CITY OF BURLINGTON

CYCLING PLAN



burlington.ca

CITY OF Burlington



Top 10 Themes for Action

1. A minimum grid within the short-term timeframe for people to experience different types of higher-order bikeways
2. Focus on the potential bike/walk to transit
3. Work towards an ultimate Spine Network for all users and abilities
4. Support the Spine Network with Connector routes as a feeder system
5. Set the stage for Grade Separated Highway Crossings and plan for a connected network in advance on either side
6. Build quality and connected Local Street Bikeways
7. Leverage existing assets such as existing multi-use pathways adjacent to roadways supported by a framework for their upgrades
8. The application of decision-making criteria based on where people live/work/play – Building infrastructure where people need to go
9. Prioritize where the funding goes with a focus on the above and with the view to unlocking potential in the city
10. Implement an intersection improvement program

Executive Summary

The City of Burlington Cycling Plan is an integral update to the City's existing plan that incorporates the significant developments that have happened in cycling facility planning and design in Canada. The plan focuses on how more everyday trips can be made by bicycle, by proposing facilities that go to where people are going, including a specific focus on growing transit ridership and attractiveness by making multimodal cycling and transit trips a convenient option for people.

The plan presents a vision of a connected city, with a Spine Network consisting of almost 130 km of facilities appropriate for people of all ages and abilities. It sets the stage for the City to move forward on building grade separated crossings over the QEW, to overcome stressful barriers for people cycling now, and to make cycling a viable option for more people who are interested in cycling for some of their trips. The investment in the City's first grade separated pedestrian and bicycle highway crossing will be leveraged by building high quality facilities at either end to get people to and from the crossing. The Connector routes extend the reach of the Spine Network with an additional 200 km of facilities.

The plan starts with a Minimum Grid: a 15 km connected network in the downtown area designed to be implemented in the near-term to showcase a range of new types of facilities recommended as part of this plan, including protected bikeways, local street bikeways, and multi-use trails, giving Burlington residents an opportunity to experience them firsthand. The minimum grid is intended to be a permanent installation with the benefit adjustments overtime.

The plan provides guidance and considerations for designing and implementing high quality connected facilities appropriate for the context of the roadway they are on. Protected bikeways are recommended on busy arterial and local street bikeways are recommended as traffic calmed neighbourhood streets to provide suitable environments for people of all ages and abilities to cycle on. Recommendations are provided for improving existing multi-use paths to make them complete, easy to use facilities. Finally, the plan includes options for enhanced intersection design, to improve the safety and comfort for people walking, cycling, using transit, and driving.



Table of Contents

1 INTRODUCTION 6

1.1 Commuter Cycling Plan 9

1.2 Vision and Objectives 10

1.3 Study Process 18

2 BACKGROUND 22

2.1 Burlington Context 23

2.2 Existing Plans/Strategies 24

2.3 On-going Strategies 27

3 PUBLIC ENGAGEMENT 28

3.1 Engagement Activities 29

3.2 Engagement Feedback 31

4 ANALYSIS 36

4.1 Existing Network 37

4.2 Gap Analysis 42

4.3 Demand (Live, Work, Play) Analysis 44

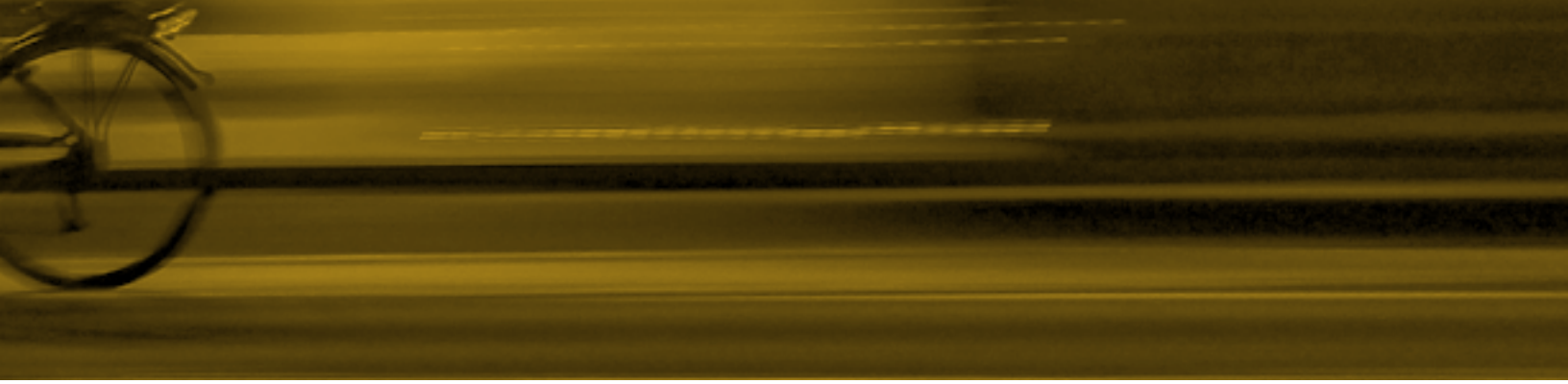
4.4 Level of Traffic Stress Analysis. 48

5 FACILITY DESIGN AND SELECTION 54

5.1 Best Practices and Guidelines 55

5.2 Facility Selection Framework 57

5.3 Site Specific Recommendations 63



6
NETWORK RECOMMENDATIONS 70

6.1 Spine Network 73

6.2 Connector Routes 74

6.3 Highway Interchange Crossings and Grade Separated Connectors..... 75

6.4 Minimum Grid 78

8
IMPLEMENTATION 90

8.1 Prioritization Summary 91

8.2 Cost Estimating.....100

8.3 Funding 103

8.4 Metrics and Evaluation..... 105

10
ENCOURAGEMENT, EDUCATION, ENGAGEMENT, AND ENFORCEMENT PROGRAMS 112

10.1 Existing Programs 113

10.2 Program Partnerships..... 115

10.3 Program Recommendations.....117

10.4 Bike Parking Program..... 125

7
ASSET MANAGEMENT 82

7.1 Minimum Maintenance Standards for Municipal Highways..... 84

7.2 Summary of Existing Practices in Burlington.....85

7.3 The Value of Maintaining Bikeways.....86

7.4 Recommendations for Asset Management of Bikeways 89

9
BIKE SHARE 108

ENDNOTES 128



1 INTRODUCTION

Cycling in Everyday Life

Learning to ride a bicycle is a memorable moment of many people's childhoods. As the child gains confidence (and the child's parent or guardian gains confidence in the child's ability) the training wheels come off and the child starts to take off, experiencing a rush of newfound independence. Riding a bicycle is fun, full of sensations like the wind in your hair, being able to cruise along while still being able to look around, and engaging with others you pass by. Yet many people never learn to cycle as a child, often because there is no where safe to do so, or the child that does learn to cycle in their quiet cul-de-sac, has no where to cycle beyond, as cycling on a busy road, is vulnerable, intimidating, and not an enjoyable experience. As a result, we forget how enjoyable cycling is and never think of it as a convenient mobility option that can be a part of everyday life to get around a growing city.

Building a connected network of separated cycling infrastructure that allows someone to directly go to where they need to go makes it possible for the child to cycle out beyond the cul-de-sac with their parent or guardian. It creates the opportunity for someone to cycle from their home, 3 kilometres (12 minutes of casual cycling) to the bus stop or GO station, or to drop off a child at school, then head off to work downtown. It lets a family bike over to the mall to run a few errands. The City is taking steps towards this vision with this update to the Cycling Plan.

A City in Transition

It important to recognize that the City of Burlington is in a time of change. As more people and businesses are moving to the City, there will be increased pressure on the transportation network to get people access to places they need to go to. The City is not undertaking new road widenings as a means to accommodate existing congestion and future growth, as these projects have a significant cost and do not resolve congestion.[12] Burlington, like many other cities, is challenged with using the limited space to accommodate and prioritize more sustainable transportation modes. Through the adoption of numerous other city policies, such as the Official Plan, Burlington is changing by strengthening the relationship between transportation and land use policy. Burlington is working toward an integrated and multi-modal transportation

system where decision-making prioritizes shifting trips away from private cars to more sustainable modes, such as walking, biking, transit and car sharing, where appropriate.

Similar to the City's plans for developing a higher-order public transit network, a higher-order cycling network is important in giving people the opportunity to shift away from private cars. For cycling, higher order facilities include physically-separated on-road bikeways, raised cycle tracks (i.e., bike lane adjacent to sidewalk in boulevard), local street bikeways, multi-use trails and grade-separated crossings over highways.

These improvements must be prioritized in order to attract the largest segment of the population to take transit or ride their bike for transportation. For Burlington, this includes a short, medium- and long-term plan to help make that happen. Part of developing a priority transit network is acknowledging that buses and trains cannot take everyone directly from where they are. Improving walking and cycling conditions helps people get to or from transit, allowing them to rethink how they can travel throughout the city, leaving their car at home for more trips, or not owning a car at all. Shifting trips to cycling trips can reduce the number of private automobiles on the road.

Cycling is not only a convenient mobility option, it is also a good form of exercise that has health benefits.[3] As the population of people that have cardiovascular health issues, such as obesity grows, cycling integrates exercise into everyday transportation, thereby removing barriers to embracing a more active lifestyle.[4][5] A shift from automobiles can also reduce air and noise pollution, and reduce greenhouse gas emissions which contribute to climate change - recognized by Burlington council as an emergency.[6][7]



1.1 Commuter Cycling Plan

The primary purpose of this plan is to develop a cycling network for everyday purposes, such as going to school or work, when running errands, attending appointments, visiting friends, or going shopping, whether people are cycling for their whole trip or cycling to or from transit. While the term 'commuter' or 'utilitarian' is often used this is a cycling plan for everyday life.

This plan is for everyone. Early on in the process of this plan, key stakeholder groupings were identified in order to frame unique perspectives and input required to ensure this plan is all inclusive.



There are a variety of people that cycle regularly as part of how they travel around Burlington.

1.2 Vision and Study Objectives

Vision

A cycling culture within the City of Burlington is encouraged and achieved through the implementation of cycling facilities that allow all people to feel confident, comfortable and safe using a bike as their mode of transportation. A cycling culture within the City of Burlington is created and sustained by focusing on a cycling network that is connected, useful and joyful.

The ideal outcome of the City's vision for the future is to make cycling a viable and convenient mobility option. A key goal in achieving this vision is the development of a minimum grid of safe, well connected, convenient and accessible cycling infrastructure features. This plan is also focusing on improving trails as part of the network, moving forward with the construction of grade-separated highway crossings, intersection improvements and local street bikeways that calm streets, and connect to accessways that provide shortcuts to destinations and between neighbourhoods. The City has stated interest in implementing a bike share system, which could help provide greater access to bikes for transportation.

Objectives

In order to achieve this vision, the following study objectives have been identified:

- Build upon the current cycling network and identify missing links in order to develop a minimum grid of on-road protected cycling facilities
- Identify key barriers to cycling and investigate strategic opportunities to improve the cycling experience and achieve continued gains in cycling mode share
- Develop a network of facilities that are considered comfortable and safe by all users and skill levels
- Review existing facility types and classifications and compare to current best practices in order to recommend revised design guidance, where appropriate, that is consistent and can be uniformly applied throughout the City
- Identify a list of priority network improvements for strategic implementation
- Develop a strategic action plan that guides the short, medium and long-term implementation of the cycling network

What Kind of Facilities for What Kind of Gain?

Guidance and best practice in the design of cycling facilities has developed significantly in the past 10 years. Single painted lines on the outer edge of travel lanes are no longer considered an appropriate facility for many of our roads when the focus is making cycling as a regular mode choice attractive to a larger segment of the population. This road design provides minimal space for people to cycle and does not inspire confidence in the majority of the population.[8] To someone who does not regularly cycle for transportation, these bicycle lanes can be intimidating. Building a network of facilities for all users and abilities is one of the objectives of this plan. Best practice shows a need to address treatments of intersections as the location of the greatest conflict between people using different transportation modes. Research on the construction of new physically separated facilities in North American cities has found that these types of facilities have acted as a catalyst for people to start cycling and feel comfortable and safe cycling more often for regular trips.[9] The perception of these facilities as being safer is a significant factor in attracting people to start cycling.[10]



People cycling along the Main Street raised cycle track in Ottawa, ON.

Some of the most attractive cycling facilities are not on roads. Burlington has an extensive trail system in place including the Centennial Trail and the Hydro Corridor Trail. These trails have a large potential to act as spines for an everyday cycling network, not just for recreational purposes. Maintaining these trails to a standard of a utilitarian or commuter route, such as providing lighting and winter clearing, is an important step in creating an attractive cycling network.[11] As a complete network of trails that extends everywhere in Burlington is not feasible, it is important to develop a network of on-road protected bikeways within the city that are connected, direct, comfortable, and safe. Connecting people to where they want to go is vital to realizing the plan's objectives.

When discussing and planning for a mode shift towards more people cycling, it can be presented in the context of "switching trips."

If someone makes five trips a day, can two of those trips change from an auto-dependent trip? This change would represent a 40% reduction in the sheer number of trips that use a private automobile. To encourage a shift towards other modes, the emphasis is placed on small changes to a portion of people's trips, rather than expecting people to fully give up their cars in exchange for a bicycle . But it also goes beyond simply targeting the trips people take to and from work. Cycling is a viable mode of transportation for trips between 1 – 5 km (up to 20 minute bicycle ride) and creating an opportunity for one of the trips people take throughout the course of a day to be by bicycle. This is especially true when considering that half of trips taken by residents in Burlington today are less than 5 km.[12]

Addressing First/Last Mile to Transit

Cities around the world are looking for ways to address their first/last mile challenges as part of designing their public transit systems to be reliable and efficient. Routing a regular bus to ensure it picks every person up and drops them off at exactly where they need to go results in long, complicated routes that make taking transit less attractive. A public transit system that is simplified, directly traveling along a corridor, is more likely to be attractive as the service will be more efficient enabling faster and more frequent service, so long as there are easy and accessible ways for people to get to that transit corridor. This is the first/last mile challenge, and where cycling can be a great option for people to quickly travel 1-3.5 km to a transit station.[13] Investing in cycling and walking infrastructure enables people to access transit, therefore making transit a more attractive option for frequent travel. To ensure this linkage with transit was emphasized, Burlington Transit was a key stakeholder during the development of this plan.

Currently of the over 8,000 people who take GO Transit regularly on the Lakeshore West Line in Burlington, 70% drive alone and park at the station. The parking lots at the GO stations in Burlington are 80-100% utilized.[14] Making it easy and attractive to ride a bicycle or walk to a GO station is necessary to accommodate more people taking GO Transit. Building connected cycling facilities for all ages and abilities and running encouragement campaigns focused on behaviour change are integral to accomplishing this goal.



Parking at GO stations frequently overflows the parking lots.

Types of Cyclists

There are many different reasons people ride bicycles. Some people ride for recreation on roads or trails, or for exercise or sport. The focus and purpose of this plan is to address a network and facilities for utilitarian (transportation) cyclists, those that use their bicycle for all or part of their commute, to run errands, or for social trips (seeing friends or family). The aim of this plan is to target the "interested but concerned" segment of the population, which includes developing a connected network with facilities for all ages and abilities that connects people to where they need to go.

Four Types of Transportation Cyclists

The Four Types of Transportation Cyclists was originally developed by Roger Geller, with the City of Portland in 2005 and has been updated as new research has emerged.[15] It organizes the population into four categories, similar to marketing, to understand people's comfort level and attitudes towards cycling. The categories and the associated percentages of the population have been developed and refined through studies in cities across North America. It has been found that these percentages are similar in communities around North America. The goal of using these categories is to understand the needs of larger segments of the population, in order to attract them to cycling.[16]



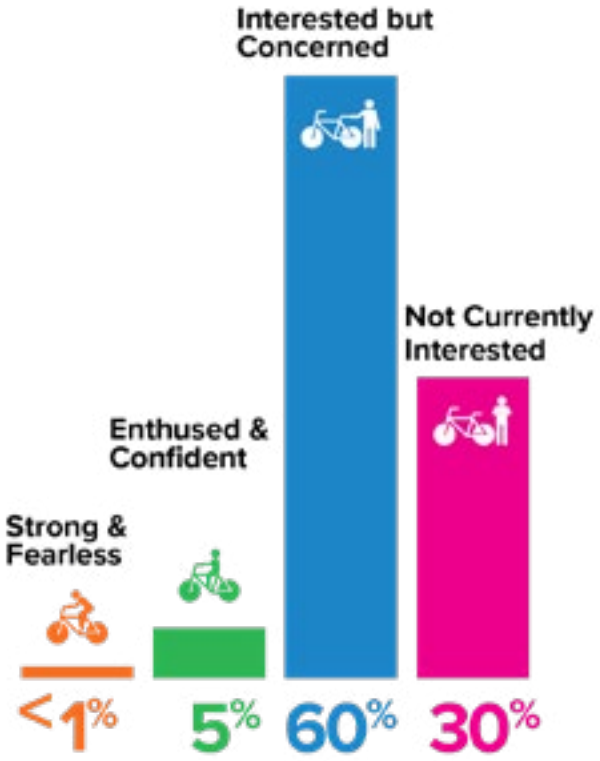
- **Strong and Fearless** *(approximately 1% of population)* – Characterized by people that are already cycling and will typically ride anywhere regardless of roadway conditions or weather. These cyclists can ride faster than other user types, prefer direct routes and will typically choose roadway connections -- even if shared with vehicles -- over separate bicycle facilities such as multi-use paths



- **Enthused and Confident** *(5-10% of population)* - This group encompasses people who are fairly comfortable riding on all types of bikeways but usually choose low traffic streets or shared-use paths when available. These people may deviate from a more direct route in favor of a preferred facility type. This group contains people who ride bicycles for a wide variety of trip types including commuting, recreation, and exercise

- **Interested but Concerned** *(approximately 60% of population)* – This user type comprises the bulk of the population and represents people who typically only ride a bicycle on low traffic streets or multi-use paths under favorable weather conditions. These cyclists perceive significant barriers to their increased use of cycling, specifically traffic and other safety issues. These people may become "Enthused & Confident" with encouragement, education and experience. By building a connected network of facilities for all ages and abilities, people in this category will have more opportunities to cycle for everyday trips

- **Not Currently Interested** *(approximately 30% of population)* – Persons in this category do not currently ride bicycles and perceive severe safety issues with riding in traffic. Some people in this group may eventually become more regular cyclists with time and education. A significant portion of these people will not ride a bicycle under any circumstances



Graphic representing the Four Types of Cyclists. The percentages of the population are averaged based on research from jurisdictions across North America.

1 of every 2 trips taken by Burlington residents in Burlington are 5 km or less - 20 minutes by bicycle.

If You Build It, They Will Come

A common complaint heard in cities considering investing in cycling infrastructure is something along the lines of "Why spend money on this? No one bikes here". This critique is situated within the current car-oriented context and does not consider how our communities in North America have changed over the past century, and how they will continue changing. Fewer people lived more than 20 km from their workplace until highways were built that allowed people to quickly drive further distances. Highways, among other factors, attracted people to live further outside of cities. Roads were built, and in response, more people chose to purchase cars and drive for their trips . The infrastructure communities invest in reflects their aspirations and where they will be going, not where they currently are. A city with a vision of becoming an active, healthy city, where people can easily and safely get around by walking, biking, and transit, must invest in the infrastructure that will take it there.

The caveat to this idea is that infrastructure should not just be built anywhere and expect to be an immediate success. Strategically developing a network of high quality, safe and comfortable cycling infrastructure should include identifying where latent (or untapped) demand is and will be, then building a network with the appropriate facilities to serve that demand. While it's hard to justify building a bridge by the number of people swimming across a river, just building a bridge is not the solution. The bridge (or cycling infrastructure) needs to be designed well, put in the right place, safe, well maintained, and direct or else will not be well used. These safe and comfortable cycling facilities separate people cycling from car traffic on busy roads. On roads with low traffic volumes, people cycling can share the road with cars with traffic calming measures.

Collecting data on how many people are using new or upgraded facilities can be important for building evidence that people are cycling. While modal splits (i.e., the percentage of the population that cycles to work) can be an indicator of how many people cycle,[17] it only reports on one type

The infrastructure communities invest in reflects their aspirations and where they will be going, not where they currently are.

of trip, and not how many people are cycling for other types of trips. This data does not account for multimodal trips well; if someone walks or cycles to transit, it is most often counted as a transit trip. The metrics and evaluation section in Chapter 8 Implementation describes more meaningful approaches to measuring and evaluating the number of people that are cycling, as well as other metrics, to understand the more multifaceted impacts of building cycling infrastructure.



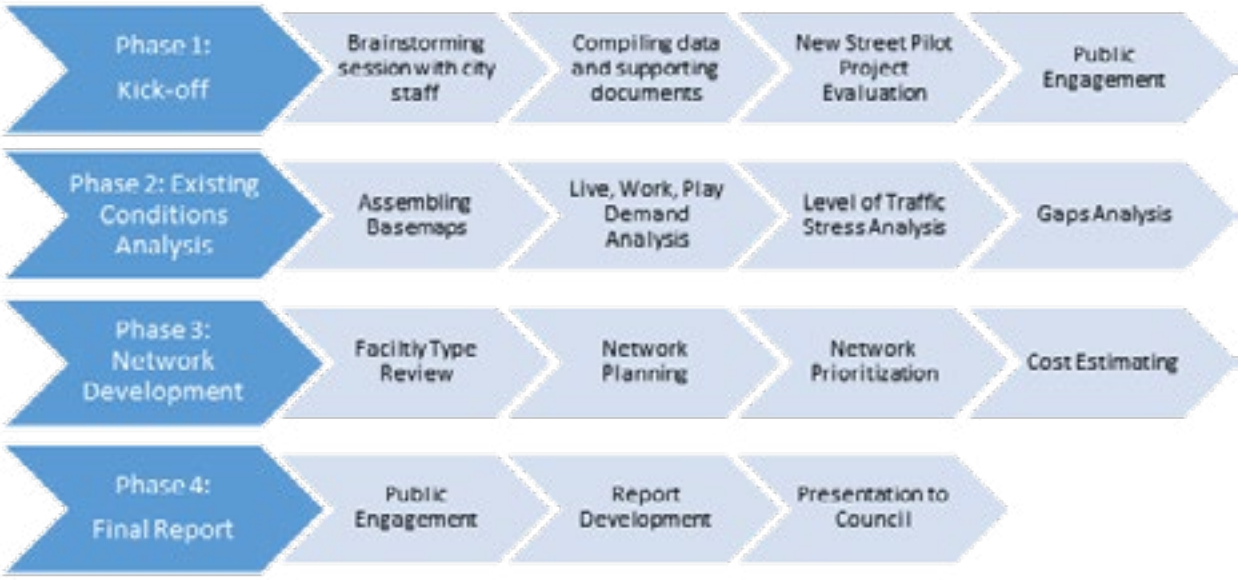
When a community is cycling friendly, parents are more likely to cycle with their children to every day activities.

Programming and Encouraging for Change

While infrastructure is integral to making Burlington a place where a large section of the population feels safe and comfortable cycling, programming and encouragement programs will also be necessary to support people to make this shift. Working with the community to develop and run programs targeting groups of the population can make behaviour change more successful.[18] Education programs that teach youth how to ride a bike and follow the rules of the road can help build confidence and lead to more youth cycling to school. Organized group rides targeting adults and supporting them to try cycling around their community could be the motivation for them to try cycling more often. Chapter 10 provides in depth recommendations for programs that will support the investment in infrastructure, and activate the potential proposed in the plan.

1.3 Study Process

A general outline of the study process for the cycling plan is shown in Figure 1 below. In addition to the steps outlined in the process below, the project team extensively consulted with stakeholders throughout. As part of the requirements of this plan, the consulting team met with a technical review committee comprised of city staff from various departments multiple times throughout the process. These meetings allowed for in-depth technical discussions around the planning for and implementation of cycling infrastructure identified in this plan. These meetings included stakeholders from Burlington Transit, Operations, Capital Works, Asset Management and Transportation Services to come together and understand any challenges or concerns about the development of cycling infrastructure in Burlington.



Graphic illustrating the process of the planning process.

In addition to the technical review committee of city staff, the consulting team also met with the council-endorsed Burlington Cycling Advisory Committee multiple times throughout the process. During these meetings, a presentation was made on the analysis and led them through network development exercises. The committee also assisted with the community engagement, helping to identify stakeholders or opportunities for pop-up events. The committee was active in providing their feedback through city staff in the development of the plan. One element of their participation was sharing their stories about cycling in Burlington and developing promotional material as part of the cycling plan.

Study Considerations

Public Input - engagement with the community to determine where people are currently riding, and where they want to ride. If they aren't riding – why not? What are the barriers to cycling within the City?

Demand – a review of existing and potential demand for increased cycling usage

Connectivity – connecting people to places and ensuring access to major destinations within the City, as well as connecting to neighbouring municipal active transportation networks

Integration – ensuring seamless integration with other travel modes (e.g. first/last mile connections to transit)

Land Use – aligning cycling facilities with key intensification areas, leveraging increased population and employment densities

Context Sensitive Design – selection of facility type based on user profiles and recognizing the recreational, utilitarian and commuter characteristics of each, as well as road types and characteristics

Constraints – ability to mitigate negative impacts of physical and natural barriers to cycling such as freeways, rail lines, and waterways

Study Methods

In the development of the proposed network in this plan, a variety of methods were used to dig deeper into understanding the City of Burlington and the people that live, work, study, and play there.

Spatial Analysis

Using geographic information systems software (GIS), data from the City of Burlington, Halton Region, and Statistics Canada were integrated into the GIS mapping software and used for analysis in the development of the cycling network. The analysis completed as part of the project included:

- A demand analysis to identify origins and destinations, based on where they live, work, study, and play
- A level of traffic stress (LTS) analysis, which considers the existing characteristics of roadways for cycling
- A gap analysis, identifying barriers and gaps in the cycling network

The methods for these analyses as well as their results are explained further in section 3. The rationale behind using these analysis tools together is that it shows where opportunities exist to that if unlocked, could have greatest potential for people to cycle. This is done by connecting existing gaps in the network, building facilities where latent demand exists, and where low stress routes are, and identifying streets that need facilities to address the high level of stress someone would feel cycling on that road.

Public Engagement

Pop-up engagement methods were used in order to get feedback from a greater cross-section of citizens than traditional public meetings. The consulting team went out to where people were, including kids' events at the art gallery and the seniors centre. Online engagement was also carried out, with an interactive map and questionnaires. The methods and the results from the engagement are in Section 4.



2 BACKGROUND

2.1 Burlington Context

Burlington is located on the western shore of Lake Ontario, adjacent to Hamilton and approximately 70 km west of the City of Toronto, in the urbanized area of Southern Ontario, known as the "Greater Golden Horseshoe (GGH)". The GGH is a dynamic and diverse area; one of the fastest growing regions in North America, and the largest urban region in Canada. The City is one of four Local Municipalities within the Region of Halton. The Regional Municipality of Halton and the Regional Municipalities of Peel, York, and Durham and the cities of Hamilton and Toronto form the Greater Toronto and Hamilton Area (GTHA), established by the Provincial government for planning purposes.[19]

As of 2016, the population of Burlington is 183,314, a 4.3% increase from 2011. The age distribution of the city is similar to the province as a whole, with 19.3% of the population over the age of 65. Young families are also attracted to living in Burlington, with 16.7% of the population between the ages of 0-14 years old. Of the 78,645 residents that commute to work, 42% stay within the City of Burlington. Currently only 695 people, or 0.8% of the commuting population reported cycling as their main mode of commuting to work, with more than twice the number of men than women.[20]

2.2 Existing Plans and Strategies

From Vision to Focus: 2018-2022 Burlington's Plan

From Vision to Focus is a four year work plan for council, with priorities for each of the focus areas presented in the Strategic Plan. The document states key actions and performance targets for each of the priorities. Priorities that relate to the Cycling Plan include:

- Reaching a 10% transit, 8% active transportation modal split by 2022
- Decrease the communities' greenhouse gas emissions
- Assess feasibility of a bike share system
- Reviewing snow clearing service levels for all mobility modes
- Complete priorities identified in the Community Trails Strategy

Burlington's Strategic Plan 2015-2040

The Strategic Plan provides a vision for transitioning Burlington from a suburban to an urban community, where future growth is focused within the existing urban area through intensification. As part of this vision for growing in place, the City recognizes the importance of creating walkable, bikeable and transit-oriented complete communities. The Strategic Plan includes numerous goals and objectives relating to cycling, such as:

- More mobility choice exists within the city and region through improved public transportation, active transportation and intensification that allows more residents to get where they need to go efficiently and with more choice



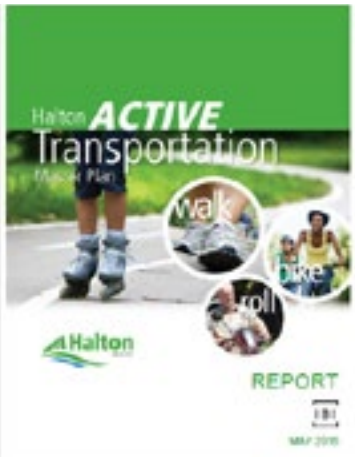


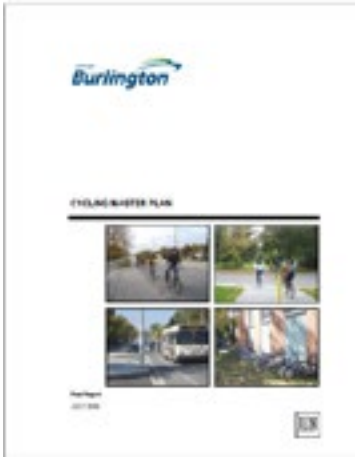
- A Complete Streets vision is implemented through a co-ordinated plan, which includes on-road and off-road bike lanes, sidewalks, multi-use paths and trails and a public transit system that are all well-connected throughout the city
- Walkability and cycling has guided the development of new and transitioning neighbourhoods and the downtown so that people rely less on automobiles
- Future development is higher density, walkable and accessible, transit oriented with appealing streetscapes. The city is a leader in walkability and bikeability scores in the province and will be fully aligned with provincial strategy and goals
- The trail system is linked to the city's park network, to neighbourhoods and to other regional systems including transit, ensuring that the city's rural area and waterfront are easily accessible and accommodate walking and cycling
- Future development in higher densities considers car-share and bike-share options

The Strategic Plan will be supported in more detail with the City's Official Plan, among other policy documents and implementation plans. Although the Official Plan review remains ongoing, the version of the plan released to date (April 2018) contains policy direction to support the Strategic Plan and implement both Regional and Provincial policy regarding the improvement of cycling facilities. A key focus of the Official Plan's updated policies is offering a balance of transportation choices and prioritizing active transportation and transit over single-occupant vehicles, as directed by the Growth Plan for the Greater Golden Horseshoe, 2017.

Halton Region Active Transportation Master Plan (2015)

Halton Region's Active Transportation Master Plan (ATMP) created a regional plan for the development of on and off-road cycling facilities throughout Halton Region. The plan envisions an intermunicipal network of facilities. As Halton Region maintains ownership of many arterial roadways within Burlington, the ATMP will include the construction of cycling facilities along some of these arterials, such as Dundas St., Guelph Line, Upper Middle





Rd., and Brant St. (from Fairview to Dundas) The ATMP also identifies a facility selection process, based on speed, number of lanes and ADT. All routes identified in the ATMP have been included in development of this cycling plan, which recommends upgrading the facilities on many regional roads because of their significant role in the City's road network. The ATMP commits to winter maintenance on all of its roadways, but places responsibility for sidewalks, multi-use paths (MUPs), trails, curb ramps, and transit stops/shelters along regional roads on the local municipality (Burlington). The plan is intended to be updated every 5 years.

The ATMP includes evaluation criteria including an active transportation (cycling and walking) modal split of 5% in the region by 2031. As of the 2016 census, the region is at 3.7% combined cycling and walking mode share (note: this percentage includes walking and cycling in a combined metric). Modal split is just one evaluation metric alongside 16 other evaluation criteria that consider other transportation, cultural, the natural environment, and economic themes. It is important to consider a variety of metrics, not solely modal splits, especially when the target mode shares are minimal increases from current mode shares.

Burlington Cycling Master Plan (2009)

The 2009 Burlington Cycling Master Plan proposed a network throughout the city with facility selection guidance. While some of the recommendations from the plan have been implemented, there are still route recommendations that have not been completed. The 2009 plan included insights and guidance from Apeldoorn, Netherlands. It is stated in the plan that it should be reviewed or updated every 5 years. Since 2009, there have been significant developments in the design guidance for cycling facilities, especially in areas of cycling facilities for all ages and abilities. This plan has used the network from the 2009 plan as a base and guidance for the update. The work from this 2009 cycling plan culminated in 2016 with Burlington receiving a silver Bike Friendly Community award.

Other Plans and Strategies

During the development of this plan, the Burlington Community Trail Strategy (2015), and Asset Management Plan (2016) were reviewed. Proposed multi-use trails identified in the Trail Strategy were incorporated into the proposed network in this plan. This plan reviewed the provincial CycleON plan to align with the strategic directions set out in that plan, which include promotion of cycling and developing cycle tourism.

The Transit Plan and Mobility Hub strategy were also reviewed to ensure this plan shares a consistent vision and direction.

On-going Plans

Rural Active Transportation Strategy

The City initiated a study for active transportation (walking, cycling, and other forms of human-powered transportation) for the rural North Burlington area. The separate plan will make recommendations for walking and cycling facilities in this contextually unique area, including the Bruce Trail. The recommendations from the Rural Active Transportation Strategy will take precedence over the recommendations from this plan for North Burlington.



3 PUBLIC ENGAGEMENT

3.1 Engagement Activities

As part of the process for developing this cycling plan, public engagement activities were completed, with in person pop-ups and an online website with a map to provide feedback and surveys for Burlington residents to share their opinions, experiences, and visions on cycling in Burlington.

The Burlington Cycling Committee was involved with developing the "Who Bikes in Burlington?" profiles to help to put faces to some of the people that use their bicycle to get around Burlington as part of everyday transportation. The profiles were published on the City's website during the development of this plan.

Pop-ups

During Community Engagement Round 1, 1,807 people were reached in face-to-face conversations over 97 hours across 17 community 'Pop-Up Events' held at community centres, libraries, GO stations and events located in all six wards of the city. Locations aimed at reaching a diverse array of residents. Over 250 people were directly engaged and some well-attended events include: Burlington's Senior Centre; Burlington Central Library; Ron Edwards Family YMCA and Aldershot, Burlington, and Appleby GO Stations.

Online Map and Survey

- 1,528 people visited an online interactive community mapping tool (Social Pinpoint) used to obtain feedback on potential network improvements.
- 782 comments were received on an interactive map of Burlington showing the existing network, the proposed network from 2009, and the proposed highway crossings. People were prompted to leave markers with comments under the following themes:
    - Where people like to cycle to
    - Where they have challenges cycling
    - Places they find hard to cycle to
    - General comments

Some comments received during the public engagement are included throughout this document.

1,372 UNIQUE USERS VISITED THE SITE AND SPENT ON AVERAGE 18 MINUTES PROVIDING SURVEY RESPONSES ABOUT CYCLING COMFORT LEVEL, CYCLING IN BURLINGTON, AND THEIR VISION FOR CYCLING IN BURLINGTON.

Second Round Of Engagement

The consulting team completed a second round of public engagement from July to September 2019. For this second round of engagement, a draft version of the plan was made available to the public. Members of the consulting team and City staff were held drop-in pop-ups for people to drop by and learn more about the recommendations of the plan and provide their feedback. One pop-up was held during the day at City Hall, and the other occurred as part of the Movies Under the Stars event at Spencer Smith Park. The pop-ups were advertised on the City's website as well as in the newspaper.

Feedback from this round of engagement was collected and reviewed by City staff and the consulting team. Revisions to the plan based on public and stakeholder feedback have been noted and included in the recommendations section of the plan.

"DUE TO NOW HAVING SECONDARY MS, I NO LONGER AM ABLE TO BICYCLE, BUT FIRMLY BELIEVE THE CITY SHOULD DO ALL IT CAN [& MORE - BUT THEN I NEVER DO ASK FOR TOO MUCH?] TO MAKE CYCLING IN AND AROUND THE CITY AS SAFE AND EASY AS POSSIBLE. THAT MEANS DEDICATED, OFF-ROAD BIKE LANES WHERE EVER POSSIBLE, HOPING TO ENCOURAGE PEOPLE TO BIKE RATHER THAN DRIVE! LIKE FIELD OF DREAMS, "BUILD THEM AND THEY WILL COME". WE OUGHT TO AIM HIGH ON THIS ONE - OUR GLOBE IS DEPENDING ON YOU, NOT TO MENTION OUR HEALTH." - RESIDENT

3.2 Engagement Feedback

Feedback Themes

In analyzing the feedback from the engagement, it was grouped into the following major themes.

Safety



Several respondents indicated that the City's current cycling network does not feel safe. A concern is that many of the current lanes are too narrow and that the painted lines, which exist on many of the City's current cycling routes, do not offer enough protection from vehicles. Particular concern was expressed for the safety of children using on-road facilities. Many people are currently uncomfortable with sharrows on high traffic roads, and especially uncomfortable crossing the QEW. Comfort levels seemed to be determined most by space of cyclists to traffic and conditions on the road.

Participants referenced a lack of safety caused by narrow bike lanes, poor sightlines on certain roads with tight corners, and poorly maintained shoulders. Participants also noted that challenges in areas where drivers do not pay attention to cyclists such as: right-hand turn lanes at intersections, parking lot entrances and exits, highway on and off ramps, and underpasses. A lack of lighting was also found to make cycling challenging in some areas after dark. Appleby Line, Dundas Street, Plains Road and Maple Avenue were all noted as challenging routes. Some participants also noted that it is difficult to get to other municipalities and to GO stations because of a lack of general safety.

Connectivity



Access to important destinations and connections between on-road and off-road networks are valuable to respondents. Participants noted the inconsistency and disjointed nature of current cycling facilities is a hindrance to cycling in the City. Increased cycling network connectivity is seen as a way of enhancing cyclist safety. The importance of better connections was emphasized specifically to key destinations and facilities such as: GO Transit Stations; local schools, public facilities, the lakeshore, neighbouring cities, existing trails, and overall improved connectivity between North Burlington and South Burlington.

Residents noted that there should be increased connectivity between on-road facilities and off-road

"THE CONTINUITY OF THE BIKE LANE HERE IS INTERRUPTED SUDDENLY. POOR CONNECTION BETWEEN BURLINGTON NORTH WITH BURLINGTON SOUTH SINCE QEW IS A BIG BARRIER. PROTECTED BIKEWAYS ARE NEEDED FOR PEOPLE TO FEEL SAFE AND RIDE MORE. ESPECIALLY WOMEN, CHILDREN AND SENIOR." (REFERRING TO WALKER'S LINE QEW OVERPASS)" - RESIDENT

recreational trails. Additionally, some participants noted that cycling infrastructure is needed to help cyclists get to areas in North Burlington. A lack of connectivity between the City's cycling routes makes it difficult for residents to access certain areas. Participants also said that a lack of continuous bike lanes make it hard for them to get to certain parts of the City. For example, participants noted difficulty accessing Centennial Trail both from downtown Burlington and from North Burlington. Residents mentioned that many lanes do not "go anywhere" or abruptly end in inconvenient places. Participants also noted that it is challenging to travel to other municipalities because of a lack of connectivity.

Infrastructure



While participants want more cycling facilities and pathways, the existing network of off-road bike trails were highlighted as positive cycling amenities. The on-going maintenance of new and existing bike lanes and trails is important to users. Cyclists want routes that are free of gravel, debris, and snow. Additionally, protected and/or buffered crossings for several of Burlington's high-speed, high-traffic roadways (e.g., Plains Road/Fairview Street, Appleby Line) are desired. Other physical barriers (i.e., QEW, Plains Road and Highway 407) and land use patterns for direct routes to destinations were noted areas where improvements could be made to enhance cycling in the City.

Some residents find that Burlington's cycling infrastructure poses a challenge on their routes. Specific issues include fading painted buffers and bike lane symbols, narrow lanes, and unpaved shoulders. Certain road design features such as median and curb-lane planters, speed bumps within close proximity of the curb, and inconsistent radius curves make certain routes more challenging. A few participants noted that some lights take too long to turn for cyclists either because they favour motorists or have sensors that do not recognize the bicycles.

"I WOULD LIKE TO BE ABLE TO CYCLE SAFELY FROM MILLCROFT/ NORTH BURLINGTON TO DOWNTOWN. I DON'T FEEL COMFORTABLE ON ANY OF THE PRESENT ROUTES EXCEPT FOR THOSE THAT GO THROUGH THE HYDRO OR GAS RIGHT-OF-WAY. THIS IS ESPECIALLY TRUE FOR WHEN MY CHILDREN CYCLE. I DON'T WANT THEM ON THE ROAD AT ALL–BIKE PATH OR NOT." - RESIDENT

Frequently Commented Locations

The Social Pinpoint platform used as part of the online engagement allowed people to leave markers and comments at locations on an interactive map of Burlington as described in section 4.1.2. A map has been included showing where people left their responses. The most frequently commented on locations included:

- Proposed grade separated crossings
- Fairview Street
- Downtown Burlington
- Centennial Trail
- Waterfront Trail

Types of Facilities

The Level of Traffic Stress (LTS) concept is a way to compare the experience of using roadways with different characteristics. A further discussion of LTS is provided in the Analysis chapter, including the LTS scores of roads in Burlington based on their existing conditions.

The LTS concept was incorporated into the engagement process, by asking participants to rank their cycling comfort levels on four cycling facility types categorized by LTS scores on a scale from 1 ("very uncomfortable") to 5 ("very comfortable"). There were 838 votes received through pop-up events and Social Pinpoint online survey. The average ranking for each of the facility types are shown on the following table (Table 2), from highest to lowest.

"THE HIGHWAY CROSSINGS ARE SO DANGEROUS BECAUSE MUCH OF THE TRAFFIC IS THINKING HIGHWAY...EITHER STILL SPEEDING AS THEY GET OFF OR SPEEDING UP TO GET ON" - RESIDENT

Table 1. Public responses to preferred context to cycle in.

Facility Type	Average Rating (out of 5)
Level of Traffic Stress (LTS) 1: Trail or cycle track separated from traffic	4.52
Level of Traffic Stress (LTS) 2: On-road buffered bikeway or protected bikeway	3.85
Level of Traffic Stress (LTS) 3: Narrow bike lane or shoulder on a busy street	2.24
Level of Traffic Stress (LTS) 4: Higher speed roadway with sharrows or no cycling facilities	1.66

The general trend, as indicated by the ranking exercise, is that residents prefer a greater degree of separation between cyclists and cars to feel safer on the road. Participant feedback demonstrates that a significant area of opportunity for the City is to find ways to encourage residents to cycle in Burlington is to modify existing cycling infrastructure or build new cycling infrastructure that are either trails, cycle tracks separated from traffic, on-road buffered bikeways, or protected. Participants were also asked to provide comments regarding the four facility types. A full list of verbatim participant responses can be found in Appendix A.

"WITH THE LARGE POTENTIAL FOR REDEVELOPMENT BETWEEN YORK AND WATERDOWN ON PLAINS EITHER SEPARATED BIKE LANES SHOULD BE INSTALLED PERMANENTLY OR A CYCLE TRACK SHOULD BE BUILT." - RESIDENT

Sidewalk Riding

A number of comments during the engagement process suggested that promoting cycling on sidewalks would be a solution to providing a safe place for people to ride bikes. It is currently legal in Burlington to ride a bicycle on a sidewalk unless there is a sign posted prohibiting it. While this is uncommon, with most municipalities prohibiting cycling on sidewalks in Ontario, this plan does not include a specific recommendation to focus on changing the municipal by-law at this time. The current by-law does little more than remove the risk to residents of being ticketed for riding on the sidewalk. It does not serve to help encourage cycling as a regular mode of transportation. Sidewalks are designed for pedestrians, and providing dedicated pedestrian and cycling facilities is important to accommodate the expected growth of users and the speed differential between people walking and people riding bicycles. A more detailed discussion regarding riding on sidewalks is in Appendix B.



4 ANALYSIS

4.1 Existing Conditions

The existing cycling network in Burlington includes these facilities, with a description of the facility treatment commonly used in Burlington:

Multi-Use Trail - bidirectional path not in a roadway right-of-way, for example, hydro corridors and rail trails. Can be used by all non-motorized uses.

Multi-Use Path (Roadway) - bidirectional path on one or both sides of roadway, separated from the road, that can be used by any non-motorized vehicle. In some scenarios it is adjacent to a sidewalk, in others it replaces the sidewalk. People on bicycles are legally required to dismount and walk across intersections where crossride treatments do not exist.

Painted Bike Lane - an exclusive space on the roadway for cyclists. Usually a single painted line, to visually separate it from the vehicle travel lane. Varying widths, between 1.5-2 metres.



The Centennial Pathway is a multi-use trail in Burlington.



A multi-use path on Burloak Drive in Burlington.



A painted bike lane in Burlington.



A sharrow pavement marking indicating a shared route on Brant Street.



A signed route in Burlington.



The New Street bike lane at a bus stop.

Painted Bike Lane/Shared Lane - One side of roadway has a painted bike lane, the other side is a shared lane with a painted sharrow.

Signed/Shared Route - route has signs for wayfinding and to prompt automobile drivers to expect people on bicycles. The roadway is shared with no dedicated road space for people on bicycles. Treatments can also include on-road painted sharrows.

Paved Shoulder - space at edge of roadway visually separated from the vehicle travel lane by a single painted line. The space is not for exclusive use of people on bicycles, and could be used for parking, walking or other activities.

Beyond the existing multi-use trails, there are currently no protected facilities in Burlington that would be attractive to the interested but concerned population segment. Prior to the start of this planning process, Burlington implemented a pilot project on New Street, which included a painted buffer, which has since been removed. The pilot identified that the bike lane had a limited impact on car travel times. The number of people cycling on New Street did not significantly increase. The pilot bike lane did not provide treatment at bus stops or intersections. This empahsizes the need to design bike lanes that connect to other cycling facilities and have appropriate treatments at conflict points such as bus stops and intersections.

Strategies and designs for intersection treatments were included in the 2009 Cycling Master Plan, but few have been implemented. Currently, some crossing treatments have been implemented along the Centennial Trail route.

At the time of this plan, the City of Burlington owned cycling network has 173 km of existing facilities by centreline with the following breakdown by facility type:

Table 2. Length of Existing Cycling Facilities

Facility	Length (Centreline kilometres)
Multi-use Trail	33
Multi-use Path (Roadway)	34
Painted Bike Lanes	40
Painted Bike Lane/ Shared Lane	6
Paved Shoulder	16
Shared Roadway	57

While the network includes facilities throughout the area south of the 407 and Dundas St., many of these facilities are not connected, with significant gaps. The existing network is shown in Map 1.

THIS PAGE INTENTIONALLY BLANK

MAP 1
EXISTING NETWORK

BURLINGTON CYCLING MASTER PLAN

EXISTING FACILITIES

- Multi-Use Trail
- Multi-Use Path
- Painted Bike Lane
- Painted Bike Lane / Shared
- Signed Route
- Paved Shoulder

FEATURES AND BOUNDARIES

- Regional Road
- Railway
- Mobility Hub
- Waterbody
- Burlington

Note: existing network conditions are shown as of 2018

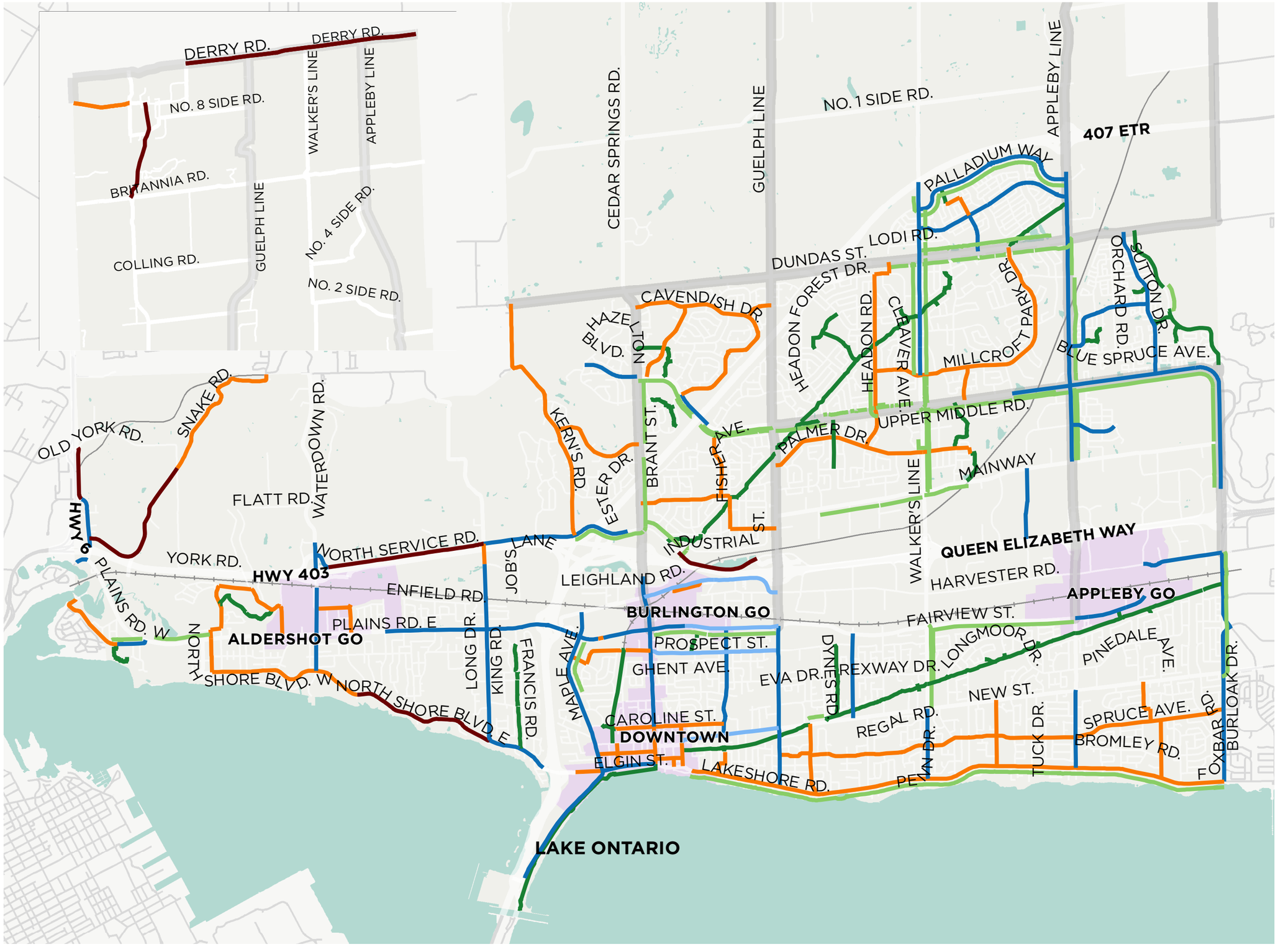
CITY OF Burlington

0 0.75 1.5 KILOMETRES

5 MIN BIKE RIDE

alta PLANNING + DESIGN

Data provided by the City of Burlington, Region of Halton, and Statistics Canada.
Map produced January 2020.



THIS PAGE INTENTIONALLY BLANK

4.2 Gap Analysis

As part of the initial analysis for the update, the existing network was reviewed and existing gaps in the network were assessed. This process was supported with field visits to confirm how or if intersections received any treatment.

- **Spot Gaps -** point-specific locations lacking dedicated bicycle and/or pedestrian facilities or other treatments to accommodate safe and comfortable non-motorized travel. Spot gaps primarily include intersections and other vehicle/bicycle conflict areas posing challenges for riders.
- **Connection gaps -** missing segments (400 metres or less) on a clearly defined and otherwise well-connected bikeway or walkway. Major barriers standing between bicycle and pedestrian destinations and clearly defined routes also represent connection gaps.
- **System gaps -** larger geographic areas (e.g., a neighbourhood or business district) where few or no bikeways exist.

Spot Gaps

Currently almost all of Burlington's intersections should be considered spot gaps, as there are almost no intersection treatments applied to guide and delineate space for people on bicycles through intersections. It was observed that existing painted lanes end before intersections, forcing people on bicycles to mix with traffic in a shared lane. These areas are high conflict zones because of the various movements of road users, with turning traffic and pedestrians. The lack of treatment could cause confusion about which user has the right-of-way and where they should be located on the road causing conflict and stressful situations.

Connection Gaps

There are many connection gaps currently in Burlington's cycling network. Many facilities end at a cross street with no facilities to connect to. Another major challenge for people cycling in Burlington is that many destinations such as malls, plazas, and GO Transit stations are setback from the street with a large parking lot between them. Navigating these parking lots can be highly stressful for cyclists, with high volumes of automobiles navigating the parking lot.

System Gaps

The existing cycling network has significant gaps with facilities suddenly ending, or not connecting to other facilities. A network should provide continuous, connected facilities. Highways are a major barrier to the cycling network. They effectively divide the city into quadrants, with only a few, distant major roads that cross the highways. The majority of roads that cross the highways have many lanes and high speeds. They also have highway interchange ramps which add to the complexity and high stress for people on bicycles using these roads.

Network Frequency

In the analysis of the network, there were discussions about network frequency. Network frequency is how often or how far apart facilities exist or should exist in each direction. Deciding on a frequency for a network is a theoretical exercise to develop a vision of how a network could be. For Burlington, grids at 200, 400, 600, and 800 metre intervals were visually overlaid on the City to encourage discussion and agree upon a vision for the cycling network frequency in Burlington.

4.3 Demand (Live, Work, Play) Analysis

Demand Approach

While research has broadly shown that Burlington has a high potential people to replace car trips with cycling trips based on the distance[21], a localized demand analysis can show where there is the most potential for cycling trips based on real destinations in Burlington.

The demand analysis model identifies expected cycling activity by overlaying the locations where people live, work, play, access public transit and go to school into a composite sketch of demand.

Each input into the model is assigned a score of 1-5 to represent the level of demand for that type of location relative to other similar destinations, for example GO stations receive a higher demand score than Burlington Transit bus stops because more people use the GO stations than individual bus stops.

Demand Results

The composite result of the demand analysis is shown in Map 2. The level of demand is visualized into 5 levels, through colours, with green being the lowest demand red areas having the highest demand. Schools (black circle with white flag) and libraries (bluish-green circle) are included on the map for context. Existing cycling facilities are included in the map to visualize where facilities exist to serve demand, and where there is demand but no facilities exist. The location and type of facilities should also be considered when viewing this map. While there may be existing facilities near areas of high demand, they may not be well connected to the network, or they may not appropriate for all ages and abilities.

The demand analysis shows that there are pockets of high demand throughout Burlington on both sides of the QEW/403 highway. Large areas of demand are located around the four mobility hubs. Some roads have continuous high demand along their length, such as Plains Road and Fairview Street, while other roads, such as New Street have some sections of concentrated demand, but



Graphic illustrating the types of destinations that were considered as part of the demand analysis.

it is not as consistent along the whole road. The results of the demand analysis help to direct and prioritize strategically where new or upgraded cycling facilities are needed. Areas with high demand are likely to have a higher number of trips to, from, and within them, and therefore more opportunity for some of those trips to be made by bicycle if there are appropriate and connected cycling facilities in these areas.

Mobility Hubs

Burlington has identified four Mobility Hubs as part of its planning and development strategies. The hubs are located around each of the GO Transit stations and downtown Burlington. The hubs are concentrated areas for development with a mix of uses over the next 20 years. The secondary planning for the Mobility Hubs is ongoing. Stated within the objectives for the hubs is a multimodal transportation network. Once these hubs are developed, it is expected that the demand to access these areas will grow, with the introduction of new residential, commercial and institutional uses.

MAP 2
DEMAND ANALYSIS

BURLINGTON CYCLING
MASTER PLAN

LIVE, WORK, PLAY DEMAND

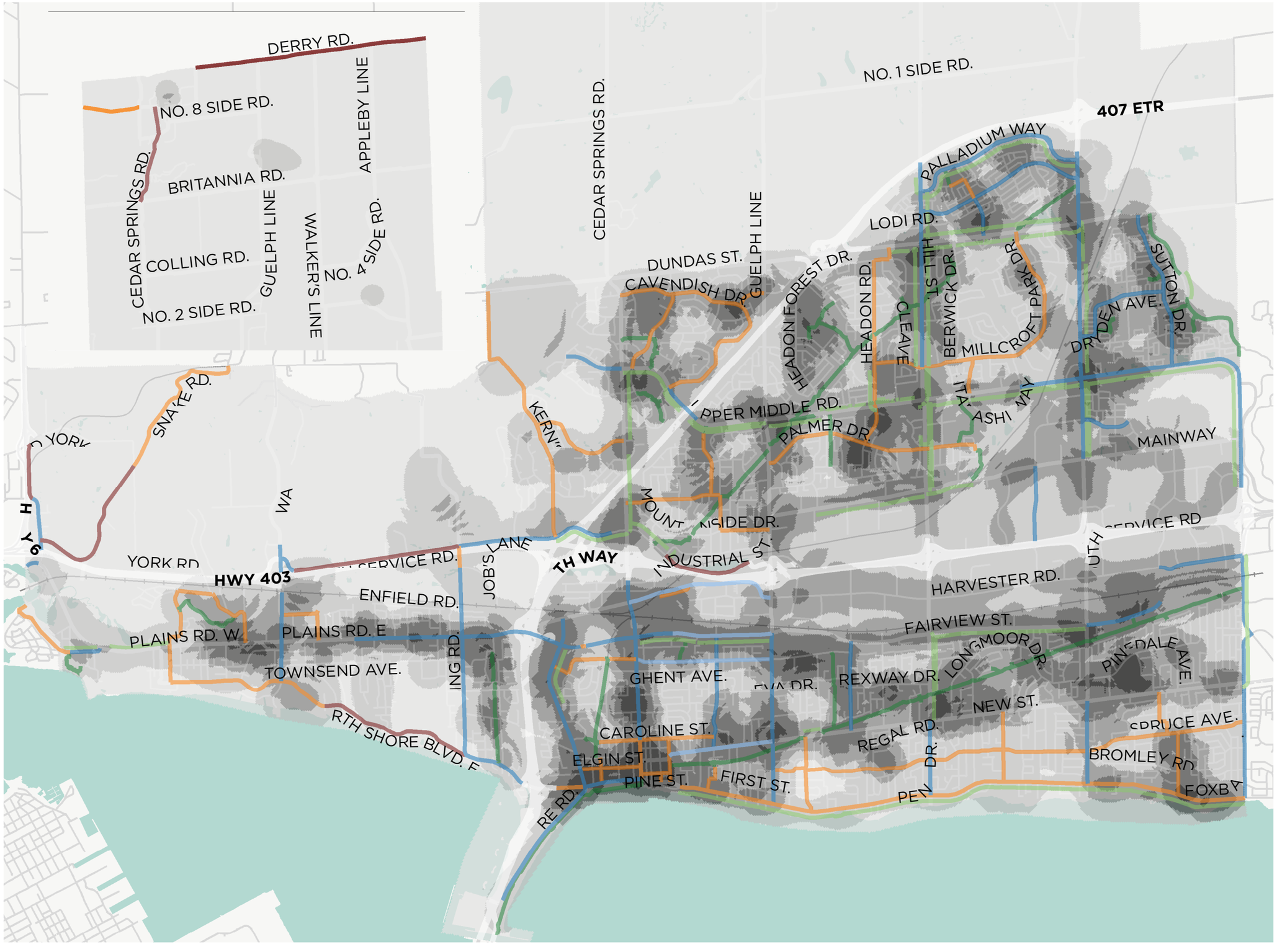
- High
- Low

EXISTING FACILITIES

- Multi-Use Trail
- Multi-Use Path
- Painted Bike Lane
- Painted Bike Lane / Shared
- Signed Route
- Paved Shoulder

FEATURES AND BOUNDARIES

- Railway
- Waterbody



CITY OF Burlington

0 0.75 1.5 KILOMETRES
5 MIN BIKE RIDE

alta PLANNING + DESIGN

Data provided by the City of Burlington, Region of Halton, and Statistics Canada.
Map produced January 2020.

THIS PAGE INTENTIONALLY BLANK

4.4 Level of Traffic Stress Analysis

Level of Traffic Stress Overview

The Level of Traffic Stress (LTS) Analysis was adapted from the 2012 Mineta Transportation Institute Report 11-19: Low-Stress Bicycling and Network Connectivity. A level of comfort for bicyclists is determined based on factors including posted speed limit, street width, and the presence and character of bicycle lanes. The combination of this criteria separates the bicycle network into one of four scores:

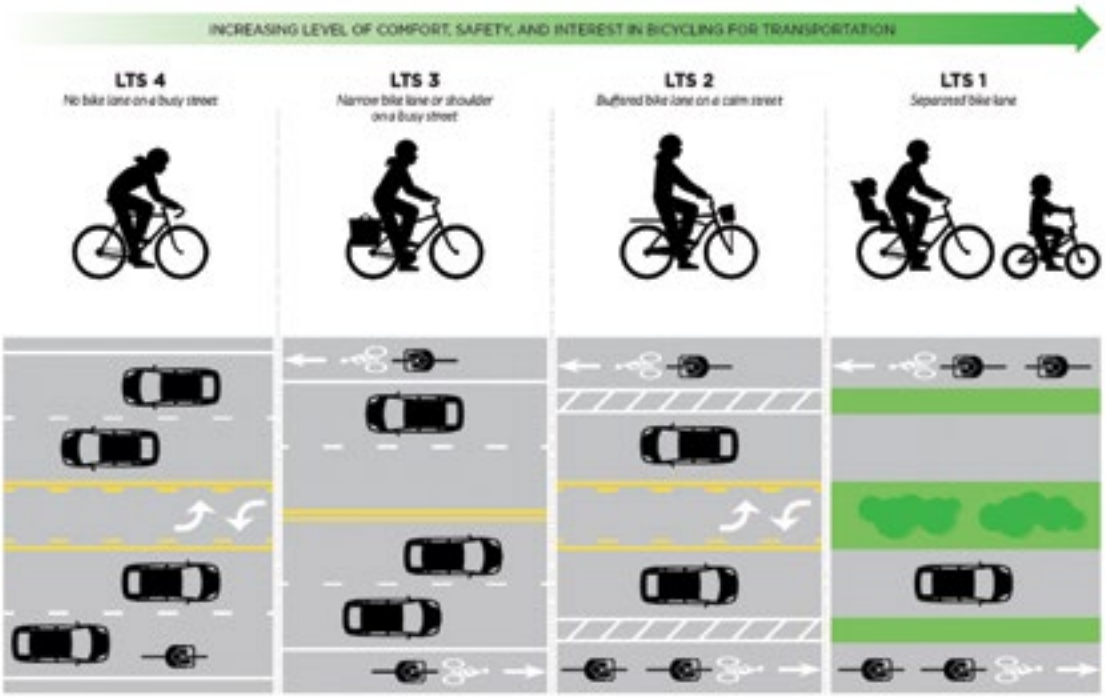
- LTS 1: Low-stress roadway suitable for all ages and abilities
- LTS 2: Roadway comfortably ridden by the mainstream adult population
- LTS 3: Roadway ridden by "enthused and confident" cyclists
- LTS 4: Roadway ridden by the "strong and fearless" cyclists

In general, a separated bicycle facility, such as a trail or a cycle track, would qualify as a low-stress (LTS 1) bikeway, while roadway shared with motor vehicle traffic operating at high speeds would receive a higher-stress score. The results of the LTS analysis helps identify existing areas that have low-stress routes and networks, as well as focus areas for improvement.

LTS provides an intuitive framework to describe the benefits of bicycle infrastructure and demonstrates that some roadways need more intervention than others to provide a truly comfortable experience. For example, the only time a painted bike lane is considered all ages and abilities is a 2 m wide facility on a roadway with posted speed of 40 km/h or lower and the best LTS score you can achieve on a roadway with four or more travel lanes without installing a protected bikeway is LTS 3.

Level of Traffic Stress Results

The following maps 3 and 4 illustrate the LTS analysis results, with low-stress roads in dark green to high-stress roads in red. Limited access roadways, such as the QEW, 403, and 407, that do not permit use of bicycles have been removed from the map. Map 3 generally shows the scores of roadways. Map 4 shows the score of existing cycling facilties and is overlaid on the results from the demand analysis (with low demand in light grey, and higher demand in darker shades), to connect where demand for mobility is, and where there are supply challenges due to high-stress roadways.



Graphic illustrating different LTS levels and corresponding user types.

The LTS analysis in Burlington illustrates how arterial roads and the highways are one of the greatest challenges for Burlington in creating a low-stress cycling network. The majority of arterials received an LTS score of 3 or 4. Even though some of these arterials have painted bicycle lanes, the characteristic of the roadway, namely the number of lanes and the posted speed limit, create an environment that are stressful, even with dedicated facilities. The arterial roads are the most continuous roads in Burlington's road network, and the only way to cross the highways. They are also where some of the highest demand is.

The LTS analysis shows that the existing facilities are not enough to impactfully lower the stress of cycling on many of Burlington's roads. While there are many lower stress roads, the majority of them are residential cul-de-sacs and do not constitute a direct, connected network that enables someone getting from point A, to point B, to point C in a reasonably direct manner.

MAP 3
LEVEL OF TRAFFIC STRESS ANALYSIS

BURLINGTON CYCLING MASTER PLAN

LEVEL OF TRAFFIC STRESS SCORE

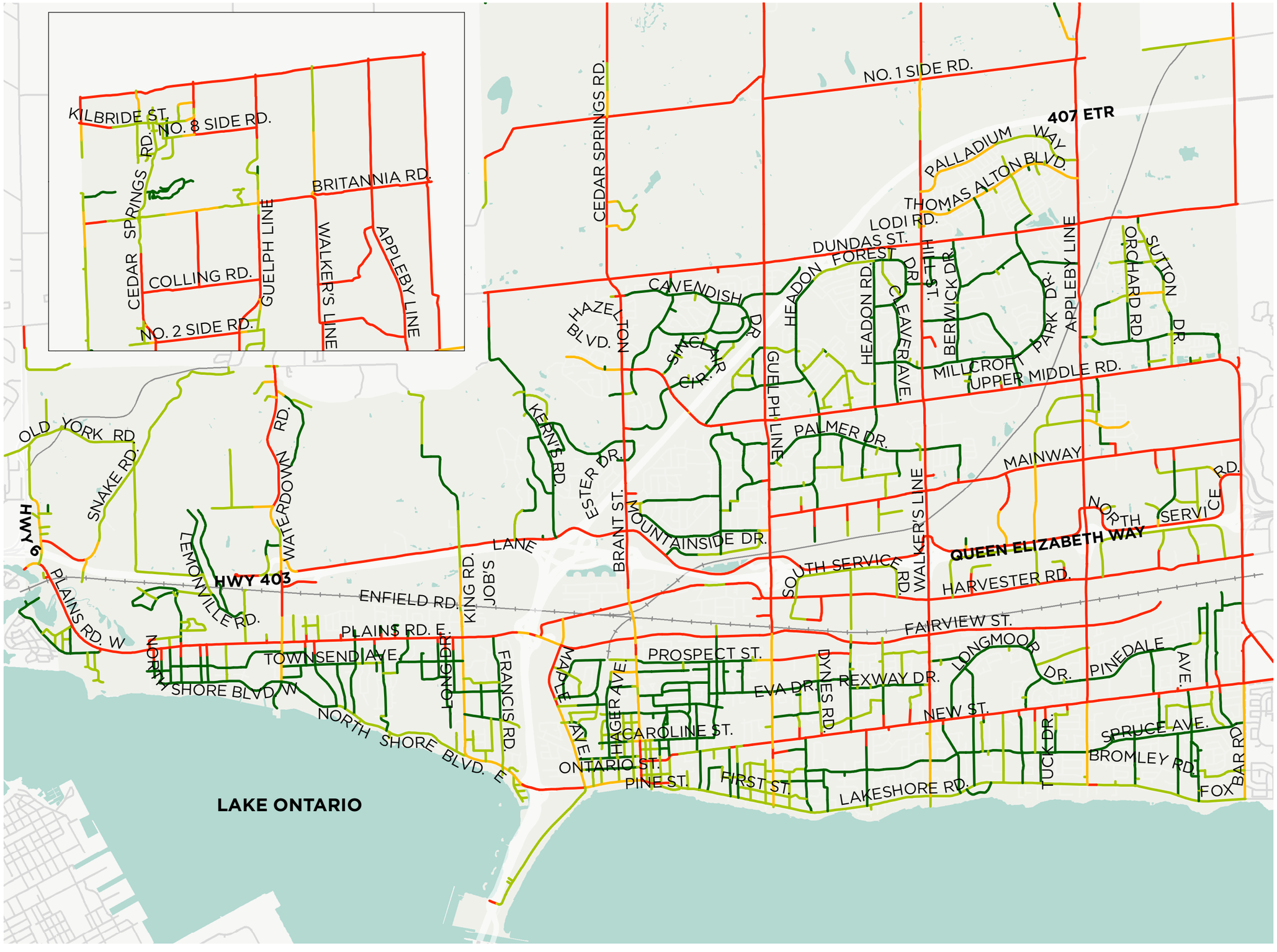
- 1 - All ages and abilities
- 2 - Interested but concerned
- 3 - Enthused and confident
- 4 - Strong and fearless

FEATURES AND BOUNDARIES

- Railway
- Waterbody
- Burlington

Level of traffic stress (LTS) analysis evaluates roadways based on their characteristics to identify how stressful roadways are to cycle on. Characteristics include the posted speed limit, number of lanes, intersection crossings and bike facilities. The higher the LTS score, the more stressful the roadway is.

Cul de sacs have been removed as they do not provide network connectivity.



CITY OF Burlington

KILOMETRES
0 0.75 1.5
5 MIN BIKE RIDE

alta PLANNING + DESIGN

Data provided by the City of Burlington, Region of Halton, and Statistics Canada.
Map produced June 2019.

THIS PAGE INTENTIONALLY BLANK

MAP 4
LEVEL OF TRAFFIC STRESS OF EXISTING FACILITIES

BURLINGTON CYCLING MASTER PLAN

LEVEL OF TRAFFIC STRESS SCORE

- 1 - All ages and abilities
- 2 - Interested but concerned
- 3- Enthused and confident
- 4 - Strong and fearless

LIVE, WORK, PLAY DEMAND HEAT MAP

- HIGHEST
- LOWEST

FEATURES AND BOUNDARIES

- Railway
- Waterbody
- Burlington

Level of traffic stress (LTS) analysis evaluates roadways based on their characteristics to identify how stressful roadways are to cycle on. Characteristics include the posted speed limit, number of lanes, intersection crossings and bike facilities. The higher the LTS score, the more stressful the roadway is.

CITY OF Burlington

0 0.75 1.5 KILOMETRES

5 MIN BIKE RIDE

alta PLANNING + DESIGN

Data provided by the City of Burlington, Region of Halton, and Statistics Canada.
Map produced June 2019.



Recently constructed facilities during the planning process may not have been included in the analysis

THIS PAGE INTENTIONALLY BLANK



5 FACILITY DESIGN AND SELECTION

5.1 Best Practices and Guidelines

A number of design guidance documents and manuals have been published and are available for reference when planning and designing cycling infrastructure. Guidance and best practice in facility design has developed over time, with each iterative document building upon the ones that have come before it. A focus of recent guidance has been on designing all ages and abilities facilities. These facilities are safer, attractive facilities for the younger and older segments of the population and are designed to accommodate different types of bicycles and tricycles that may be wider or have different operating dimensions from bicycles. By designing facilities to accommodate for all ages and abilities, the facilities would be attractive to a much larger segment of the population.

The following is a sample list of useful design guidance documents and manuals:

- Transportation Association of Canada (TAC), Geometric Design Guide for Canadian Roads (2017)
- Ontario Traffic Council (OTC), Book 18: Cycling Facilities (2013 - Update currently in progress)
- National Association of City Transportation Officials (NACTO), Designing for All Ages & Abilities (2017)
- National Association of City Transportation Officials (NACTO), Urban Bikeway Design Guide (2014)
- Massachusetts Department of Transportation (MassDOT), Separated Bike Lane Planning and Design Guide (2015)
- Federal Highway Administration (FHWA), Separated Bike Lane Planning and Design Guide (2015)
- Federal Highway Administration (FHWA), Small Town and Rural Multimodal Networks (2016)
- Vélo Québec, Planning and Designing for Pedestrians and Cyclists (2010)
- CROW, Design Manual for Bicycle Traffic (2007)

Facility Terminology

In the 2017 update for the TAC Geometric Design Guide for Canadian Roads, terminology was developed to more clearly differentiate between all the types of cycling facilities. As part of this plan, the terminology for cycling facilities in Burlington has used the terminology from TAC and the structure for differentiating between facilities. TAC groups facilities into "Separated" and "Unseparated" bikeways, and clearly defines the types of separation provided by the facilities within the Separated Bikeways grouping. Bikeway is used as a catch-all term for cycling facilities. Additional facility types such as advisory lanes are not included the general summary below. These facilities are recommended and could be implemented as appropriate where opportunity existis. Photos of the facilities are available in 5.2.2.

Separated Bikeways

- Multi-use Trail

  Independent corridor

- Multi-use Path

  Physically separated within *roadway corridor*

- Protected Bikeway

  Includes on-road physically separated

  Includes in-boulevard physically separated "raised cycle track" [note: "Bike Path" from TAC]

- Painted Buffered Bike Lane

  Visually separated

- Painted Unbuffered Bike Lane

  Visually separated [i.e., single white line]

Unseparated Bikeways

- Local Street Bikeway

  Also called "Bicycle Boulevard" or "Neighbourhood Greenway"

- Shared Use Lane

- Paved Shoulder

  Called "Bicycle Accessible Shoulder" in TAC

5.2 Facility Selection Framework

The facility selected for roadways is based on factors that have been identified in best practice and guidance documents and based on the vision and goals of the cycling plan update. Best practice and guidance documents most often consider vehicle speed and traffic volume in their recommendations for facility selection, with consideration also given to the setting of the roadway. The vision identified for this plan, of developing an all ages and abilities network has also guided the facility selection process. Facilities for roadways have been selected based on their context with attention to their speed and traffic volumes. To meet all these needs, two network categories have been introduced in section 5.2.1, followed by the descriptions of facilities in section 5.2.2.

Proposed facilities were selected based on:

- Either existing or proposed facility
- The priority in the network (whether it is a spine or connector)
- The level of traffic stress, which considers road characteristics such as posted speed limit and the number of lanes
- If the road is part of the proposed frequent transit route network

Network Designation

Spine Network

The Spine Network is comprised of Spine Routes, which are a new designation introduced for this cycling plan. Spine Routes will reach all parts of the city, providing a connected network that will consist of facilities that offer a higher order of protection for cyclists, and should be designed towards an all ages and abilities standard, to address the objectives of this plan. The Spine Network designation indicates that the route should be a priority for operations (snow plowing, street cleaning, etc.). The Spine corridors were selected to correspond with the demand live, work, play heat map analysis and align with transit.

Facility Types eligible to be considered a Spine Route include:

- Multi-use Trail
- Multi-use Path
- Protected Bikeway
- Painted Bike Lanes – Buffered and Unbuffered*
- Local Street Bikeway
- Grade Separated Connector
- Highway Interchange Crossing

**Note: Unbuffered painted bike lanes are included in the Spine Network, but only in very specific circumstances, on streets with lower vehicle volumes and speeds.*

Connector Route

Connector Route is the designation given to all other cycling facilities in the proposed network of this plan. Connector Routes will help people get to or from the Spine Network. Connector routes have a lower priority for implementation, maintenance, and operations than spine routes.

The facility types on Connector Routes include:

- Multi-use Trail
- Multi-use Path
- Protected Bikeway
- Painted Bike Lane – Buffered and Unbuffered
- Shared Use Lane
- Paved Shoulder
- Grade Separated Connector
- Highway Interchange Crossing



Multi-use trail in Ottawa, ON.

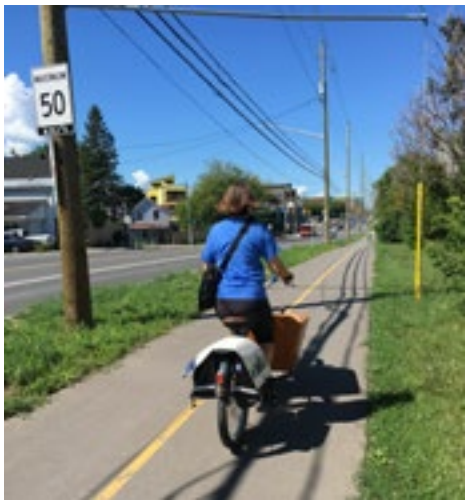
Facility Descriptions

Multi-use Trail

Multi-use trails are separated facilities that are shared by pedestrians (including people using motorized assistive-mobility devices), cyclists, and people using other non-motorized modes (skateboards, rollerblading, etc.) making them a low stress facility. They are bidirectional and can be treated with a marked centreline to delineate the space. Existing multi-use trails in Burlington include the Centennial Trail or Hydro Corridor Trail. Consideration must be given at road crossings on how to comfortably and safely provide a continuous facility.

Providing lighting, maintenance, and clearing will increase the reliability of the multi-use trails. The volumes of people using spine network multi-use trail should be monitored. Upgrades in sections of high use could be considered to reduce conflicts with regular commuters travelling at higher speeds. The TAC Geometric Design Guide includes guidance for when separated paths in trail corridors are recommended based on the volumes of different users.

Multi-use trails are typically the responsibility of the Parks and Open Space, Capital Works department which calls them multi-use recreation trails. The Cycling Plan identified these corridors as beneficial for connectivity and improved mobility for people cycling in Burlington. The



Multi-use path in Ottawa, ON.



On road protected bike lane in Toronto, ON.



Raised cycle track in Ottawa, ON.

feasibility, facility recommendations, including the surface type and implementation for these projects will be determined in consultation with the Transportation department to help advance cycling initiatives.

Multi-use Path

Multi-use paths are similar to multi-use trails. The defining difference is that multi-use paths are built within the road right-of-way. Special consideration should be given to intersections and driveways.

Protected Bikeway

On road protected bike lanes and raised cycle tracks have been grouped together as one designation. The reason behind this is both facilities provide a physical separation and are the appropriate facility choice on roads that have higher speeds, number of lanes, and traffic volumes. The decision to implement a protected bikeway or a raised cycle track is project dependent and can be influenced by a variety of factors, such as on road space, space in right-of-way, utility locations, etc. At the master planning level, it is more appropriate to indicate which roads should have physically separated facilities, instead of specifying the type of physically separated facility that should be applied to a specific road. This emphasis here is the requirement for physical separation and where the emphasis should be placed to make it a successful facility (i.e., type of separation, intersection and bus stop treatments, signal timing/phasing, connected network and transitions).

Protected bikeways can include a variety of physical separation treatments, including a parking lane, flexible delineator posts, pinned parking curbs, planter boxes, concrete barrier curbs, or other physical separation materials. Raised cycle tracks provide physical separation by



Buffered bike lane in Toronto, ON.

having the bikeway above the grade of the roadway. They are commonly at the same grade as sidewalks, but separation treatment is necessary to distinguish the bikeway from the sidewalk. Raised cycle tracks should have some form of treatment at driveways and intersection crossings, including bend in or out, signal timing/phasing, paint, and/or signage. Both types of bikeways can provide the equivalent level of protection and comfort if designed correctly.

Painted Bike Lane

Painted bike lanes can include a buffered or unbuffered treatment. The buffered treatment designates a visual area to separate the bicycle lane from the vehicle lane beyond a single painted line. Buffered painted bike lanes are considered more comfortable with the wider visual separation on faster roads with higher traffic volumes compared to unbuffered bike lanes. Painted bike lanes indicate space for the exclusive use of cyclists. Challenges for painted bike lanes exist where there is heavy vehicle curbside activity, such as parking, loading, or drop-offs. Since there is no physical separation, painted bike lanes can be prone to automobiles entering the bike lane.

Local Street Bikeway

The local street bikeway facility is a shared roadway treatment that is beyond a signed route treatment. Local street bikeways are located on local roads that have design improvements to slow and divert automobile traffic and prioritize bicycle traffic. Cycling is considered more attractive on these roads because of slow motor vehicle speeds and low vehicle volumes. Treatments are implemented at major and minor intersections that the local street bikeway crosses to prioritize and facilitate safer crossing for cycling traffic. On road directional markings (sharrows) and wayfinding signage help route cyclists in a clear manner. TAC includes extensive guidance on the development of local street bikeways. Consideration must be given to design elements, route planning, speed management, volume management and street crossings to be successful. The following lists summarizes the key elements of a local street bikeway. Examples of treatment applications are available in Appendix C.



Full street closure as part of a local street bikeway in Ottawa, ON.



Shared use lanes in Toronto, ON.

Key Elements include:

- **Route Planning -** direct access to destinations
- **Signs and Pavement Markings -** easy to find and to follow
- **Speed Management -** slow motor vehicle speeds
- **Volume Management -** low or reduced motor vehicle volumes
- **Minor Street Crossings -** minimal cyclist delay
- **Major Street Crossings -** safe and convenient crossings
- **Offset Crossings -** clear and safe navigation
- **Green Infrastructure -** enhancing environments

Shared Use Lane

A shared lane is a general purpose lane with sufficient width to accommodate the automobiles and cyclists. These facilities are not low stress unless located on streets with a low traffic volume and speed limit. The lanes can be marked with sharrow markings to provide guidance on where cyclists should be riding.

Signage in the boulevard can identify the road as a bike route, and give guidance for how people driving and people cycling should be sharing the roadway. A shared use lane creates space for more confident cyclists that are comfortable riding in traffic.

Paved Shoulder

On roadways with shoulders, there is an opportunity to pave the shoulders to provide a space for cyclists. Shoulders are not for the exclusive use of cyclists and are recommended in rural areas where there are lower traffic volumes. On higher speed facilities, the use of rumble strips within the painted line or buffered area is recommended to provide a more comfortable experience.



A paved shoulder with rumble strip in Ottawa, ON.

Grade Separated Connector

Grade separated connectors are a low stress facility to be used to connect two sides of an otherwise challenging or impassable barrier, such as a highway, railways, and waterbodies. Grade separated connectors must be connected to other cycling facilities on either end. These crossings should be placed strategically to facilitate a highly used, direct crossing, especially where low stress on road facilities may be challenging to implement. All grade separated connectors should have low stress facilities on both sides.

Highway Interchange Crossing

This is in reference to opportunities for design interventions at highway interchanges to create a lower stress bikeway connection for cyclists. Attention should be directed to addressing the conflict zones at on- and off-ramps and providing separation along the bikeway if possible. Some strategies at on- and off-ramp conflict zones include minimizing the turning radii forcing traffic to slow down, as well as clearly marking crossing zones. Further study on designing facilities for this context are currently underway as part of the OTM Book 18 update.



Grade separated connector over the QEW in Hamilton, ON.

5.3 Site Specific Recommendations

In addition to the facilities described above, the following section provides recommendations on design and treatment options that should be incorporated as part of this plan. They include upgrades to existing facilities, treatments for intersections, and treatments at transit stops. These are locations where the City has had challenges implementing a complete facility and where consistently identified as spot or connection gaps during the analysis of the existing conditions. Each topic provides a discussion around the existing conditions, and a variety of treatment options that could be implemented where appropriate.

Upgrading Multi-Use Paths

Burlington's existing cycling network contains 32 km of multi-use paths adjacent to roadways. While these facilities have been built over the years with the intent of being beneficial to cyclists, they are not consistent in design, with significantly varying widths and surface treatment, condition, and configuration.

In some instances, narrow paths are provided on both sides of the roadway, while in other instances, a single wider multi-use path is provided on one side. These facilities contain no signage for facility users or for motorists. Points at which multi-use paths cross driveways and roadways are not marked and generally contain no pavement markings.

In order for these facilities to be comfortable, safe, attractive, and convenient for people riding bicycles, significant changes are recommended, including a standardised approach to the design and maintenance of these facilities.

For these facilities to be successful, there are a number of improvements that should be made in order for these to constitute a cycling facility for the purposes of the Cycling Plan. The following are general principles that apply to the design of multi-use paths. See Appendix D for more details.



The grade is maintained through the driveway on this multi-use path in Granby, QC.

Table 3. Considerations for better multi-use paths.

Consideration	Notes
Presence of Sidewalk	When a MUP is adjacent to a sidewalk, the facility should be signed and treated as a dedicated cycling facility, and classified as a cycle track
Width and Facility Designation	In order to be designated for two-way bicycle and pedestrian traffic, MUPs should be 3.0 metres wide (a minimum of 2.4 metres is acceptable in constrained conditions). MUPs that are narrower than this should either be widened, or should be designated for one-way bicycle travel, and a parallel facility for the other direction of travel should be provided on the opposite side of the roadway. One-way MUPs should be reclassified and signed as cycle tracks, and be 2.0 metres wide to promote comfortable travel for people riding all sizes of bicycles, and to allow social side-by-side riding and passing
Intersections	While MUPs provide a high level of comfort for people riding bicycles midblock, they can have significant safety concerns where they cross roadways if not properly managed. The design of these facilities should not neglect intersections and driveway crossings. Recommendations for crossing design are discussed in more detail in 5.3.2 Intersection Improvements section
Driveways	Roadways with more frequent driveways present more turning conflicts between motorists and cyclists, especially when MUPs carry bidirectional bicycle traffic. Driveways should be designed to clearly give priority to MUP users over motorists, by maintaining the MUP surface condition across driveways, and using extra pavement markings or signage as needed
Signage and Pavement Markings	Signage and pavement markings should be applied consistently, to communicate the intended use of the facilities, and alert cyclists and motorists of upcoming conflicts and right-of-way
Surface Conditions	People riding bicycles are more sensitive to irregularities in surface conditions than people driving cars, due to a lack of suspension. Elderly cyclists are especially sensitive to bumps and other irregularities. MUPs should be designed with continuous concrete or asphalt surfaces with level joints. Curb cuts should be provided at crossings
Maintenance	MUPs should be maintained free of cracks and bumps, to provide a smooth riding surface. In winter months, MUPs should be kept clear of snow
Obstructions and Hazards	Vertical obstructions, such as utility poles and signposts present a collision hazard to people riding bicycles and reduce the effective width of a facility. Wherever possible, these should be located outside of the travelled portion of the MUP. When a pole cannot be placed elsewhere, it should be clearly marked as a hazard
Design Consistency	Consistency in design is important for helping people understand how to use MUPs. Facility design should follow a consistent and standardized approach with signage, pavement markings, widths, and geometry
Connectivity and Transitions	Connectivity to other cycling facilities and streets from MUPs is essential. Especially when a MUP exists on only one side of the roadway, controlled crossing opportunities, including curb cuts, should be provided for cyclists to cross the roadway. Ensure that where MUPs end, there is a clear transition to another place to cycle, whether it is the roadway or another off-road facility

Bikeways at Transit Stops

A common experience of people cycling on roads with transit is that they can get stuck behind buses when they stop at a bus stop. Not only does this delay cyclists and cause confusion whether they wait behind the bus or pass it, it is also stressful. On roads that are both Spine Network cycling routes and high frequency transit routes, thoughtful design treatments should be implemented at all bus stops that consider and enhance the experience for pedestrians, cyclists, and transit.

The design should maintain separation of cyclists from the roadway, and demarcate where yield priority is between boarding and alighting transit users and cyclists. Further guidance on this subject is expected be included in the forthcoming update to OTM Book 18. Some examples of existing treatments are provided below.

King Street, London, ON

This facility, constructed in 2019, is an example of a protected bike lane adjacent to a high-volume transit corridor on an arterial roadway. The stop island is fenced off directing transit users to walk at a specific crossing that is delineated and signed, requiring cyclists to yield to crossing pedestrians.



Bus stop island treatment with bike lane in London, ON.

Richmond Road, Ottawa, ON

The raised cycle track is demarcated from the sidewalk with textured pavers. A 'bicycles yield to pedestrian' sign is placed before the stop. The transit shelter is on the sidewalk side of the bikeway.



Bus stop treatment with raised cycle track in Ottawa, ON.

Sherbourne Street, Toronto, ON

The loading area and bikeway are shared. Transit users wait behind the tactile walking surface indicators. Cyclists must stop and wait when a bus is at the stop.



Shared bike lane and bus loading zone in Toronto, ON.

Main Street, Ottawa, ON

The raised cycle track has a zig-zag paint to distinguish the bikeway through the transit stop as a potential conflict area. It also indicates that cyclists should stop before the bus platform when a bus is present.



Bus stop and raised cycle track in Ottawa, ON.

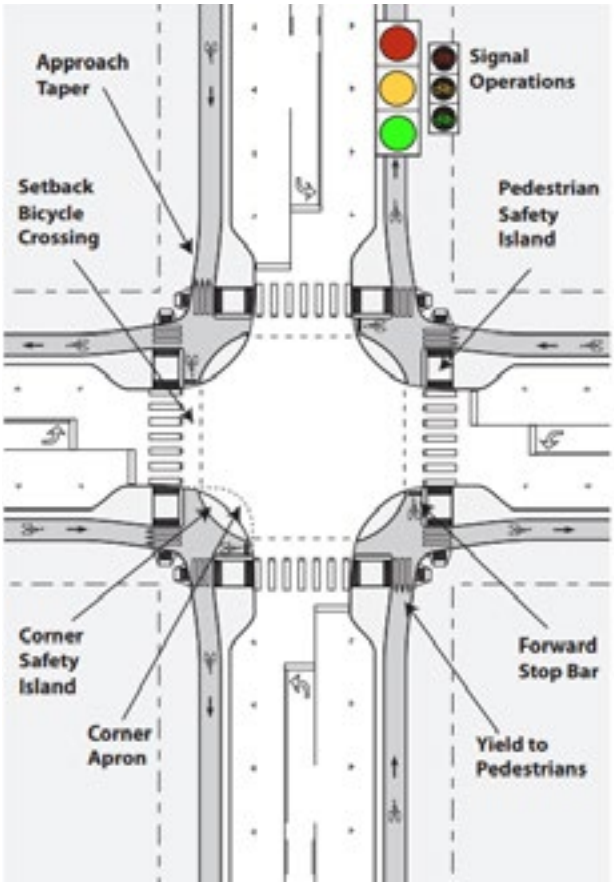
Intersection Improvements

Intersection Improvement Selection

Proposed intersections for improvement were selected based on: being classified as a spine route; specific engagement feedback; discussions with the Cycling Advisory Committee; the 2009 cycling plan; analysis throughout the development of this plan. The application of intersection improvements is not limited to the intersections identified in this plan. The improvements included in the following section, the Intersection Improvement Toolbox, should be applied, as appropriate, as part of any bikeway development. Additional guidance on application of the treatments can be found in OTM Book 18 and TAC GDG. Including intersection improvements are integral for creating a complete cycling facility. Intersection improvements can be used to connect or transition between facilities.

Intersection Improvement Toolbox

The toolbox summarizes different types of intersection improvements that enhance the experience for everyday cycling travel by reducing conflict points between motor vehicles and cyclists, and using design and engineering to control speeds and lower the potential severity of conflict. Intersections are one of the largest barriers to building a connected network, that includes all ages and abilities facilities. The toolbox includes facilities that help to achieve a more safe and comfortable connected network.



Graphic illustrating the features of a protected intersection.

Protected Intersection

Reduces the number of conflict points, and shortens the crossing distance for cyclists and pedestrians. The corner safety island tighten the radii of turning cars, slowing down their movement. Further guidance and considerations will be included in

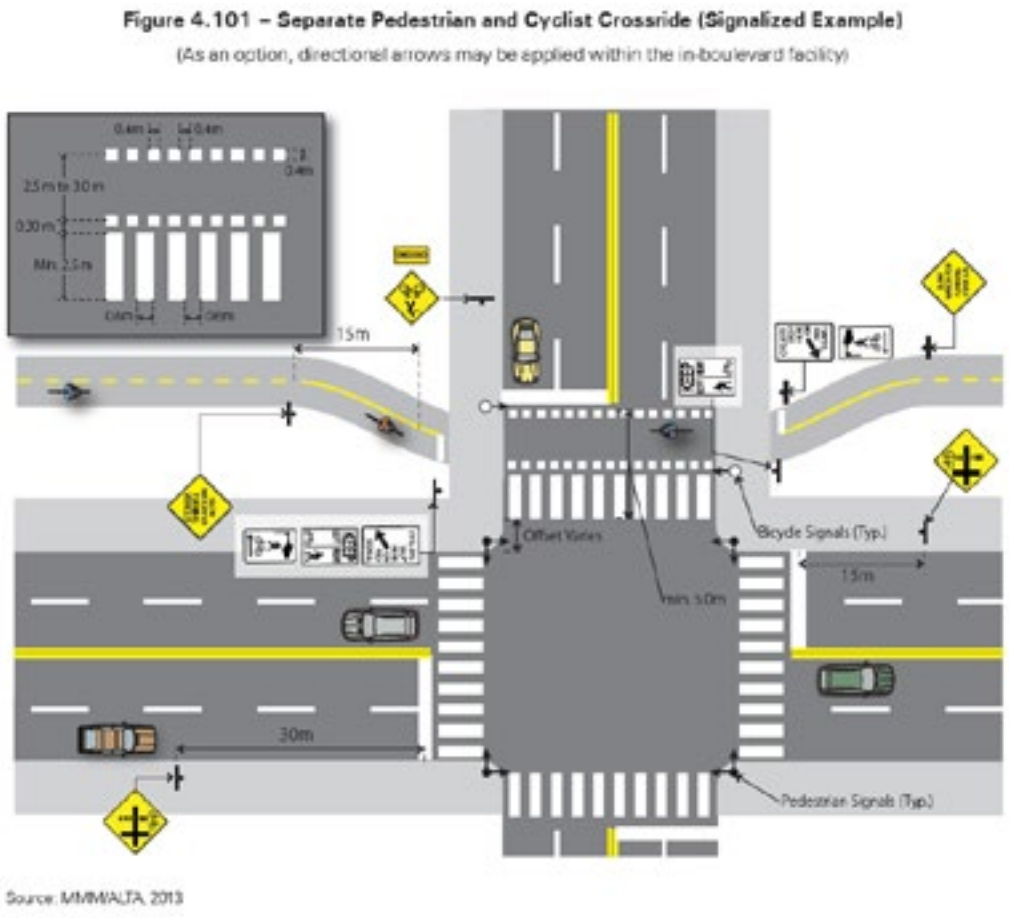


Illustration detailing a separated crossride treatment from OTM Book 18.

the OTM Book 18 update.

Signal Separation

Separating cyclist and car intersection movements through signalization is another strategy to achieve separation.

Combined Crossride

Allows for cyclists to ride across a crossing. The combined crossride has pedestrian and cyclist users sharing the space where pedestrians should walk in the middle, and cyclists to the outside.

Separated Crossride

Enables cyclists to ride across intersections. Pedestrian and cyclists are separated.

Mixed Crossride

Enable cyclists to ride across intersections. The crossing space is mixed, with pedestrians and cyclists sharing the space, without prompts to where each user should be within the crossride.

Two-Stage Left Turn Box and Jug Handle

These intersection improvements clarify and support how cyclists can do a two-stage left turn. This prevents cyclists from having to move into the left lane and wait in the middle of the intersection for a gap in oncoming traffic.



A two-stage left turn box in Ottawa, ON.

Raised Crossings

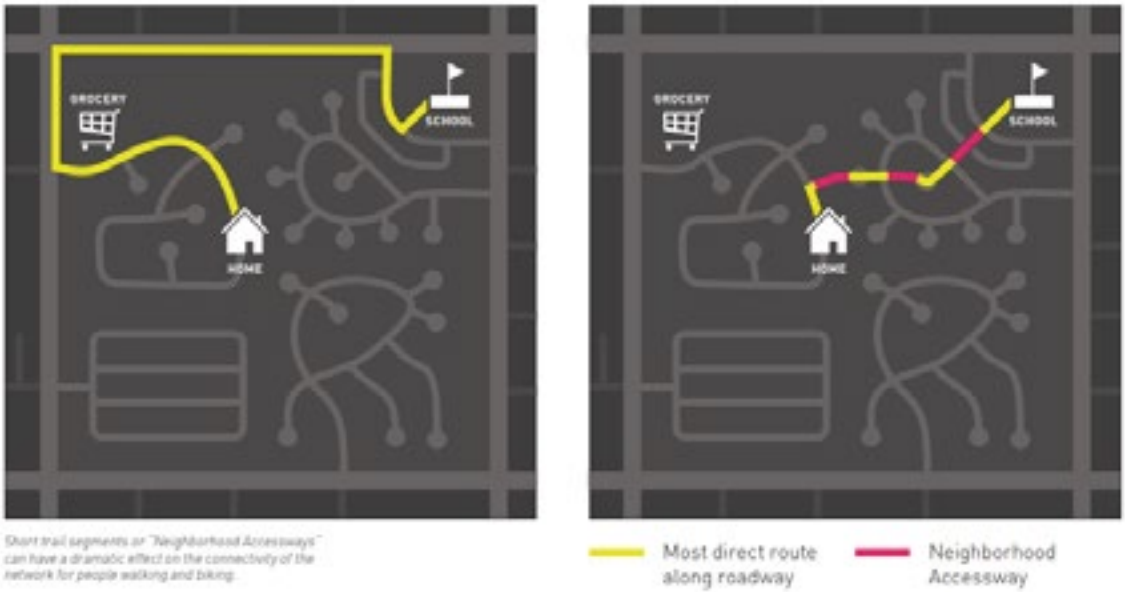
By raising the crossings, pedestrians and cyclists have a smooth at-grade path of travel. The raised crossing acts as a speed bump for automobile traffic, slowing them down and identifying priority for people walking and cycling.



A raised crossing with a separated crossride in Ottawa, ON.



6 NETWORK DEVELOPMENT AND RECOMMENDATIONS



Graphic illustrating how accessways can develop more direct routes to destinations in cities with a curvilinear and cul de sac street network.

The following section presents the proposed Spine Network and Connector routes. The networks are comprised of existing and proposed facilities, as well as facilities already being built or soon to be built. Together the Spine and Connector networks with both existing and proposed facilities is the ultimate plan network. The networks were developed by considering the analyses described in Chapter 3. Appropriate facilities have been identified based on the characteristics of the roadway. The networks have been developed to provide different routes to move around the city based on their ability, but with an intention to provide connected facilities for people to travel by bicycle to areas of demand throughout the City.

One strategy used to develop routes inside neighbourhoods in Burlington, where the road network does not follow a grid, was to connect on-road and off-road routes. Utilizing connections through available rights-of-way such as school properties, city owned facilities, or utility owned properties can significantly shorten the distance to get from point A to B, as shown in the following image from the Atlanta Regional Council Walk, Bike, Thrive! Bike-Pedestrian Plan.[22]

This plan does not include facilities on roads that are owned by Halton Region but are within the boundary of Burlington. The existing and planned facilities for these roads are in the Halton Region Active Transportation Master Plan (2015), which is planned for an update in 2020. The ultimate proposed network shown on Map 5 and in detail in Appendix H include all existing, planned, and proposed facilities from this plan. They show the region owned roads as thick grey lines. The maps show the ultimate proposed plan by network type and facility type.

Table 4. Comparing length of existing and proposed cycling facilities by facility type.

Facility Type	Existing Kilometres (centerline)	Proposed Kilometres (centerline)	Ultimate Plan Kilometres (centerline)
Multi-Use Trail	33	20	57
Multi-Use Path	34	1	15
Protected Bikeway	--	65	65
Painted Bike Lane – Buffered	2	21	23
Painted Bike Lane – Unbuffered	38	6	18
Local Street Bikeway	--	30	30
Shared Use Lane	57	8	44
Paved Shoulder	16	59	66
Grade Separated Connector	--	4	4
Highway Interchange Crossing	--	2	2
Total Kilometres	**180**	**221**	**377**

** Facilities planned for implementation outside of this project may contribute to the Ultimate Plan length of kilometres planned. Some existing facilties may be upgraded to other facilty types*

The ultimate proposed network includes a significant increase in the number of kilometres of protected bikeway facilities. A recommendation of this plan is for protected bikeways on roads throughout the City, in order to support a network of facilities for all ages and abilities. Many of these roads do not currently have cycling facilities, or the existing facilities are inadequate given the vehicle volumes, speeds, and size of the roadway. A significant portion of the recommended protected bikeways are on roads that currently have multi-use path facilities on a portion of their length. As discussed in a previous section, these facilities do not provide adequate treatment at intersections and driveways. The existing multi-use path could be upgraded to in-boulevard cycle track facilities. Identifying these facilities as protected bikeway facilities establishes the level of standard they should receive, making them more appropriate for all ages and abilities.

6.1 Spine Network

The Spine Network includes existing and proposed facilities. Some existing facilities that are a part of the Spine Network include the Centennial Trail and the Hydro Corridor Trail. While these facilities are already built and part of the Spine Network, improvements are recommended to enhance the experience of people using the trails. The facilities proposed for the Spine Network provide more comfort to a person using the facility, being more appropriate for all ages and abilities. Table 5 summarizes the Spine Network on whether it is existing or proposed, and by facility type and total length.

Table 5. The existing and proposed Spine Network by facility type.

Facility Type	Existing Kilometres (centreline)	Proposed Kilometres (centreline)
Multi-Use Trail	28	7
Multi-Use Path	4	0.5
Protected Bikeway	0	50
Painted Bike Lane – Buffered	0	0
Painted Bike Lane – Unbuffered	3	--
Local Street Bikeway	0	29
Grade Separated Connector	0.1	3
Highway Interchange Crossing	--	2

6.2 Connector Routes

The Connector routes also include existing and proposed facilities. The Connector routes are intended to connect to the Spine Network providing a range of facility types that are appropriate for a range of people. The Connector routes are summarized in Table 6.

Table 6. The existing and proposed Connector routes by facility type.

Facility Type	Existing Kilometres (centreline)	Proposed Kilometres (centerline)
Multi-Use Trail	7	13
Multi-Use Path	10	0.5
Protected Bikeway	0	18
Painted Bike Lane – Buffered	2	21
Painted Bike Lane – Unbuffered	9	6
Shared Use Lane	36	8
Paved Shoulder	2	59
Grade Separated Connector	--	2
Highway Interchange Crossing	--	--

6. 3 Highway Interchange Crossings and Grade Separated Connectors



The highway interchanges are major barriers and challenges in the development of a low stress cycling network in Burlington. The nature of interchanges, where automobiles are coming on or off of highway access ramps at high speeds, makes cycling across the highway highly stressful. A challenge with any on-road or adjacent to road design is that it must cross these ramps, creating a high stress conflict point. The highway right-of-ways are owned by the Ontario Ministry of Transportation, creating a jurisdictional challenge for work to be completed at the interchanges. As part of this plan, options for on-road and grade separated crossings were considered at planning level feasibility.

Locations for grade separated crossings that are identified in previous planning efforts include Maple Park-Aldershot, Burlington GO (Industrial St.), Cumberland Hydro Corridor, and Appleby GO (refer to the map in Appendix E). This plan considers all of these crossings as part of an ultimate network. One of the goals of this plan is to determine the prioritization for which grade separated crossing should be built first. Using the demand (live, work, play) analysis and the gap analysis, the crossing at Burlington GO, between Truman Street and Industrial Street has been given the highest priority for development. This crossing would connect the end of the existing Hydro Corridor Trail to the Burlington GO Mobility Hub, and would connect via other proposed spine routes to Downtown Burlington Mobility Hub. The connection with the Hydro Corridor Trail would create an all ages and abilities facility connection between most of the area of the City north of the QEW, to the south part of the City. As a result, the city could experience an increase in the number of people that cycle to Burlington GO station.

Further study and consultation with stakeholders are needed to determine the most feasible alignment for the crossing, with either a bridge, or using the existing railway tunnel underneath the highway at this location. The complete analysis can be found in Appendix E.

In anticipation of the grade separated connectors, this plan includes Spine Routes that connect on both sides to all the proposed grade separated connectors. These Spine Routes should be implemented or upgraded in conjunction with a grade separated connector to remove spot gaps, creating seamlessly connected facilities.

MAP 5
PROPOSED NETWORK

BURLINGTON CYCLING MASTER PLAN

SPINE NETWORK

- Multi-use Trail
- Multi-use Path
- Protected Bikeway
- Local Street Bikeway
- Painted Bike Lane
- Grade Separated Connector
- Highway Interchange Crossing

CONNECTOR ROUTES

- Multi-use Trail
- Multi-use Path
- Protected Bikeway
- Painted Buffered Bike Lane
- Painted Bike Lane
- Shared Use Lane
- Paved Shoulder
- Grade Separated Connector
- Highway Interchange Crossing

FEATURES AND BOUNDARIES

- Intersection Improvement
- Regional Road
- Railway
- Waterbody
- Burlington

CITY OF Burlington

0 0.75 1.5 KILOMETRES

5 MIN BIKE RIDE

alta PLANNING + DESIGN

Data provided by the City of Burlington, Region of Halton, and Statistics Canada.
Map produced July 2019.

The development of trails (outside of the road right-of-way) are typically the responsibility of the Parks and Open Space, Capital Works department. The Cycling Plan identified these corridors as beneficial for connectivity and improved mobility for people cycling in Burlington. The feasibility, facility recommendations, including the surface type and implementation for these projects will be determined in consultation with the Transportation department to help advance cycling initiatives

LAKE ONTARIO

Final recommendations for roads north of Dundas Street and Highway 407 will be provided in the Rural Burlington Active Transportation Strategy

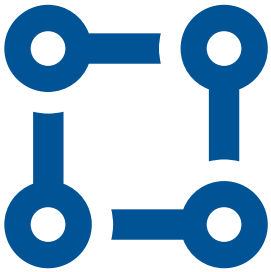
THIS PAGE INTENTIONALLY BLANK

6.4 Minimum Grid

A proposed minimum grid of bicycle facilities for downtown Burlington is included as part of this plan. The minimum grid consists of various facility types that have been proposed as part of the Spine and Connector networks within downtown Burlington, including the area defined as the Downtown Burlington Mobility Hub. The minimum grid network has a route frequency that varies between 300-600 metres. The routes included in the minimum grid target the areas with the highest demand in the downtown area.

The minimum grid is proposed as a tool for quick implementation of a connected network of bikeways. This provides the public an opportunity to ride and experience a connected low-stress cycling network. Staff simultaneously gain experience implementing a variety of bikeway facility types. Quickly implementing the minimum grid responsibly uses monetary and staff resources. Rapidly implementing a system of bikeways can encourage increased bicycle usage compared to gains in ridership due to implementing a single project without a connected network. The quick implementation approach encourages experimentation, with the opportunity to try out different products and designs for achieving low-stress bikeways, such as protected bike lane separator types. This approach of testing out different products will help city staff make decisions for future bikeways based on treatments that are particularly successful during the quick implementation.

The proposed grid was revised based on feedback from the Burlington Cycling Committee and the public that the grid should include connections to the Waterfront Trail, and bring people to Burlington GO station. The updated minimum grid network is shown in Map 6.



For the minimum grid project to be successful, criteria have been developed.

Minimum Criteria for Minimum Grid:

- The route was selected based on a number of variables. Does the route being implemented meet the intended route criteria?

  Based on demand and the live/work/play analysis

  Connecting key origins/destinations such as a school

  Offers a variety of facility types to experience

  Is a connected network and not contain spot or connection gaps

- Does the proposed design to be implemented include higher-order intersection treatments for cyclists?
- If the route implemented includes a transit route, does the design address bus/bike conflicts?
- Has an approach to communications, engagement/ consultation and monitoring being adopted?



MAP 6
MINIMUM GRID

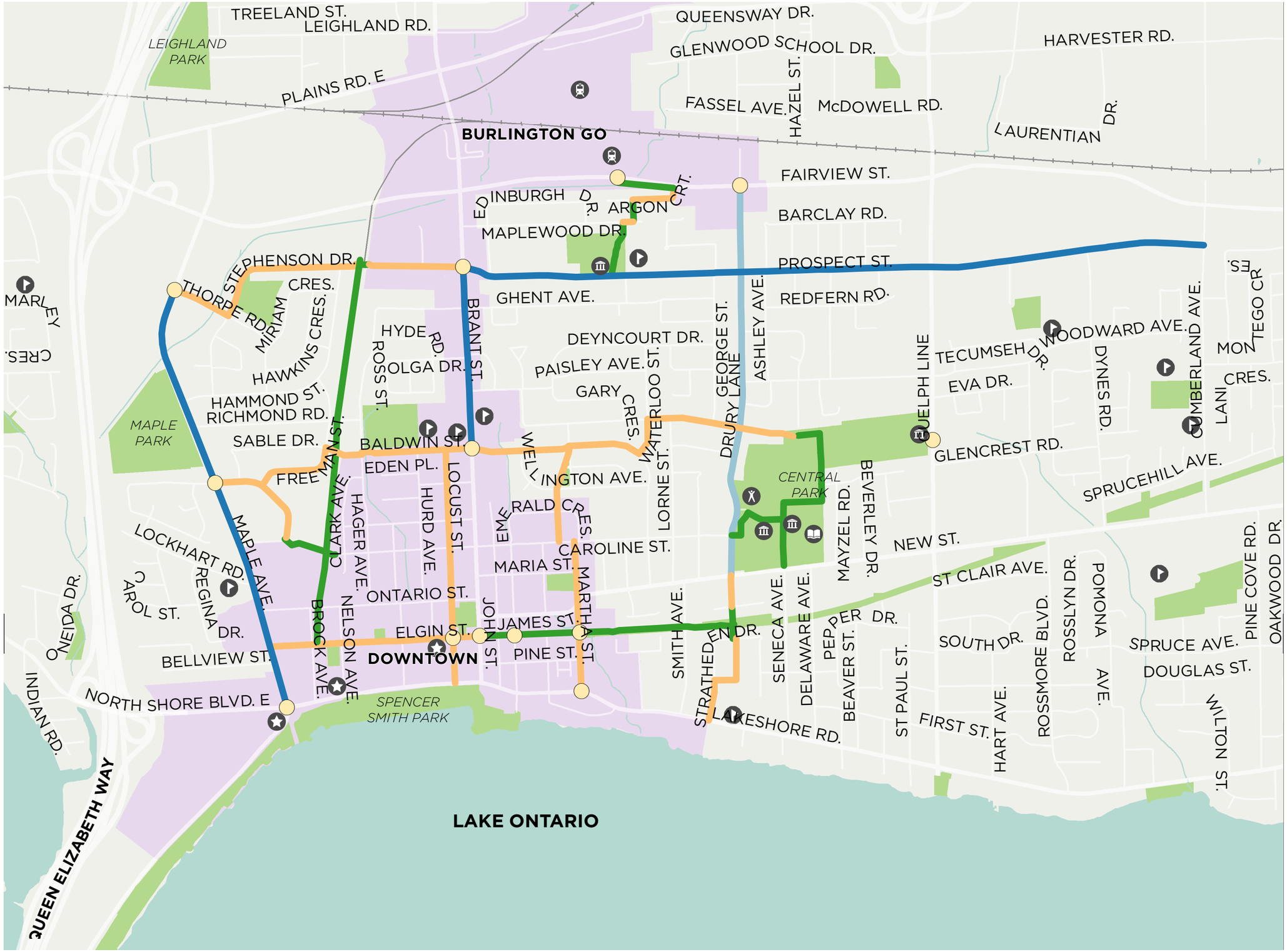
BURLINGTON CYCLING MASTER PLAN

FACILITY TYPES

- Protected Bikeway
- Painted Bike Lane
- Local Street Bikeway
- Multi-Use Trail
- Intersection Improvement

FEATURES AND BOUNDARIES

- GO Station
- Library
- Sports Facility
- Cultural Facility
- Community Centre
- School
- Park
- Railway
- Mobility Hub
- Waterbody
- Burlington



CITY OF Burlington

0 0.25 0.5 KILOMETRES

1 MINUTE BIKE RIDE

alta PLANNING + DESIGN

Data provided by the City of Burlington, Region of Halton, and Statistics Canada.
Map produced Sept 2019.

THIS PAGE INTENTIONALLY BLANK



7 ASSET MANAGEMENT

Asset management considers the operations and management of infrastructure, from day-to-day maintenance to lifecycle costs. An Asset Management System supports infrastructure planning, with the goal of a long-term strategy for decision making, providing adequate service, and a coordinated approach to infrastructure practices. Burlington's Asset Management Plan (2016), outlines the City's approach to management of assets from roadways, to vehicle fleet and equipment, to information technology services.

Maintenance and operations for roadways and other transportation routes typically fall under the following themes:

- Inspections
- Pavement sweeping/blowing
- Snow plowing/ice removal
- Litter removal
- Shoulder plant trimming (weeds, trees, brambles)
- Tree and shrub plantings, trimming
- Culvert, gutter and drainage grate inspection/repair
- Sign replacement
- Crack sealing and repair
- Pothole repair
- Pavement marking replacement
- Asphalt repaving and reconstruction
- Major damage response (washouts, fallen trees, flooding)

The City has established maintenance practices for trails and existing on-road bike lanes. As stated in the Asset Management Plan, practices need to respond and evolve as the city's policy and infrastructure changes. As such, new practices will have to be developed to respond to the new types of bikeways being recommended in this plan.



7.1 Minimum Maintenance Standards for Municipal Highways

In 2018, the Province of Ontario updated O. Reg. 239/02: Minimum Maintenance Standards for Municipal Highways, part of the Municipal Act.[23] The updated regulation establishes non-prescriptive maintenance standards for addressing snow accumulation on on-road and in-boulevard cycling facilities. The following table sets out the desired depth that snow should be equal to or less than, to provide a minimum bicycle lane width of either one metre or the actual bicycle lane width – whichever is less.

Table 7. O. Reg. 239/02 snow removal - bicycle lane winter maintenance.

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

7.2 Summary of Existing Practices in Burlington

Burlington has plans, policies, and established practices in place for the maintenance of trails and existing on-road bike lanes. Currently, the following practices and equipment are used:

- Primary trails are candidates for winter clearing, where as secondary trails are not
- Identification and tracking of key locations of concern so that maintenance on trails can be proactive as opposed to reactive
- Bollards and other trail amenities are either removable or outside the maintenance vehicle clearway
- Procedures for trail closures, including community notification and barricades
- Bike lane sweeping is done in tandem with road sweeping
- Additional bike lane sweeping and cleaning is addressed on a complaint-driven basis
- Maintenance considerations outlined in Community Trails Strategy Table C.8

7.3 The Value of Maintaining Bikeways

Maintaining the cycling network protects the public investment, ensures adequate safety levels, and supports a high quality of life for residents of Burlington. Maintenance generally refers to the operations, repair, and service standards. When considering a budget for a project, the ongoing costs are often not included within that price tag. It needs to be recognized that these ongoing costs can be significant for any type of municipal infrastructure project, and must be included when making decisions about projects.

Maintenance activities include but are not limited sweeping, snow plowing, weeding, litter removal, crack sealing and repair, sign replacement, pavement marking painting, landscape maintenance, repaving, and eventual replacement. Some of these activities must completed multiple times per year, while others are every 5, 10, or 20 years. Refer to Table 2 for recommendations on the frequency of various maintenance activities. Accounting and budgeting for this planned maintenance is important to ensure the ongoing quality of the facility.

Winter Maintenance

A significant barrier to people cycling year-round is that bicycle facilities are often not maintained, or if they are, they are low priority and are not reliably cleared, making them unpredictable and cycling a less attractive option for travel during winter. In Canada, there is latent demand for cycling through all seasons, under certain conditions, including separated facilities.[24] [25]

Similar to the approach for roadways, identifying a winter priority network, selects the most important routes to be cleared first after a snowfall event as well as receive an application of de-icing material in anticipation of a snowfall or freezing event. These routes often correspond with the routes with the highest volumes, that provide access to major destinations, such as schools, downtown Burlington, major Burlington Transit stops, and GO Transit stations.

Best practices for winter maintenance are dependent on the context of the city, and consider the type of winter weather and the types of bikeway facilities. In cities with consistent sub-zero temperatures, bicycle facilities are designed to

Table 8. Recommended cycling facility maintenance activities.

Maintenance Activity	Why	Frequency
Inspections	Ensure bikeway conditions are safe, elements and surface of bikeway are satisfactory	Seasonally
Pavement sweeping/ blowing	Remove debris, gravel, and broken glass to provide a usable, safer bikeway surface	As needed, with higher frequency in the early spring and fall
Pavement sealing	Provides a flat, smooth surface and extends the roadway life by preventing further damage	As needed
Pothole repair	Potholes can pose a safety risk to people cycling. Providing a smooth, flat surface improves comfort and safety	Soon after report or inspection identification
Culvert and drainage grate inspection	Ensure that water is not pooling in/around bikeway. The drainage grates should have a pattern that bicycle tires cannot fit into	Before winter and after major storms
Pavement markings replacement	Replacing pavement markings maintains visual separation enhancing user comfort	As needed
Signage replacement	Ensure that signage is up-to-date, and is not damaged due to wear or vandalism	As needed
Shoulder plant trimming (weeds, trees, brambles)	Maintaining a usable clearway by removing overhanging and impeding vegetation	Seasonally as needed, with attention to the middle of growing season and early fall
Tree and shrub plantings, trimming	Replacing and trimming vegetation along bikeways makes it an attractive and usable facility	As needed every few years
Major damage response (washouts, fallen trees, flooding)	Ensure that bikeways are usable and free of damage and debris as soon as possible after a major weather event or incident along the bikeway	As soon as possible
Snow/ice clearing and removal	Clearing and removing snow and ice from bikeways ensures they are safe and comfortable to use year-round	See 7.2 Winter Maintenance for detailed recommendations

have more room for snow storage. Snow removal operations are also common. In cities similar to Burlington with regular freeze-thaw cycles, winter maintenance should focus on clearing access to drainage and de-icing strategies. Cycling facilities should be designed to accommodate the clearway of a snow operations vehicle. Clearway space is wider than the actual vehicle width to allow for a margin of error, preventing plow hits and damage to infrastructure.

The type of de-icing surface application depends on the city. Proactive de-icing in anticipation of a snowfall or freezing event has been found to reduce the need for plowing afterwards. There are a variety of de-icing materials that can be used, but their usage is dependent on their availability and the types of maintenance vehicles and applicators that the city has in its maintenance fleet. More detailed information on materials and other considerations can be found in the Alta Planning + Design, White Paper #2: Winter Bike Lane Maintenance.[26]



Winter plow clearing of the on road protected bike lane on Laurier Avenue in Ottawa, ON.

7.4 Recommendations for Asset Management of Bikeways

Based on the considerations and best practices available, there are a variety of recommendations for the City of Burlington to consider related to the asset management and maintenance of bikeways:

- All new cycling facilities must include a program for maintenance funding as part of construction. These can include agency partnerships, developer paid maintenance mechanism, or other means
- Maintenance funding is vital to ensuring long term sustainability of the facility. The City should develop an average cost for year-round maintenance of bikeways based on existing and new practices
- The City should develop a Level of Service plan in order to identify equipment required to maintain the bicycle infrastructure, the staff required and the materials needed. This would include a clear indication of any special maintenance needs for a specific design implemented (i.e., bicycle signal, green thermoplastic, type of surface)
- Winter Maintenance requirements are also to be reviewed in the Level of Service document. This includes consideration by the City for a higher-level policy related to a winter priority network
- The City should review its current fleet and equipment to determine if new or more equipment is required to provide adequate service snow accumulation on bicycle facilities



8 IMPLEMENTATION

8.1 Prioritization Summary

The approach to prioritization is comprised of two parts. The first, the quantitative evaluation process uses the vision and objectives from the plan as guiding principles in for establishing criteria to evaluate project prioritization for the plan's network using a scoring system. This identifies the projects for prioritization based on the highest need. The second part is the qualitative evaluation process which adjusts the results of the quantitative analysis based on available opportunities. The criteria of the qualitative analysis can be reapplied as needed throughout the life of the plan to expedite implementation and utilize opportunities as they become available.

Quantitative Evaluation Process

Below are the objectives of this plan. Following each of listed objectives below is the corresponding principle that informs the criteria evaluated in the scoring process.

- To build upon the current cycling network and identify missing links in order to develop a minimum grid of on-road cycling facilities **(Connectivity)**
- To identify key barriers to cycling and investigate strategic opportunities to improve the cycling experience and achieve continued gains in cycling mode share **(Comfort + Demand + Connectivity + Mobility)**
- To develop a network of facilities within a larger network that are considered safe and comfortable by all users and skill levels **(Comfort + Network + School Access)**
- To review existing facility types and classifications and compare to current best practices in order to recommend revised design guidance, where appropriate, that is consistent and can be uniformly applied throughout the City **(Comfort + Network + Jurisdiction)**
- To identify a list of priority network improvements for strategic implementation **(Network)**
- Develop a strategic action plan that guides the short, medium and long-term implementation of the cycling network

Table 9 shows the how each criteria is defined for the quantitative evaluation process. Every proposed project will be evaluated on these criteria.

Table 9. Quantitative prioritization criteria.

Criteria	Operational Definition
Demand	Within area of top 50% of demand
Connectivity	Connects to 2 existing facilities
Comfort	Increased user comfort by lowering of current LTS score
Network	Part of Spine Network
Jurisdiction	On/in City of Burlington road right-of way
Public Engagement	Feedback indicating desire to bike here or challenge/ difficulty cycling here (from Social Pinpoint)
School Access	Within 500 m of a school point
Mobility	Within 1 km of Mobility Hub boundary

Each criterion is worth 1 point. The total points for each proposed project are summed up, and prioritization is assigned based on Table 10. The higher the score that a route receives, or the more the route matches the objectives of the plan, the higher priority that route has for implementation based on the quantitative analysis.

Table 10. Quantitative scoring.

Priority	Score
Short-term	5 points or more
Medium-term	3-4 points
Long-term	0-2 points

The quantitative process provides a useful, objective analysis of the projects that will make the greatest change and are of the highest need. This is a good, informed starting point for implementation. It is important to note that not all short-term projects will be feasible in the 1-5 year time horizon. It could be that planning for short-term projects is completed in the short-term, such as completing functional planning or detailed design.

Qualitative Evaluation Process

Understanding there are other factors that influence the prioritization process, the following criterion in Table 11 were developed to provide rationale for changing the priority of a project.

An example of how qualitative prioritization is used is the minimum grid concept. While some projects that are part of the minimum grid are short-term priorities, other projects are medium-term priorities. Based on the concept for the minimum grid to implement the projects together, the projects that received a medium-term priority should be moved up to short-term priorities. The outcome of the prioritization process is summarized in Map 7.

Catalyst Projects

Catalyst projects are quick projects that resolve existing spot and connection gaps, that unlock potential for a facility. An example could be a multi-use trail through a City owned property that create a more direct connection between a neighbourhood and a school. Individual intersection and crossing improvements could be other examples of catalyst projects. These projects are small in nature and could include interim approaches while waiting for complete planned capital works projects.

Table 11. Qualitative prioritization criteria.

Criteria	Description
Potential to leverage other funding	Initiating projects will help secure funding
Pair with planned project	Pairing a project based on planned work/project on same or nearby road
Policy directive	Project specified by policy or City Council
Community interest	Local community has expressed interest in bicycle infrastructure improvements
Geographic balance	Project improves the balance of bicycle funding to be spent among geographic sectors of the city. Project expands the percentage of Burlington's residents living within half a kilometre of a bicycle facility

Short-Term Projects

There are 52 projects recommended for short-term implementation between 2020-2025, with their quantitative score, and qualitative considerations. The projects are shown in dark blue on Map 7, and the project table can be found in Appendix F. A summary table of proposed short-term projects is below in Table 12.

Table 12. Short-term priority projects by facility type.

Facility Type	Spine Network Kilometres (centreline)	Connector Routes Kilometres (centreline)
Multi-Use Trail	3	2
Multi-Use Path	0	0.5
Protected Bikeway	43	12
Painted Bike Lane – Buffered	0	2
Painted Bike Lane – Unbuffered	0	0
Local Street Bikeway	18	--
Shared Use Lane	--	2
Paved Shoulder	--	0
Grade Separated Connector	1	0
Highway Interchange Crossing	1	0
Total	***66***	**18.5**

Medium-Term Projects

There are 47 projects recommended for medium-term implementation between 2026-2031, with their quantitative score, and qualitative considerations. The projects are shown in light blue on map 7, and the project table can be found in Appendix F. A summary table of proposed short-term projects is below in Table 13. The priority of these projects could change over time if criteria in the qualitative process are identified.

Table 13. Medium-term priority projects by facility type.

Facility Type	Spine Network Kilometres (centreline)	Connector Routes Kilometres (centreline)
Multi-Use Trail	4	3
Multi-Use Path	0.5	0.5
Protected Bikeway	7	6
Painted Bike Lane – Buffered	0	13
Painted Bike Lane – Unbuffered	0	3
Local Street Bikeway	11	--
Shared Use Lane	--	5
Paved Shoulder	--	0
Grade Separated Connector	1.5	1.5
Highway Interchange Crossing	0.5	0
Total	**24.5**	**32**

Long-Term Projects

There are 27 projects recommended for long-term implementation from 2032-2037, with their quantitative score, and qualitative considerations. The projects are shown in pink on Map 7, and the project table can be found in Appendix F. A summary table of proposed short-term projects is below in Table 14. The priority of these projects could change if criteria in the qualitative process are identified.

Table 14. Long-term priority projects by facility type.

Facility Type	Spine Network Kilometres (centreline)	Connector Routes Kilometres (centreline)
Multi-Use Trail	0	7.5
Multi-Use Path	0	0.1
Protected Bikeway	0	0
Painted Bike Lane – Buffered	0	7
Painted Bike Lane – Unbuffered	0	4
Local Street Bikeway	0	--
Shared Use Lane	--	1.5
Paved Shoulder	--	54
Grade Separated Connector	0	0.2
Highway Interchange Crossing	0	0
Total	**0**	**79.3**

THIS PAGE INTENTIONALLY BLANK

MAP 7
PROPOSED PROJECT PRIORITY

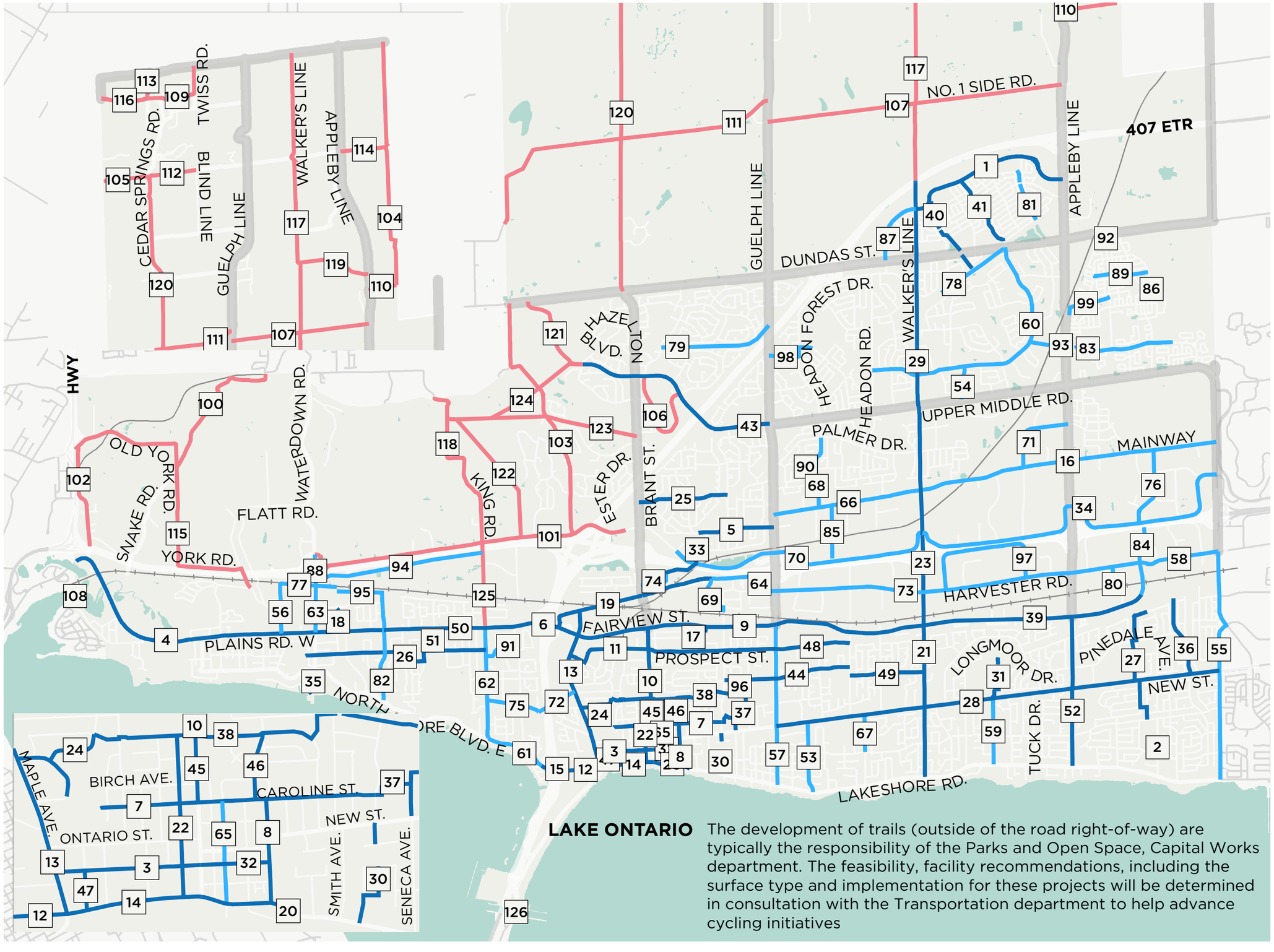
BURLINGTON CYCLING MASTER PLAN

PROJECT PRIORITY

- Short-Term
- Medium-Term
- Long-Term

FEATURES AND BOUNDARIES

- Regional Road
- Railway
- Waterbody
- Burlington



LAKE ONTARIO The development of trails (outside of the road right-of-way) are typically the responsibility of the Parks and Open Space, Capital Works department. The feasibility, facility recommendations, including the surface type and implementation for these projects will be determined in consultation with the Transportation department to help advance cycling initiatives

CITY OF Burlington

0 0.75 1.5 KILOMETRES

5 MINUTE BIKE RIDE

alta PLANNING + DESIGN

Data provided by the City of Burlington, Region of Halton, and Statistics Canada.
Map produced January 2020.

THIS PAGE INTENTIONALLY BLANK

8.2 Cost Estimating

To support the implementation of this plan, the following information was developed specific to costing of the various elements of the proposed cycling network.

A high-level cost estimating methodology was produced, based on unit costs established in consultation with City of Burlington staff. Four sample projects were then selected from the short-term prioritized projects and the methodology was applied high-level cost estimates (refer to Appendix G for more information). The per-kilometre estimate for each facility type from the high-level estimates is shown in Table 15.

It is important to note that these estimates are high-level, and are intended for project planning purposes only. Costs are based on 2019 dollars and are expected to vary significantly by the type of implementation project (new construction, reconstruction, rehabilitation, resurfacing, etc.). For example, a road reconstruction project creates more opportunity for items such as curb reconstruction to be covered as part of a larger project budget, rather than being specific to cycling.

Table 15. High-level cost estimates for each type of cycling facility project.

Facility Type	High-level Cost Estimate (per km)
In-Boulevard Cycle Track (Protected Bikeway)	$560,000
On-Road Protected Bike Lane (Protected Bikeway)	$180,000
Local Street Bikeway	$50,000
Multi-Use Trail	$350,000

Cost estimates include markups for Contingency (10%), Engineering & Design (10%), Contract Administration (5%), Traffic Control (7.5%), and Testing / External Costs ($15,000). Estimates are exclusive of curb removal and reconstruction, intersection reconstruction, and any road widening required for the addition of cycling infrastructure. Cycle tracks are assumed to be constructed within existing boulevard space.

Estimates for each facility type include the following components:

- **Local street bikeways -** include shared lane markings ("sharrows"), "Bike Route" signs, and speed humps
- **In-boulevard cycle tracks -** include 1.8m wide asphalt surface on each side of road (including base), bicycle signals at every signalized intersection (mounted on existing poles), minor relocation of utilities (poles, streetlights), pavement markings (including lines, stencils and green movement markings at intersections), and signs
- **On-street protected bike lanes -** include continuous precast concrete curb with flexible delineator posts, bicycle signals at every signalized intersection (mounted on existing poles), pavement markings (including striping, lines, stencils and green movement markings at intersections), and signs
- **Multi-use pathways -** adjacent to roadways include 3.0m wide asphalt surface (including base), bicycle signals at every signalized intersection (mounted on existing poles), striping, and signs (no intersection treatments)
- **Multi-use trail corridors -** include 3.0m wide asphalt surface (including base), striping, and signs (no intersection treatments). Controlled crossings at roadways (signals or PXOs) are not included

Prospect Street Estimate

A sample cost estimate has been produced for Prospect Street, which is scheduled for capital works in the short-term. A protected bikeway is proposed for the street, as an opportunity to provide residents a first "preview" of a protected facility. Prospect Street is also part of the proposed minimum grid network.

Prospect street runs through two significantly different contexts, and as such, it was divided into two sections for the cost estimate:

- **Brant Street to Guelph Line** *(1.9 kilometres)* - primarily residential area, two-lane cross section with narrow boulevard
- **Guelph Line to Cumberland Avenue** *(1.1 kilometres)* - commercial/office area, four-lane cross section with wide boulevard

For the residential section, the narrow

boulevard space and existing on-road cycling lanes were taken into consideration. For the purposes of this cost estimating exercise, the selected facility is on-road physically-separated bicycle lanes, separated by continuous pre-cast concrete curbs. The cost estimate includes construction of the separation treatment, bicycle signals at all existing signalized intersections, pavement markings (lines, stencils), signs, and green pavement markings to demarcate the conflict area where the bicycle lanes cross roadways. It is assumed that no relocation of utility poles is required for this segment, and the estimate excludes any curb reconstruction, traffic signalization, and intersection reconstruction required. The high-level cost estimate for this section is **$390,000, or $210,000 per kilometre**.

For the commercial section, where no existing cycling facilities exist and the operating speed of the roadway is higher, the selected facility is cycle tracks, placed in the existing wide boulevard. The cost estimate includes the construction of 1.8m wide cycle tracks on each side of the roadway (including clearout, sod, and granular), bicycle signals at all existing signalized intersections, minor relocation of utility poles (10 percent of poles), pavement markings (lines, stencils), signs, and green pavement markings to demarcate the conflict area where the bicycle lanes cross roadways. The estimate excludes any curb reconstruction, traffic signalization, and intersection reconstruction required. The high-level cost estimate for this section is **$620,000, or $560,000 per kilometre**.

For more information on this high-level cost estimate for Prospect Street, as well as the other two sample facilities, refer to Appendix G.

8.3 Funding Opportunities

For the recommendations in this plan to be implemented, the City could use a mix of the following funding approaches. City staff should regularly review this plan in order to identify, plan for, and incorporate its recommendations into capital works schedule.

Lifecycle Infrastructure Renewal Projects

A challenge for getting new or upgraded facilities to be built is that as roads are resurfaced or rebuilt, only a “like for like” is budgeted, meaning if painted bike lanes were there before, that is what will go back in as part of the renewal project. Coordination is needed to ensure that these opportunities to implement new facilities are leveraged with planned works. This will require that operations and maintenance for the new or upgraded facilities are budgeted for and included into ongoing operation and maintenance plans.

Leveraging Grant Programs

This plan will identify priority projects which could be prepared to a “shovel-ready” status so that they can take advantage of this grant program. It is likely that there will be future programs providing project funding opportunities. Having an updated cycling plan is important in order for Burlington to effectively take advantage of these opportunities. Grant opportunities include the FCM Green Municipal Fund and other provincial and federal programs. Developing cycling infrastructure can support a reduction to the approximately 40% of greenhouse gas emissions that are from the transportation network and support municipal goals for reducing the city’s carbon footprint.

Private Developers and Partnerships

Private developers should be required to build new facility types or upgrade existing facilities as part of development projects. This is achieved through the adoption of this cycling plan providing clarity for expected cycling facility types and improvements into the future. Other municipalities in Ontario have created transition plans for corridors with significant redevelopment potential to facilitate the creation of bikeways over time as properties are redeveloped. This in turn leads to the construction of an ultimate plan for the corridor. Burlington has an opportunity to undertake a similar approach. In all situations, the City should coordinate new cycling facilities with other City sponsored projects to take advantage of economy of scale, including staging, traffic control, materials, and mobilization costs.

City Funding

The City should consider identifying an ongoing amount of funding towards implementing the recommendations identified in this plan. This may require redirecting money from other programs or adjusting fees.



8.4 Metrics and Evaluation

As the City of Burlington builds new cycling facilities, there will be an interest in evaluating the new facilities. Most often, people will want to know basic quantitative metrics, such as how many people are using the new facilities. The metrics used for evaluation can be multi-faceted and should include much more than simply vehicle throughput. Metrics that evaluate if the goal of the project was accomplished should be considered. In the context of this cycling plan, metrics should include safety, people throughput, the number of new cyclists that did not previously cycle, and comfort of cyclists. Using these metrics, the project is being evaluated on whether it is accomplishing the objectives of the City and cycling plan, and not the status quo.

When evaluating a network, there are a variety of analysis methods and measures that can be used. The US Federal Highway Administration Guidebook for Measuring Multimodal Network Connectivity (2018) presents a many of these, including network completeness, route directness, access to destinations, network quality, bicycle level of traffic stress, and low stress connectivity. Examples of ways to evaluate connectivity include:

Network completeness

- How complete is the planned bicycle and pedestrian network?
- What portion of streets contain non-motorized facilities?

Network Density

- Does the street network allow travel between destinations via a number of routes?
- Do designated bicycle and pedestrian facilities allow people to travel between destinations via a number of routes?

Route Directness

- Do nonmotorized facilities allow users to travel throughout a community via direct routes?

Access to Destinations

- How well do bicycle facilities connect to key destinations?

Network Quality

- What is the objective quality of connectivity provided by an existing or planned network?

Table 16. Common metrics to evaluate cycling facilities.

Theme	Metric	Monitoring Factors	Methods to Measure
Safety	Crashes – Number of	• All Users • Pre- and Post-	Police reports, data collection
	Injuries – Number of	• All Users • Pre- and Post-	Police reports, data collection
	Vehicle Travel Speeds	• Pre- and Post-	Bluetooth, radar
Mobility	Volumes – in pilot area and surrounding streets	• All Users • Pre- and Post-	Manual counts, video, infrared, pneumatic tubes, in-ground electromagnetic
	Travel Time – in pilot area and surrounding streets	• All Users • Pre- and Post-	Bluetooth, video
Economic and Street Vitality, Quality of Life	Sidewalk Cycling	• Number of Cyclists using sidewalk • Pre- and Post	Manual counts
	Parking Availability	• Number of spaces lost or gained • Pre- and Post • Changes to parking demand and utilization • Pre- and Post • Income from parking • Pre- and Post	Parking data, video, manual counts
	Loading and Unloading	• Number of dedicated zones created • Pre- and Post	Counts
	Economic Effects	• Compare retail or other sales metrics along corridor • Pre- and Post • Compare with a control area to identify seasonal trends	Sales data
		• Survey of testimonials of merchants • Pre- and Post	Surveys, interviews
		• Intercept survey of shoppers (find out the mode they used) • Pre- and Post	Surveys, interviews
	Perception of Safety/ Quality of Street, Level of Support, Beautification	• All Users • Pre- and Post • Can help evaluate the different treatments used	Surveys, interviews

THIS PAGE INTENTIONALLY BLANK



9 BIKE SHARE

Development of a bike share system in Burlington could help in attracting more people to cycling as part of everyday transportation. Bike sharing systems are highly supportive of public transit, providing a convenient, and worry-free first/last mile option, as it removes the fear of your bike being stolen from where you parked it to take transit. The easy-to-ride bicycles are a good way of attracting people to try cycling in a city, as it is generally quick, simple, and reasonably priced to use a bike share bicycle, even for the first time.

In order for a bike share system to be successful, there needs be a safe and comfortable place to ride a bike. Bike share users can be less experienced with cycling, therefore a network of all ages and abilities facilities is integral to make using the system attractive. The service area for a bike share system should be focused around all ages and abilities suitable facilities and areas of demand for travel, such as GO Transit stations and commercial areas.

Burlington could work to implement a system that is being used in adjacent municipalities, such as the SoBi bike



Docked based bike share system in Toronto, ON.

share in Hamilton, or the Bike Share Toronto system. The systems use different technology and use different approaches for how bikes are taken out and returned. Bike Share Toronto uses a docked based system where bikes can only be taken out from and returned to dock stations that are installed throughout a service area. SoBi is a hybrid system, that has stations, but also allows for bike to be locked and returned anywhere within the service area. Many dockless systems have been permitted to operate in North American cities in recent years. These systems allow for people to lock and leave bikes anywhere. Their locations are tracked via GPS and displayed on a smart phone app that is used to unlock the bikes.



Hybrid bike share system in Hamilton, ON. [Photo: @BikeMonth]

There are different costs associated with each type of system, and whether the system is public, non-profit, or privately owned. Many privately owned dockless systems do not have upfront costs to the city, as they are privately owned and managed. This ownership model can result in unpredictablity for the system as the city does not have control over the system.

When implementing a bike share system, the City should plan for frequent, convenient station locations at destinations within the system's service area. As stations are spaced further apart, the walking distance to or from a station increases to a point where using the system becomes less convenient and attractive.[27] As part of the research completed for Toronto's bike share system, it was identified that distances beyond a 5-10 minute



Dockless bike share hub in Ottawa, ON.



A person riding an e-scooter in Portland, OR.

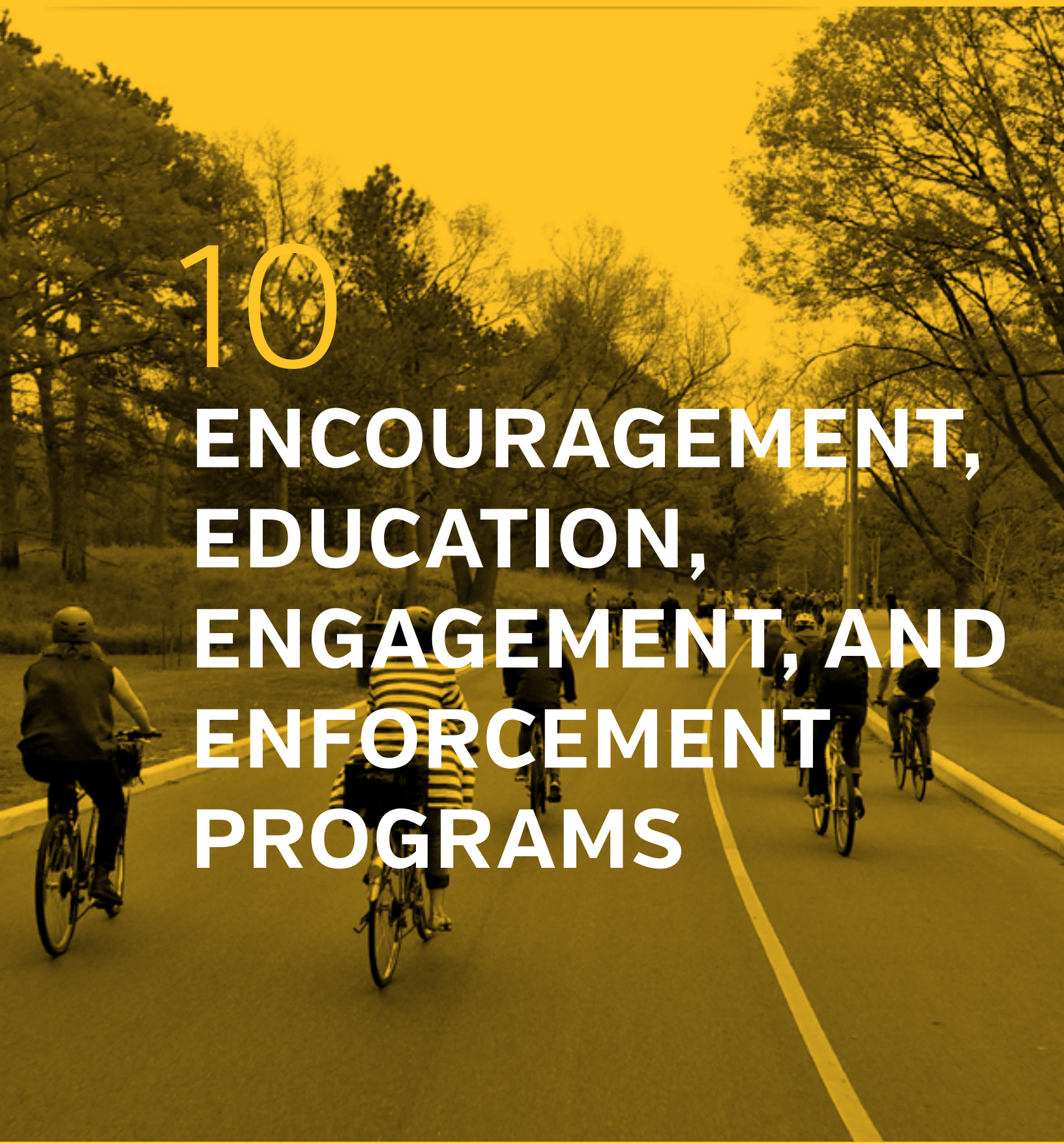
walk (or between 420-840 m) were a significant deterrent to using the system.[28]

The City should consider adopting a system that includes electric assist (e-assist) types of bicycles. These bicycles have an electric motor that operates when the user is pedaling. The benefits of an e-assist style bikes are that they reduce additional barriers to people cycling by supporting people with different physical abilities, and increased travel distance and assist with travel over hilly terrain.

The MTO approved a five year pilot for e-scooters in Ontario.[29] E-scooters have become a popular form of transportation in the US and internationally, with successful pilots in 2019 in Calgary, Edmonton, Montreal, and Waterloo Region. E-scooter operators are commonly permitted to deploy their systems in a municipality.

In jurisdictions that have e-scooters operating, they are used by a wide-segment of the population for different types of trips most often under 2 km, including trips to work, errands, social, and connecting to transit. In Calgary's pilot, they found that 1 in 3 e-scooter trips replaced a car trip.[30] E-scooters are most often operated in bike lanes and on low-stress roads.

E-scooters and bikes are devices under the emerging umbrella term of shared micromobility, which also includes e-mopeds and other light, personal devices that are accessed through a sharing-based model instead of private ownership. Permitting shared micromobility operators to establish services in Burlington will provide new, additional mobility options for residents.



10 ENCOURAGEMENT, EDUCATION, ENGAGEMENT, AND ENFORCEMENT PROGRAMS

A City that cycles doesn't just rely on building infrastructure – it focuses on building a culture of cycling. Burlington has been effective at creating new programs and partnerships to promote cycling, but there are opportunities to build on the existing successes by strengthening the existing programs in the community and adding new complementary programs to help to build a more diverse cycling community in Burlington.

This chapter will present recommendations for new programs and policies that could be implemented in Burlington to help to foster the creation of a strong culture of cycling in the City. Recognizing the limited resources available to the municipality, this chapter will recommend a relatively small number of new programs. These recommendations focus on growing and strengthening programs and partnerships that already exist within the City. The new and expanded programs that are presented here are based on examples from around North America where communities have made great strides towards being among the most bicycle friendly jurisdictions in North America.

10.1 Existing Programs

Currently there are more than 30 existing efforts related to bicycle programming taking place in Burlington. These programs represent a number of partnerships across the community, representing a variety of both public and private stakeholders. A summary of the existing programs related to bicycle programming can be found in the following table.



Table 17. Existing programs for cycling in Burlington.

Program Type	Audience	Existing Programs
Education	Youth	Lids for Kids Cycling Summer Camps Safety Village
	Others / All	Public Service Announcements CAN-BIKE Courses Bike Maintenance Clinics
Encouragement	Youth	Bike to School Week Winter Walk and Bike to School Day
	All	Bike to Work Day Bike Month Interactive Cycling Map / HamBurl Cycling App Car Free Sundays Mayor's Think Outside the Car Challenge Commuter Challenge Ward Rides with City Councillors Cycling Information in Welcome Wagon package Cycling Ambassador Program Rolling Horse Community Bike Shop
Enforcement	All	Police Officers on Bikes Helmet and Light Giveaways Targeted Enforcement Blitzes re: aggressive and distracted driving Distribution of Share the Road brochures
Evaluation and Planning	Youth	Active Transportation Survey
	All	Active Transportation Survey Bike and Trail Counters Burlington Cycling Advisory Committee



10.2 Program Partnerships

Burlington's existing cycling culture has been shaped by a variety of public and private stakeholders. The resulting partnerships have delivered an impressive array of cycling programming, and it is valuable to consider the existing partnerships in order to conceptualize how existing programs can be strengthened and how future programs can be designed and implemented. Maintaining and growing partnerships with these key stakeholders will be key to creating a stronger culture of cycling in Burlington in the future.

Burlington Cycling Advisory Committee

The City's Cycling Advisory Committee has played a pivotal role in the development of new programs and partnerships, as well as development of this plan. Working with City Staff, the BCAC has undertaken outreach and education initiatives, has been the public face of cycling in Burlington and has provided new connections for programming.

Halton Regional Police

Halton Regional Police have a long history of working with municipal partners in Halton Region to advance cycling safety. With officers on bikes making cycling more visible and with educational and enforcement blitzes around cycling topics, they remain important partners for road safety in Burlington.

Halton Region Public Health

Public Health has helped to organize and orchestrate a number of initiatives related to health promotion and injury prevention in Burlington, including Active and Safe Routes to School programming, helmet fit seminars and educational campaigns.

Halton Regional School Boards

Both the public and Catholic School boards in Halton have been engaged in School Travel Planning initiatives in Burlington, and have taken an active role in promoting Active and Safe Routes to School initiatives in the City.

Rolling Horse Community Bike Shop

Rolling Horse makes bikes more accessible to those who need them within the community. As a non-profit bike shop, Rolling Horse is helping to develop new skills for repairing and maintaining bikes within the community, and can serve as a hub where cycling culture in Burlington can grow and flourish.

BurlingtonGreen Environmental Association

A long-standing community partner in Burlington, BurlingtonGreen has not been as actively involved in active transportation issues as in issues of tree protection, transit enhancements and greenspace preservation, but there is an opportunity for them to play a larger role in the Active Transportation discussion in the community.

Local Bike Shops

Many local bike shops serve as community hubs for group rides, bike maintenance clinics and more for the local cycling community.

There are other community partners, including cycling clubs, and other organizations, who contribute to the culture of cycling in Burlington, but the above listed stakeholders are those that have the potential to affect the most significant change in the community.





10.3 Program Recommendations

The following recommendations are based on experience from some of the leading cycling communities in North America – those communities that have a similar climate to Burlington. Communities that have achieved Gold or Platinum level Bicycle Friendly Communities designations were prioritized. Examples of the communities that were examined, along with their BFC designation level and the year in which they first achieved it are:

- Ottawa, Ontario (Gold, 2014)
- Waterloo, Ontario (Gold, 2018)
- Fort Collins, Colorado (Platinum, 2013)
- Madison, Wisconsin (Platinum, 2015)
- Bloomington, Indiana (Gold, 2014)
- Vancouver, British Colombia (N/A)

Program Enhancements

These recommendation are for programs that already exist in Burlington but were identified as an opportunity to enhance the program further.

Education



Active School Travel

The City of Burlington has already been working on Active and Safe Routes to School programming with partners at the Health Unit and the School Boards, but there is an opportunity to bring in a larger number of partners and to offer programming at more schools. Through a partnership with the province of Ontario, Green Communities Canada has established the Ontario Active School Travel Fund, which aims to help communities hire an Active School Travel Coordinator to liaise between stakeholders and deliver programming designed to get more kids walking and cycling to school. Regardless of if Burlington is a successful recipient of the

funding from Green Communities Canada, hiring an Active School Travel Coordinator would be an ideal step to develop stronger connections with more schools in Burlington, and to begin expand cycling education across the school system. Many organizations in Burlington, including the Halton Regional Police and BurlingtonGreen, have existing relationships within schools, and are in frequent contact with staff and administration at most schools in Burlington for a variety of programs and events. Those connections could be expanded to include more emphasis on cycling education in schools to help to ensure that all students know the rules of the road, and how to operate a bicycle safely. Other suggestions for encouraging more active school travel in Burlington include:

- Installing Bike Repair stations at all high schools in Burlington
- Hosting Trips for Kids events taking students on mountain bike trips
- Providing support for after-school bike clubs
- Supporting and leading biking school buses

Recommended partners:

Burlington Cycling Advisory Committee, Halton Region School Boards, Halton Region Public Health, Halton Regional Police, BurlingtonGreen, Rolling Horse Community Bike Shop.

Inspiration: Cycling into the Future - Waterloo Region

Cycling into the Future is a cycling education program that has been delivered in Waterloo Region for the past several years. Through a funding partnership with the Cities of Kitchener, Cambridge and Waterloo, Cycling into the Future has resulted in hundreds of Grade 5 students learning how to safely operate a bicycle. The goal is to ensure that each student in Waterloo Region learns basic bike handling skills and the rules of the road, resulting in a population that is more aware of the rights and responsibilities of people on bikes in the future.



Encouragement

Bike Month

For the past 7 years, Burlington has hosted a Bike to Work Day Breakfast at City Hall – this has become a signature event for the City of Burlington. But beyond the Bike to Work Day Breakfast, Burlington does not have a consistent program of Bike Month events. Maximizing the number of events during Bike Month can help to target the "interested but concerned" population of potential riders in Burlington, and can build a strong sense of community around cycling. Events could include learn to bike workshops, bicycle tune-ups, and a community bike swap. Consider partnering with Rolling Horse Community Bike Shop, MEC and BurlingtonGreen to offer weekly guided bike tours around Burlington during Bike Month, and expand the offerings of events to ensure that June is a month-long celebration of cycling in Burlington.

Recommended Partners:

Rolling Horse Community Bike Shop, MEC, BurlingtonGreen, BCAC, Halton Region Public Health, Smart Commute Halton

Inspiration: Bike to Work Month – Ottawa

The City of Ottawa has hosted arguably the most successful Bike Month in Ontario for the past several years, in part because the community has focused on building effective partnerships to deliver the event. Rather than keep the organization and delivery of the month-long campaign in-house, The City of Ottawa provides funding to EnviroCentre, a local non-profit, to bring Bike to Work Month to life. As a result, the Bike to Work Month offerings in Ottawa have grown rapidly - with new partners coming on board, new initiatives spearheaded by EnviroCentre being made available each year, and new interest in the promotion growing each year. This is an excellent example of a community providing resources to a local non-profit to help to make an event stronger, to build capacity and to develop a stronger culture of cycling in a City.

Car Free Days and Open Streets Events

Burlington's Car Free Days have been an anchor event for the community since they began, and the potential exists to expand the availability of Open Streets festivals to provide more residents with the opportunity to explore their community at a human scale without being concerned about interacting with motor vehicles. These are excellent tools to promote and introduce active transportation to the interested but concerned population. Consider expanding the length of the routes available to ensure that there is space for residents to move and explore. For a good resource about how to deliver an effective Open Streets event, see 8-80 Cities Healthiest Practice Open Streets Guide.

Recommended Partners:

BCAC, Halton Regional Police

Inspiration: Ride the Drive – Madson, Wisconsin

Celebrating its 10th year in 2018, Madison's Ride the Drive Open Streets event has served as a catalyst for change in Madison, Wisconsin – North America's most recent Platinum BFC award Winner. The route always includes John Nolen Drive as the central spine of the Open Streets event, providing residents with the opportunity to experience a piece of infrastructure that is normally quite busy with automobiles in a new way. Ride the Drive brings thousands of Madison residents out each year to experience the 6-8km route. There are activity hubs at local parks and BIAs, leaving the space between relatively open for people to walk, run, ride, wheel and more.

Enforcement



Bike Registration and theft control

One of the most significant barriers to cycling is the fear of bike theft. While bike theft can be limited with adequate bike parking and good quality bike locks, there is no lock that will stop a truly determined thief with the right tools. In order to curb bike theft, some communities are turning to online bike registry tools like Project 529. Encouraging residents to register their bikes on Project 529 and distributing stickers indicating that a bike has been registered at community events could help to deter bike theft in Burlington, and local bike shops could help customers

to register their bike at the time of purchase as well to ensure that more bikes in Burlington can be tracked and returned in the event that they are stolen.

Recommended Partners:

BCAC, Halton Regional Police, Local Bike Shops, Rolling Horse Community Bike Shop

Inspiration: Project 529 Bike Theft Reduction – Vancouver, British Colombia

In Vancouver, bike theft was hitting epidemic levels, with over 2,000 bikes being stolen in the area each year. The stolen bikes almost never made their way back to their rightful owner, since most bikes are not registered. The City of Vancouver partnered with the Vancouver Police Department and Project 529 to register as many bikes in the City as possible, offering free decals at local police departments and hosting free registration events throughout the City. As a result of their efforts, Vancouver has seen a 30% reduction in Bike Theft since launching their partnership with Project 529.

Evaluation and Planning



Cycling Counts Reporting

Burlington has been collecting data about cycling in the City for several years now, but most of the information collected is presented only in its raw form – numbers without any context or story behind them. In order to show the impact that the City's cycling infrastructure and programming are having, creating an annual document that tells the story of how cycling is changing in Burlington would be a useful investment of time and resources. The document should be one that is highly visual, features stories about particular projects, testimonials from Burlington residents who use the new infrastructure, and highlights the overall progress of the cycling program in Burlington. This type of document can help to communicate the long-term impacts of the investments that are being made in a way that is hard to capture with raw numbers.

Recommended Partners:

BCAC, City Communications Department

Inspiration: Active Waterloo Cycling Report – Waterloo, Ontario

Waterloo has a similar program of counting people riding bikes to Burlington, with a number of permanent and mobile counters around the community. The City has taken that data and turned it into a highly informative document called the Active Waterloo Cycling Report, a bi-annual document that is meant to highlight the successes of the cycling program in Waterloo. By focusing the report on identifying overall ridership increases, highlighting key investments and their place within the broader active transportation network and identifying new opportunities to attract more of the "interested but concerned" population, the Active Waterloo Cycling Report not only serves to keep the City accountable to its active transportation targets, but also to provide decision-makers with the data necessary to support their decisions to invest more resources into cycling in Waterloo.

New Programs

While most of Burlington's existing programs can be strengthened to create a vibrant culture of cycling, a few key gaps in programming have been identified, especially if the community is aiming to become one of North America's most bikeable communities.

Women Cycling



When it comes to cycling in Burlington, the gender divide is particularly stark. According to the 2016 Statistics Canada Census, only 30% of bike commuters in Burlington are women, representing a significant untapped market for cycling in the City. Creating programs designed specifically to make more women feel comfortable on bikes can significantly expand the cycling community in Burlington. Base projects on well-established programs like the League of American Bicyclists' Women Bike Program which focuses on developing bike programs that focus on "The 5 Cs" - Comfort, Convenience, Confidence, Community and Consumer Products. Support the development of Women-only rides,

women-only nights at local bike shops and consider sponsoring and hosting a Women's Cycling Expo, where women can learn about family cycling, gain new skills and knowledge about bike repair, connect with women-only ride groups and learn about women-specific cycling products that are available at Burlington's local cycling shops. For inspiration, look to some of the programming that has been offered in Fort Collins, Colorado, where weekly women's only rides, an annual Women's Bike Expo and an annual CycloFemme ride form the basis of a broad ranging program to encourage women to ride more often.

Recommended Partners:

City Staff (Lead agency), BCAC, Bike shops, Cycling Clubs

Bike Valet



Bike Valet can serve both as a transportation demand management strategy and a tool to develop a stronger culture of cycling. Similar to a coat check, bike valet allows event attendees to leave their bike at a staffed, secure location, and then trade in their tag at the end of the event to get their bike back. For events in Burlington like the Burlington Sound of Music Festival, Canada Day Fireworks, Ribfest and other activities that draw large numbers of people to a central location, Bike Valet can serve the purpose of both encouraging people to ride their bikes and to connect with riders to talk about Burlington's cycling programs. Some communities in North America have required Bike Valet as part of the Special Events permitting process to ensure that active transportation is considered in the planning of any event taking place within the community. Burlington could emulate those models, purchasing the materials for the Bike Valet (including bike racks, fencing and a tent), then contracting Bike Valet operation services out to a group like BurlingtonGreen or Rolling Horse Community Bike shop.

Be sure that Bike Valet serves as an opportunity not only to encourage people to ride, but also to engage the community in dialogue about cycling in the City. Bike Valet tents can be a great place to talk to residents about upcoming cycling events or investments, to hand out cycling maps or other information and to seek feedback from the community about the City's cycling efforts.

Recommended Partners:

City Parks and Recreation Department (to purchase and store Bike Valet Materials), City Special Events department, BurlingtonGreen, Rolling Horse Community Bike Shop.



Individualized Marketing Efforts

Within Burlington, there are a number of neighbourhoods where multimodal transportation (for example, biking to the GO Station) represents a relatively easy choice. As more low-stress cycling routes are added to those major mobility hubs, cycling to transit stops will potentially be a more attractive option to residents, but those residents may need help in changing their ingrained habits. Communities around Ontario have experienced significant success with Individualized Marketing efforts, with 32% of residents engaged in the #GetAjaxMoving campaign choosing to bike more after receiving their walking and cycling toolkits. Burlington could create hubs of active transportation around your mobility centres, focusing on communities within 3km – an easy 10-15 minute bike ride – of those transit hubs. Consider creating active transportation toolkits to help residents choose low-stress routes to their destinations, and offering residents assistance and incentives to choose active travel to get to their destination, even if they only use active travel occasionally and for part of their journey.

Recommended Partners:

City Transportation and Transit Staff, Metrolinx, BCAC

Staff Position to Coordinate Programs

In order to facilitate and implement the updated and new programs recommeneded in this plan, it is recommended that the City hire a staff position dedicated to the coordination and implementation of programs related to cycling and walking in Burlington.

10.4 Bike Parking Program

The City should continue to identify locations for bike parking to be installed at destinations throughout Burlington. The following recommendations are guidance based on the Association of Pedestrian and Bicycle Professional (APBP) best practice documents.[3132]

Types of Bike Parking

Bike parking can be categorized into two types, which underline how the parking will be used and the different elements that should be included in its provision. Both types are important as they serve different users.

Short-Term Parking

Short-term parking should be designed to meet the needs of people visiting businesses and destinations, where the duration of the stay is around 2 hours long. The parking should be highly visible, in close proximity to the entrance of the destination, and easy to use. This parking could be located in the boulevard as part of a street furniture program, on private land, or on the road as a bike corral replacing on-street parking.

Long-Term Parking

Long-term parking is designed to meet the needs of people who routinely park at a destination such as a home, workplace, or transit hub. Long-term parking should be weather protected and more secure by being located in a restricted area such as a private parking garage, interior bike room, cage or bike locker that requires a key or pass to access.



Short-term on-street bike corral parking in Toronto, ON.



Long-term bicycle locker at City Hall in Burlington, ON.



Short-term ring and post parking in the street furniture zone of sidewalk in Toronto, ON.



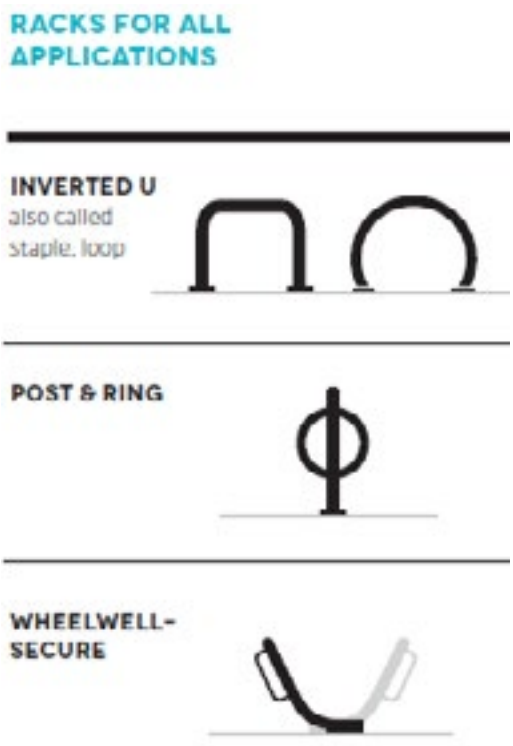
Long-term bicycle parking in covered cage in parking lot in Toronto, ON

Rack Styles and Placement

There are many different styles of bicycle racks that are available on the market, that can be customized to suit in an array of colours. This does not mean that all styles are recommended.

Fundamentally, racks should be intuitive to use correctly, provide two points of contact to support the bicycle and provide locking location options to the wheel and frame.

Racks should be spaced appropriately to provide access to bicycles and sufficient clearway to maneuver the bicycle in or out of the bike parking. Recommended dimensions are included in the APBP guidance. It is important to consider different types of bicycles and that some rack styles and dimensions may be insufficient for recumbent, cargo, tricycle, and other bicycle types. Providing parking for these bicycle types should be considered.



Recommended rack styles from the APBP Essentials of Bike Parking guide.[26]

Bike Parking in Policy

A common way to ensure the provision of short-term and long-term bicycle parking is by including required minimums as part of the zoning by-law. This requires new buildings to provide short-term and long-term parking. A request based service managed by the City can also used to provide parking at locations where there is no or inadequate parking.

Moving forward, it is recommeded that the City review and follow bike parking minimum best practices to ensure the provision of adequate bicycle parking.

Endnotes

1. Stanisljevic, J. (June 14, 2019). Traffic congestion reconsidered. The Conversation. http://theconversation.com/traffic-congestion-reconsidered-111921.

2. Litman, T. (September 2012). Generated Traffic and Induced Travel: Implications for Transport Planning. Victoria Transport Policy Institute.

3. Garrard J, Rissel C, Bauman A. (2012). Health benefits of cycling. In: Pucher J, Buehler R, eds. City Cycling. Cambridge, Massachusetts: MIT Press: 31.

4. Bryan SN, Katzmarzyk PT. (2011). The association between meeting physical activity guidelines and chronic diseases among Canadian adults. Journal of Physical Activity and Health; 8(1).

5. Warburton DER, Katzmarzyk PT, Rhodes RE, Shephard RJ. (2007). Evidence-informed physical activity guidelines for Canadian adults. Applied Physiology, Nutrition and Metabolism.

6. Garrard J, Rissel C, Bauman A. (2012), Health benefits of cycling. In: Pucher J, Buehler R, eds. City Cycling. Cambridge, Massachusetts: MIT Press: 31.

7. City of Burlington Climate Emergency Declaration, Approved by Council April 23, 2019. https://www.Burlington.ca/en/live-and-play/resources/Environment/Climate-Emergency/Final-Burlington-Climate-Emergency-Declaration-12-pt-font.pdf

8. Jensen, S. U., Rosenkilde, C., and Jensen, N. (2007). Road safety and perceived risk of cycle facilities in Copenhagen. Copenhagen: Trafitec Research Center.

9. Lusk, A., Furth, P., Morency, P., Miranda-Moreno, L., Willett, W., Dennerlein, J. (2010). Risk of injury for bicycling on cycle tracks versus in the street. Injury Prevention.

10. Buehler, R. and Pucher, J. (2011). Cycling to work in 90 larger American cities: New evidence on the role of bike paths and lanes. https://link.springer.com/article/10.1007/s11116-011-9355-8

11. Cervero, R., Caldwell, J., and Cuellar, J. (2013).Bike-and-Ride: Build it and they will come. https://www.nctr.usf.edu/wp-content/uploads/2013/12/jpt16.4_Cervero.pdf

12. University of Toronto. (2011). Transportation Tomorrow Survey area summary: City of Burlington. http://dmg.utoronto.ca/pdf/tts/2011/travel_summaries_by_ward/burlington_wards11.pdf

13. Sarper, S. (2018). Enabling cycling access to rail stations: Prioritizing and bridging unsafe connections. The development and testing of a 4-step bike-rail cycling corridor identification tool to improve cycling access to rail stations in Toronto, Canada. ResearchGate.

14. Metrolinx. (2016). GO rail station access plan. http://www.metrolinx.com/en/regionalplanning/projectevaluation/studies/GO_Rail_Station_Access_Plan_EN.pdf

15. Geller, R. (2009). Four types of cyclists. https://www.portlandoregon.gov/transportation/44597?a=237507

16. Alta Planning + Design. Understanding the “Four Types of Cyclists”. https://blog.altaplanning.com/understanding-the-four-types-of-cyclists-112e1d2e9a1b

17. Statistics Canada. (2016). Journey to work data. https://www150.statcan.gc.ca/n1/daily-quotidien/171129/dq171129c-eng.htm

18. The Centre for Active Transportation. (2019). Building bike culture beyond downtown: A guide to suburban community bike hubs. https://www.tcat.ca/resources/cycling-behaviour-and-potential-in-the-greater-toronto-and-hamilton-area/

19. City of Burlington. (April 2017). Burlington Official Plan [Draft]

20. Statistics Canada. (2016). Census of Population

21. Mitra, Smith Lea, Cantello, & Hanson. (2016). Cycling behaviour and potential in the Greater Toronto and Hamilton Area. http://transformlab.ryerson.ca/wp-content/uploads/2016/10/Cycling-potential-in-GTHA-final-report-2016.pdf

22. Atlanta Regional Commission. (2016). Walk. Bike. Thrive! https://cdn.atlantaregional.org/wp-content/uploads/2016/05/walkbike-thrive-part-1-final-web-.pdf

23. Ontario Municipal Act. O. Reg. 239/02: Minimum maintenance standards for municipal highways (May 3, 2018). https://www.ontario.ca/laws/regulation/020239

24. Miranda-Moreno, LF., Nosal, T., Kho, C. (2013). If we clear them, will they come? Study to identify determinants of winter bicycling in two cold Canadian cities. Transportation Research Board. https://trid.trb.org/view/1241864

25. Fisher, C. (2014). Cycling through winter. Plan Canada; Winter 2014. http://www.cip-icu.ca/Files/Awards/Plan-Canada/Cycling-Through-Winter

26. Alta Planning + Design (2014). Winter bike lane maintenance: A review of national and international best practices. https://altaplanning.com/wp-content/uploads/winter-bike-riding-white-paper-alta.pdf

27. National Association of City Transportation Officials. (April 2015). Walkable station spacing is key to successful, equitable bike share. Equity Practioners’ Paper #1. https://nacto.org/wp-content/uploads/2015/09/NACTO_Walkable-Station-Spacing-Is-Key-For-Bike-Share_Sc.pdf

28. WSP/MMM Group. (April 2016). Feasibility Study for the Expansion of Bike Share Toronto.

29. Ministry of Transportation Ontario. [November 27, 2019]. Electric Kick-Style Scooters (e-scooters). http://www.mto.gov.on.ca/english/vehicles/electric/electric-scooters.shtml

30. City of Calgary. [December 18, 2019]. https://pub-calgary.escribemeetings.com/FileStream.ashx?DocumentId=117277

31. Association of Pedestrian and Bicycle Professionals (APBP) [2015]. Essentials of Bike Parking

32. Association of Pedestrian and Bicycle Professionals (APBP) [2010] Bicycle parking guidelines (2nd edition)