7 Cycling Projects Priority Analysis

A project rating process was developed to inform the program years for the proposed Cycling Network routes, ranking the costs and benefits of projects city-wide. This priority analysis to determine a list of cycling projects for the 10-year capital plan involved data from the following sources:

- Feasibility analysis;
- Cycling Impact Analysis;
- MetroQuest Digital Draft Map cycling project support / non-support; and,
- Cycling project cost.

7.1 Feasibility Analysis

The Ten Year Cycling Network Plan provides a vision for which streets may be linked together to form a cohesive, connected network of cycling routes. The detailed design for each cycling route will be undertaken leading up to the year that the project is scheduled for construction. However, in order to plan for the funding of the network, an initial assessment of what type of cycling facility type would be required (and how it could be implemented) was needed. A cost estimate could then be assigned to the project.

The feasibility analysis considered two aspects:

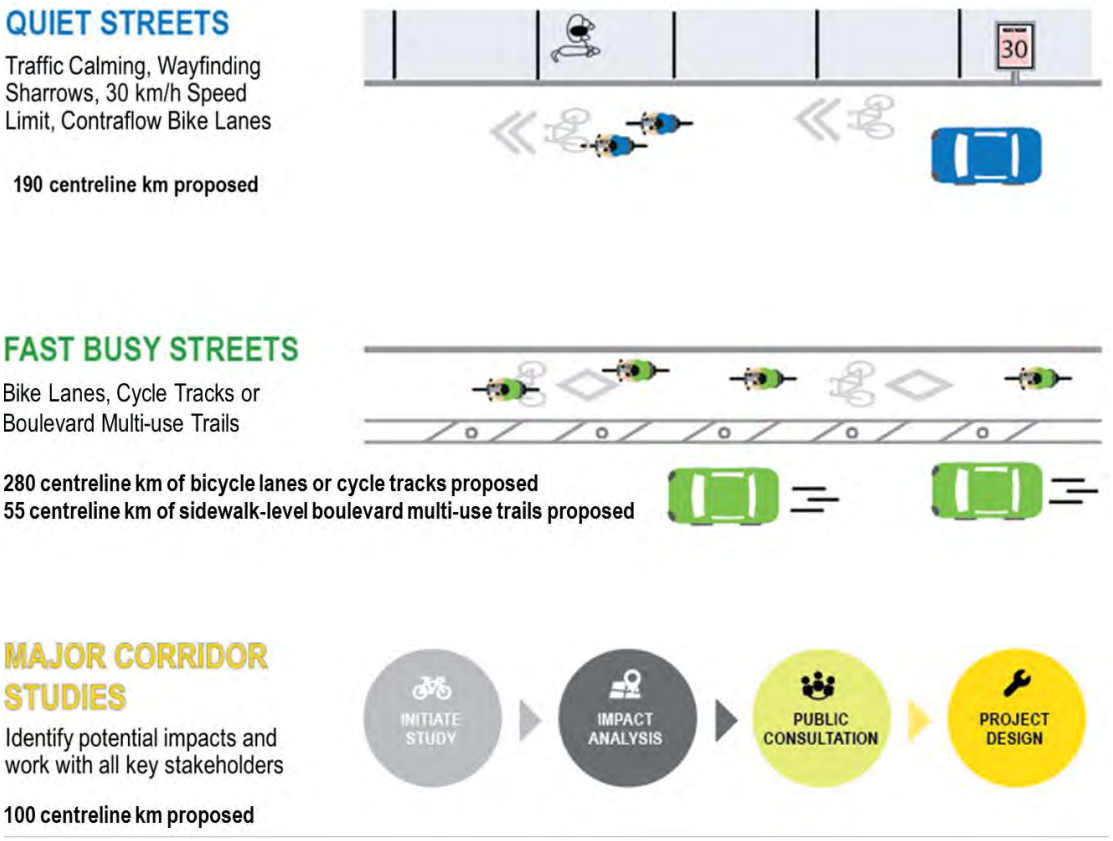
- The type of cycling facility suitable for a given route or corridor based generally on the number of lanes, and the volume and speed of traffic; and
- The way in which the cycling facility may be implemented from simply installing signs and pavement markings through to complete road reconstruction.

During detailed design, additional analysis and public consultation will be undertaken to confirm or revise the type of cycling facility and the method of implementation. The detailed design will also identify any changes to traffic operations, parking, transit, intersections, etc.

7.1.1 Identifying Suitable Cycling Facility Types

The proposed Cycling Network is illustrated in Appendix A, at both the city-wide and district scale. At the planning stage, projects for new routes were considered in three categories, as described in Exhibit 7-1.

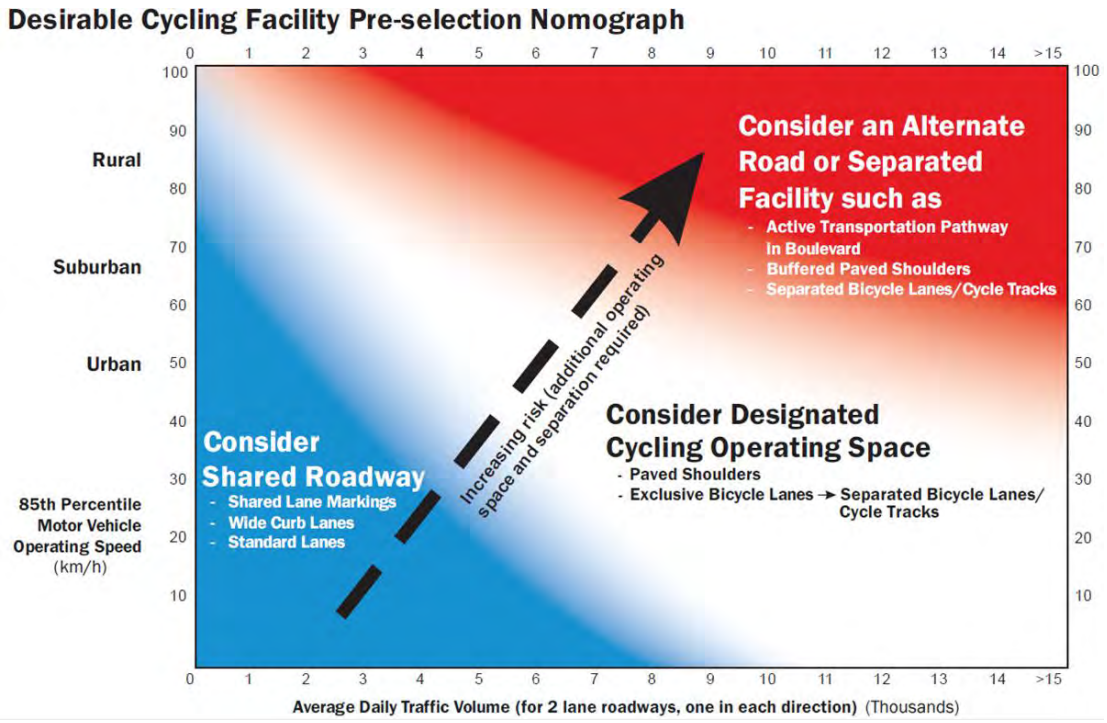
Exhibit 7-1: Street Types for Proposed Cycling Network



The City of Toronto is preparing *On-Street Bikeway Design Guidelines*, planned for completion in 2019. This new resource is being informed by design guidelines, including facility type selection, from *Ontario Traffic Manual Book 18 Bicycle Facilities*, the National Association of City Transportation Officials (NACTO) *Urban Bikeway Design Guide*, and from other jurisdictions. The City of Toronto also has their own *Multi-Use Trail Design Guidelines*.

Ontario Traffic Manual Book 18: Cycling Facilities provides guidance concerning the selection of cycling facility types for different types of streets. It includes a Facility Selection Decision Support Tool, with a pre-selection nomograph as illustrated in Exhibit 7-2.

Exhibit 7-2: OTM Book 18: Cycling Facilities Pre-Selection Nomograph



As presented in *OTM Book 18*, and the NACTO *Urban Bikeway Design Guide*, the initial cycling facility type chosen depends on two primary characteristics: the average daily traffic volume of a roadway, as well as the operating speed of the vehicles on that roadway. At a city-wide planning level, it is therefore possible to identify what range of facility types may be appropriate for a corridor, based on the traffic volumes and speeds of that corridor. Other factors also play into what facility type is chosen based on the nature of the street. *OTM Book 18* has a list of 13 other factors considered: costs, on-street parking, level of bike use, function of street, collision history, etc. These will be part of the City of Toronto's *On-Street Bikeway Design Guidelines* as well.

7.1.1.1 Fast Busy Streets

The faster and busier a street is, the greater the need to provide a dedicated area for cycling. A painted bicycle lane will provide a dedicated area where motor vehicles may not lawfully stand, stop or park. By-lawed dedicated bicycle lanes may be identified by a diamond symbol. This diamond symbol is the pavement marking used in Ontario to signal to road users that special provisions beyond those stipulated in the Ontario Highway Traffic Act have been enacted.

In many circumstances, painted bicycle lanes can provide a dedicated facility that will improve the cycling safety and provide a reasonable level of comfort for most road users. However, painted bicycle lanes may not provide sufficient safety and comfort on every roadway.

As part of the detailed design process, the merits of providing buffered bicycle lanes or cycle tracks may be considered. Buffered bike lanes create an additional measure of comfort for cycling, with a painted hatched area on the roadway to help separate cyclists from motor vehicles.

Cycle tracks are dedicated bicycle lanes where physical separation has been introduced between the cycling travel area, and the travel area used by motor vehicles. Since 2013, the City of Toronto has been installing a variety of different cycle track designs. Permanent cycle

tracks may be constructed (if the right-of-way width allows) at the time that a road is being reconstructed. If the preferred design of a cycling facility is of a cycle track, but the installation cannot be realized in coordination with a road reconstruction, then a retrofit to the existing roadway may be installed. "Retrofit" cycle tracks may be installed using a variety of lane separators such as flexible bollards, precast curb stones, planters, or more permanent concrete curbs. Retrofit materials may also be used as part of permanent designs.

For some streets which have very high traffic speeds and traffic volumes, the Plan has identified the feasibility of providing a trail at sidewalk level, away from the roadway. Boulevard facilities may be multi-use or separate cyclists and pedestrians, depending on context. Although they are often more costly than painted facilities, providing facilities adjacent to the roadway in the boulevard is a strategy that may be necessary to achieve a comfortable cycling environment in certain parts of the city.

Exhibit 7-3: Planters Used as Separators for the Richmond Street Cycle Track[xix]

Toronto's 2001 Bike Plan primarily focussed on painted bicycle lanes or multi-trails in the boulevard. Increasing the amount of physically separated infrastructure available will help to enable more people to feel comfortable cycling in our city. Cycle tracks may provide an enhanced level of comfort and safety for people new to cycling, improve comfort and safety of existing cyclists of all ages and abilities, and separate cyclists from pedestrians.

For the feasibility analysis, the speed and traffic volume thresholds presented in Exhibit 7-4 were used to initially determine if a Fast Busy Street should have dedicated bike lanes or separated facilities such as cycle tracks or multi-use trails. The initial cycling facility was adjusted as various implementation strategies, presented in Section 7.2, were considered. The preference was to provide a separated facility on Fast Busy Streets if there was an implementation strategy opportunity such as a co-ordinated road reconstruction project.

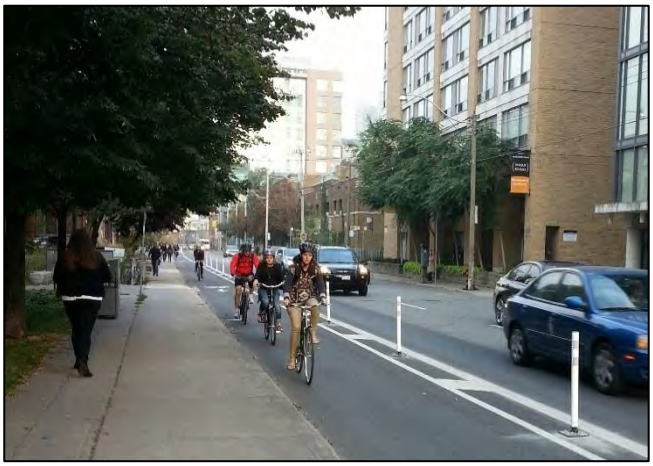
Exhibit 7-4: Fast Busy Street Speed and Volume Thresholds for Dedicated and Separated Cycling Facilities

SPEED (km/h)	DAILY TRAFFIC VOLUME (vehicles/day/2 lanes)														
	2,000	3,000	4,000	5,000	6,000	7,000	8,000	9,000	10,000	11,000	12,000	13,000	14,000	15,000	16,000
30	Not applicable to														
40	Fast Busy		Shared or						Dedicated						
50	Sts.	Dedicated										Dedicated or			
60						Separated						Separated			

Exhibit 7-5: Types of Cycling Facilities Suitable for Fast Busy Streets

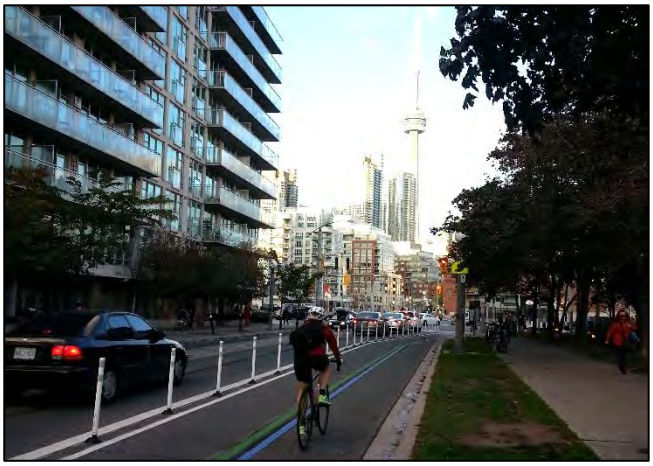
Bike Lane

Buffered Bike Lane



Cycle Track with buffer and bollard separators

Cycle Track with curb separator



Bi-directional Cycle Track

Boulevard Multi-use Trail

7.1.1.2 Quiet Streets

On local streets where there is little traffic, and traffic is slower moving, a dedicated cycling facility is often not required. The installation of wayfinding signs and markings to help cyclists navigate along a route is often sufficient. Quiet Street cycling routes combine traffic volume management, pavement markings, wayfinding signage and posted 30 km/h speed limits. The routes identified in the Ten Year Cycling Network Plan represent useful links between dedicated cycling routes on arterial roads or trails. In some cases, local street routes may also provide alternatives to routes on busier arterial roads, or provide connections between two designated cycling facilities.

The City of Toronto has started a city-wide roll out of the Toronto 360 Wayfinding Strategy ("TO360"). It is a pedestrian wayfinding system, which is a central component of the City's ambition to make Toronto a more walkable, welcoming and understandable place for visitors and residents alike. TO360 provides consistent wayfinding information through a unified signage and mapping system delivered by the City and project partners.

Exhibit 7-6: Example of a Contra-flow Bike Lane on a Local Street

A pilot project to install updated wayfinding signs on cycling routes in coordination with the TO360 wayfinding project was installed in the summer of 2015[xx]. These signs highlighted routes for the Pan Am Games in the Harbord-Hoskin area near St. George St. The new signs include information about the distance to the next cycling route, as well as nearby public facilities such as public libraries, community centres and destination parks. Pavement markings will also help to reinforce the wayfinding signage on Quiet Street cycling routes.

On May 5th, 2015 Toronto City Council adopted the 30 km/h policy. City Council approved warrants for establishing 30 km/h speed limits. The adoption of this City policy included a provision that roadways identified as Quiet Street cycling routes will be signed for 30 km/h operation at the time that the Quiet Street cycling route is installed.

At the time that a Quiet Street cycling route is programmed for installation, physical traffic calming measures may be considered as part of the detailed design to ensure that the operating speed provides an environment which is comfortable for cycling. This may include speed humps, curb extensions, or the narrowing of general purpose travel lanes with the addition of contra-flow bicycle lanes. Contra-flow bicycle lanes, i.e. bicycle lanes that allow cyclists to ride against traffic on a street that allows traffic to travel in one direction only, can help cyclists travel through neighbourhoods which have been traffic calmed with discontinuous one-way streets. These are also effective on longer, continuous one-way streets.

Exhibit 7-7: Range of Design Features for Quiet Streets

Sharrow Pavement Markings


Wayfinding Sharrow Pavement Markings

Traffic Restrictions with Bicycle Exceptions

Cycling Route Signage


Contra-flow Bike Lane


Physical Traffic Calming Feature (traffic circle)

Physical traffic calming measures discourage traffic from using the cycling route so that the overall number of cars using a street is reduced. For information on some of the typical measures which may be installed on local and collector streets, please refer to the City of Toronto's *Traffic Calming Guidelines*[xxi]. Residents may petition for traffic calming to be considered, and then safety and other technical warrants are evaluated.

Beyond these standard traffic calming measures, many jurisdictions are installing traffic diverters, which are considered a traffic operational measure in Toronto (a petition from residents is not required). Traffic diverters may lower motor vehicle volumes, with some jurisdictions targeting volumes as low as 500 vehicles per day. Some examples of physical interventions that are in use to create Quiet Street cycling routes in North American cities are described below.

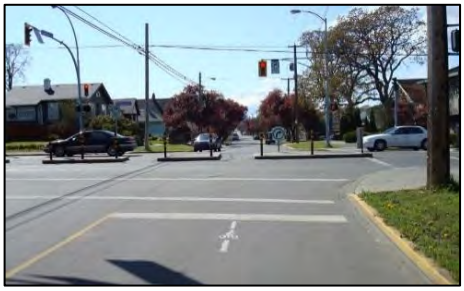
Exhibit 7-8: Physical Traffic Diversion Measures

Right-in / Right-out Island – This type of measure restricts movements at an intersection to prevent left turns and through vehicles from accessing the other side of the intersection. This measure can help to reduce short cutting and through traffic along a street segment.

Photo Source: NACTO Urban Bikeway Design Guide

Diagonal Diverter – This measure restricts through and right movements at an intersection to limit through traffic. The diverter can be designed to permit pedestrian, cycling and emergency vehicle access.

Photo Source: City of Toronto



Raised Median through Intersection – This measure prevents left and through movements at an intersection, however special "cut-throughs" can be provided to facilitate these movements for cyclists, pedestrians and emergency vehicles. This measure can reduce short cutting and through traffic along a street segment, as well as reduce crossing distances for pedestrians.

Photo Source: IBI Group

Partial / Directional Closure – This measure involves a curb extension of vertical elements that extend to the centreline of a roadway, restricting approaching traffic from entering the roadway. Bicycle and pedestrian access is maintained.

Photo Source: City of Toronto

Full Closure – This intervention restricts all vehicular movements at an intersection or midblock while permitting bicycle and pedestrian access.

Photo Source: City of Toronto

For the feasibility analysis, the speed and traffic volume thresholds presented in Exhibit 7-9 were used to initially determine if a Quiet Street was appropriate for shared use.

Exhibit 7-9: Quiet Street Speed and Volume Thresholds for Shared Cycling Facilities

SPEED (km/h)	DAILY TRAFFIC VOLUME (vehicles/day/2 lanes)				
	1,000	2,000	3,000	4,000	5,000
30	Shared[1]				
40				Shared or	
50			Dedicated[2]		N/A
60				to Quiet St.[2]	

Notes:
1: Add traffic calming measures to reduce speeds to 30 km/h
2: Add traffic calming and / or operational measures to reduce speed to 30 km/h and reduce traffic volumes to "shared" cycling facility thresholds

7.1.1.3 Major Corridor Studies

On fast busy streets which have significant commercial activity, it is critically important to work closely with stakeholders such as merchants who are members of Business Improvement Areas to achieve their support for a proposed cycling facility.

The Cycling Network Implementation Plan therefore identifies a number of major commercial corridors as necessitating Studies to thoroughly evaluate the opportunities and costs of introducing a bike lane or cycle track.

The scope of Major Corridor Studies may include (but is not limited to) the analysis of:

- Traffic impacts;
- The loading and delivery needs of merchants to run their businesses;
- The solid waste pick-up needs for businesses such as restaurants;

- Parking impacts to the corridor and adjacent streets / parking lots;
- Transit operations;
- Streetscape enhancements; and,
- Accessible parking and loading / unloading.

Adequate funding is critical to ensure that these projects are sufficiently resourced to undertake the public consultation and outreach necessary to work with affected stakeholders.

As all Major Corridor Study areas identified are on arterial roadways, the objective of the study will be to identify the opportunities and challenges to install dedicated cycling infrastructure facilities, such as bike lanes, cycle tracks, or, in some cases, multi-use trails in the boulevard. Shared lane pavement markings ("sharrows") are not considered a cycling facility type on arterial roadways; they may be used, however, to connect short gaps in the network.

Proposed Major Corridor Studies:

Included within this proposed network are approximately 100 centreline km along eight arterial roadways (split into seventeen segments) for which Major Corridor Studies would be undertaken to evaluate the feasibility of bicycle lanes, cycle tracks, or boulevard multi-use trails. Major Corridor Studies are recommended for the fast busy arterial streets listed in Exhibit 7-10.

On these major corridors, it is recognized that to achieve any Cycling Network link, a Major Corridor Study would be needed to properly assess traffic impacts and work with all affected stakeholders. Because major corridors being considered for study may be long, and many change in character along their length, for the purposes of consultation, these corridors have been broken up into sections, as noted.

Exhibit 7-10: Major Corridor Studies

STREET NAME	PROPOSED STUDY SEGMENT
Yonge Street	6 Study Areas Proposed: • Steeles Avenue to Hendon Avenue • Hendon Avenue to Avondale Avenue • Avondale Avenue to William Carson Crescent • William Carson Crescent to Eglinton Avenue • Eglinton Avenue to Bloor Street • Bloor Street to Front Street
Bloor Street	2 Study Areas Proposed: • Dundas Street West to Keele Street • Keele Street to Sherbourne Street (this Study includes Lansdowne Avenue and Dupont Avenue)
Danforth Avenue	2 Study Areas Proposed: • Broadview Avenue to Danforth Road • Danforth Avenue / Kingston Road (Danforth Road to Eglinton Avenue)
Jane Street	Study Proposed South of Hwy 401 to Steeles Avenue
Kingston Road	Study Proposed between Eglinton Avenue and Highland Creek Trail
Kipling Avenue	Study Proposed between Bloor Street and Waterfront Trail
Lake Shore Boulevard West	Study proposed between Toronto's City limit with Mississauga and the Humber River

STREET NAME	PROPOSED STUDY SEGMENT
Midland Avenue	3 Study Areas Proposed: • Steeles Avenue to Sheppard Avenue • Sheppard Avenue to Lawrence Avenue • The Gatineau Trail to Waterfront Trail

7.2 Implementation Strategies

An initial assessment of how each cycling project could be implemented was assessed. These implementation strategies range from low-cost installation of signs and pavement markings through to higher-cost construction. A range of implementation strategies was considered for each type of cycling facility, as detailed in Exhibit 7-11.

Exhibit 7-11: Implementation Strategies for Each Type of Cycling Facility

The following thresholds were considered for some of the implementation strategies:

- The potential to narrow travel lanes was based on providing a target lane width of 3.2 m on Fast Busy Streets;
- The opportunity to remove a travel lane was based on converting a four-lane roadway to three lanes (two travel lanes and a two-way, centre, left-turn lane), and six-lane roadways to five lanes. This was considered possible if the four-lane roadway carried a daily traffic volume of 20,000 vpd or less and if a six-lane roadway carried 30,000 vpd or less;
- If a boulevard was wide enough and did not contain street lighting poles, utility poles or street furniture, then there was an opportunity to construct a boulevard multi-use trail or boulevard cycle tracks without road reconstruction; and
- Boulevard cycling facilities were not recommended when there were multiple driveways present. This was determined by viewing these routes using Google Streetview.

7.2.1 Major Capital Infrastructure Co-ordination Opportunities

The office of Major Capital Infrastructure Coordination (MCIC) is responsible for improving methods of coordination and communication among City divisions and with other organizations that develop and operate utilities and infrastructure across the city. MCIC's mandate involves early intervention in the capital planning process, and case management of identified risks associated with planning, design and implementation of major capital infrastructure projects. MCIC's mandate emphasizes the timely exchange of information between sponsors of individual projects to ensure that concurrent and consecutive investments in linear and site-specific projects are performed in a logical and cost-effective sequence.

Various capital projects for other infrastructure within City of Toronto road rights-of-way provide opportunities for co-ordinating with the implementation of cycling projects. Major capital infrastructure coordination may reduce the cost of implementation for some bike lane, cycle track and trail projects, due to construction efficiencies. Incorporating cycling projects into the projects co-ordinated and tracked by MCIC required the following actions:

- Identifying those types of projects most likely to provide construction efficiencies for Cycling Network projects;
- Comparing the MCIC projects to the Cycling Network projects in order to identify those cycling projects with co-ordination opportunities. This was done using GIS mapping for the MCIC projects and Cycling Network; and,
- Determining which MCIC project opportunities could be leveraged for each funding scenario. For the lower funding scenarios, not all Cycling Network projects with MCIC project opportunities could be scheduled due to limited annual funding, i.e., the MCIC project opportunities were greater than available funding.

The alignment of Cycling Network projects with MCIC project opportunities is an important element of the Ten Year Cycling Network Implementation Plan and allows for more efficient use of City resources. It is a 'Complete Streets' approach to implementing enhancements for all road users, i.e. using infrastructure renewal projects to deliver other improvements within the road corridor within the overall scope of the renewal project. However, the timing requirements for project delivery through MCIC require a pre-planning process three years in advance.

At the time that a road is being resurfaced, cost savings may be achieved for painted facilities, since there is no cost to move lane lines where new pavement is being installed. At the time that a road is being reconstructed, significant changes may be made to the geometrics of the

roadway, including changing the locations of catch basins and curbs. When roads are being reconstructed, it therefore may be possible to achieve cycling facilities that are grade separated such as cycle tracks or multi-use trails.

MCIC projects are reviewed and adjusted quarterly and projects are shifted from year to year based on a variety of changing resources and priorities. The MCIC co-ordinated Cycling Network projects will also need to shift accordingly to match assigned road projects.

For example, if a cycle track installation is scheduled to follow a road reconstruction, and the road reconstruction is contingent upon work being finished by Toronto Water, the TTC, or a third party Utility, the installation of the cycle track will be moved if the scope of work for the overall coordinated project changes. Changes to the MCIC project schedule may result in changes to the target delivery year of a Cycling Network project.

The need for MCIC project coordination may move the scheduled dates of projects in the proposed cycling infrastructure delivery schedule. Concerned stakeholders should be mindful that the Cycling Infrastructure Program recommended in each scenario may change as a result of the need to maintain project coordination with other divisions and agencies.

Although coordinating with MCIC projects will require some flexibility in the Cycling Infrastructure Delivery Program, through the integration of the Cycling Network into the MCIC process, it is anticipated that Cycling Network projects can be implemented more efficiently than has been achieved in the past.

7.2.1.1 Types of MCIC Projects for Co-ordination

City of Toronto staff identified the following types of MCIC projects that provide the greatest opportunity for efficiencies compared to standalone cycling projects:

- Road resurfacings – Adding painted bicycle lanes often means changing the widths of the other lanes on a roadway. Cost savings may be achieved, because the removing and re-painting of lane lines on multi-lane roads is not necessary if bike lanes are painted in coordination with a road resurfacing project; and
- Road reconstructions – For cycle tracks, boulevard multi-use trails and bike lane projects, the cost for adding additional pavement width, signs, pavement markings, engineering design of the cycling facility, grading, reconstructing curbs, relocating utilities, traffic control, contract administration, etc. are accounted for in the co-ordinated MCIC project.

Road resurfacing and reconstruction may be undertaken due to the renewal of a number of other infrastructure projects, such as the replacement or rehabilitation of bridges, streetcar tracks, watermains, and storm and sanitary sewers. It is important to take advantage of these MCIC project opportunities because once major infrastructure construction has occurred, there is a reluctance to return to the same roadway corridor for additional construction or modifications in the near term. City policy includes a five-year moratorium on disturbing roads and a ten-year moratorium on disturbing bridges after major reconstruction.

Not taking advantage of these opportunities may require delaying a Cycling Network project for a number of years until it is seen as cost-effective to return to make changes to the corridor.

Exhibit 7-12: Reallocation of Lane Lines to Install Painted Cycling Facilities May be Undertaken in Co-Ordination with Road Resurfacings

One of the greatest challenges in achieving capital works co-ordination is the scheduling of public consultation in advance of the capital project. Often, in order to install bike lanes the road must be re-apportioned to repurpose an existing use. A typical example of this is a "road diet" where the number of general purpose travel lanes are reduced, in order to convert a 3.3 m travel or parking lane into two dedicated bicycle lanes. Since removing existing parking or travel lanes typically necessitates public consultation, the public and councillors must be engaged far enough in advance of the capital work to ensure that comments are received for consideration as part of the bike lane design process.

In addition to this, the approval of many traffic modifications and the bylaws to install dedicated bike lanes require the approval of the Public Works and Infrastructure Committee, followed by City Council. The reporting process necessitates approximately four months to a year, following public consultation. From a project management perspective, it can be challenging to align consultation and reporting requirements with the City's capital work program.

7.2.1.2 MCIC Project Schedule Co-ordination

Achieving MCIC project schedule co-ordination is complicated by a number of factors:

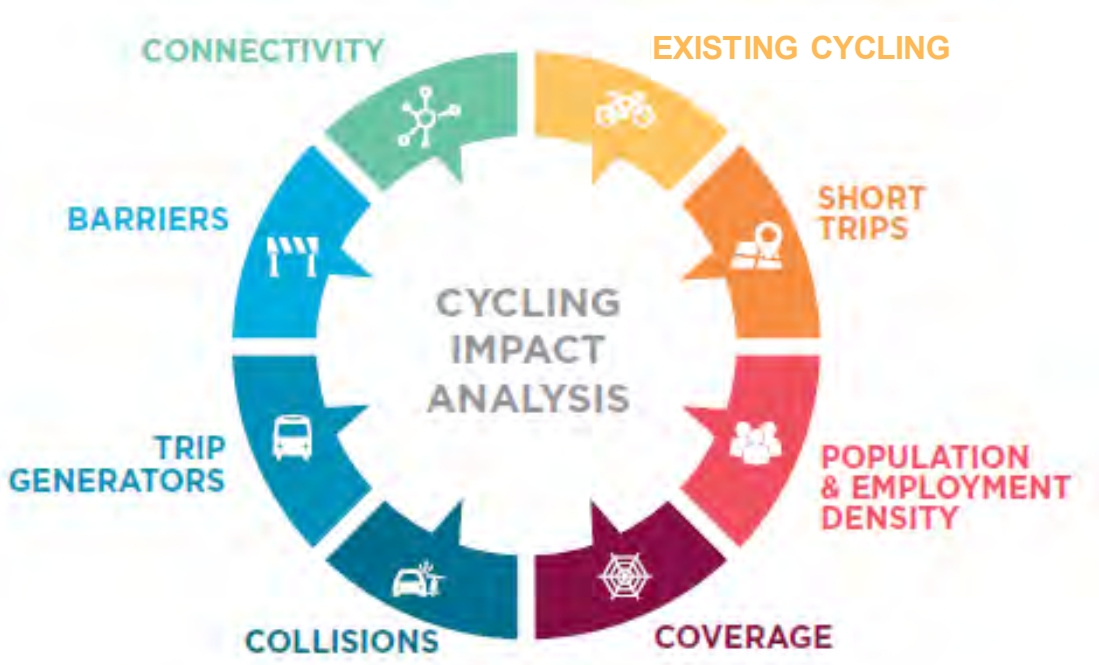
- The limits of MCIC co-ordinating projects and cycling project segments typically do not correspond;
- MCIC co-ordinating projects, and / or cycling projects are implemented over multiple years;
- At the time of the Ten Year Cycling Network Plan, only the road program through to 2018 was reasonably firm, the 2019 to 2021 road program was still tentative and incomplete. Therefore, projects from 2019 onwards are at a higher risk of being rescheduled or re-scoped;
- MCIC projects beyond five years are identified as being constructed in 2022-2025; and,
- Timing of cycling projects is contingent on public / stakeholder consultation and Council approval.

7.3 Cycling Impact Analysis Weighting

The Cycling Impact Analysis is intended to evaluate the relative impact that a planned cycling facility will have on bicycle use and safety. This analysis is intended to help the City objectively evaluate the relative benefits of planned cycling facilities and, together with the feasibility

analysis and consultation feedback, establish an order in which projects may be implemented. The Cycling Impact Analysis looked at the eight areas of analysis mapped in Section 5, as shown in Exhibit 7-13.

Exhibit 7-13: Eight Criteria used in the Analysis of Cycling Impact Undertaken for Each Planned Cycling Facility



The impact analysis considers only the alignment of the planned cycling facility. It does not consider what type of facility is being implemented or the cost; the latter is accounted for in the feasibility analysis. Rather, the impact analysis assumes that all new facilities will be context appropriate, providing cyclists with an equivalent level of comfort and safety regardless of type.

The Cycling Impact Analysis scores were incorporated into the priority analysis as follows:

1. A raw score is calculated for each criterion;
2. Each criterion is assigned a score from 1 to 4 based on the raw quartile scores. (4 represents the most value and 1 represents the lease value);
3. Barriers and connectivity scores are weighted twice as much as the other criterion; and,
4. After weighting, the scores are summed and converted to a quartile score from 1 to 4.

The eight criteria were assessed using GIS software and a variety of geospatial data provided by the City of Toronto and the 2011 Transportation for Tomorrow Survey (TTS). The methodology and data sources are summarized in Appendix B. The raw results for each criterion were divided into quartiles and a corresponding score from 1 to 4 were assigned as follows:

- 1 point for results in the 1st quartile;
- 2 points for results in the 2nd quartile;
- 3 points for results in the 3rd quartile; and,
- 4 points for results in the 4th quartile.

Points were subsequently weighted and added together to calculate a total score for the project. The weights for all criteria were set to one, except those for the barrier crossing and the connectivity criteria, which were both set to two. The higher weighting of these two criteria was based on feedback from the public consultation process. Both the Cycling App data and pin drop data received from the MetroQuest Digital Draft Map highlighted the critical importance of safe barrier crossings, and a desire for a network of direct routes which serve cyclists for trips beyond the reach of an individual project.

Data sources, a summary of the cycling impact results for each project and more information about the methodology for the connectivity calculation is provided in Appendix B.

7.4 Phase 2 Survey Preferences

Respondents to the MetroQuest Digital Draft Map Survey chose cycling projects that they supported or ones that they did not support; each project could have a different number of respondents or votes. The MetroQuest Digital Draft Map Survey data were incorporated into the priority analysis as follows:

5. The total number of votes of support and non-support for each cycling project was converted into a quartile "volume" score from 1 to 4;
6. The support votes as a percentage of the total votes were calculated and then converted into quartile "relative support" scores from 1 to 4;
7. The volume score was weighted twice as much as the relative support score; and,
8. After weighting, the scores were added together and converted to a quartile score from 1 to 4.

7.5 Cycling Project Costs

All projects were assigned a cost to construct based on per kilometre cost of construction consisting of:

- Estimate of the quantity and cost of **materials and labour for major items** required to install or construct the cycling facility based on the type and implementation strategy;
- Percent of the material and labour costs for a **contingency** to account for unforeseen items and site-specific corridor conditions to be determined during detailed design. It is assumed to be 25% at the project planning stage; and,
- Percent of the material and labour costs for **engineering** for the design of the cycling facility and **contract administration** to oversee the construction contract and installation. It is assumed to be 25% for Quiet Street routes (higher design cost since material and labour costs are very low) and 15% for Fast Busy Streets.

The unit costs of construction for the various types of cycling facilities and implementation strategies were reviewed in detail with City of Toronto staff. They are provided in Appendix C.

7.6 Bringing it All Together: Cycling Project Priority Ranking

Project priority rankings were identified to inform when projects should be scheduled within the ten year horizon of the plan. An assessment of opportunities to coordinate with major capital work (such as road resurfacings or water main work) were identified as the first step to rank each project.

The Cycling Impact Analysis helped to identify which of the proposed projects would provide the most transportation and safety benefit to the network. The public consultation feedback identified the most popular routes and desire lines. For projects where coordinating with capital work was not a factor, these scores were combined to rank each proposed new project.

From the public consultation, the number of votes received for and against each project on the MetroQuest Digital Draft Map were compiled to generate a quartile score. Based on this voting quartile, each project had a draft map consultation score, where four was the highest possible score and one was the lowest possible score. The result from these aggregated scores was used to help rank when a project should be scheduled.

Exhibit 7-14: Illustrating the Combining of Feasibility, Analysis and Consultation Scores

The priority rating combines the Cycling Impact Analysis quartile score (highest to lowest), MetroQuest cycling project support quartile score (highest to lowest), and project cost converted to a quartile score (lowest to highest) to determine a priority listing of projects as follows:

Cycling impact weighted quartile score + (Metroquest support weighted quartile score) x 0.5 + Project cost quartile score = Overall score

The projects with the higher overall scores are considered of higher priority. The project ratings are provided in Appendix D.

8 Ten Year Cycling Network Implementation Plan Capital Scenarios

The Ten Year Cycling Network Plan capital scenarios were developed for five levels of funding for the ten years from 2016 to 2025. Each scenario included funding the implementation of:

- Approved Bikeway Trails Implementation Plan projects;
- The Ten Year Cycling Network (Connect and Grow projects);
- Existing Network upgrades (Renew projects); and,
- Bicycle parking, i.e. bike racks and bike stations.

City of Toronto staff prepared the capital plan scenarios for the approved bikeway trails, Renew projects and bicycle parking; IBI Group prepared the draft capital plans for the Connect and Grow Cycling Network for City staff review. For the Cycling Network, each scenario considered the opportunity to implement cycling projects co-ordinated with other major capital infrastructure, provide a balance of Major Corridor Studies, Fast Busy Street and Quiet Street cycling facilities, and the priority rating of individual projects to schedule them over the 10 years.

8.1 Funding Levels

The projects to be funded for the year 2016 were presented to Public Works and Infrastructure Committee on September 22, 2015. The 2016 budget was approved at $13.5 M; $11.5 M for infrastructure implementation and $2 M for project delivery. This is an increase of $4 M over the 2015 forecast capital budget.

The five levels of funding for the 10-year plan are as follows:

- $8 M per year (Base Case)—This is considered the “base” level of funding equivalent to what was approved to be funded in recent years. It is equivalent to $73 M over nine years (2017 to 2025);
- $12 M per year—This level of infrastructure funding would be similar to the amount approved for 2016. It is equivalent to $108 M over nine years (2017 to 2025);
- $16 M per year—The first year (2017) for this scenario would provide $12 M of funding with $16 M in subsequent years. It is equivalent to $140 M over nine years (2017 to 2025), doubling the funding provided in the $8 M per year base case;
- $20 M per year—The first year (2017) for this scenario would provide $12 M of funding, the second year (2018) $18 M, with $20 M in subsequent years. It is equivalent to $150 M over nine years (2017 to 2024); and,
- $25 M per year—The first year (2017) for this scenario would provide $12 M of funding, the second year (2018) $18 M, with $25 M in subsequent years. It is equivalent to $155 M over eight years (2017 to 2023).

Public Works and Infrastructure Committee requested Transportation Services at its meeting on March 1, 2016, to consider options for funding of $20 M per year and $25 M per year, in addition to the other three funding scenarios, as part of the Ten Year Cycling Network Implementation Plan report. The intention of this direction was to model options which would allow for an accelerated delivery of infrastructure.

8.2 Balancing Delivery of Annual Program

In developing the five funding scenarios, the known MCIC project opportunities were considered first in scheduling the Cycling Network projects. At the lowest funding level of $8 M/year, not all known MCIC project opportunities can be realized.

The cost of Major Corridor Studies have been balanced against the delivery of lower cost projects, to ensure that a variety of cycling facilities are installed every year. This combination of different types of cycling routes allows for the network to connect and grow in various areas of the city at a moderate rate. Faster expansion of the Cycling Network on a kilometre basis could be achieved earlier if all of the Quiet Streets were programmed first in the ten-year capital plan, but the network would lack the connectivity provided by Major Corridor Studies and Fast Busy Street cycling facilities. In contrast, if all of the Major Corridor Studies and Fast Busy Street cycling facilities were programmed earlier, the Cycling Network would expand more slowly due to their higher cost, and lack neighbourhood connections provided by the Quiet Streets. A balanced approach also ensures that the workload of staff can be managed within a calendar year on a range of more complex and simpler projects to implement.

The project priority rating was also considered in scheduling the Cycling Network projects with the aim of delivering projects that scored higher earlier in the ten-year capital plan.

8.3 Ten Year Implementation Plan Scenarios

The Ten Year Cycling Network Implementation Plan for each funding scenario is provided in Appendix E along with maps that illustrate the Cycling Network achieved in one to five, and six to ten years for each funding scenario. The five funding scenarios are characterized in terms of what they can achieve as follows:

$8 M per year Program Scenario ($73 M from 2017 to 2025):

This Program would initiate the delivery of about one-third (27% or 366 km) of the proposed Cycling Network. A total of eight Major Corridor Studies would be initiated including Yonge south of Bloor, Yonge in North York, Bloor from Six points to the Don Valley, Danforth between the Don Valley and Eglinton, Lakeshore between Humber and Mississauga, and Jane from Steeles to Hwy. 401. Half of the Major Corridor Studies and a significant number of other projects would have insufficient funding for opportunities with Major Capital Infrastructure Co-ordination (MCIC) scheduled between 2016 and 2020. This inability to capitalize on the MCIC opportunities in the first five years will result in higher costs to implement these cycling projects overall. This scenario would be delivered with the current level of resources (staff and consultant services).

$12 M per year Program Scenario ($108 M from 2017 to 2025):

This program would initiate the delivery of about half (51% or 413 km) of the proposed Cycling Network. Most of the Major Corridor Studies would be initiated, except for Midland, that would provide safe routes to cycle to four GO Transit / SmartTrack stations. Funding would be insufficient for the proposed study to cross Hwy. 401 at Yonge Street. The proposed Danforth Major Corridor Study from Broadview to Danforth Road would not be initiated until 2019. Two additional Full-time Equivalent (FTE) staff starting in year 2017 would be needed to deliver the projects.

$16 M per year Program Scenario ($140 M from 2017 to 2025)

This program would initiate the delivery of most (85% or 511 km) of the proposed Cycling Network. All of the Major Corridor Studies would be initiated but there would be insufficient funds to implement them all within the ten-year period. This scenario would include funds to connect the Richmond-Adelaide cycle track across the Don Valley into the east end; significant projects to improve Flemingdon Park where Overlea crosses the Don Valley; as well as a proposed

highway crossing at Dufferin and design for a crossing of Hwy. 401 at Warden Avenue to connect the proposed boulevard multi-use trail to the approved Warden Hydro Corridor Trail. Funding would be available for the proposed studies on Midland and to cross Hwy. 401 at Yonge Street but insufficient to construct these facilities within the ten-year period. Four additional Full-time Equivalent (FTE) staff starting in year 2017 and two starting in year 2018 would be needed to deliver the projects.

$20 M per year Program Scenario ($150 M from 2017 to 2024):

This scenario would deliver all of the proposed Cycling Network (518 km) and may allow compression of the project delivery period from 10 years to 8-9 years. It may be more difficult to implement as the issue is not only funding but timing coordination to meet the three-year pre-planning requirement of MCIC co-ordinated projects. Four additional Full-time Equivalent (FTE) staff starting in year 2017, another four starting in year 2018, and two starting in year 2019 would be needed to deliver the projects.

$25 M per year Program Scenario ($155 M from 2017 to 2023):

This scenario would deliver all of the proposed cycling projects (518 km) and may allow for a compression of the project delivery period from 7-8 years, instead of 10 years. It may be more difficult to implement as the issue is not only funding but timing coordination to meet the three-year pre-planning requirement of MCIC co-ordinated projects. Four additional Full-time Equivalent (FTE) staff starting in year 2017, four starting in year 2018, four starting in year 2019 would be needed to deliver the projects.

The $8 M, $12 M and $16 M scenarios identify network opportunities that may be supported by the Province or Federal Government funding. The staff recommended $16 M scenario identified three studies and six projects that could be initiated, but were not fully funded for construction.

9 Cycling Network "Renew" Program

The City of Toronto's on-street network currently includes over 200 lane kilometers of painted bicycle lanes, 15 kilometers of Cycle Tracks and 300 lane kilometers of Quiet Street routes which have been signed or marked to facilitate cycling travel.

An audit of this existing network found that approximately 58% of the installed routes may be "renewed" so that they are compliant with current standards for signs and markings. Examples of “renewing” routes may include:

- The upgrading of existing bike lanes to buffered bike lanes, or cycle tracks which have a physical separation between the cycling travel area and the adjacent motor vehicle lanes. Separators, which may be installed to upgrade a bike lane, include (but are not limited to) flexible posts or bollards, planters, rubber or concrete curbs;
- The upgrading of existing “signed roadway” cycling routes to “Quiet Street” cycling routes with the installation of physical traffic calming measures such as speed humps, or traffic diverters outlined in Exhibit 7-7 and Exhibit 7-8;
- The installation of green markings in existing bike lanes and intersections, to highlight conflict areas. An example is provided in Exhibit 9-1;
- The installation of intersection modifications, including but not limited to signalized crossings with bicycle detection, signalized crossings with cross ride markings and bicycle signals, traffic signal phasing and bike boxes; and,
- Improvements to transit stops where they interact with cycling facilities.

Exhibit 9-1: Example of Green Pavement Markings Installed at Sherbourne Street and Wellesley Street East

9.1.1 Renewing Quiet Street Cycling Routes

Renewing existing cycling routes on Quiet Streets may consist of implementing the following improvements:

Pavement Markings:

City-wide, the renewal of our existing signed cycling routes means that the existing wayfinding on local and collector roadways can be enhanced with pavement markings called sharrows.

Where the cycling route turns, the use of wayfinding sharrows can be particularly important, as these pavement markings help to support wayfinding signs.

Traffic Calming Measures:

Many of the city's existing "Quiet Street" cycling routes have posted speeds of 30 km/h, with physical traffic calming measures installed such as speed humps, or conflicting one-way streets, to help prevent motor vehicle through traffic. Guidance for the installation of these traffic calming measures is available for review in the City of Toronto's *Traffic Calming Guidelines*[xxii]. Residents may petition for traffic calming to be considered, and then safety and other technical warrants are evaluated.

The City of Toronto's 30 km/h policy stipulates that city-wide local and collector streets designated as part of the Cycling Network may be signed as 30 km/h, once pavement markings such as sharrows or contra-flow bike lanes have been installed. The extent to which additional physical traffic calming measures are installed is at the discretion of the community and in some cases may require public consultation for more significant installation. For more information about the types of traffic calming that may be appropriate for some Quiet Street cycling routes, please see Section 7.1.1.2.

Operational Measures:

Changes to traffic operations, such as physical modifications to divert or restrict traffic, and intersection modifications such as changes to phasing, bicycle detection, new signals or new pavement markings, can be implemented to create renewed Quiet Street routes. In Toronto, since these are operational measures, a petition from residents is not required to implement them. For more information about the types of traffic diverters that may be appropriate for some Quiet Street cycling routes, please see Section 7.1.1.2.

Wayfinding Signage:

Previously, the City's Cycling Network information system focussed on blue signs that number cycling routes. The north-south routes are signed with odd numbers (1, 3, 5…) and the east west-routes are signed as even numbered routes (2, 4, 6…). The numbers are lowest in the south-west corner of the city and increase as you travel north and east. As part of the TO360 wayfinding project, the City of Toronto's cycling wayfinding standards were reviewed in 2015. The outcome of this project is a series of strategies to enhance and improve the City's existing cycling wayfinding system.[xxiii] As per the new strategies, the route numbering system is no longer being implemented and is gradually being phased out.

The City of Toronto's Cycling Network wayfinding signage is being upgraded on an ongoing basis. The new wayfinding signs being installed include useful information about how far it is to the next Cycling Network route, as shown in Exhibit 9-2.

Exhibit 9-2: Examples of City of Toronto's New Wayfinding Signs

9.1.2 Renewing Cycling Facilities on Fast Busy Streets

The renewal of cycling facilities on Fast Busy Streets will update the facilities to provide greater comfort, guidance and separation for cyclists. A range of treatments will be considered, based on the local context, such as:

- The addition of pavement markings at intersections and conflict areas;
- Two-stage and advanced bike boxes to assist cyclists in making turns at intersections;
- Improvements to transit stops where they interact with cycling facilities;
- Potential changes to traffic signals to provide efficient timing and phases for cyclists and other street users;
- Painted buffers added to bike lane lines; and,
- Separators, such as flexible posts, curbing, planters, etc., added to bike lanes where there is sufficient width.

Renewal projects for existing Cycling Network routes will be programmed to follow road resurfacing and reconstructions, in order to ensure cost effective delivery.