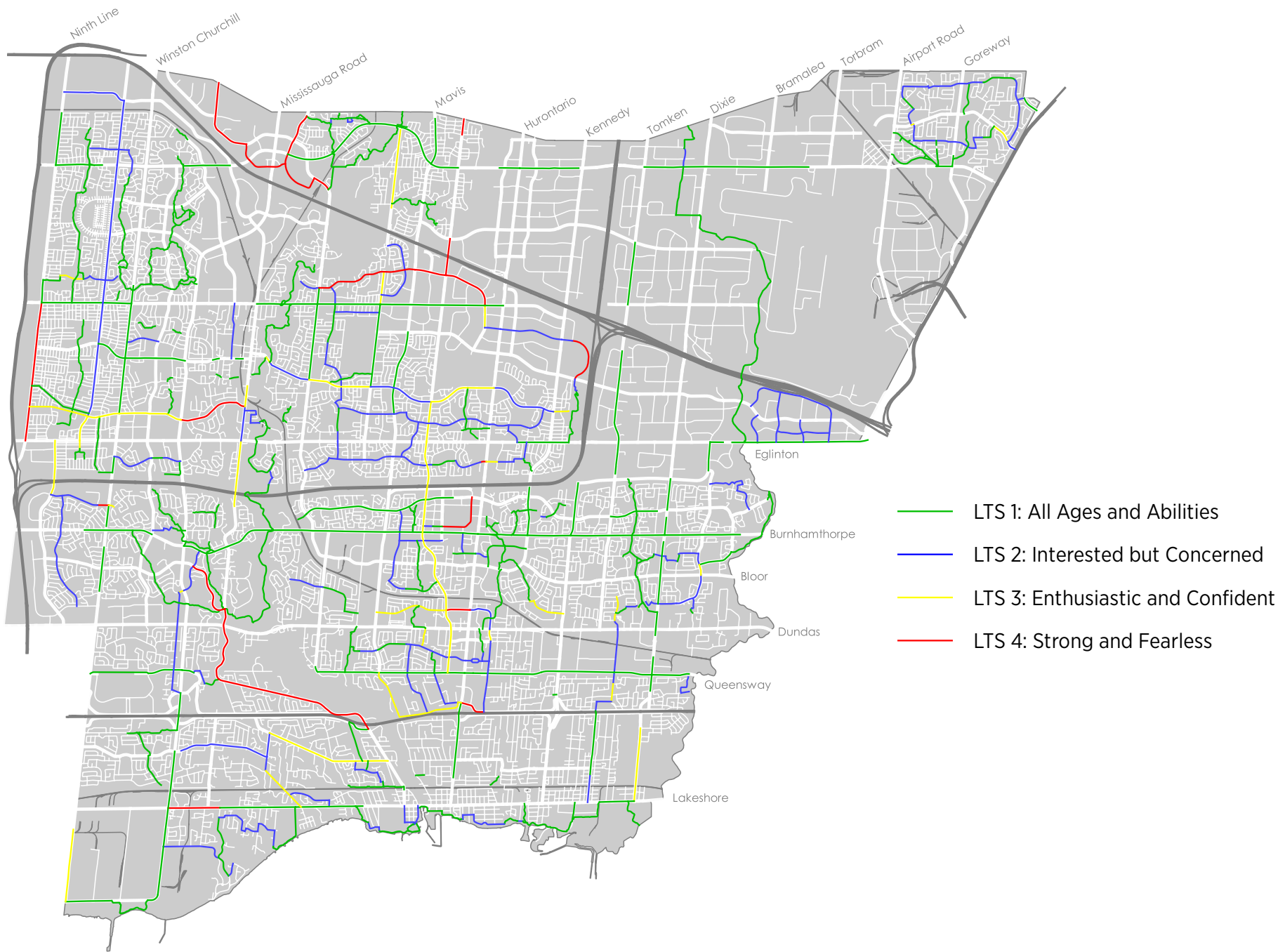
**Table 4:** Levels of traffic stress—definitions

<b>LTS 1</b>	Low traffic stress and requiring less attention from cyclists. Suitable for almost all cyclists, including children (interested but concerned cyclists).
<b>LTS 2</b>	Low traffic stress but requiring attention and therefore suitable for most adult cyclists (interested but concerned cyclists).
<b>LTS 3</b>	More traffic stress than level 2, suitable for adults who are confident cyclists (enthusiastic and confident cyclists).
<b>LTS 4</b>	Highest level of stress, suitable for strong and fearless cyclists.

**Figure 11** shows the level of traffic stress associated with different cycling facilities across the existing cycling network (as of March 2018). The map helps to illustrate where lower stress bicycle facilities are interrupted by high-stress gaps in the cycling network, and where some existing bicycle facilities may not be comfortable enough to be used by most cyclists.

A traffic stress analysis was also completed for the recommended cycling network and is discussed in section 6.3.

Figure 11: Level of traffic stress of the existing cycling network







## 6 Recommended Cycling Network

This chapter presents a recommended cycling network for the City of Mississauga that will meet the needs of cyclists of all ages and abilities, and support the vision of Mississauga as a city where people choose to cycle for recreation, fitness and daily transportation needs. This chapter includes information on how the network was planned, the recommended routes and types of bicycle route facilities, and how these create a connected, comfortable and convenient network for travelling by bicycle.

### 6.1 Planning the Cycling Network

Cycling network planning was guided by the vision and goals of the 2018 CMP, and informed by an analysis of the existing conditions, needs and opportunities research, and input from technical stakeholders and the community. Six route selection principles were developed during this process and used to review the existing cycling network and guide recommended changes.

#### Route Selection Principles:

- Integrate new facilities with the existing cycling network
- Provide continuous and barrier-free routes
- Provide connections to key destinations
- Prioritize connections to public transit
- Provide access to all neighborhoods
- Provide safe and comfortable routes

Data analysis tools were developed using available cycling-related data to evaluate and update the 2010 proposed cycling network. Data categories are illustrated in **Figure 12** and include:

- **Population and Employment Density**—Canada Census data;
- **Connectivity**—gap analysis of the existing and proposed network;
- **Network Coverage**—proximity of residences and businesses to the cycling network;
- **Level of Comfort**—traffic stress analysis of the existing and proposed cycling routes (See section 5.7 and **Appendix VIII**);

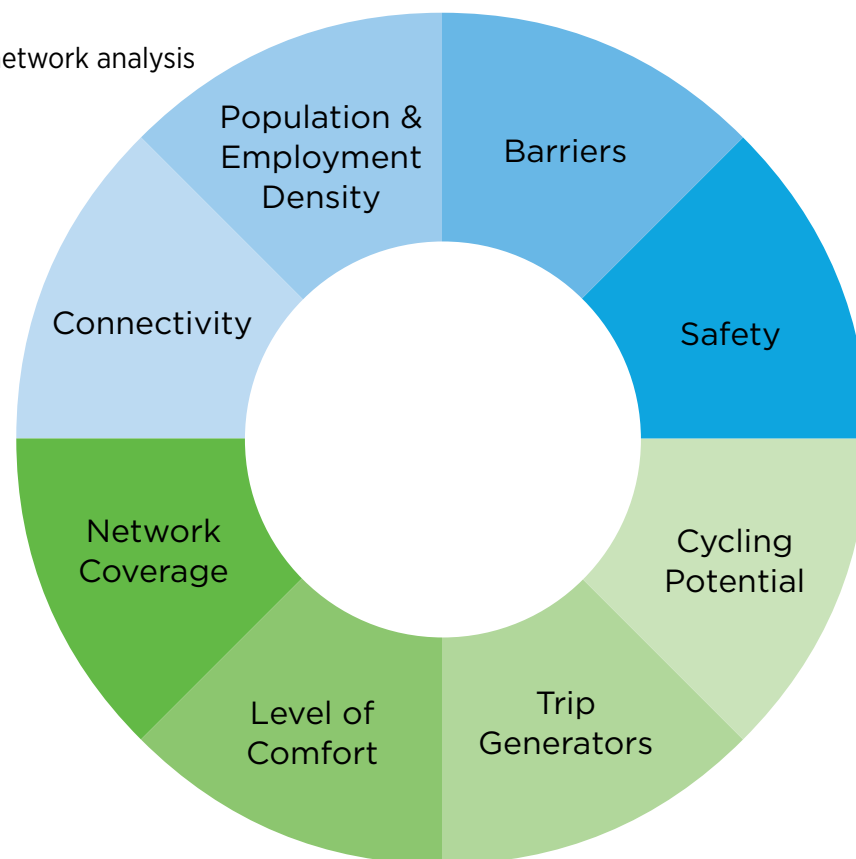


- **Trip Generators**—proximity of the cycling network to community facilities, transit, and other important destinations;
- **Cycling Potential**—location of short auto trips (5 km or less) that could potentially be converted to cycling trips—Transportation Tomorrow Survey data (2011);
- **Safety**—Peel Regional Police collision data (See section 5.5); and
- **Barriers**—location of geographical and human-made barriers (rivers, ravines, highways, rail corridors).

More information on the cycling network analysis is provided in **Appendix III**.

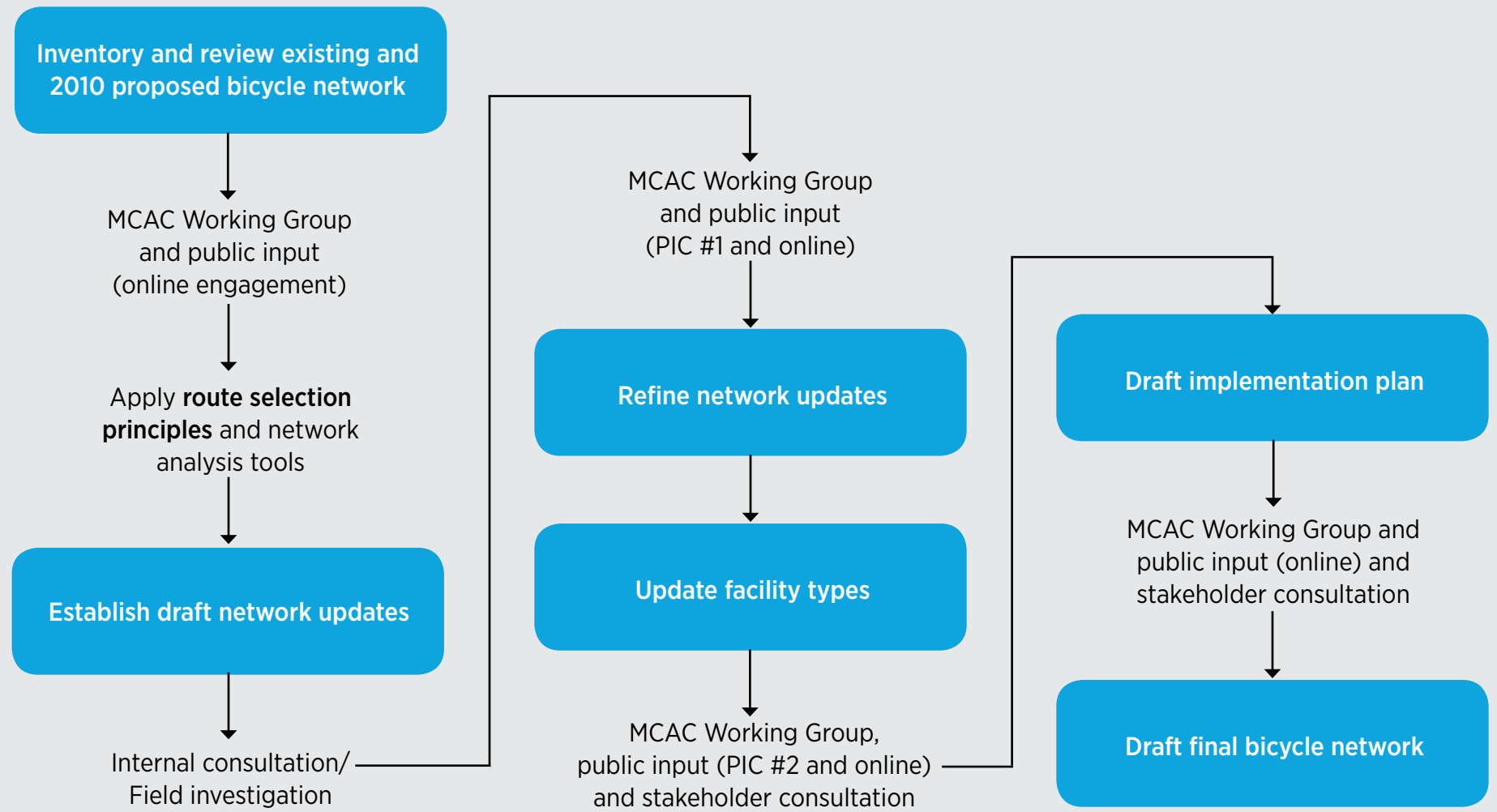
The cycling network planning process is illustrated in **Figure 13**. There were several opportunities for public and stakeholder input during the network planning.

**Figure 12:** Data categories for the cycling network analysis



Comments were received in-person, by email, telephone and through the *Does Cycling Move You?* website. Two Public Information Centres (PIC), or “open houses,” were held to directly gather public input and display the work to date.

**Figure 13:** Cycling network planning process



## 6.2 Types of Bicycle Facilities

A cycling network that encourages more people to cycle is one that offers a safe and comfortable environment for cyclists of all ages and abilities. Dedicated bicycle facilities improve safety and comfort by separating cyclists from motorized vehicle traffic and/or reducing traffic speeds.<sup>3</sup> These measures are at the heart of the Vision Zero approach to eliminating traffic fatalities.

Existing cycling facilities in Mississauga include:

- Conventional bike lanes;
- Shared routes where bicycles share the roadway with cars; and
- Multi-use trails (two-way trails shared by cyclists and pedestrians).

There are several other types of bicycle facilities that are designed to provide safe and comfortable cycling conditions on different roadway environments. **Table 5** shows the different types of bicycle facilities being implemented in Canadian and North American cities.

3. Teschke, K. et al. "Route Infrastructure and the Risk of Injuries to Bicyclists: A Case-Crossover Study." *American Journal of Public Health*. 2012, 102:12, pp.2336-2343.

**Table 5:** Types of bicycle route facilities

Facility	Description
Conventional Bicycle Lane	Signs and pavement markings. Reserved for bicycle use only.
Buffered Bicycle Lane	Bicycle lanes that have a painted buffer to provide extra space between cyclists and other traffic lanes. Reserved for bicycle use only.
Separated Bicycle Lane	Bicycle lanes that are physically separated from other traffic lanes by flexible posts, planters, parking stalls, curbs, or other barriers. Reserved for bicycle use only.
Raised Cycle Track	Bicycle lanes that are physically separated by a curb and raised higher than the street, either to sidewalk level or slightly lower. Reserved for bicycle use only.
Park Multi-Use Trail	Paved trails in park lands, shared by cyclists and pedestrians.
Boulevard Multi-Use Trail	Paved trails in the boulevard beside major roadways, shared by cyclists and pedestrians.
Paved Shoulders	On rural roads, paved shoulders provide a designated space for cyclists to ride.
Signed Bicycle Route	A route shared between cyclists and motorists on local streets with slower speeds and less traffic. May also include traffic calming and design elements to prioritize bicycles.
Sharrows and Signs	A route shared between cyclists and motorists. Includes signs and sharrow pavement markings. May also include traffic calming, low speed limits and design elements to prioritize bicycles.
Advisory Bike Lanes	On narrow roads with low traffic volumes and slow speeds, advisory bike lanes show the preferred space for cyclists on routes shared between cyclists and motorists.

## 6.2.1 Choosing Bicycle Facility Types

Building a safe and comfortable cycling network means choosing the right type of bicycle facility for each location. Bicycle facilities are chosen based on the goal of reducing the exposure of cyclists to traffic stress and conflict. As illustrated in **Table 5**, there is a range of bicycle facility types that provide more or less separation between motorists and cyclists. In principle, greater separation should be provided where traffic volumes and operating speeds are higher. There are three types of separation that can be used:

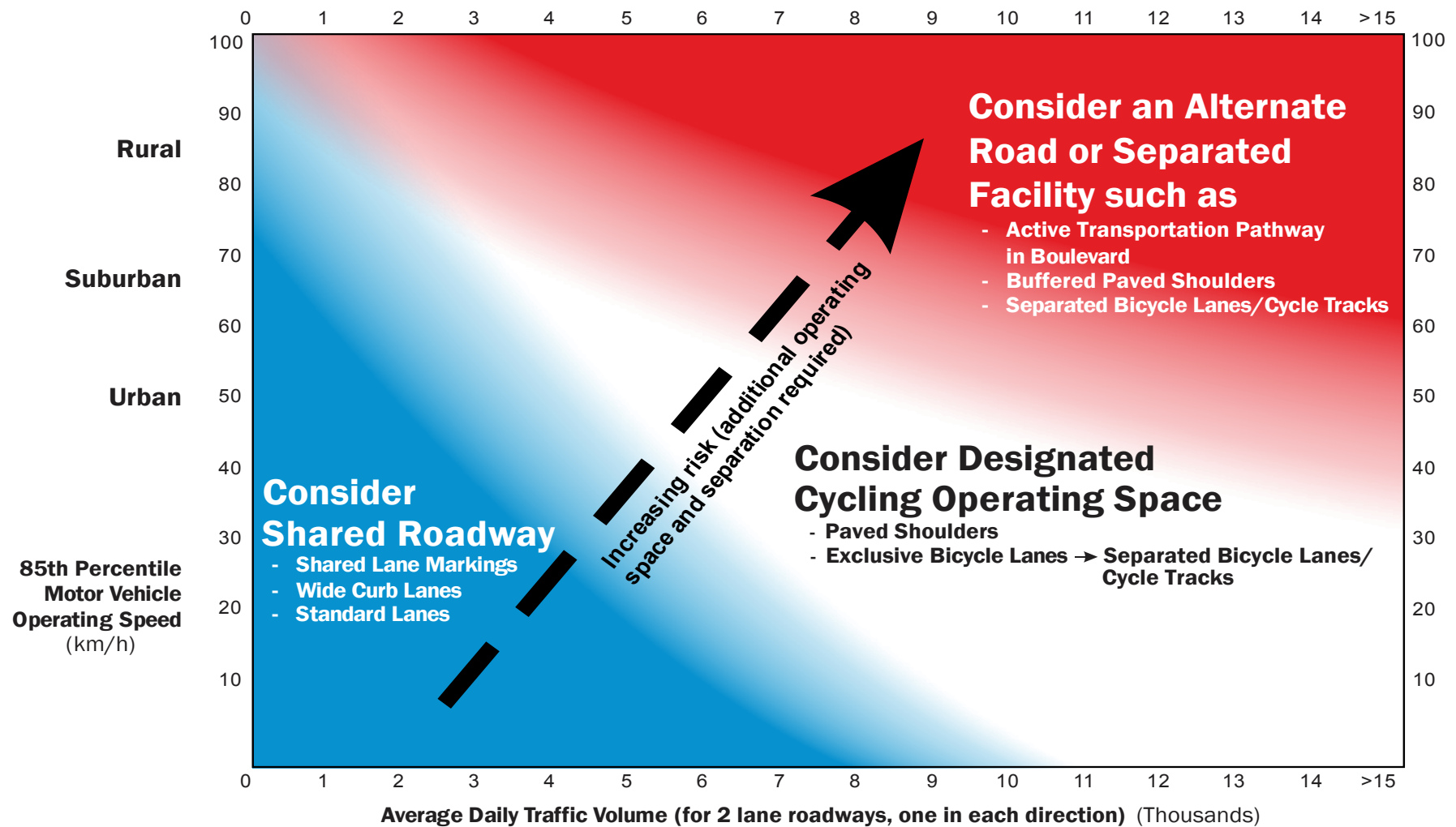
1. Spatial (dedicated space for bicycles separated by a painted line);
2. Physical (physical barriers between the cycling facility and other motor vehicles like bollards, curbs, planters, or parked cars); and
3. Time (stop controls or traffic signals that separate bicycle movements from turning motor vehicles).

One or more of these kinds of separation may be used depending on the facility type and the surrounding environment. However, a context sensitive approach to identifying appropriate bicycle facility types is critical. Many factors must be taken into account such as:

- the frequency of intersections and driveways;
- the visibility of cyclists particularly when separated from, or set back from, the roadway;
- an increased potential for conflict at intersections and driveways that is introduced by two-way cycling facilities; and
- potential conflict between cyclists and pedestrians on mixed-use facilities.

This project followed the bicycle facility type selection process outlined in *Ontario Traffic Manual Book 18* (2013). This is a three-step process that begins by selecting a facility type based on motor vehicle speeds and volumes as shown in **Figure 14**, followed by a detailed look at other traffic and site specific characteristics to determine the most suitable kind of facility.

Figure 14: Ontario Traffic Manual Book 18—Cycling facility pre-selection tool (Image Credit: MMM 2013)





## 6.3 Proposed Cycling Network

The 2018 Cycling Master Plan envisions a comfortable, connected and convenient cycling network that includes separated bike lanes, cycle tracks, multi-use trails, conventional bike lanes and shared routes as summarized in **Table 6**. Once implemented, these facilities will create a cycling network that Mississauga residents and visitors of all ages and abilities will feel comfortable using.

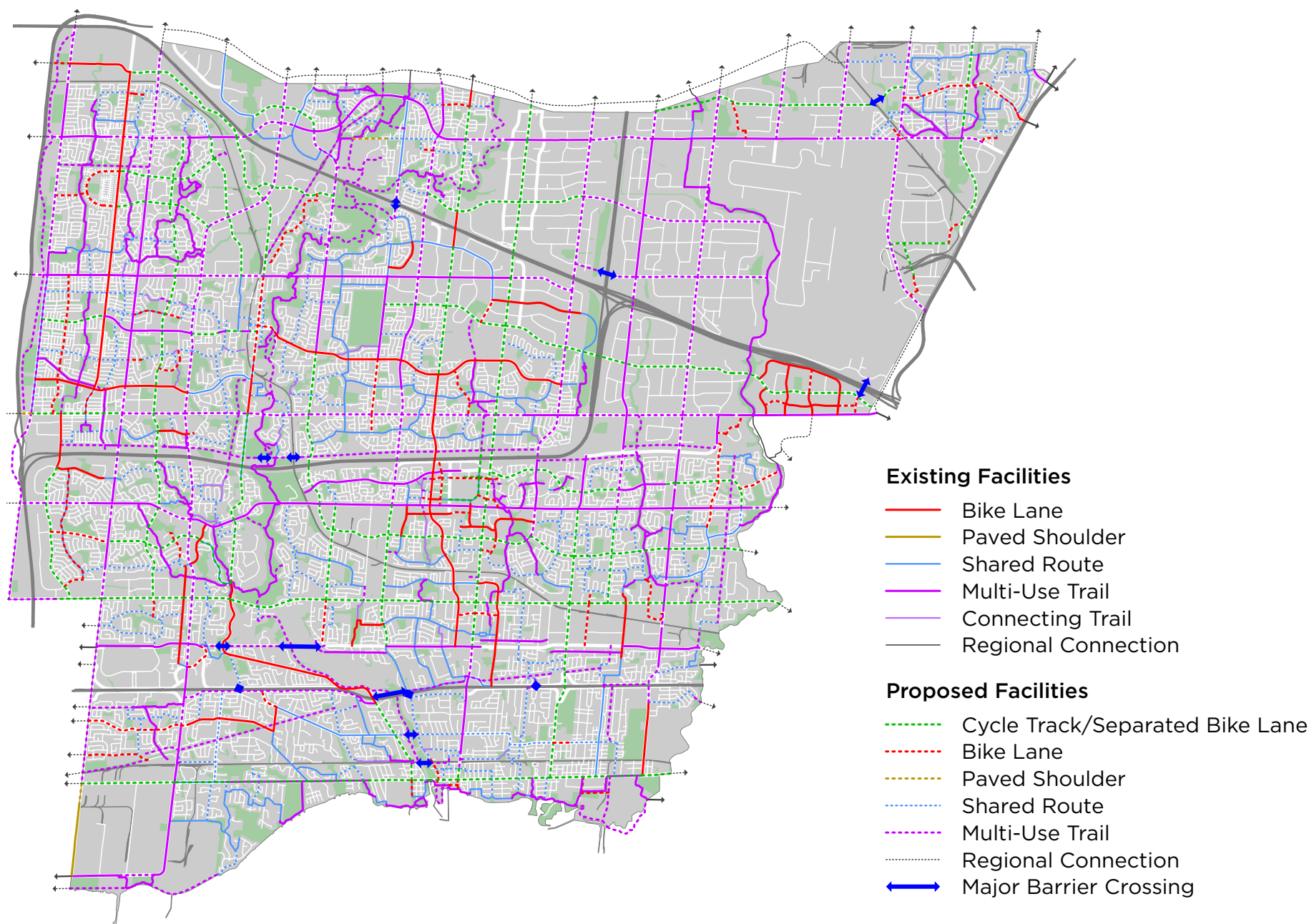
**Table 6:** Summary of proposed cycling network facilities lengths and costs

Facility Type	Existing km	Upgrade km	Upgrade cost	New km	New Cost	Total km	Total Cost
<b>Cycle Tracks/Separated Bike Lanes</b>	0	20	\$9,416,000	150	\$97,430,000	170	\$106,846,000
<b>Bike Lanes</b>	51	1	\$46,000	56	\$12,360,000	108	\$12,406,000
<b>Multi-Use Trails (Boulevard)</b>	68	15	\$0	125	\$40,838,000	208	\$40,838,000
<b>Shared Routes</b>	87	0	\$0	131	\$6,591,000	218	\$6,591,000
<b>Multi-Use Trails (Parks)</b>	70	34	\$15,821,000	89	\$51,456,000	193	\$67,277,000
<b>Totals</b>	276	70	\$25,283,000	551	\$208,675,000	<b>897</b>	<b>\$233,958,000</b>

Note that lengths may differ from other sources due to the measuring methodology used. Parkland multi-use trail lengths only include major trails, and minor trails that connect cycling facilities.

The proposed cycling network is illustrated in **Figure 15**. More detailed information on proposed cycling network routes is provided in **Appendix I**.

**Figure 15:** Proposed cycling network

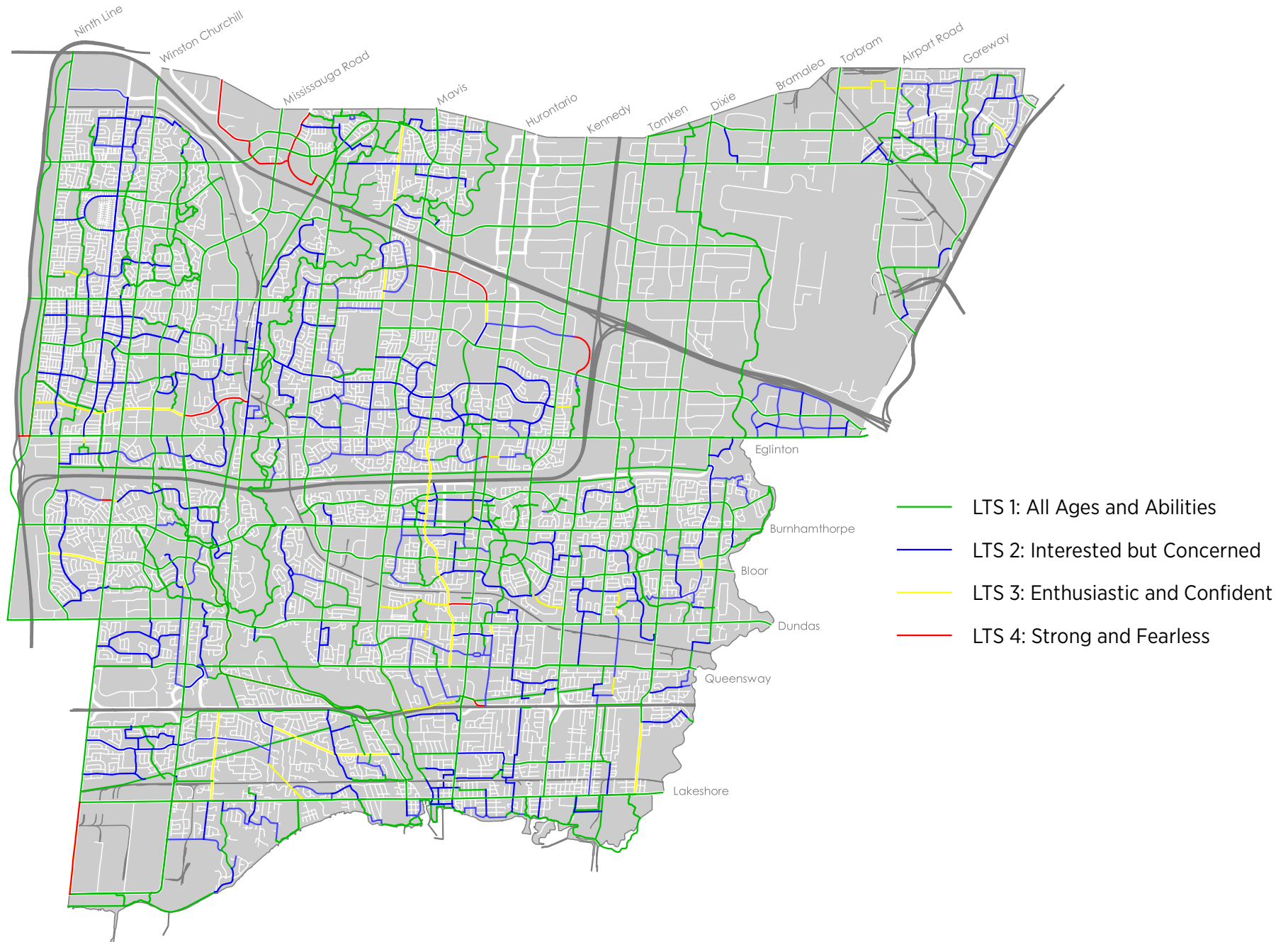


A level of traffic stress analysis was completed for the proposed cycling network to illustrate how segments of the recommended cycling network facilities would serve different types of cyclists. For more information on the level of traffic stress analysis see section 5.7. **Figure 16** shows what the LTS ratings of the proposed cycling network would be when all recommended facilities and proposed facility upgrades have been implemented. Proposed upgrades to existing bicycle facilities are discussed in section 6.5.

The majority of recommended cycling facilities will provide a comfortable cycling environment for cyclists of all ages and abilities. In a few instances, existing cycling routes are not comfortable for cyclists of all ages and abilities and have not been identified for upgrade. These facilities include routes with more rural conditions where cycling volumes are expected to be low, or routes where comfortable alternative routes are located nearby.

Level of traffic stress analyses in other cities often show local, residential roads as very comfortable for cyclists of all ages and abilities (LTS 1). Because Mississauga has a suburban built-form, with relatively wide, local, residential roads, and higher posted and operating speeds on local roads than in more urban locations, most of Mississauga's local roads are classified as LTS 2. (Although LTS 2 is comfortable for most adult cyclists, it tends to be less comfortable for children and can be a deterrent to cycling for children and their parents.) In some cases, traffic calming measures may be an option to reduce the traffic stress on these cycling routes.

**Figure 16:** Level of traffic stress of the proposed cycling network





### 6.3.1 Classifying Bicycle Routes

Recommended cycling network routes have been organized into primary and secondary cycling routes. These classifications help to clarify the role these routes play within the cycling network and will help to prioritize new and developing programs and priorities for the network such as design strategies, maintenance and existing facility upgrades.

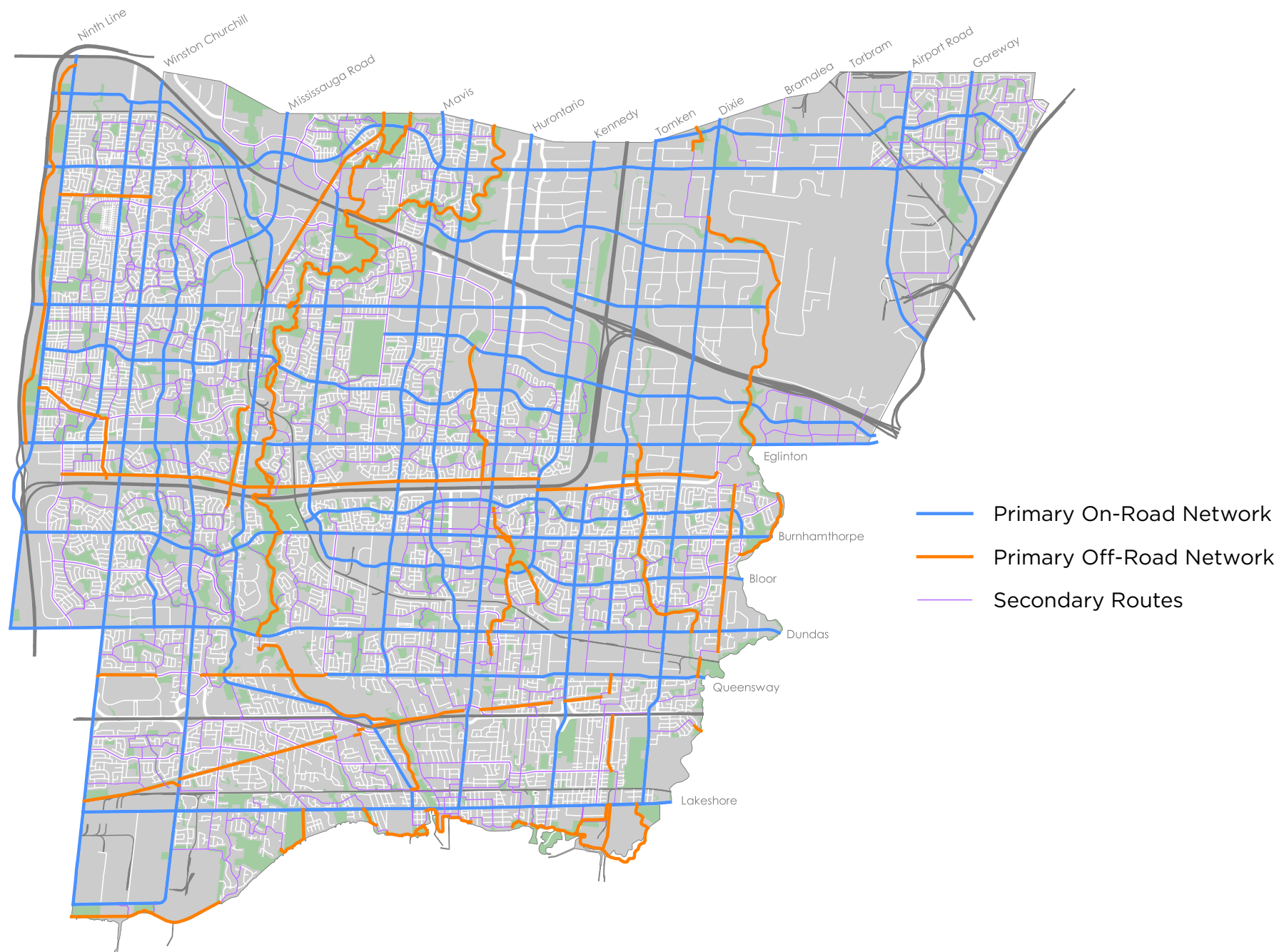
The purpose of the primary cycling routes is to provide direct connections to and between key destinations and locations identified in the city's Official Plan such as:

- the downtown, major nodes;
- community nodes;
- corporate centres;
- intensification corridors; and
- major transit station areas.

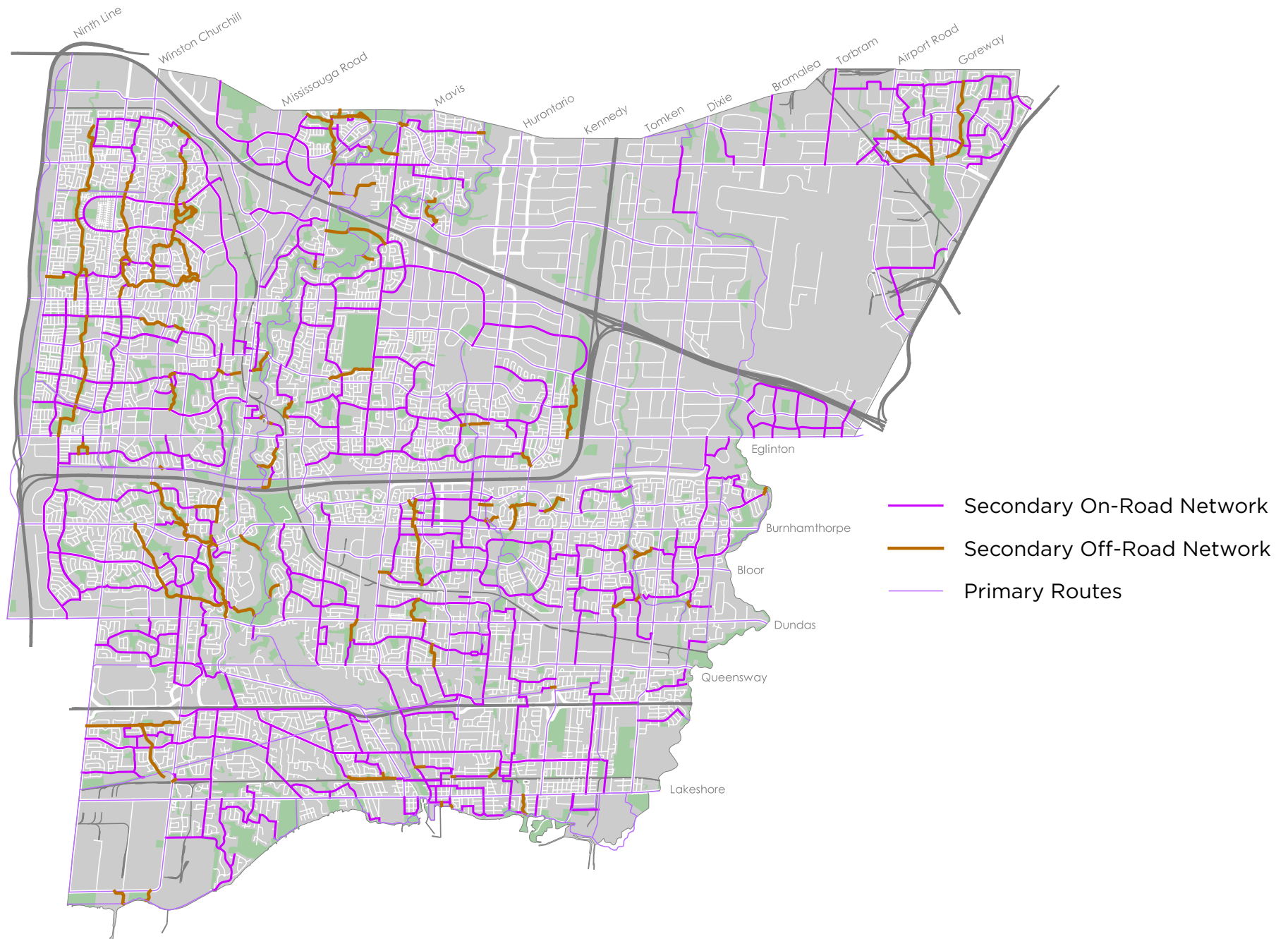
Primary cycling routes also serve to connect Mississauga to adjacent municipalities.

Secondary cycling routes are intended to connect the primary cycling routes with local neighbourhoods and neighbourhood-based destinations.

**Figure 17: Primary cycling routes**



**Figure 18: Secondary cycling routes**



## 6.4 Corridor Studies and Complete Streets

A “Complete Streets” approach describes a process to create a comprehensive, integrated transportation network for all kinds of travel modes. Mississauga’s Strategic Plan promotes a Complete Streets approach which is supported through Mississauga Official Plan policies to promote and enable multi-modal transportation.

Providing a complete transportation network does not mean that every street must provide dedicated facilities for all transportation modes, instead it means that the whole transportation network will provide convenient, safe, and connected routes for all modes of transportation throughout the city. Some streets may be prioritized for one or more modes over others. For the purposes of cycling network planning, roadways in Mississauga that provide direct and continuous connections across the city, such as arterial roads, major collectors and parallel streets are corridors that must be evaluated as Complete Street Corridors, particularly where there are no continuous parallel routes.

Recommended on-street bicycle facilities on arterial roads, major collectors or parallel streets should be evaluated as part of a Complete Street Corridor Study. Most major and minor arterial and major collector streets with proposed bicycle facilities that are intended to achieve LTS 1 or 2 will require further study. Further study is needed to evaluate the suitability of each roadway for the proposed treatment and to better understand the impact cycling facilities will have on other modes of transportation. These major streets provide access to key destinations, provide direct connections across the city and/or to adjacent municipalities and there are no parallel routes available that can provide the same function for the cycling network. Many of Mississauga’s arterial and

major collector roads serve this important function for many different modes of transportation, which is why further study is required to understand the impacts to all modes including cycling.

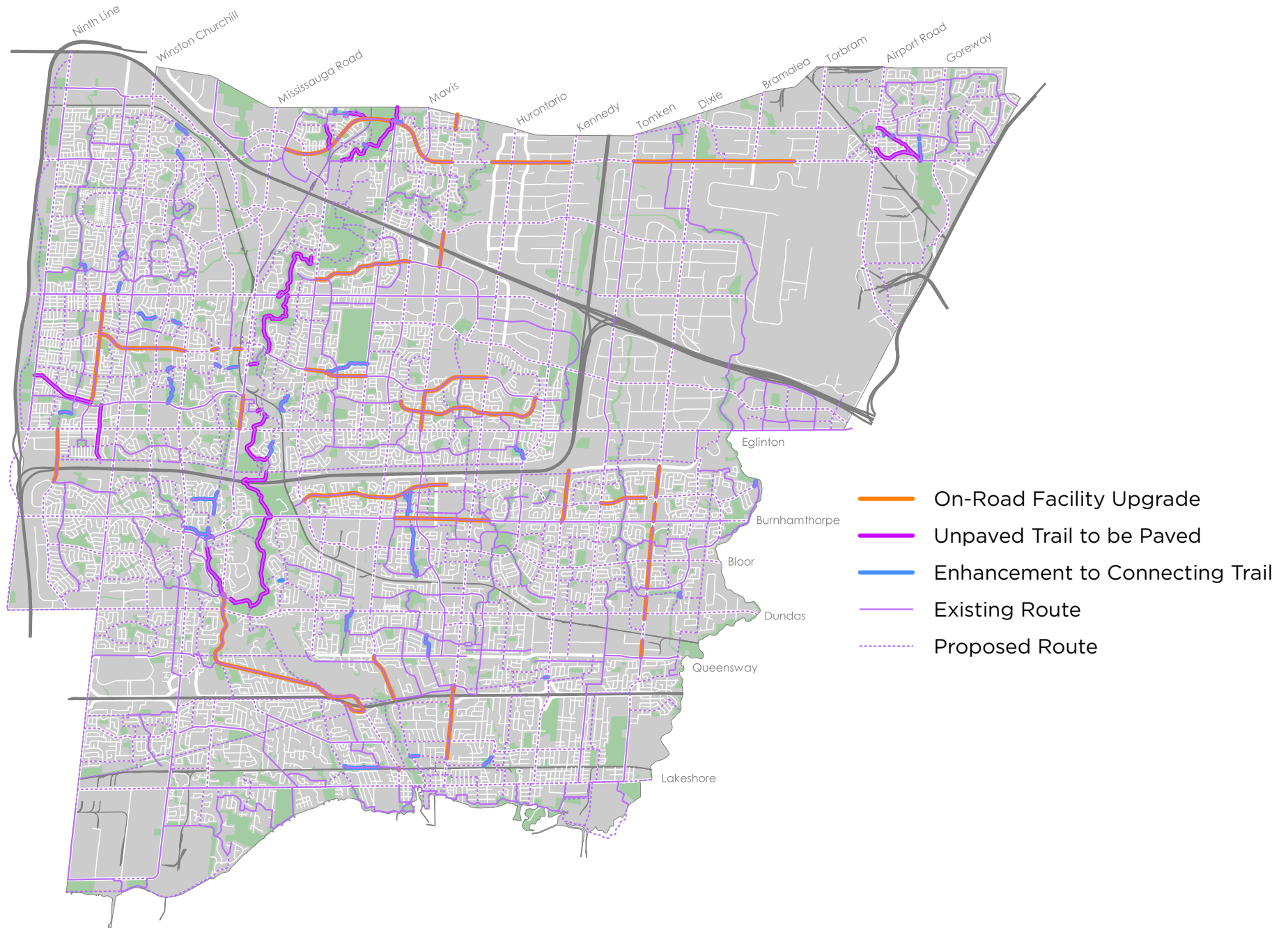
## 6.5 Proposed Upgrades

Design guidance for cycling facilities is continuing to evolve as more bicycle facilities are built and evaluated. (See section 3.5.) This includes information on design features like facility widths, clearance from obstacles, pavement markings, surface materials, and different kinds of separation, as well traffic calming devices and other tools to improve safety and comfort for cyclists on shared cycling routes.

Producing geometric design standards and guidelines for bicycle facilities that are specific to Mississauga is an important step toward building new bicycle facilities and providing upgrades to existing facilities so that they are safe and comfortable for cyclists of all ages and abilities. It is recommended that the City of Mississauga create a bicycle facility design guide that is informed by the most up-to-date design guidance and periodically update the guide to reflect advances in this field. (See recommendation 2.1.2 in section 3.3.) Locations where upgrades to the existing cycling network are recommended are shown in **Figure 19**. More information on bicycle facility design best practices is provided in the sections that follow and in **Appendix V**.



**Figure 19:** Recommended upgrades to existing cycling network (on-road routes and trails)



## 6.6 Intersections

Safe and comfortable intersection design reduces delays for everyone while also reducing conflicts and the risk of injury in the event of a collision. Intersections are where conflicts are most likely to occur and there are several variables that have an impact on safe intersection design:

- Bicycle facility type;
- Traffic volumes (all modes);
- Design speed;
- Roadway width;
- Delay (for all modes);
- Current and future land use;
- On-street parking; and
- Roadway geometry and topography.

Intersection designs that are safe, comfortable and convenient for cyclists and all other road users are those that:

- Provide good sight distance (so that all road users can be seen when moving through the intersection);

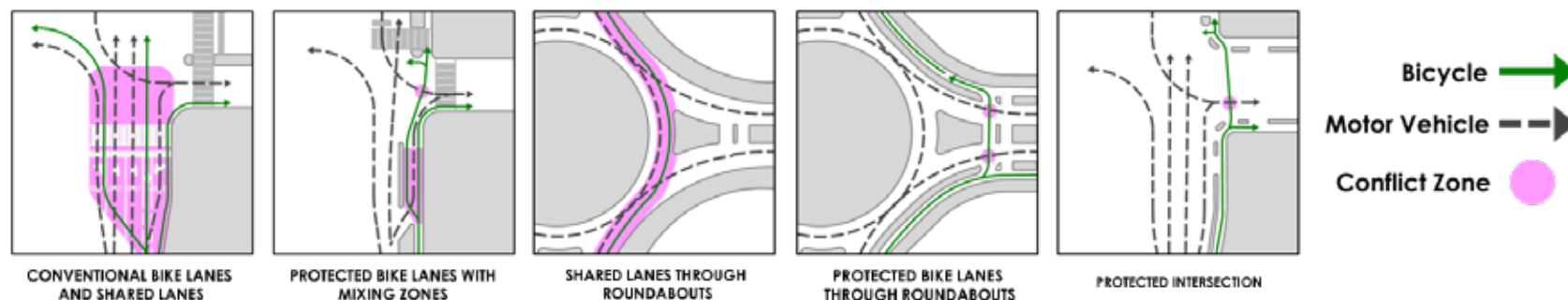
- Reduce the potential for conflict between road users;
- Reduce speeds at conflict points so that if there is a collision severe injuries are less likely; and
- Clearly communicate where vehicles, bicycles and pedestrians should be and who has priority.

Different types of intersections provide more or less exposure to conflicts as illustrated in **Figure 20**, with conventional bike lanes and shared lanes having the highest exposure to conflicts and protected intersections the lowest.







Improving safety and comfort at intersections where bicycle facilities cross roadways or driveways is necessary to build a connected, comfortable and convenient cycling network. The design of intersections on new bicycle routes must consider updated policy and design guidance, and principles for safe intersection design.

Intersection improvements are planned within the context of each project. Options for improvements include design elements that have already been used in Mississauga and new design elements and principles such as those shown in **Figure 21**.

**Figure 20:** Conflict zones for cyclists and motorists at different types of intersections  
(Image adapted from MassDOT Separated Bike Lane Planning & Design Guide)



**Figure 21:** Intersection design elements for comfortable cycling

<p>1.</p>  <p>Unsignalized and signalized crossrides</p>	<p>4.</p>  <p>Protected mid-block crossings</p>
<p>2.</p>  <p>Green pavement markings</p>	<p>5.</p>  <p>Protected crossings at roundabouts</p>
<p>3.</p>  <p>Pavement markings through intersections</p>	<p>6.</p>  <p>Fully protected intersections</p>



7.



Recessed crossings

10.



Reduced radii on highway ramps to slow down turning traffic at highway interchanges

8.



Reduced corner radii to slow down turning traffic

11.



Two-stage left turn bike boxes

9.



Removal of channelized right turn lanes

12.



Pavement markings and geometry at driveways to slow traffic and improve visibility of cycling facilities, particularly multi-use trails



### 6.6.1 Roundabouts

Current national and provincial design guidance supports a shared bicycle route in single lane roundabouts if traffic speeds and volumes are low. Cyclists move into the centre of the roundabout and share this space with motor vehicles. It may be appropriate to separate cycling routes at some single lane roundabouts if they are part of a cycling route that is intended to provide a comfortable facility for cyclists of all ages and abilities. Multi-lane roundabouts typically have higher traffic volumes and speeds and are not suitable for shared-use therefore a separated bike path is recommended by current Canadian design guides.

However, provincial design guidance identifies Type 2 pedestrian crossovers (PXOs) and crossing guards as the two appropriate crossing controls for roundabouts. At roundabouts where a separated bike path is recommended, a PXO would require that cyclists dismount and walk across the intersection under current provincial law. This introduces a significant challenge to developing bicycle-friendly intersections at roundabouts. Expecting cyclists to dismount and walk at intersections is not recommended due to the significant energy required by cyclists to stop and start. Cyclists should be accommodated along the full length of a cycling route, including through all types of intersections.<sup>4</sup>

There are a small number of existing roundabouts in Mississauga and several more are in the process of being planned and designed. Many of these locations are on designated cycling routes and other roadways used by cyclists. Safe crossings that accommodate cyclists are needed at roundabouts and must be developed in partnership with the Province of Ontario to remove regulatory barriers.

### 6.6.2 Mid-Block Crossings

There are several locations in the existing cycling network where mid-block crossing treatments are needed to improve safety and comfort for cyclists. Mid-block crossings are needed to provide access across roadways where there is no crossing control. These may be locations where cycling routes on local roadways intersect with major roadways, or where off-road trails intersect with roadways mid-block.

There are many different types of crossing treatments that could include elements like signage, pavement markings, traffic calming devices, or signals. The type of crossing treatment is selected based on the context of each crossing. Factors such as traffic volumes, number of traffic lanes, distance from adjacent intersections, and sight lines for cyclists, pedestrians and motor vehicles must be considered.

Pedestrian crossovers (PXOs) are an example of mid-block crossing treatments but, as noted previously, under current provincial law cyclists must dismount and walk when using a PXO. It is recommended that mid-block crossing treatments should accommodate both cyclists and pedestrians. The City of Mississauga should work with the Province of Ontario to allow the accommodation of cyclists at mid-block crossing locations where PXOs are warranted.

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4. *Ontario Traffic Manual Book 18*. 2013, p.9.

## 6.7 Multi-Use Trails

Multi-use trails are an important part of Mississauga's active transportation network. They are located in parks, along green corridors (creek and river valleys, and hydro corridors), and in the boulevards of several major arterial roads. Multi-use trails are shared by pedestrians and cyclists, including people pushing strollers or using walkers, rollerblades, skateboards, wheelchairs, or other non-motorized modes of transportation. Because they are separated from the roadway, multi-use trails offer a comfortable environment for people of all ages and abilities. But, there is potential for conflict at intersections and driveways, and between different kinds of trail users travelling at different speeds. These conflicts can impact safety on multi-use trails.

Available design guidance, research and feedback from community members and other stakeholders show the following elements (as shown in **Figure 22**) would improve conditions on existing trails, and ensure safety and comfort on new trails.

**Figure 22:** Multi-use trail design elements for comfortable cycling

1.



Separating cyclists and pedestrians on busy multi-use trails and trails that are intended to provide for higher speed commuting

2.



Using consistent surface materials along the full length of a multi-use trail, to clearly communicate where the trail begins and ends, and where pedestrian-only areas exist, including at intersections

3.



Providing a paved or suitably compacted surface to allow for bicycles to operate safely

6.



Designing driveway crossings so that they are visible, reduce conflicts and communicate the right of way for cyclists and pedestrians

4.



Designing new trails and upgrading existing trails so that obstacles like utility poles, bollards and other street furniture are not located on the operating portion of the trail

7.



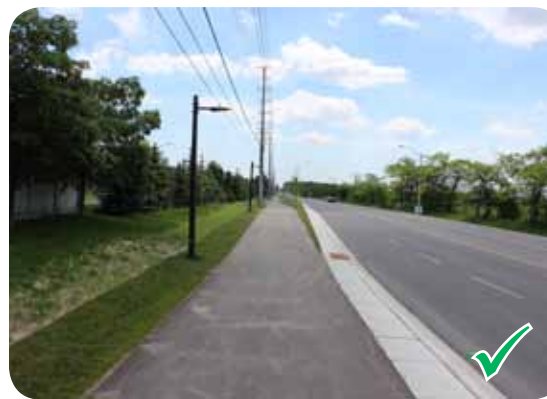
Installing a continuous centreline (broken or solid where appropriate) and other pavement markings as needed to communicate the correct location and direction of travel and where overtaking is permitted

5.



Avoiding the use of barrier gates (P-gates) as they can be a hazard for trail users including persons with visual or other impairments

8.

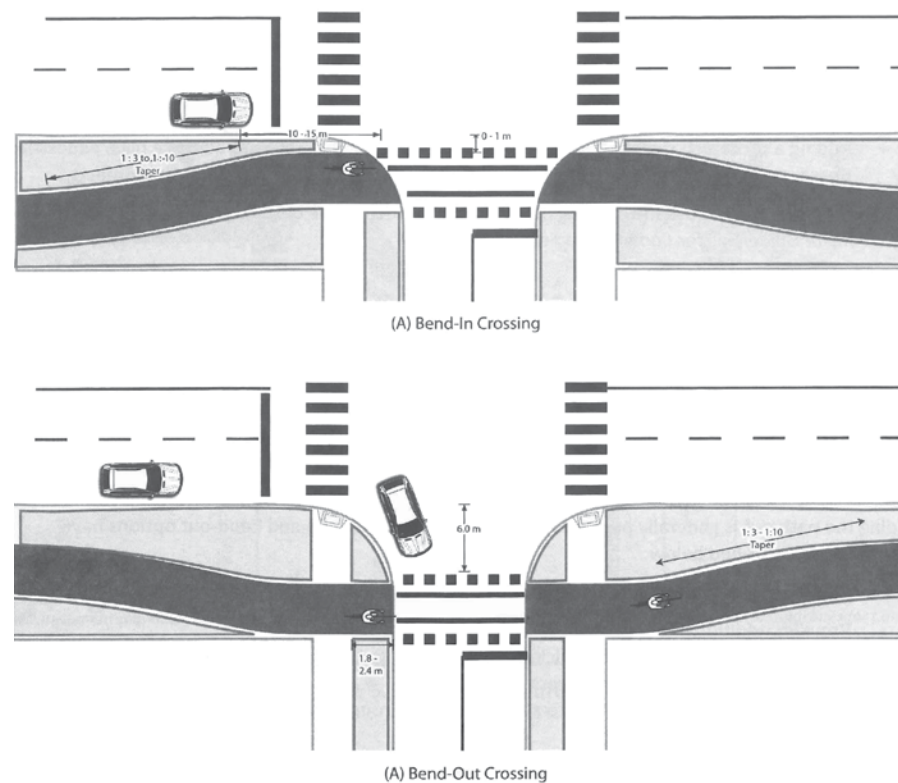


Considering lighting on linear trails that function as comfortable commuter cycling route alternatives to major roadways



### 6.7.1 Driveways and Intersections Along Multi-Use Trails

In practice, well-designed driveway crossings of multi-use trails and two-way bike paths follow one of two basic designs: “bend-out” crossings or “bend-in” crossings as illustrated in **Figure 23**.



All pavement markings shown are indicative only. Refer to the MUTCD or TAC Bikeway Traffic Control Guidelines for Canada for approved guidance on pavement markings.

**Figure 23:** “Bend-in” and “bend-out” boulevard trail crossing  
(Image credit: TAC Bicycle Integrated Design, 2017)

***Bend-Out Crossing:*** A bend-out crossing is typically used when there is a high volume of trail users and motor vehicle traffic. This design aims to provide spatial separation between vehicles entering or exiting the driveway and trail users. This increases the visibility of trail users and provides more reaction time to help avoid conflicts. Extra space between the roadway and trail crossing also gives vehicles entering or exiting the driveway a place to stop and wait for traffic to clear without having to block the trail, or hold up traffic on the roadway.

***Bend-In Crossing:*** A bend-in crossing is typically used when bicycle and motor vehicle traffic volumes are lower. It aims to increase visibility of cyclists at intersections by bringing them into the sight lines of vehicles approaching the intersection, and includes elements like smaller curb radii to slow down traffic turning traffic. Wider driveways or intersections may have a median, to stop traffic from making wide turns in front of crossing cyclists.

Pavement markings are an important feature of all multi-use trail crossings and should indicate pedestrian and cyclist paths. Bicycle signals are also needed at signalized intersections and can be used to separate bicycle crossing time from turning motor vehicles where turning volumes are high. Additional design features such as raised crossings and medians may also be incorporated into either of these types of intersection designs where appropriate to provide additional safety benefits.



## 6.8 Maintaining the Cycling Network


Regular, reliable year-round maintenance is a critical part of a comfortable and safe cycling network that will encourage and facilitate cycling all year round.

Bicycles are affected by surface conditions more so than motor vehicles. Bicycles are more likely to get a flat tire, damaged wheel, or to lose control because of obstacles, debris or damage to the surface of a roadway or trail. This could include small potholes or cracks; small amounts of ice, snow or water; wet leaves in autumn; and small pieces of glass, loose gravel or other debris. Thus, the maintenance needs for cycling facilities may be different than for pedestrian and motor vehicle routes.

When designing cycling facilities, it is important to plan for maintenance. New types of bicycle facilities proposed in this Plan, like separated bicycle lanes, must be wide enough to allow for maintenance vehicles to pass. The type of separation used (flexible bollards, planters, curbs, etc.) might impact maintenance depending on the season and the maintenance equipment.

Although cycling activity is reduced in the winter months, year-round cycling is important to people who may have limited transportation options like students or people working at times or in locations where transit is not always available. The popularity of winter recreational cycling is also on the rise with fat bikes and tires designed for winter traction on snow and ice.

A coordinated cycling facility maintenance program that includes priority winter cycling routes is recommended to support a comfortable and safe cycling network.



## 7 Recommended Supporting Programs

### 7.1 Bicycle Parking

Bicycle parking is an important part of a connected, convenient and comfortable cycling network and a bicycle-friendly city. Countries with the highest cycling rates in the world like the Netherlands, Denmark and Germany, have made strong investments in building and maintaining a large bicycle parking supply and they recognize this as a key reason why so many people use bicycles. Similarly, cities in the GTHA, elsewhere in Ontario and the US have developed city-wide bicycle parking programs to support bicycle use for recreation and transportation.

People who choose to ride bicycles must be confident that there will be safe and secure places to park at their destinations. They may need to park their bicycles for a couple of hours, a full workday or even overnight. Different kinds of bicycle parking are needed to meet these different needs.

#### 7.1.1 Short-Term Bicycle Parking

In Mississauga, short-term bike parking is available on some sidewalks in Port Credit, Clarkson, and the downtown area, and at many community centres and recreational facilities. Short-term bicycle parking is also available at GO Transit stations, the City Centre Transit Terminal and Mississauga Transitway stations. Mississauga residents told us they would also benefit from more and better quality bicycle parking at other kinds of destinations like:

- Older community centres and libraries;
- Cultural centres, such as the Civic Centre, the Living Arts Centre, and the Hershey Centre;
- Busy streets with front-facing businesses;
- MiWay transit terminals;
- Elementary, middle and secondary schools;
- Parks and the waterfront; and
- Shopping plazas.

More short-term bicycle parking is needed across the city to provide secure bicycle parking at many different types of destinations.

## 7.1.2 Long-Term Bicycle Parking at Transit Stations

Bicycle parking at transit stations provides the option of getting to transit by bicycle which could reduce the need for large parking lots and parking structures. However, many people will not feel comfortable parking their bicycles at a transit station or stop for several hours or all day if the

bike parking is not secure. Starting in 2018, Metrolinx will begin installing secure bicycle parking stations (long-term bicycle parking) at all GO Transit stations. It is recommended that long-term bicycle parking be provided at other transit terminals to support more people cycling to public transit.

**Figure 24:**  
Examples of short-term and long-term bicycle parking

Short-term bicycle parking



Long-term bicycle parking





### 7.1.3 Bicycle Parking at Schools

In 2014, Region of Peel Public Health introduced a Bicycle Parking Program to fund, install and monitor bicycle racks at participating schools. After installing new racks at 41 schools in the region, there was a 21% increase in bicycles being parked at those schools. By the end of 2017, 125 new bicycle racks had been installed at 79 schools in the region. Approximately half of those schools are in Mississauga.

### 7.1.4 Bicycle Parking on Private Property

Mississauga's Transportation Demand Management Strategy and Implementation Plan has developed bicycle parking standards to be included in the city's Zoning By-Law. Once added into the by-law, these standards will require new commercial and residential developments to build long-term and short-term bicycle parking and in some cases facilities like showers and lockers. This will provide bicycle parking at new apartment buildings, condos and office buildings, where people live and work, to help make cycling more attractive.

As the cycling network continues to develop, the demand for bicycle parking will continue to increase. A dedicated city-wide bicycle parking program is recommended to increase bicycle use; support a connected, convenient and comfortable cycling network; and foster a culture of cycling in Mississauga by:

- Supporting the implementation of bicycle parking through the Zoning By-Law;
- Proactively identifying bicycle parking needs and priorities;
- Purchasing, installing and maintaining different types of bicycle parking on public property; and
- Promoting bicycle parking programs operated by partners like Metrolinx and the Region of Peel.

**Figure 25:** Cover of Mississauga's 2018 Transportation Demand Management Strategy





## 7.2 Bike Share

Public bike share systems are popular in many cities. They provide 24-hour access to shared bicycles. Public bike systems are designed for one-way trips, like a taxi. Bicycles are picked up and parked at a docking station, or at a designated location within a service area. Bike share service areas are usually in downtown or other areas where there is a dense population of people living and working, and where there are dedicated bicycle routes.

Bike share systems are a popular strategy to encourage more cycling, and have been successfully implemented and expanded in many cities worldwide. From 2010 to 2016, the number of bike share systems in the United States grew from four to 55, and in Canada from one to five. (Two of these systems have been implemented in the GTHA: Toronto and Hamilton.)

In suburban cities like Mississauga, access to transit is a key priority to make public transit more accessible and encourage its use. Bike share can help address these “first and last mile” challenges of public transit, and add value to transit investments.

Bike share provides several benefits to cyclists:

- Access to a bicycle without having to own and maintain one;
- The option to use a bike for some parts of a trip and not others, or only one-way;
- Access to a bicycle at one or both ends of a transit trip;
- Removes any worry about bicycle parking or theft; and
- Provides a travel option that is very affordable.

Most people participating in the 2018 Cycling Master Plan project said they would like to use bike share for errands, shopping, recreation and/or commuting.

Mississauga’s downtown, Port Credit and area in between (as shown in **Figure 27**) is home to approximately 150,000 residents as well as others visiting the area, and includes important business, work, transit and entertainment destinations. Cities with bike share programs like Hamilton have similar population densities and destinations in their bike share service areas. However, bike share programs also need connected cycling routes on which people feel comfortable riding. The cycling network in Mississauga is still developing. Recommended cycling routes on several major corridors like Hurontario Street, Dundas Street and Lakeshore Road are not in place now, but will be key connecting cycling corridors within this area.

Successful bike share programs increase cycling trips and promote a culture of cycling. The next step toward building a successful bike share system in Mississauga is to understand the market for bike share, the best technology, operating model and appropriate timing with the developing cycling network.

**Figure 26:** Different types of bike share systems

### *Station-based bike share*

- Bikes must be parked at fixed docking stations
- Payment made at station, on website or mobile app
- Bikes unlocked at station
- Bikes cannot be reserved



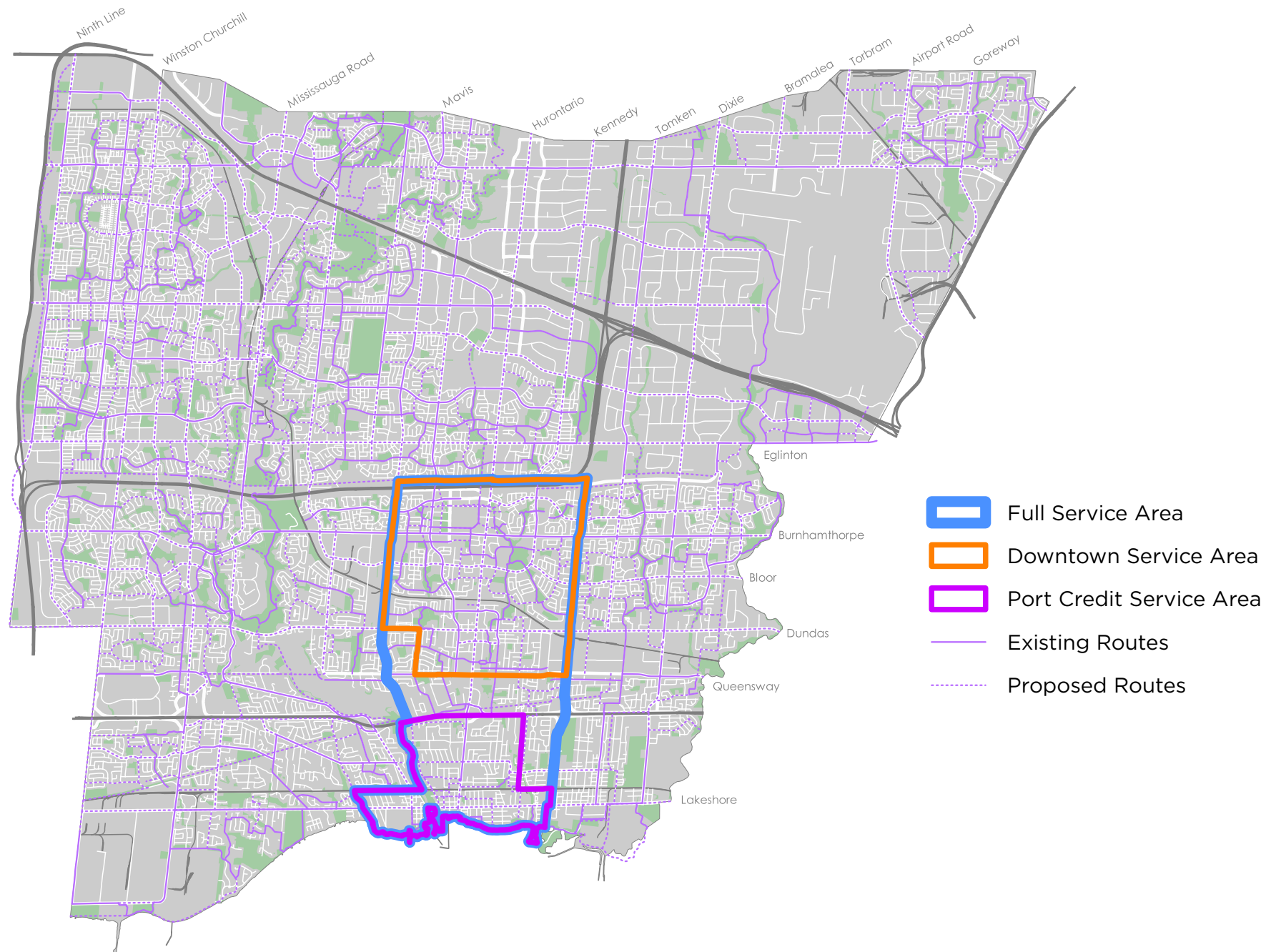
### *Bike-based bike share*

- GPS-equipped bikes must be parked in service area
- No stations but may have designated parking areas
- Payment made on website or mobile app
- Bikes reserved and unlocked by mobile app



Photo Credit: Raise the Hammer

**Figure 27:** Conceptual bike share service areas in Mississauga





## 7.3 Promotion and Education

Promotion and education programs are an important complement to bicycle route infrastructure and play a critical role in improving safety for cycling, increasing the number of cycling trips, and fostering a culture of cycling. Studies have shown that the decision to start cycling is significantly influenced by the physical environment but also other factors including individual desires, abilities and social influences.

Mississauga has made significant progress in increasing awareness of cycling in the city. The efforts of Active Transportation Office staff, Mississauga Cycling Advisory Committee (MCAC) members, Region of Peel staff and other stakeholders have created annual programs that promote a cycling culture to residents. In 2017 these programs included:

- Bike Month;
- Bike to School Week;
- MCAC Community Rides and the Tour de Mississauga, which combined hosted approximately 4,000 cyclists;
- Mississauga Bike Challenge and Mississauga Bikes website providing online information and incentives for cycling; and
- Cycling Ambassador Program.

During project consultation, people indicated that they would like to have more information about cycling issues, such as the timing and location of upcoming cycling network projects; where to report problems like potholes or a lack of bicycle parking; where to go with general questions related to cycling; and how to show support for new cycling network infrastructure. All across the city we heard from residents who would like to see more education opportunities and campaigns to educate cyclists and drivers about how to interact safely on the city's roadways.

Cycling events like the annual Tour de Mississauga and MCAC's Community Rides are popular among many different types of cyclists and have helped to foster a cycling culture in the city.

The city's Recreation Department currently offers cycling skills education based on the nationally-recognized CAN-BIKE program. The program currently focuses on entry-level skills and has between 50 and 80 participants each year.

The city's Cycling Ambassador Program was first recommended in Mississauga's 2010 Cycling Master Plan. Cycling Ambassadors are a team of summer staff whose job it is to promote and model safe cycling across the city. By engaging with communities across Mississauga, these staff members help to encourage cycling by promoting new programs and facilities, and educate cyclists and drivers by distributing safety information. They may also provide support to cycling network projects by helping to engage and consult with community members.

### 7.3.1 The Five Es

The "five Es" is a framework that is often used to acknowledge that improvements to transportation safety, including cycling, are best accomplished through a combination of well-designed infrastructure and other supporting projects and programs. The five Es are:

1. Engineering;
2. Education;
3. Encouragement;
4. Enforcement; and
5. Evaluation.



The proposed cycling network and design-focused recommendations in Chapter 3 outline a strategic role and responsibility for the city to address engineering-related initiatives that will support Cycling Master Plan goals. Evaluation is also a critical part of improving cycling safety and achieving Master Plan goals and is discussed in Chapter 9.

Promotion and Education programs and projects play the important role of addressing the remaining three Es:

- Education programs improve cycling safety and awareness. This can include live training or print/digital resources that teach cycling skills and teach drivers how to share the road safely with bicycles.
- Encouragement programs provide incentives and support for people so that they are motivated to try cycling or cycle more often.
- Enforcement programs ensure that all road users including cyclists are operating legally and respectfully. Police and by-law staff are an important part of enforcement programs, as is signage to remind road users of their legal rights and responsibilities.

Promotion and education recommendations and actions in Chapter 3 are categorized under the above three Es.

It is recommended that Mississauga grow and support cycling promotion and education programs and initiatives described in Chapter 3 and continue to foster relationships with key partners including Peel Regional Police, Public Health, and regional transportation staff, Smart Commute Mississauga and members of the local cycling community.

Details about cycling promotion and education best practices are outlined in **Appendix IX**.

## 8 Implementing the Plan

The implementation plan for the cycling network was developed by costing all of the proposed cycling facilities as stand-alone projects, and creating four funding scenarios that offer different amounts of savings by coordinating implementation with scheduled road rehabilitation and major road construction projects. The City of Mississauga funds its cycling infrastructure through two departments: Transportation and Works (within street rights-of-way), and Community Services (within parkland).

The total plan costs in **Table 7** are based on stand-alone construction of all cycling facilities and upgrades.

**Table 7:** Capital cost breakdown

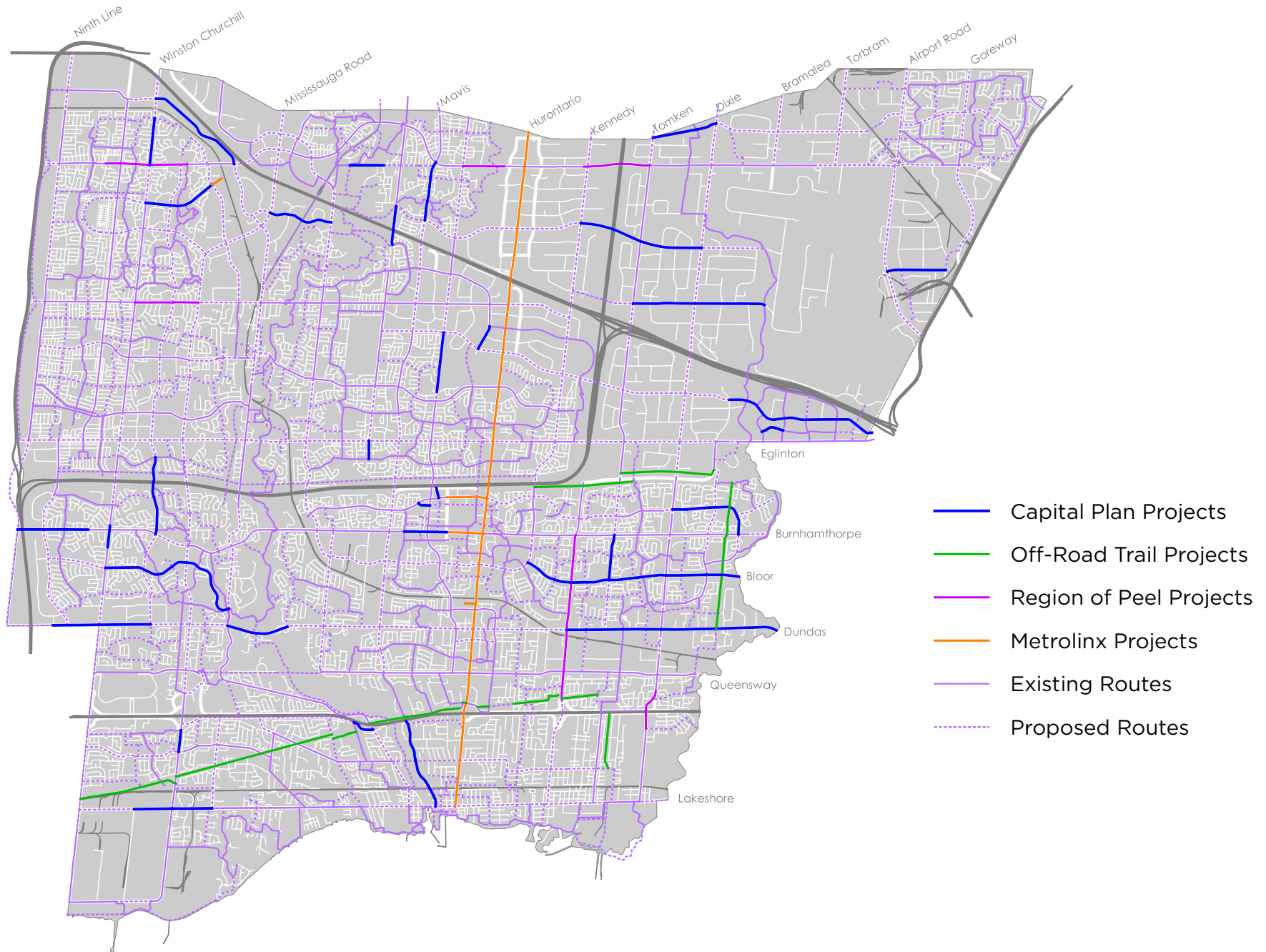
Network Components	Cost
Primary Network	\$134,000,000
Secondary Network	\$34,000,000
Off-Road Trail Network (Community Services)	\$38,000,000
Off-Road Trail Road Crossings (Transportation & Works)	\$18,000,000
Major Crossing Structures	\$43,000,000
<b>Total Network and Structures Cost</b>	<b>\$267,000,000</b>

Note that all costs in this report are estimates, and expressed in 2018 dollars. Full project lists can be found in **Appendix I**. More details about the implementation plan and five-year coordinated plan projects can be found in **Appendix II**.

### 8.1 Capital Plan Coordination

A major consideration of the implementation plan is the extent to which it takes advantage of the Roads Service Area capital plan, which outlines scheduled road rehabilitation and major construction with five-year and ten-year horizons, respectively. Many proposed cycling facilities would realize cost savings and public benefits by being implemented in coordination with these projects. Cost savings can be most realized on projects that require moving curbs and adding new pavement, such as to install cycle tracks. Other cycling facility types, such as signed routes or the addition of bike lanes where there is already sufficient pavement width, may not benefit as much financially from being implemented in coordination with road rehabilitation or major construction; however, other benefits can be realized through coordination, including faster implementation of cycling infrastructure, less overall construction disruption to the roadway, and less perception of “missed opportunities” and repeated road construction.

**Figure 28:** Five-year implementation plan map



## 8.2 Capital Cost Estimates

Costs for implementation are based on unit costs in **Table 8**. These are estimates; final costs will be determined through detailed design of each bicycle network project. The unit costs of bicycle facilities new to Mississauga have been estimated based on experience in other cities. Cost assumptions for these facilities will be refined over time, based on experience in the Mississauga context.

Opportunities for cost savings will be investigated for all projects including work such as signs and pavement markings which may be completed in-house by city staff at lower cost.

**Table 8:** Unit costs by facility type and construction

Cycling Facility	Cost per km
Cycle Track or Separated Bike Lane: <i>Road widening with full curb reconstruction</i>	\$990,000
Cycle Track or Separated Bike Lane: <i>Road widening coordinated with road rehabilitation project</i>	\$720,000
Separated Bike Lane: <i>Addition or lane conversion on existing roadway</i>	\$220,000
Multi-Use Trails and Off-Road Trails: <i>Addition to boulevard or parkland</i>	\$580,000
Bike Lane: <i>Road widening with full curb reconstruction</i>	\$870,000
Bike Lane: <i>Road widening coordinated with road rehabilitation project</i>	\$350,000
Bike Lane or Advisory Bike Lane: <i>Addition or lane conversion on existing roadway</i>	\$60,000
Paved Shoulder: <i>Addition to edge of roadway</i>	\$90,000
Shared Route with traffic calming: <i>Addition to existing roadway</i>	\$50,000

## 8.3 Bike Parking and Intersection Enhancement

The 2018 Cycling Master Plan recommends an annual bike parking program as well as intersection improvements. \$50,000 per year would allow the installation/replacement of approximately 100 bike parking spaces a year. \$150,000 would fund approximately three intersection improvements per year, at \$50,000 each, when coordinated with scheduled intersection improvements. There are approximately one to two intersection improvements programmed per year in the capital plan. The recommended amount of funding could increase the rate of intersection improvements for cycling facilities.

**Table 9:** Yearly cost of additional capital programs

Bike Parking Program	\$50,000
Intersection Enhancement Program	\$150,000
<b>Total</b>	<b>\$200,000</b>

## 8.4 Recommended Funding

The Active Transportation Office (within the Transportation and Works Department) programs the capital plan for cycling infrastructure on Mississauga-owned road rights-of-way (ROWs). Capital planning for off-road trails outside of road ROWs is handled by the Community Services Department. As a result, there are two funding components, one for Roads Service Area and a second for the Parks and Forestry Service Area.



### 8.4.1 Funding Scenarios—Roads Service Area

Four capital funding scenarios were developed for the cycling infrastructure to be planned, budgeted and constructed by the Roads Service Area (as summarized in **Table 10**). Each scenario would require a different number of years to complete the network. This represents the primary and secondary on-road networks, which make up the bulk of the total cycling network.

**Table 10:** Roads service area funding scenarios

Scenarios	A (current)	B	C	D
Yearly funding allotment	\$1,450,000	\$3,575,000	\$5,262,500	\$6,950,000
Length constructed per year (km)	5	12	18	25
Years to complete network	95	40	27	20

Major crossings require more detailed design work to get cost estimates; that is beyond the scope of this plan. These structures are typically funded on a project-to-project basis, and thus not included in the funding scenarios.

### 8.4.2 Funding—Parks and Forestry Service Area

Trails through parklands are planned, budgeted and built by the Community Services Department, in coordination with the Active Transportation Office. Trail construction and rehabilitation has been consistent, and major network pieces are funded and under construction. Funding from the Region of Peel and Ontario Municipal Commuter Cycling program has been fairly consistent. Community Services seeks funding for construction on a project-to-project basis. The current levels of funding for Community Service's trails are considered adequate. Following approval of the 2018 Cycling Master Plan, an update to the priority of projects will be undertaken by Community Services, in consultation with the Active Transportation Office.

## 9 | Evaluating the Plan's Success

Measuring the progress of a plan step by step helps to identify what is working and what changes, if any, are needed to meet a plan's goals over time.

This chapter provides a list of performance measures (objectives that can be measured) and identifies the data that will be collected by the city and its partners to measure them. This information will be used for regular progress reports on the 2018 CMP. Some information will be available annually, while other data is collected less often and will be reported less frequently.

### 9.1 Performance Measures

**Table 11** shows a list of recommended performance measures to monitor and evaluate the progress of the 2018 CMP. These performance measures were developed in collaboration with internal city divisions and external partners. They are based on available data wherever possible and will be further supported through this Plan as described in Chapter 3, Recommendation 1.5: Establish programs for routine collection, maintenance, and publication of cycling data.

**Table 11:** Recommended performance measures

GOAL	OBJECTIVE	MEASUREMENT
Improve safety for cycling	Reduce bicycle collision rates	Bicycle collision rates
	Reduce the severity of bicycle collisions	Proportion of severe injuries and fatalities
	Increase awareness of bicycle safety among drivers	Number of people participating in bicycle safety driver education programming
	Increase awareness of bicycle safety among cyclists	Number of people participating in cycling safety training and education programming; and distribution of cycling safety education materials
	Increase awareness of bicycle safety among the general public	Social media stats from cycling safety campaigns targeting cyclists and drivers

GOAL	OBJECTIVE	MEASUREMENT
<b>Increase the number of cycling trips in Mississauga</b>	Increase the number of cycling trips city-wide	Number of cyclists travelling by bike on a typical day in Mississauga as a proportion of total trips
	Increase the number of short cycling trips (5 km or less) city-wide	Proportion of short distance trips (5 km or less) that are made by bicycle
	Increase the number of cycling trips in certain locations (e.g., downtown)	Number of cyclists entering and exiting certain zones or neighbourhoods
	Increase the number of Smart Commute members cycling to work	Proportion of employees cycling to work at Smart Commute member workplaces
	Increase the number of school-age children (elementary, middle and high school) cycling to/from school	Proportion of school-age children cycling to/from school
	Increase the number of cyclists accessing transit	Proportion of transit users accessing GO Rail Stations by bike; and number of bikes in bike racks on MiWay buses
<b>Build a connected, convenient and comfortable bicycle network</b>	Increase the number of new cycling facility projects being monitored	Proportion of new projects being monitored for before and after conditions on new cycling facilities
	Increase the number of residents served by cycling routes	Proportion of the city's population living within a certain distance to the cycling network
	Increase the number of key destinations served by cycling routes	Proportion of key destinations served by cycling network
	Increase the number of key destinations with bicycle parking facilities	Proportion of key destinations with bicycle parking
	Achieve consistent investment in completing the cycling network and providing end of trip facilities	Annual budget for Cycling Master Plan projects
		Proportion of budget spent
		Amount of funding from outside agencies
		Proportion of outside funding spent
	Increase the number of bicycle-friendly intersections	Proportion of intersections in cycling network with bicycle-friendly designs
	Improve cycling facility maintenance on priority routes	Proportion of cycling routes prioritized for maintenance
	Improve winter conditions for cyclists	Proportion of cycling routes in winter maintenance program
	Increase proportion of cycling facilities designed to updated Mississauga standards	Proportion of km lengths
		Proportion of intersections
	Increase overall length of cycling facilities in the cycling network	Number of km of new cycling facilities by facility type

GOAL	OBJECTIVE	MEASUREMENT
Foster a culture of cycling	Increase public awareness of cycling	Number of social media impressions focused on cycling
		Number of cycling-related alerts or messages sent through the city's Roads App/collected through Pingstreet
		Number of face-to-face engagements related to cycling
		Total number of programs and campaigns delivered (either with city as lead or as partner with agency or community group)
		Number of headlines about cycling in local media
		Level of satisfaction of existing cyclists/number of non-cycling residents who intend to take up cycling
	Increase participation in cycling-related events or programs	Number of participants in cycling courses (e.g., CAN-BIKE).
		Number of participants/organizations participating in cycling events
		Number of different types of cycling events—targeting different kinds of cycling
		Number of different groups/ages/demographics represented at cycling events
	Increase cycling participation in other community events	Number of community events with cycling included in some way
	Achieve consistent investment in cycling education, promotion and programming	Amount allocated to cycling education and promotion in annual budget
		Proportion of allocated funding spent
		Amount of funding from outside agencies
		Proportion of outside funding spent



## 9.2 Data Sources

There are several data sources that include bicycle ridership data for Mississauga including large survey data sets from the Transportation Tomorrow Survey (TTS) and Statistics Canada Census data.

The city's Transportation and Works Division and the Region of Peel count bicycles on specific bicycle facilities. Turning movement counts are taken regularly at many intersections. There is also a cordon count conducted by the Region of Peel which is a vehicle survey that counts the number of people driving and cycling into and out of different areas within the region. Counting stations are typically along municipal borders on highways and major roadways which may not be where most cycling activity occurs.

Collision data is collected by Peel Regional Police and provided to the city and the region as raw data. This includes bicycle-related collisions.

With each of these data sources there are limitations and room for improvement. Large survey data sets that gather cycling-related information from very small sample sizes are of limited use. Bicycle counts may show significant variability from year to year because of the sensitivity of bicycle ridership to issues like cold, snowy winter months, rainy weather or other storm events, and different patterns of peak activity during the day based on the location and its potential to support cycling trips for various purposes like shopping, errands, recreation and entertainment. Counting methods that are designed for motor vehicles may not be taken at locations where cyclists are riding, they may not accurately count the number of cyclists and in some cases they may categorize cyclists as pedestrians, especially if they are riding on sidewalks or through pedestrian crossings.

A bicycle counting program that is designed to provide more reliable data on bicycle ridership is needed to establish better baseline data and continue to monitor the outcomes of Cycling Master Plan investments.

## 10 | Next Steps

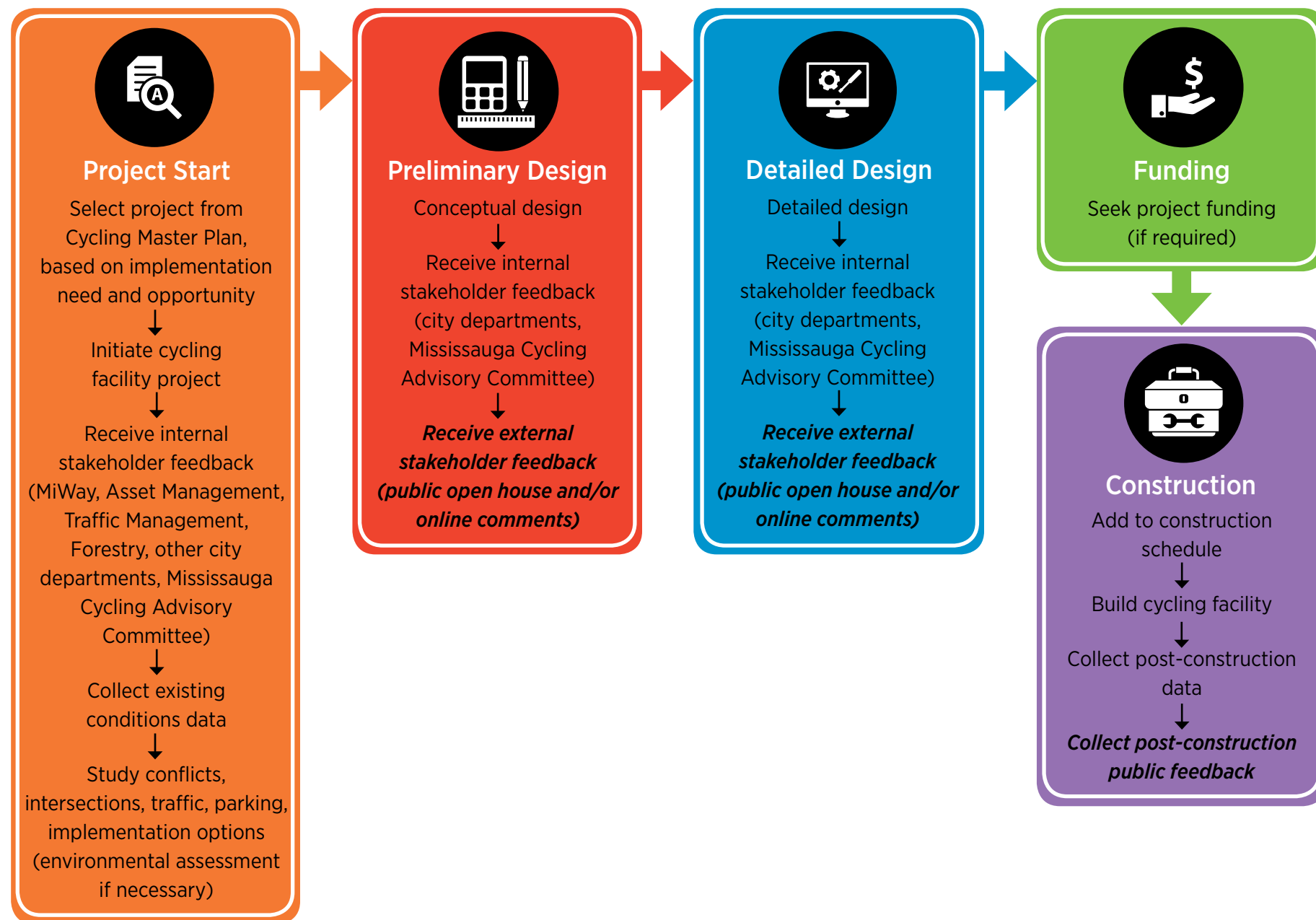
The 2018 Cycling Master Plan is a long-term plan that will be implemented over many years. It is a plan that belongs to Mississauga residents and will continue to be guided by the community. As each cycling network project is implemented, community members and other stakeholders will have the opportunity to provide input. For the cycling network to achieve the goals of the 2018 CMP it must be complete with no gaps. Completing the cycling network is a key priority to meet the City of Mississauga's Official Plan, Strategic Plan and Climate Strategy goals.

### 10.1 How We Can Continue to Work Together

**Figure 29** illustrates how cycling network projects are implemented and where there are opportunities for the public to help shape those projects.



**Figure 29:** Cycling network project implementation process



## 11 | Appendices

The appendices, listed below, are available online as separate documents.

- I. [Recommended Cycling Network](#)
- II. [Implementation Plan](#)
- III. [Cycling Network Analysis](#)
- IV. [Policy Context](#)
- V. [Bicycle Facility Design Best Practices](#)
- VI. [Existing Conditions Assessment](#)
- VII. [Engagement and Consultation](#)
- VIII. [Level of Traffic Stress](#)
- IX. [Cycling Promotion and Education Best Practices](#)



