Improving Active Transportation and Public Transit Integration

A Guidebook for Policy and Planning

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the centre for active transportation

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1. Introduction

Introduction

Transit projects rank among the largest public sector infrastructure projects. And yet in our modelling and planning of our transportation network, we too frequently tend to look at public transit in isolation, set against other modes of travel. Experience and research tells us that transit operates most effectively when planned and built in close connection to walking and cycling facilities. A well-planned, well-designed, and well-funded active transportation network around transit stations and transit stops will maximize the value of the enormous capital investments governments make in transit.

Cities are laboratories. They offer an endless variety of contexts for finding out what works and what doesn't. When looking at how best to integrate active transportation and transit, we have so many places to look for inspiration. It can be hard to know where to start at times. This guide will help orient you in your search. Rather than act as an exhaustive list of what other jurisdictions have done, this guide aims to provide a sense of the variety of approaches that are available to address the ever-important first-mile/last-mile challenge of planning: to avoid generating single-occupant car trips while getting people to and from transit.

The guide is divided into three parts. It begins at the policy level, examining the planning approaches of seven jurisdictions in Canada and the United States to streamlining connections between active transportation and transit. The examples highlight a growing recognition among transit agencies that maximizing opportunities for access to transit by non-auto modes of travel is a fundamental best practice. This guide also profiles the potential of transit projects to serve as Complete Streets projects, capable of transforming streets to accommodate all users while substantially increasing the people-moving capacity of the corridor.

Image: Toronto Transit Commssion

The best, and most easily replicated, approach to ensuring safe and effective access to transit on foot or bike is to embed an active transportation analysis in the planning stages for new transit projects and the communities that transit will serve. Transit and transportation organizations should strive to include processes that continually ask whether their station designs (and operations) are living up to policies that emphasize integration with active transportation modes. Remedial measures are always more expensive and often logistically challenging to implement.

An equity lens is an emerging key component of any policy integrating active transportation and transit. Municipal agencies rarely have all the resources they want or need. Choices have to be made. As the policy examples show, assessing those choices by evaluating how they impact the most vulnerable in the community, those with reduced mobility, or those who can least afford an increase in transit fares or an increase in their commute times, is a central aspect of any effective integration policy. Particularly when improving accessibility for vulnerable groups might be as simple as filling in a gap in the sidewalk network.

The second component of this guide is an examination of many approaches where infrastructure and programming have played a key role in improving active transportation and public transit integration. This section highlights the need to align non-auto modes in design and operation. Any program that improves mobility, whether it be by foot, by bike, or by transit, brings the ability to get around urban areas without a car within reach. That benefits cities in the end.

The infrastructure and programming guide shows why attention to detail matters. It highlights that, for example, while bicycle sharing programs are a new positive, a bikeshare system is more likely to feed riders to transit systems in cities with newer rapid transit infrastructure. Details such as the presence of mature trees at transit stops positively impacts the perception of wait times at bus stops. These are valuable but subtle insights that will help ensure you get the little things right.

The case studies in this guide also highlight the importance of prioritizing the user experience. We get the transportation mix that we plan for. On a large scale, if we plan a city of cars, we get cars. At the small, station/stop scale, if we want cyclists we have to plan for cyclists. Installing protected bike lane access to stations tells riders their safety is a priority. To ensure that people with mobility challenges have full access to public transit, we have to plan for them by considering options that eliminate barriers through approaches such as universal design.

The final section of this guide consists of audit tools for walking and transit to transit that will help apply the case studies examined to your local context. As noted earlier, attention to detail is critical. The lessons from other municipalities are only valuable if correctly applied.

Effective integration of active transportation and public transit requires a co-ordinated multi-stakeholder effort. Given the long-standing axiom that all transit users are pedestrians at some point in their trip, it would be logical to think of planning for transit as planning for pedestrian and cyclists as well. But, logical as it may seem, taking an integrated approach within our car-dominated cities requires persistence and the forging of alliances. This guide provides a resource to staff at planning and transit agencies, as well as community advocates, to help them make that case. Further, this guide demonstrates the value of including active transportation in transit planning from the very start.

2. Policy Best Practices

A. Planning for Active Transportation and Public Transit Integration

Many Canadian cities are currently undertaking improvements to both their public transit systems and active transportation networks, but specific policy documents intended to improve the integration of these modes remain uncommon in a Canadian context. How to avoid generating single-occupant car trips while getting people to and from transit is commonly referred to as the "first and last mile" problem. Making it easier to walk or bike to transit makes people more likely to use transit (Transit Center 2016). Additionally, transit projects often present opportunities to simultaneously improve conditions for people walking or cycling.

This guide highlights examples and best practices drawn from existing plans for public transit and active transportation integration. As the American planning context on this issue is generally more developed than in Canada, the guide draws on plans, funding strategies and policies from American transit agencies, municipalities and regional planning bodies in Denver, Portland, Los Angeles, San Francisco and Atlanta, while also profiling two relevant plans from the Greater Toronto and Hamilton Area and Metro Vancouver.

The lack of a formal integration plan does not mean that walking or cycling to transit is necessarily worse than in a jurisdiction with a plan. However, formal plans can provide an analytical framework to identify problems and strategies to improve facilities and routes, as well as establishing funding schemes and creating partnerships between transit agencies and other actors. Dedicated plans for improving access for walking and cycling to transit can play a vital role in prompting a shift towards more sustainable modes by attracting new transit users, while also ensuring that existing riders are able to safely access transit by walking or cycling. This section proposes six best practices that are drawn from plans intended to improve public transit and active transportation integration in two Canadian and five American cities.

B. Six Best Practices for Planning for Active Transportation and Public Transit Integration

Undertake system-wide analysis

Improving access to and from transit using active transportation involves acting on a variety of scales, from a local bus stop to a major terminal. System-wide analysis and mapping are essential elements of improving pedestrian and cycling access to transit across a transit agency's service area. GIS mapping and in-person site visits can determine both needed improvements and existing opportunities for active transportation and public transit integration. System-wide improvements to transit stops that are guided by detailed analysis can also further equitable access to transit, particularly regarding bus services, which are more likely to be used by low-income people who may lack access to a car.

1

Develop specific and detailed plans

While design guidelines and idea books are essential starting points and useful references, their utility can be greatly diminished if they are not accompanied by an implementation strategy. Plans should identify specific sites for improvement and propose concrete measures accompanied by detailed timelines and cost estimates.

2

Conduct outreach to riders and transit agency staff

Outreach to transit users and staff can help identify barriers to using active transportation to access public transit and suggest possible improvements that can be implemented. Out of the plans surveyed in this document, outreach to transit staff was uncommon, with only Portland's Trimet conducting significant outreach to transit operations. This practice can provide valuable input, particularly regarding strategies to reduce conflicts between cyclists and buses, and ways to better accommodate bicycles on board transit vehicles.

3

4

Provide dedicated, predictable and long-term funding

As demonstrated in the San Francisco Bay Area, dedicated funding is an essential measure in improving public transit and active transportation integration. Grant-based programs can encourage area municipalities to partner with transit agencies in developing safe routes to transit, while transit agencies can focus on improving transit stops and stations to better accommodate cyclists and pedestrians.

5

Form Partnerships and Assign Clear Roles

As few transit agencies have jurisdiction beyond their facilities, forming partnerships with municipalities and other relevant parties is necessary to ensure better conditions for people accessing transit via cycling and walking. It is essential for transit agencies and their partners to ensure that roles and responsibilities are clearly defined for different aspects of improving facilities and programming for active transportation and public transit integration.

6

Improve Active Transportation and Public Transit Simultaneously

Reconfiguring streets to prioritize public transit and active modes can significantly increase the people-moving capacity of a street. Transit agencies and their partners should strive to include improved active transportation infrastructure in new transit projects at every opportunity. Some cities are shifting towards a Complete Streets planning framework that is based on the principle that streets should be designed to be safe for all users of all ages and abilities. As new public transit projects often involve major construction work, they represent an excellent opportunity to simultaneously install active transportation improvements.

C. Jurisdictional Best Practices Overview

City - Agency - Plan	Best Practices Overview
Greater Toronto and Hamilton Area – Metrolinx – "GO Rail Station Access Plan"	A comprehensive overview of "First and Last Mile" access and automobile parking conditions at existing and future GO Transit rail stations. Includes extensive sections on potential walking and cycling to transit infrastructure improvements. The first system-wide audit of transit station access conducted in Canada.
Vancouver – Translink – "Cycling For Everyone: A Regional Cycling Strategy for Metro Vancouver"	Outlines a regional cycling strategy for Metro Vancouver. Includes transit facility upgrades and a funding program to incentivize municipalities to build cycling connections to transit.
Atlanta – Atlanta Regional Commission – "Bike To Ride"	Illustrated "idea book" of potential strategies that can be used to improve active transportation and public transit integration.
Denver – Regional Transportation District – "Bicycle Parking and Accessibility Plan," and "State of the System"	A plan for bicycle parking and accessibility, and an example of including active transportation access to transit in strategic documents.
Los Angeles – Metro – "Active Transportation Strategic Plan"	Comprehensive active transportation plan for the region. Includes both a regional active transportation network and specific measures to improve walking and cycling near transit.
Portland – Trimet – "Pedestrian Network Analysis," TRIMET BIke Plan," "Enhanced Transit Corridors Plan," and "Transportation for Everyone: Central City in Motion Implementation Plan"	The first American transit agency with dedicated plans for both walking and cycling to transit. Walking plan is based around GIS analysis of all bus stops in Trimet's service area. Bike plan also uses GIS mapping to identify areas in need of cycling infrastructure improvement.
San Francisco Bay Area – "Safe Routes to Transit"	Overview of Safe Routes to Transit grant program, which is funded by road tolls. Shares the cost of improvements with municipalities. Received support for major expansion in 2018.

D. Canadian Planning Context

A large number of Canadian transit agencies provide instructions to users on their web pages on how to bike to transit, store a bicycle at transit facilities, and take a bicycle aboard transit vehicles. Additionally, many Canadian cities have adopted cycling, walking or road safety plans, which include measures to improve transit access through active transportation.

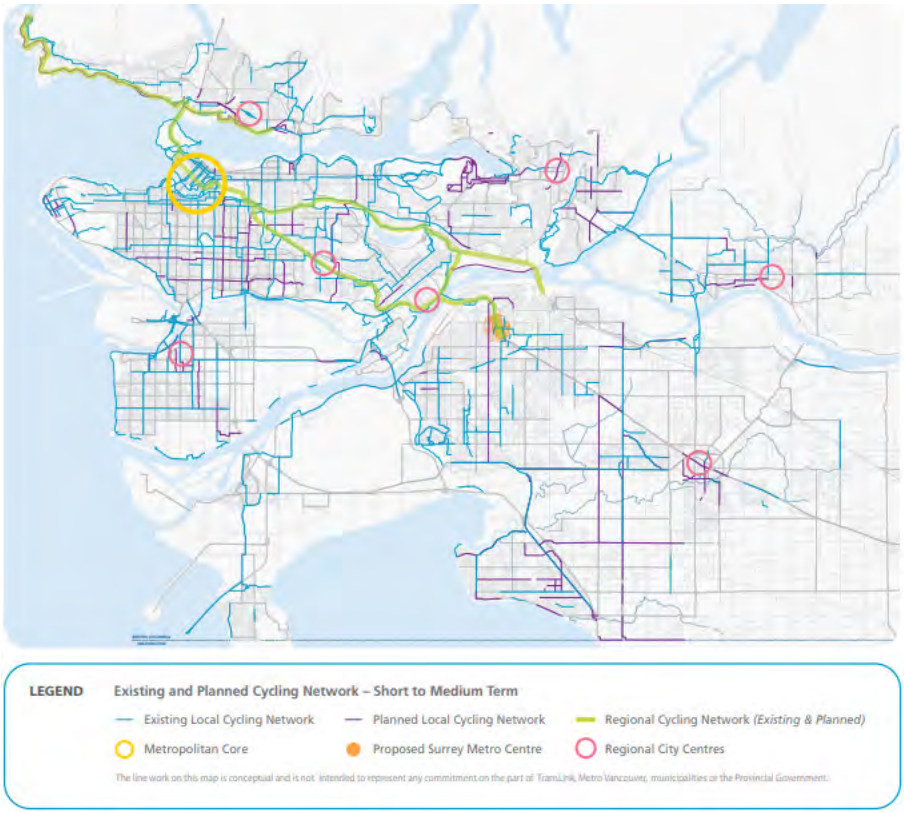
While no Canadian transit agency or municipality currently possesses a stand-alone plan for active transportation and public transit integration, both Metrolinx in the Greater Toronto and Hamilton Area and Translink in Metro Vancouver have planning documents that are designed to improve active transportation access to public transit. This represents a gap in both the Canadian public transit and active transportation contexts that should be addressed.

As walking, cycling and transit modal shares are generally higher in Canadian cities when compared to their American counterparts, the lack of a formal plan does not necessarily mean that accessing transit in Canada by walking or cycling is more difficult or less common than in American cities. However, formal plans provide a number of tangible benefits, such as clearly establishing partnerships and responsibilities between municipalities and transit agencies, creating funding structure, providing a means to assess barriers to accessing transit and potential active transportation improvements, and using transit construction as an opportunity for active transportation improvements.

Case Study: Vancouver, British Columbia

With a broad mandate for regional transportation, Metro Vancouver's Translink currently has the most comprehensive cycling strategy for a transit agency in Canada. Cycling for Everyone: A Regional Cycling Strategy for Metro Vancouver (2011) is directed towards building a regional cycling network that connects with transit. It includes funding for transit facility improvements and support for a Safe Routes to Transit program, and on building a cycling network on regional roads in Metro Vancouver. The plan also intends to both improve existing cycling infrastructure and build new multi-use paths along SkyTrain lines. This highlights the capacity of transit corridors to serve as complete mobility corridors.

Through both direct investment and grants to the region's municipalities, the plan aims to build a regional cycling network across Metro Vancouver by increasing the portion of Translink's budget for cycling from 0.2% to 1.5%.



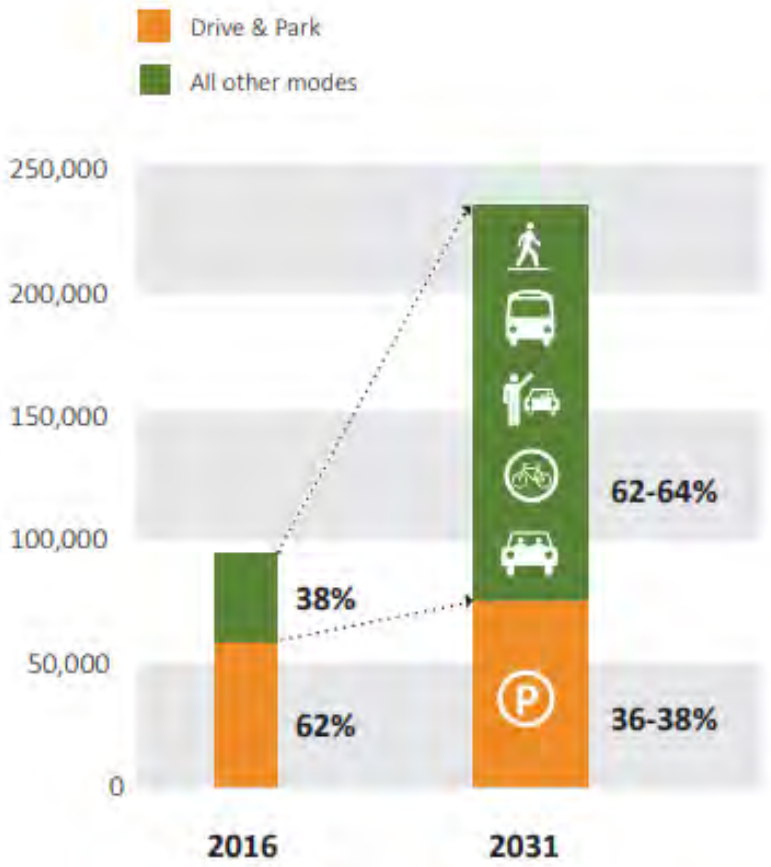
A map of existing and proposed cycling infrastructure in Metro Vancouver, with the regional network highlited in green. (Image: Translink)

Translink has a considerably broader mandate than most Canadian or American transit agencies, as it is responsible for transit construction and operations, and goods movement, roads and active transportation on a regional scale. This means that its approach to cycling and public transit integration could be difficult to apply to other jurisdictions. However, Translink's approach to cycling is an example of a planning body treating cycling as a viable regional transportation mode while also providing sufficient resources to ensure the proposed active transportation network is constructed and connects to transit infrastructure.

Case Study: Greater Toronto and Hamilton Area

Metrolinx, the regional transit planning agency for the Greater Toronto and Hamilton Area, has a first and last mile plan for all transportation modes in the GO Rail Station Access Plan (2016). The plan provides ambitious targets for station access in 2031, proposing a 3.5% to 5.5% increase in rates of walking to GO stations and an increase in cycling as a means of accessing GO stations from 1% in 2016 to in between 2% and 4%. It is based on a comprehensive survey of GO rail stations that is used to identify potential barriers to accessing transit and opportunities for improvement for every station in the network, including future stations that have yet to open.

The plan provides modal share targets for accessing each GO train station for 2031, and a list of recommended improvements both on station property and on nearby streets that focuses heavily on pedestrian and cycling infrastructure. It also proposes general strategies for active transportation access to the GO Train network, such as expanding bike parking and developing partnerships with bike share services. The plan recognizes the importance of surrounding land uses to walkability and proposes encouraging intensification at many GO Stations.



Along with a large increase in service, GO Transit envisions a major shift in how people access GO Transit facilities by 2031. (Image: Metrolinx)

The Access Plan is not accompanied by a detailed implementation plan or a dedicated funding strategy, and Metrolinx does not currently have a means of financially incentivizing municipalities to improve walking and cycling connections to GO stations.

E. American Planning Context

In general, newer transit systems in the western United States tend to have adopted more developed cycling and transit integration plans. Plans generally focus either on cycling specifically or active transportation more broadly. Plans specifically for walking to transit remain uncommon, with only Portland's Trimet having adopted both a walking and cycling plan. As a majority of people walk to transit in most jurisdictions in both Canada and the United States, this represents a considerable opportunity for future planning (Transit Centre 2016, p. 40). A number of transit agencies have conducted detailed audits of their transit facilities and the surrounding environment to both diagnose problems and identify opportunities for improvement.

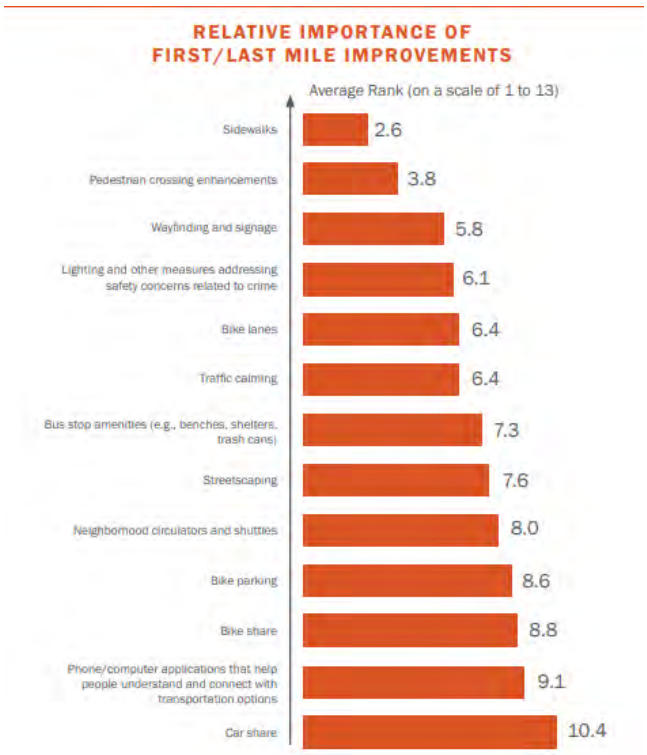
This section provides an overview of planning documents from five American urban regions that could help inform the development of similar documents in a Canadian context. While not exhaustive, the plans and programs highlighted here are meant to cover a range of approaches to integrating active transportation and public transit, such as bike parking, transit agency strategic planning, walking to transit, cycling to transit, regional cycling strategies, and funding mechanisms.

Case Study: Denver, Colorado

Denver, Colorado has a dedicated bicycle access plan, and also considers active transportation access to transit in a strategic overview of the region's transit system. Denver's Regional Transportation District (RTD) has a wide-ranging Bicycle Parking and Accessibility Plan (2015) that proposes eighteen strategies in six categories: encourage bike access; increase and improve bike access to transit; modify and enhance bike parking; enhance bike marketing; tracking and evaluating; andimplementation.

The plan describes the current conditions for bike parking at RTD facilities through a detailed inventory. It advocates for improved maintenance of existing facilities, and an increased number of bike racks, bike lockers and secure bike rooms. The plan also includes the results of a survey of nearly 1,400 transit users on their experience with bike-transit journeys. This survey found that the presence of secure bike parking was the factor that made cyclists most likely to bike to transit. The plan proposes that transit agencies set a specific goal for cycling access to transit, which RTD hopes to more than double by 2025 to 5%.

RTD's State of the System (2017) provides a comprehensive overview of the transit system that includes an extensive section on how people access buses and trains in Denver, which also addresses the form of the built environment surrounding transit stops and stations. The document dedicates an entire chapter to transit access, looking at street connectivity, and pedestrian and cycling connections to transit.



A survey of RTD users found that sidewalks were by far the most desired First Last/Mile improvement for accessing transit. (Image: RTD)

The report breaks down RTD's service area into regional zones and provides detailed information on transit proximity demographics and the percentage of residents in each area without access to a car. While intended as a broad document covering many aspects of the RTD system, the plan highlights how active transportation access can be integrated into transit agency strategic documents.

Case Study: Portland, Oregon

Portland's Trimet is among the most ambitious transit agencies in terms of comprehensive planning for active transportation and public transit integration. TRIMET's Pedestrian Network Analysis (2011) is an ambitious survey of the entire TRIMET's bus and light rail network. Using GIS mapping, TRIMET analyzed nearly 7,000 bus and light rail stops in its service area to understand how transit fits into its surrounding physical environment, and what measures are necessary to improve pedestrian access to transit. The plan highlights the need to not only focus on attracting new users to transit, but also on ensuring that existing riders have a safe and comfortable means of reaching transit.

TRIMET calculated 15 minute walksheds for each transit facility that takes into account physical barriers, rather than simply drawing a distance-based radius around the facility. (Image: TRIMET)

Trimet used a three-part GIS analysis to produce a composite score for all bus stops by looking at stop environment, nearby destinations, deficiencies and opportunities. The analysis identified clusters of low-scoring stops and matched them to groupings of low-income households and people of colour. Trimet selected ten initial focus areas for further observation in person to identify specific areas of concern in need of improved pedestrian infrastructure. These case studies identified pedestrian destinations and obstacles in the vicinity of bus stops, and explained how improvements to pedestrian infrastructure could fit into wider policy objectives.

With each focus area, Trimet provides several examples of poor pedestrian infrastructure, but also of "something positive to build from," such as recently improved sidewalks, bike lanes or bus shelters. The plan concludes with an outline of strategies that can be used to improve the pedestrian experience when accessing transit.

TRIMET's Bike Plan (2016) serves as a complementary document to the Pedestrian Network Analysis. The plan focuses on four areas for improving cycling and transit integration: access to transit stations and stops; bike parking and "end of trip" facilities at stations and stops (including bike share); accommodating bikes on buses and trains; and bike and bus interactions on the street.

Case Study Continued: Portland, Oregon

TRIMET's Bike Plan is one of the few planning documents surveyed to address on-street bike/bus interactions, and to draw on consultations with both transit users and transit operators as a strategy for improving conditions for cyclists. Trimet employs a similar GIS analysis as their Pedestrian Plan to evaluate stops and stations to identify deficiencies regarding access gaps, bike parking (both a lack of it and overcapacity), security issues, and potential partnerships with municipalities or private employers. The plan identifies 17 focus areas where bike access to transit should be improved, and 11 locations to increase bike parking. The plan provides six recommended actions that are accompanied by detailed implementation strategies. The plan is summarized in a clear and accessible web page setting out the goals and strategies contained within the plan, although it does not track implementation.

As large vehicles with poor visibility, buses and streetcars pose a particular danger to cyclists. Trimet is one of the few agencies to take measures to reduce bike-bus conflicts. (Image: TRIMET)

Portland has also moved towards a Complete Streets approach, where public transit and active transportation are simultaneously improved through street design changes. As part of its Enhanced Transit Corridors Plan (2018) to improve bus service, the Portland Bureau of Transportation in conjunction with Trimet have committed to a wide range of pedestrian and cycling facility improvements across the city alongside the introduction of infrastructure designed to improve bus speeds and reliability. These improvements include floating bus stops that allow cyclists to pass behind boarding areas in a protected lane, level bus boarding and curb extensions at bus boarding areas.

For its rapidly intensifying downtown, Portland's city council adopted the Transportation for Everyone: Central City in Motion Implementation Plan (2018) that will repurpose 1% of the central city's area for transit and 1% for cycling and walking improvements. The plan identifies 18 street corridors that will see the installation of measures like transit right-of-ways, protected bike lanes, and improved pedestrian crossings. The plan also addresses potential conflicts between cyclists and transit vehicles through the installation of floating bus stops and left-side bike lanes on one-way streets. The plan is scheduled to be implemented with two phases over 10 years with a total estimated cost of US$72 million. It is estimated that with these reconfigurations, Central Portland's streets will be able to move 60% more trips in 2035 than in 2015.

Case Study: Los Angeles, California

Los Angeles Metro's Active Transportation Strategic Plan (2016) is one of the most extensive and detailed active transportation and public transit integration plans. It adopts a broader view of active transportation, encompassing walking, people using mobility devices, skateboarding, rollerblading and cycling. The 572-page plan is divided into three volumes: the first provides an overview of the goals of the plan and methodology; the second provides dozens of case studies of transit facilities to identify problems and opportunities for active transportation access; and the final section is a toolbox of measures to improve active transportation and public transit integration.

LA Metro maps transit facilities and their surroundings to identify barriers to using active transportation to access transit, but also assets that improve the experience and safety of walking or biking to transit. (Image: LA Metro)

While the plan is focused on public transit access, it also outlines a regional active transportation network for Los Angeles, similar to Translink's Regional Cycling Strategy. The plan identifies Metro as the primary stakeholder, but also lists the many possible partners the agency can work with to improve active transportation and public transit integration. It sets out cost estimates for fully constructing station access improvements and the regional active transportation network, and proposes possible funding sources. The plan establishes targets for increasing rates of cycling and walking to transit in 2025 at both a regional and project level.

Like Trimet in Portland, Los Angeles Metro employed GIS analysis, community consultation and site visits to examine the active transportation environment around Metro's 661 transit stations and bus stops with the highest ridership. The analyses include maps of the transit facility and surrounding area, and highlight specific access problems to be addressed, as well as existing active transportation assets in the vicinity. Some of the sites are also accompanied by detailed cost estimates of the needed pedestrian and cycling infrastructure. The report's final volume serves as a toolbox for active transportation and transit planning with sections on infrastructure design, outreach strategies, local active transportation plans, performance metrics and cost estimates.

Case Study: San Francisco Bay Area, California

With the Safe Routes to Transit (SR2T) program, the San Francisco Bay Area has one of the few dedicated funding programs for walking and cycling improvements to transit access. In 2004, voters approved a US$1 increase to bridge tolls in the region to fund public transit, with a small portion going to SR2T. The program gave out US$20 million in five rounds of grants largely to area municipalities to partially fund 54 projects in the region with a total cost of US$60 million. Projects included a bike station, sidewalk and bike lane installation near Bay Area Rapid Transit (BART) stations, modifying BART cars to accommodate bicycles, installing pedestrian and bicycle crossings, crosswalk restriping, and a bike sharing project.

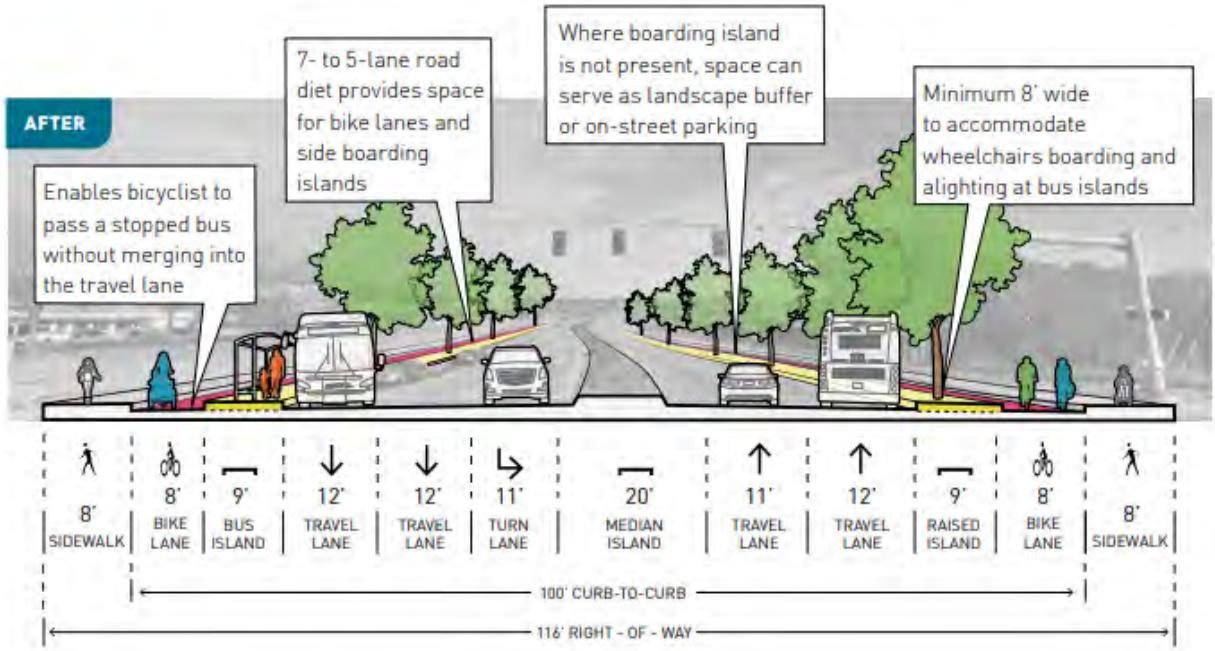
A map and images of active transportation improvements to the Glen Park Station area in San Francisco undertaken through a $168,000 grant from the Safe Routes to Transit project. SR2T projects have the additional benefit of improving active transportation conditions in areas surrounding transit. (Image: TransForm - Safe Routes to Transit)

Sanders et al (2014) conducted a detailed analysis of the projects funded by SR2T and documented numerous tangible benefits from the program. SR2T projects resulted in a notable increase in both cycling and walking to transit whenever improvements were undertaken, with rates of accessing transit through active transportation increasing by 3% and driving decreasing by 2.5% after SR2T improvements. Additionally, the researchers found that people walking or cycling to transit were far more likely to stop at local businesses than drivers, indicating that active transportation improvements also benefit commercial areas near transit.

In June 2018, voters in the Bay Area approved a further bridge toll increase that will provide US$4.45 billion for transit improvements, including US$150 million for additional rounds of SR2T projects and an 805km multi-use trail running along the entire San Francisco Bay.

Case Study: Atlanta, Georgia

As part of its Walk! Bike! Thrive! (2016) plan for active transportation in Metro Atlanta, the Atlanta Regional Commission (a Metropolitan Planning Organization responsible for regional-scale planning) produced a supplementary "idea book" to improve cycling and transit integration. Bike to Ride (2017) provides an overview of potential strategies to improve both access to transit and bike parking at transit. It treats cycling to transit as a major opportunity for a modal shift, and notes that despite nearly a third of the region's residents living within a 5-minute bike ride of transit, only 0.3% of transit users access transit via cycling.



An example of a potential transformation of a suburban arterial road to accommodate cyclists, pedestrians and transit, while also serving as an opportunity for new street trees. (Image: Atlanta Regional Commission

The idea book provides a framework for planning transit/cycling networks, and a checklist for analyzing routes to transit, station environments and bike parking facilities. The bulk of the document consists of richly illustrated examples of infrastructure improvements that could be used to improve access to transit, to reduce bike/bus conflicts, to redesign streets to better accommodate active transportation and public transit, and to design bike-friendly park-n-ride lots. The guide also focuses heavily on suburban environments, highlighting potential strategies such as neighbourhood accessways for cycling and walking to bypass circuitous road networks, ways to cross major barriers, and retrofits to suburban arterials to make them cycling-friendly. While inspiring, the idea book is intended to inform local governments and transit agencies in Metro Atlanta of the strategies available to them, rather than serve as a detailed implementation plan.

3. Infrastructure and Programming

A. Introduction

Although dedicated active transportation and public transit integration plans are rare in Canada, many worthwhile programs and infrastructure solutions are being undertaken by municipalities and transit agencies. Taken in conjunction with the policy guide, this document aims to provide an overview of programming and infrastructure that can improve active transportation and public transit integration. It is intended to provide examples that have been used to address "first and last mile" transit access and egress using walking and cycling, while also highlighting some examples of using transit projects as opportunities to simultaneously improve active transportation infrastructure. Unlike the policy guide, the focus here is centred on a Canadian context to a much greater degree. This guide is organized as follows:

- **Active Transportation Routes to Transit:** Ways of improving active transportation routes to transit, such as Complete Streets approaches, wayfinding, and transit corridors that are also active transportation corridors.

- **Public Transit Station Facilities:** Strategies for improving active transportation facilities at public transit stations for light rail transit (LRT), bus rapid transit (BRT), subways and commuter rail.

- **Public Transit Stop Facilities:** Active transportation-friendly approaches to designing transit stops for local buses, streetcars and "bus rapid transit-lite" services, with sections on improved stop design, and accessibility for people with disabilities.

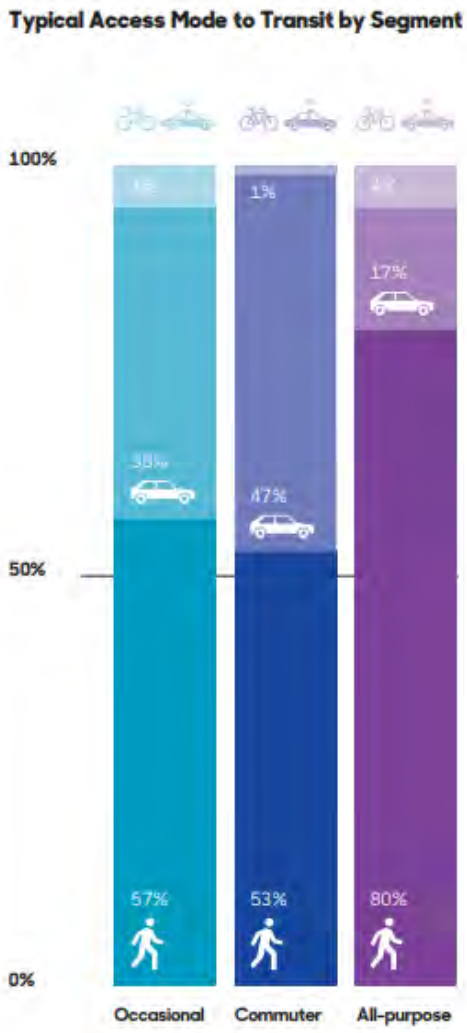
- **Multi-Modal Service Integration:** The potential for service integration across different modes, such as bikeshare and transit fare integration, and public transit as a means of overcoming physical barriers for cyclists.

- **Mitigating Transit Vehicle and Vulnerable Road User Conflicts:** With their large size and poor visibility, transit vehicles pose a danger to cyclists and pedestrians. This section looks at strategies to reduce or eliminate potential conflicts between transit vehicles and vulnerable road users.

This document provides a broad overview of measures that municipalities and transit agencies can employ to improve active transportation and public transit integration. Each section provides a description of the infrastructure or programming, accompanied by examples from the Greater Toronto and Hamilton Area, as well as inspirational examples from other Canadian and American cities. It is not meant to be exhaustive, but rather to provide a set of best practices supported by examples that can be drawn upon to guide future initiatives at a variety of scales, ranging from local bus stops to busy rail stations.

B. Active Transportation Routes to Transit

For many people, walking or cycling to transit is unnecessarily difficult, often indirect, and frequently unsafe. Fortunately, improving active transportation journeys to transit is both inexpensive and can be carried out relatively quickly when compared to the expensive capital investments often required for new transit infrastructure. Incidents such as the 2018 death of a 21-year-old woman who was struck by the driver of an SUV and killed after exiting a Toronto Transit Commission (TTC) bus on a suburban arterial street with no sidewalk, no nearby crosswalk and poor street lighting, highlight the need for comprehensive improvements to pedestrian and cycling infrastructure that connects to transit, especially in car-oriented suburban environments.



Transit Center's research shows that all-purpose transit users overwhelmingly walk to transit, while walking rates remain high for less frequent transit users (Image: Transit Centre).

Improving active transportation routes to transit has the ancillary benefit of making the area around transit facilities more conducive to walking and cycling. A 2015 survey conducted by the TTC found that 11% of TTC users ride their bikes to transit at some point, and a further 61% of transit users would consider doing so with improved infrastructure. This represents a huge opportunity for both ridership growth and to improve conditions for existing transit users. Transit Center's report Who's On Board (2016) provides a simple lesson regarding the importance of walkability to transit ridership: "If someone can walk to transit, he or she is more likely to be a frequent transit rider" (p. 41).

TCAT's report Cycling Behaviour and Potential in the Greater Toronto and Hamilton Area (2016) highlights the potential to shift short trips in the region towards cycling, noting that over one third of trips could be cycled. For example, just 1% of commuters arriving at Pickering GO Station currently cycle, despite 85% of users living within 4.7 kilometres of the station (Metrolinx 2015).

This section highlights some approaches to creating safe routes to transit for cyclists and pedestrians, such as dedicated programs, improved wayfinding, and the potential for transit corridors to also serve as active transportation corridors.

B.1 - Safe Routes to Transit

Dedicated safe routes to transit programs have been adopted in a number of American jurisdictions, such as San Francisco Bay Area's Safe Routes 2 Transit program. These generally consist of grant-based schemes to incentivize municipalities to improve pedestrian and cycling connections to transit. Beyond grant-based programs, some American transit agencies have also taken steps to improve pedestrian facilities themselves. Since transit agencies rarely have jurisdiction beyond transit facilities, building safe walking and cycling routes to transit requires cooperation between municipal and regional governments and transit agencies.

Creating safe pedestrian and cycling connections to transit has been identified as a goal in a number of municipal plans in the Greater Toronto and Hamilton Area (GTHA), such as the City of Toronto's Walking Strategy (2009, s. 3.4) and the City of Hamilton's Cycling Master Plan (2016, s. 7.4). However, the ability to access transit through active transportation currently varies enormously across the GTHA. Identifying gaps in pedestrian and cycling infrastructure requires initiatives such as mapping existing infrastructure and conducting walking and cycling to transit audits.

Trails To GO

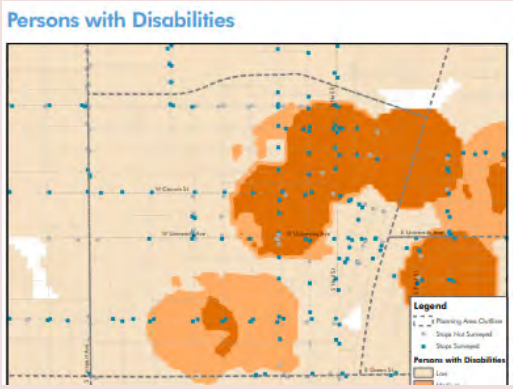
In conjunction with the Waterfront Regeneration Trust, Metrolinx and municipalities in the GTHA have created signed Trails to GO routes that connect GO Train stations to the Waterfront Trail, which runs along the shore of Lake Ontario parallel to GO Transit's Lakeshore line. There are currently 12 Trails to GO in GTHA municipalities, and one in Niagara Falls for seasonal GO Train service. The infrastructure of Trails to GO varies from quiet on-street routes with signage to multi-use trails. At present, Trails to GO only connects GO Stations to the Waterfront Trail in one direction, generally to the south. Many GO Stations on the Lakeshore Line are located immediately south of either Highway 401 or the Queen Elizabeth Way, which creates a major barrier for cyclists and pedestrians that could potentially be addressed in the future. In addition to Trails to GO, Ajax has implemented a wayfinding pilot project, "Bike This Way," which connects Downtown Ajax to the GO Station with signage and painted bike lanes.

Map of the Trails to GO showing the cycling routes to the Waterfront Trail along the shore of Lake Ontario (Image: Great Lakes Waterfront Trail)

Champaign-Urbana, Illinois

As part of Champaign-Urbana, Illinois' Sustainable Choices 2040 Long-Range Transportation Plan (2016) the regional planning agency for a mid-sized, American city has mapped and ranked sidewalk access for every bus stop in the Champaign-Urbana Mass Transit District's service area. This is accompanied by an accessible website to track annual progress towards the plan's goal of sidewalk connections for every high ridership bus stop in Champaign-Urbana.

Additionally, as part of its Transit Facility Guidelines (2015), the regional planning agency surveyed over 1,000 bus stops and mapped streetlight coverage, the percentage of nearby low-income residents, the percentage of nearby people with disabilities, cycling access to transit, and other factors. The guidelines also include detailed maps of 31 neighbourhoods in the area that show destinations, transit facilities, sidewalk coverage, and ridership potential, while also providing recommendations on potential upgrades to bus stop facilities. Champaign-Urbana provides an excellent example of comprehensive mapping of active transportation routes (or the lack thereof) and couples this exercise with a funded plan to improve both transit facilities and ways to access them.



Mapping persons with disabilities allows transit agencies to plan for accessible transit facilities (Image CUUTAS)

Denver, Colorado

Denver, Colorado has addressed deficient sidewalks through a comprehensive mapping program as part of its Denver Moves: Pedestrian and Trails Plan (2017). Denver's mapping not only identifies gaps in sidewalks, but also tracks sidewalk width, comfort level and buffers from streets. The mapping found that across the city nearly 10% of streets were missing sidewalks, and a further 30% had sidewalks that were too narrow. Slightly lower figures were observed with sidewalks close to bus stops and transit stations.

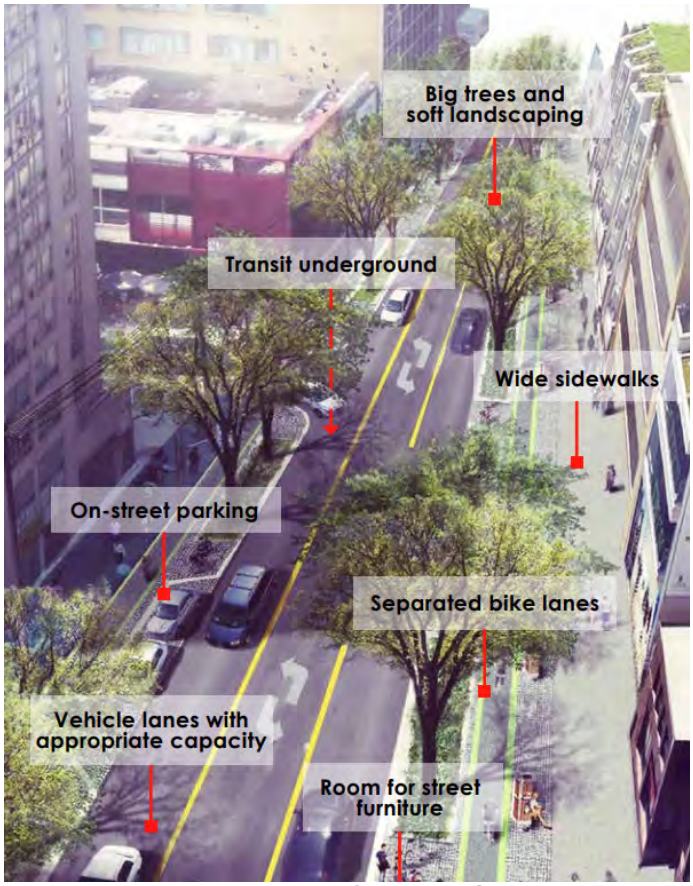
As part of a US$937 million infrastructure bond approved in 2018, Denver will spend US$30 million on its Sidewalks to Transit (2017, p. 103) program. Sidewalks to Transit focuses on sidewalk gaps within 100 metres of a transit station and within 30 meters of a bus stop or bikeshare station. The program will initially focus on improving 153 sidewalk segments along 64 kilometres of roadways over a 4-year period.

B.2 - Transit Corridors as Walking and Cycling Routes

Public transit corridors, such as rail or bus rapid transit lines, represent potential opportunities to build or improve pedestrian and cycling infrastructure. While the opportunity can be limited with underground subways, other forms of public transit infrastructure can be retrofitted to include cycling and walking infrastructure or can include active transportation infrastructure as part of their initial construction. The addition of active transportation infrastructure to transit projects can increase the people moving capacity of a corridor, while also making transit easier to access.

The GTHA has a number of existing, under construction and proposed transit projects that include significant active transportation improvements:

City of Toronto: The Finch West LRT in northwestern Toronto is expected to include raised cycletracks along its 11-kilometre length in northwest, suburban Toronto. Eglinton Connects is a comprehensive streetscape plan for Eglinton Ave., a major east-west thoroughfare in midtown Toronto, which will be implemented in conjunction with the 19-kilometre Eglinton LRT, due to be completed in September 2021. Eglinton Connects will both improve the pedestrian environment and see the installation of cycle tracks along Eglinton Ave. Planned east and west additions to the LRT are also expected to include improved cycling infrastructure, which would create a protected cycling corridor stretching for over 40-kilometres across midtown Toronto.



An example of the proposed Complete Streetscape for the underground section of the Eglinton Crosstown LRT illustrating the transformative impact of new transit projects (Image: Eglinton Connects)

The West Toronto Railpath in Toronto's west end is one of the few examples of active transportation infrastructure in the GTHA along a heavy rail corridor. It currently runs for slightly over two kilometres, but a planned southward extension will double its length with construction scheduled to begin in 2021. The Railpath connects to the GO and Union-Pearson Express Station at Bloor St, which also includes a bikeshare station.

Durham Region: As part of its Pulse BRT service, Durham Region has added nearly six kilometres of dedicated bus lanes and buffered bike lanes along the Highway 2 corridor.

Brampton: Brampton Transit plans on upgrading its busy Queen St. Zum corridor with dedicated bus lanes in the near future and the project is expected include protected cycle tracks.

Mississauga: The upcoming Hurontario LRT will include cycle tracks along a busy, north-south suburban arterial street for 20-kilometres. Dedicated bike lanes are also slated to be included in Mississauga's planned east-west, 17-kilometre BRT line along Dundas St.

York Region: The Viva BRT network in York Region has seen cycle tracks and buffered bike lanes installed along much of its rapid transit network. Viva corridors have also resulted in major upgrades to the pedestrian realm in York Region with wider sidewalks and a large increase in street trees. Highway 7's shift from auto-centric suburban arterial to a street that accommodates cycling, transit and walking was featured in TCAT's Complete Streets Transformations (2016).

C. Station Environment

This section looks at transit facilities with higher passenger capacity that operate primarily in a dedicated right-of-way, such as subways, commuter rail, light rail and bus rapid transit. Some bus rapid transit and light rail systems do operate in both mixed traffic and their own right-of-way.

The outdoor and indoor environments of transit stations can accommodate cyclists and pedestrians through design, facilities and programming. Station improvements should be coupled with safe routes to transit for pedestrians and cyclists.

Situating transit stations in an environment that is already conducive to walking and cycling is an obvious step in encouraging active transportation as a means of accessing transit. Transit Center's survey of transit users, Who's On Board (2016), found that walkability was a key factor in peoples' willingness to use transit, and that "[l]arger stations should be designed to facilitate walking, with multiple pedestrian access points and with wide sidewalks and highly visible crosswalks leading to the station" (p. 41). However, many transit stations are in areas that are not conducive to walking or cycling, such as on major arterials roads or even in highway medians. This means many stations require a variety of interventions, both small and large-scale, to become active transportation-friendly.

This section focuses on active transportation access in the immediate station area, bike parking and storage, and active transportation-friendly parking lots.

C.1 - Station Access

While safe routes to transit are essential, so too are comfortable, safe and accessible stations for pedestrians and cyclists. Research conducted by Ryan and Frank (2009) and Werner, Brown and Gallimore (2010) has demonstrated a positive correlation between a walkable built form and increased transit use. Stations in suburban areas that are designed around park-n-ride users can be particularly difficult to access by walking or cycling.

Ensuring accessibility for people with disabilities is another key consideration in transit facility design. A report by the Canadian Urban Transit Association (2013) proposed that making transit facilities fully accessible can reduce the need for paratransit, which is expensive to operate and often inconvenient for users. As even transit users who drive to transit must still walk from their vehicles to a station platform, transit facilities should be treated as a form of pedestrian infrastructure. Transit facilities should have multiple, clearly indicated entrances, and at least one barrier-free means of accessing boarding areas.

Pickering Pedestrian Bridge

Unlike some more established North American commuter railways, GO Transit's rail service is a relatively recent addition to the GTHA, launching in 1967. As a result, many of its stations are not located in built-up communities, but rather along existing rail corridors in industrial settings that are often adjacent to major highways, resulting in an environment at many stations that is poorly suited to walking and cycling.

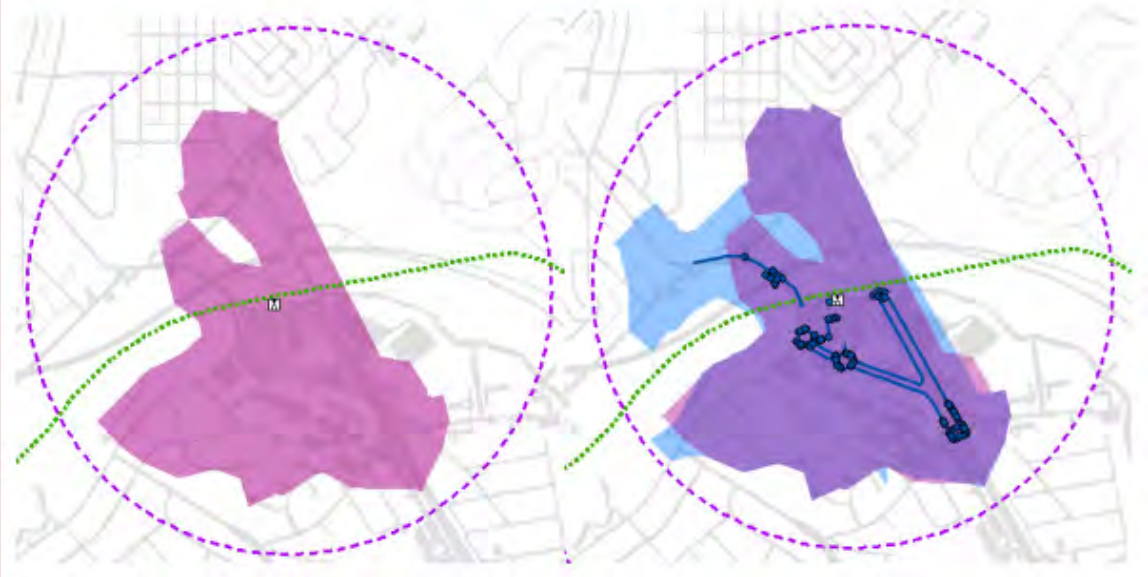
The Pickering Pedestrian Bridge is one of the longest enclosed pedestrian bridges on Earth (Image: Metrolinx)

GO Transit has recognized that many of its stations are in need of major active transportation improvements, which are outlined in the GO Rail Station Access Plan (2016). Recent station renovations have resulted in more pedestrian and cyclist-friendly access to GO Transit on a variety of scales. The Pickering GO Station Pedestrian Bridge is a 250-metre, fully-enclosed bridge that spans fourteen lanes of highway traffic and six railway tracks and cost an estimated $38 million. It allows easy access to destinations north of the station, as well as facilitating transfers to Durham Region Transit buses. The Pickering GO bridge adds an additional station entrance as it allows pedestrians to directly access the train platforms, rather than taking a circuitous route along busy

Washington D.C.

The Washington Metropolitan Area Transit Authority's (WMATA) Metrorail Station Investment Strategy (2016) provides a range of interventions to improve walking and cycling access to transit stations. The strategy estimated that accessibility improvements to Metro stations would lead to a 20% reduction in paratransit use. WMATA calculated that when accessibility improvements were combined with active transportation improvements, they provided nearly a two to one return on investment due to reduced paratransit use and increased ridership.

Figure 3: Walkshed Changes Resulting from a Proposed Project at Naylor Road



Calculating walksheds based on walking time, rather than a set distance, can help to identify barriers to accessing transit, as well as showing how new projects can improve active transportation access to transit facilities (Image: WMATA).

WMATA also calculated 0.5-mile (0.8 kilometre) walksheds around Metro stations based on distance traveled as a pedestrian, rather than simply drawing a "crow flies" circle around stations. This more nuanced approach allows planners to identify barriers to accessing transit and to show how individual projects can increase transit walksheds. Some Metro stations have incorporated numerous pedestrian improvements in their immediate environment. Waterfront Station features three crosswalks with curb bulb-outs in just a 65-metre stretch outside the station's main entrance.

C.2 - Bicycle Parking and Storage

Ensuring that cyclists have a safe place to park their bicycles while using transit is an essential component to supporting cycling to transit. Wang and Liu (2013) note that while data on the capacity of improved bike parking to increase transit ridership is limited, the available data suggests a considerable increase in rates of cycling to transit from 2001 to 2009 in the United States. This coincides with major expansion of bike parking and the introduction of other bike-friendly measures, such as the widespread adoption of bike racks on buses, by American transit agencies.

Bicycle parking at transit stations can take the form of bike racks, sheltered bike racks, bike cages, lockers bike or rooms/stations. All forms of bicycle parking have advantages and disadvantages, and different types can be mixed at transit facilities as is appropriate to the context.

Regardless of type, bicycle parking should be well maintained with regular tagging and removal of abandoned bicycles and adequate lighting to ensure safety. Parking should be conveniently located near station entrances or even within stations if space permits.

In contrast with the high cost of building automobile parking, even the most expensive bicycle parking is far cheaper. Recent parking structures at GO Stations in the GTHA have cost nearly $40,000 per space and a proposed park-n-ride garage in suburban Seattle is expected to cost an astounding US$118,000 per space. By contrast, a bicycle locker costs approximately $3,000 to install. Improving both the quality and quantity of bike parking can help improve transit ridership and the experiences of current cycle commuters.

Bicycle Parking Facility	Description
Bike Racks	Bike racks should support a bicycle at two points and interfere with racks and baskets as little as possible. The Association of Bicycle and Pedestrian Professionals' Essentials of Bike Parking (2015) provides a guide to types of bike racks, appropriate placement and identifies designs that should be avoided. Bike racks are the cheapest form of bike parking, but they are also the least secure.
Sheltered Bike Racks	Sheltered bike racks are groupings of bike racks covered by a roof, and are often enclosed on three sides. Sheltered bike racks protect bicycles from the elements to some extent, but do not add a level of security.
Bike Cages	Bike cages are free-standing bicycle parking facilities with numerous bike racks that are enclosed and require a key to access. They add an additional level of security over sheltered bike racks and protection from the elements.
Bike Lockers	Bike lockers hold a single-bike and are usually clustered together at transit facilities. Bike lockers require an annual or monthly membership, and while very secure, they are less spatially efficient and cost considerably more than other forms of bike parking.
Bike Rooms/Stations	Bike rooms are indoor facilities with numerous bike racks that can be located inside transit facilities and require a key card to access. Bike stations are similar to bike rooms, but include more amenities like showers, lockers and bike repair facilities, although the terms are sometimes used interchangeably. Some bike stations are staffed by attendents. TCAT's report Toronto Bike Stations and Lockers: Options for Non-Profit Operations (2018) provides an overview of different approaches to management of bike stations.

TTC and GO Transit Bicycle Parking

Many transit agencies in the GTHA have expanded bicycle parking facilities in recent years. Both the City of Toronto and GO Transit now have bike lockers at many transit stations and in March 2018, GO Transit announced a significant expansion of secure bike parking at both GO Bus and GO Train facilities. GO Transit plans to install 8 secure bike lockers at 15 park-and-ride lots, for a total of 120 lockers, and will construct 26 secure bike rooms at GO train stations by 2022.

In the City of Toronto, bike racks provide nearly 2,500 bicycle parking spaces at or near TTC subway stations, some of which are covered. The City of Toronto also provides of bicycle lockers at 5 subway stations and at 6 GO Transit stations within Toronto. Bike stations or rooms are now open at three TTC subway stations: Union Station, Victoria Park Station, and Finch West Station. Union Station's Bike Station has two rooms with a total 240 spaces, and features showers and a change room for commuters. The upcoming Eglinton Crosstown LRT line will include bike stations at four of its twenty-five stations when it opens in 2021.

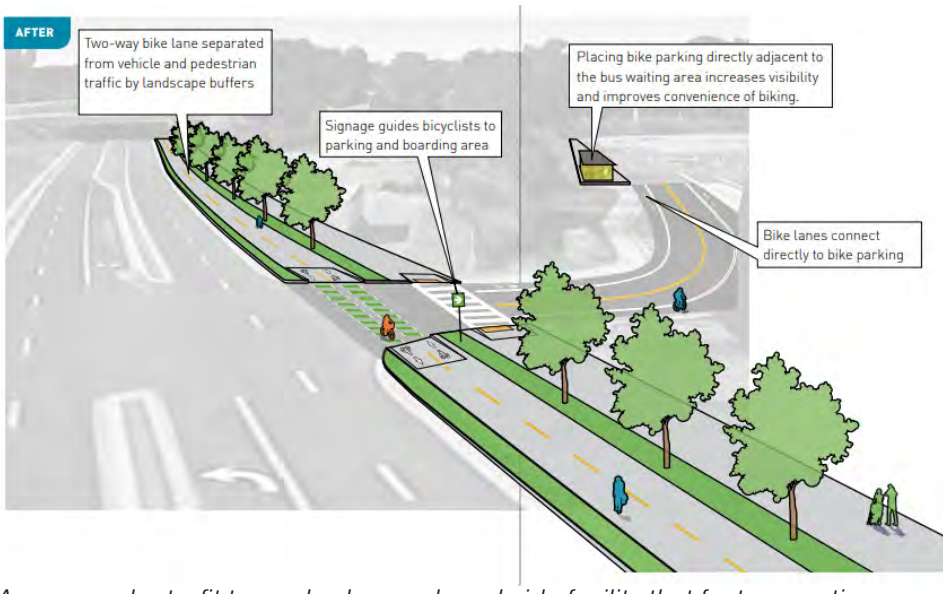
Bikestation

Bikestation is an American non-profit that has developed bike stations in five American cities. Its stations are all located in or immediately adjacent to major transit facilities. Its largest Bikestation is located at Washington D.C.'s Union Station and can hold 130 bikes in a 150 sq. m. (1,600 sq. ft.) facility, which is approximately the same footprint as 8 standard car parking spaces. The facility is staffed during busy hours and offers 24/7 access to members. It also provides basic bike repair facilities, bike rental and storage lockers.

The interior of Washington D.C.'s Bikestation at Union Station (Image: Transportation for America)

C.3 - Active Transportation-Friendly Parking Lots

Automobile parking lots can be found at many transit facilities, with suburban commuter rail services generally drawing the highest percentage of park-n-ride users. Having to cross large parking lots can present a major obstacle to people walking or biking to transit, and can also be hazardous for people walking to and from their vehicles. Existing parking lots can be retrofitted to provide safe cycling and walking routes from nearby streets, while new parking lots should be designed for active transportation from the outset.



A proposed retrofit to a suburban park-and-ride facility that features active transportation connections directly to boarding area, allowing people walking and cycling to avoid crossing parking lots (Image: Atlanta Regional Commission)

The Atlanta Regional Commission's Bike to Ride (2016) idea book contains a proposed design for cycling and walking-friendly parking lots. The document proposes that transit station parking lots should feature continuous pedestrian and cycling routes that lead directly to the station building and adjacent bike parking facilities. In comparison with the massive cost of building new parking structures, surface parking lots can be cheaply and quickly retrofitted to include pedestrian and cycling pathways.

Appleby GO Station

GO Transit is one of the largest parking providers in North America, with nearly 70,000 parking spaces. With electrification on some lines and service increases across its network, GO Transit anticipates a major increase in ridership and a shift towards access by sustainable transportation modes in the coming decades.

Appleby GO Station's parking lot is one example in the GTHA that includes marked bike lanes and painted sidewalks through the station's parking lots, on both the north and south sides of the Lakeshore West rail corridor. The parking lot's bike lanes currently link directly to on-street bike lanes on the south side of the station.

D. Stop Environment - Bus, streetcar and BRT-lite

Transit stops for local buses, streetcars and BRT-lite services can benefit from similar types of active transportation infrastructure improvements as transit stations, although generally at smaller scales. BRT-lite stops are often referred to as stations. As stops for these forms of public transit are usually located on sidewalks and accessed by foot, they should be treated as pedestrian infrastructure. A number of documents exist that can help guide transit agencies and municipalities to both devise plans to improve their transit stops and to provide examples of specific design features and amenities for improved transit stops:

- Transit Center's guide From Sorry to Superb: Everything You Need to Know about Great Bus Stops (2018) outlines a comprehensive framework for developing plans to improve transit stops for transit agencies and their municipal partners. The guide provides five lessons for transit agencies to improve their bus stops: to develop detailed inventories of their stops; to form stop guidelines and a plan to ensure all stops meet them; to establish a process for collaborating with municipal governments and other relevant parties for transit stop improvements; to increase funding on a long-term stable basis; and to use advertising to pay for bus stop improvements.

- NACTO's Transit Street Design Guide (2016) provides a wide-ranging and richly illustrated guide to designing streets around public transit, and promotes using transit improvements as opportunities to simultaneously reorient streets towards pedestrians, cyclists and transit users. The guide provides numerous examples of transit stop designs in a wide variety of streetscapes, and advocates that streets be designed to move people, rather than motor vehicles.

- As part of its Transit-Supportive Guidelines, the Ontario Ministry of Transportation (MTO) has developed a set of principles for the design and placement of transit stops. The MTO guide identifies transit stop improvement strategies in terms of location, waiting area design, user amenities and public art.

Overall, the major challenge to improving transit stops stems from their sheer number, with many transit agencies having thousands of stops. Due to the comparatively small-scale of transit stops, improvements can generally be carried out quickly and inexpensively.

D.1 - Stop Design

People waiting at transit stops benefit from a safe, accessible and comfortable pedestrian realm. Fan, Guthrie and Levinson (2015) showed that people waiting for transit generally experienced wait times that felt considerably longer than they actually were. Perceptions of wait time were particularly lengthened for women waiting for transit at stops that were perceived to be unsafe. However, real-time stop information, shelters, and benches were found to reduce the perception of waiting time for all users, and safety improvements to stops, such as improved lighting, considerably reduced the perception of waiting time for women.

Lagune-Reutler et al (2015) found that the perception of waiting times was considerably reduced by the presence of mature trees in the vicinity of the stop, to the point where many respondents underestimated their wait times in heavily treed areas.

At a minimum, bus and streetcar stops should include a shelter, seating, adequate lighting, sufficient level space for accessible boarding, a nearby crosswalk, route information and bicycle parking. Real-time information should also be provided at busier stops. Transit stop upgrades can contribute to ridership gains especially if combined with increased transit service, but they can also simply improve the experience and safety of existing transit users.

Brampton Zum

The recent introduction of bus rapid transit and BRT-lite services in suburban GTHA municipalities has led to considerable improvements to transit stop environments. Brampton Transit launched Zum, a bus rapid transit-lite service, in 2012, and it now has five lines with features such as branded stops, off-board fare payment, limited stops, and real-time information.

A Brampton Transit Zum stop with a large, covered waiting area, seating, and a heated area for the winter. Clear signage also makes navigation easy and obvious (Image: City of Brampton).

Zum stops are fully accessible and feature generous concrete boarding areas with a strip of red, textural material marking the end of the curb. Zum stops also feature heated waiting areas in the winter, a welcome amenity in cold climates. Many Zum stops also include bicycle parking. Zum's enhanced transit stop environment and steady, annual service increases have led to Brampton Transit having the highest rates of transit ridership growth in Canada for several years in a row.

D.2 - Stop Accessibility

Transit stops should be fully accessible to people using mobility devices. Accessible stops also benefit people using strollers or hand carts. While currently uncommon, level boarding at transit stops can improve accessibility and speed up boarding. Curb bulb-out boarding areas also create space for accessible boarding.

The National Aging and Disability Transportation Center's Toolkit for the Assessment of Bus Stop Accessibility and Safety (2016) outlines a process for designing accessible transit stops around principles of universal design, which advocates for creating spaces that are not simply accessible, but usable by everyone regardless of ability. The toolkit is based around three principles for transit stop design: barrier-free design, accessible wayfinding, and safety and warning. The toolkit provides a wide variety of examples and potential strategies for designing better bus stops. It includes an extensive checklist that can be used to analyze transit stop environments and to highlight potential improvements. The toolkit stresses the importance of regular maintenance to transit stops, in addition to capital improvements to improve facilities.

Hamilton Bus Stop Accessibility

The City of Hamilton's Transit Bus Stop Accessibility Criteria & Guidelines (2014) are a detailed example of municipal accessibility standards for transit stops. The guidelines include numerous best practices for designing accessible transit stops for both standard and articulated buses. It proposes that all bus stops feature concrete landing pads that run the length of the bus. This ensures that bus ramps have adequate space to deploy from the front entrance and that people using mobility devices have space to maneuver.

An example of a bus stop in Hamilton that lacks a boarding pad or sidewalk connections (Image: City of Hamilton).

The City of Hamilton proposed a city-wide bus stop accessibility audit in 2014, but it was not undertaken beyond an initial phase in the form of a photo essay that highlighted a number of bus stops that failed to meet accessibility guidelines. The photo documented accessibility problems at many Hamilton bus stops, such as slopes just past the bus ramp deployment area that wheelchair users could roll down and stops where ramps would deploy into obstacles like fences, benches and ditches. Uneven sidewalks can also prevent ramps from deploying, highlighting the importance of maintenance at transit stops. A lack of curb cuts and nearby crossings can render stops inaccessible, even if they feature an accessible boarding area.

E - Cycling and Transit Service Integration

Krizek and Stonebraker (2010) describe cycling and transit as an “unrealized marriage” that has the potential to significantly increase the catchment area of transit, especially for longer distance services. A number of measures have recently been undertaken in the GTHA to promote cycling to or from transit as a first/last mile solution, namely through improved bicycle parking facilities at stations and installing bikeshare stations at transit facilities. In recent years, it has become increasingly easy to take bikes on transit vehicles in the GTHA, although not necessarily during peak travel hours.

A small number of North American transit agencies, bikeshare systems and municipalities have adopted innovative programs to seamlessly integrate transit and cycling journeys, going beyond simply using cycling as a means of accessing transit.

Vulnerable road users and transit vehicles sharing the same road space can present a potential conflict that should be mitigated through education, infrastructure and programming.

This section looks at bikes on transit, bikeshare and transit integration, and transit as a means to cross physical barriers.

E. 1 - Bikes on Transit

Being able to take a bicycle onboard a transit vehicle is a cost-effective means of facilitating multi-modal journeys. Bicycle-transit integration can take many forms depending on the transit vehicle. At its simplest, it involves bringing a bicycle onboard a vehicle. Buses are usually equipped with front racks that hold one to three bicycles. Rail vehicles can have designated areas for bikes, or provide entire cars dedicated to bicycles. Many newer transit vehicles, such as the newest generation of Toronto streetcars, are equipped with a designated bicycle area. As part of its "Quick Wins" series of transit investments starting in 2008, Metrolinx provided funding to ensure all buses in the GTHA were equipped with front-mounted bike racks. Due to crowding, bicycles are not allowed on GO trains or inside TTC vehicles during peak hours, although folding bicycles are always permitted.

Data pertaining to the ridership impact of being able to take bicycles on transit is fairly scarce, but the existing literature suggests that allowing bikes on transit can both encourage ridership, and improve the experience of existing riders.

In a study of 10 Florida transit agencies, Datz (2005) reported that about 25% of bicycle on bus users were new to transit, and that 77% of users increased their transit usage due to bike racks on buses. Datz found that the service was heavily used by low income and racialized transit riders, who often rode further than 1.6 kilometres (1 mile) to access transit, but generally had far shorter journeys from transit to their destinations.

Datz's study indicated that if bus racks were full, bike-bus transit users were willing to lock up their bikes. This highlights one potential challenge with bicycle and transit integration in that it can become a victim of its own success, whereby too many users can overwhelm the bicycle capacity of transit vehicles. As such, it is important to provide secure bicycle parking at every transit facility so that transit users can safely and conveniently lock their bicycles before boarding transit.

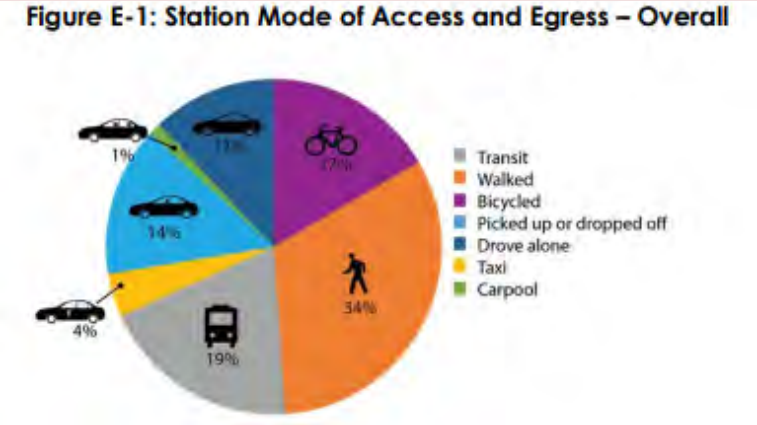
GO Transit - Bike Train to Niagara Falls

GO Transit, in partnership with the non-profit organization Transportation Options, operates the "Bike Train," a seasonal train service from Toronto's Union Station to Niagara Falls throughout the summer. The service allows users to transfer to the Niagara Region's WEGO express bus service, which is equipped with bike racks, without an additional fare to reach the nearby town of Niagara on the Lake. The trains feature a dedicated bike car that can hold up to 46 bikes, and there are more bike spaces in all other cars.

The service is intended to facilitate tourism, but with the planned expansion of service across the GO Train network, it could serve as a potential model for including dedicated bike cars more widely in the GO network. Ridership on the Bike Train service also increased by 46% from 2016 to 2017, indicating that easy bicycle and transit integration can contribute to significant ridership gains.

Caltrain

Caltrain, the commuter rail service serving the San Francisco peninsula and Silicon Valley, has one of the most successful bicycle and commuter rail integration programs in North America. All Caltrain trains are equipped with two or three bicycle cars with a lower level equipped with racks for up to 40 bicycles. Passengers are given tags to place on their bikes that indicate their destinations, which allows cyclists to sort their bicycles on racks to disembark with other riders at the same station. About 9% of Caltrain riders now bring their bikes onboard trains.



Caltrain carries a similar number of passengers as GO Transit's Lakeshore West Line, but rates of using active transportation to access Caltrain are over five times higher than GO Transit's figures. This highlights the need for programming and infrastructure to shift transit access modal share (Image: Caltrain).

Caltrain launched a "bikes board first" pilot program in early 2018 to speed up boardings, which has significantly reduced dwell times. Caltrain also tracks the number of riders who were unable to board due to crowding, and managed to reduce this number in 2018 while increasing the number of people who brought their bikes onboard by 6%. At some stations, nearly 35% of passengers use their bicycles to access Caltrain, and it is estimated that 17% of access and egress trips to Caltrain stations are made by bicycle.

E.2 - Bikeshare and Transit Integration

Bikeshare programs have been identified as a means of addressing first/last mile transit access, but research suggests they can also substitute for short transit journeys. In an analysis of Washington D.C.'s bikeshare system and its impact on transit ridership, Ma, Liu, and Erdogan (2015) found that six of the seven busiest bikeshare stations were located at Metro Stations, and the authors estimated that a 10% increase in bikeshare ridership would correspond to a 2.8% increase in transit use.

Shaheen and Martin (2015) propose that bikesharing and transit play different roles depending on the context. The authors found that bikesharing in dense, urban areas is used to both access transit, but also to replace short transit journeys. In a survey of bikeshare users in Montreal, Toronto, Minneapolis-St. Paul and Washington D.C., Shaheen and Martin found that they were 38% less likely to use the bus and 43% less likely to use rail transit, with majorities reporting no change in their transit use, although these figures varied widely both within and across cities. Bikeshare users in Minneapolis-St. Paul, with a fairly new LRT system, were far more likely to increase transit use than users in cities with older, more established transit systems. Suburban bikeshare users were far more likely to report increased transit use. These findings indicate that suburban bikeshare users widely use bikeshare to access transit, but are much less likely to use bikeshare to replace transit journeys.

This suggests that integrating bikeshare into new suburban transit projects from the outset can provide ridership benefits. Locating bikeshare stations at transit facilities benefits both modes by providing a wider range of mobility options.

Toronto Bikeshare

The GTHA is presently home to two bikeshare systems: Hamilton's SOBI and Toronto Bike Share. Toronto Bike Share has expanded its network considerably since launching in 2011, and now has stations located at or very close to many transit facilities.

Support for bikeshare network expansion has increasingly come from capital transit funding programs. A $4.9 million funding commitment from Metrolinx in 2015 allowed the network to almost double the number of stations in 2016, leading to a nearly 80% increase in ridership in 2017. For its 2018 expansion of 90 stations, Toronto Bike Share received $4 million from the federal government's Public Transit Infrastructure Fund and $4 million of matching funds from the City of Toronto. As an incentive, holders of Presto cards, the fare card for the GTHA, receive a 30% discount on their first year of Toronto Bike Share membership.

Kansas City, Pittsburgh and Milwaukee

While many cities in Canada and the United States have placed bikeshare stations at transit facilities, Kansas City, Pittsburgh, and Milwaukee have taken additional steps to integrate bikeshare and transit services. Holders of Pittsburgh's transit pass can take an unlimited number of free 15-minute journeys on Healthy Ride, the city's bikeshare system. Trips beyond 15 minutes are billed at US$2 per 30 minutes. Rides do not have to be integrated into a transit journey, but this approach encourages multi-modal transportation and can contribute to more equitable bike share access.

Starting in August 2018, monthly bus passes in Kansas City, Missouri now grant transit users full access to bikeshare memberships with unlimited 60-minute rides at no additional charge.

Milwaukee, Wisconsin has taken steps to integrate bikeshare into its transit system more formally. Nearly 80% of bikeshare stations are located at intersections that are also home to a transit stop. The transit agency's buses now announce both connecting transit routes and the presence of bikeshare stations. Milwaukee also introduced an integrated fare card that allows users to pay for both transit and bike share journeys, although unlike Pittsburgh and Kansas City, bike share membership requires an additional payment.

E. 3 - Using Transit to Cross Physical Barriers

Transit can be a useful means of overcoming physical barriers encountered by cyclists, but transferring from bike to transit almost invariably requires fare payment. Hamilton's Mountain Climber program is an innovative and unique program that allows cyclists to board buses for free at designated stops at the base or the top of the Niagara Escarpment, a steep ridge that runs through the city, and then disembark at the first stop after the Escarpment. Not only can Mountain Climber users bypass a steep obstacle, but they also avoid riding on busy arterial roads with no cycling infrastructure.

Hamilton Street Railway's Mountain Climber program is an innovative program that shows that transit can be used to facilitate cycling journeys that can be both exhausting and dangerous (Image: City of Hamilton).

Users of the service place their bikes on front-mounted bike racks, inform the transit operator they are using the Mountain Climber program and do not have to pay a fare. The program works for all bus lines that service each corridor. The program began with a pilot project in May 2017, which was made permanent in June 2018. An additional two routes were selected for a pilot project running from 2018 to 2019. It is estimated that each line will cost $2,100 in capital funding and $600 in lost transit revenue annually.

The Mountain Climber program is the only program of its kind in Canada, but its success could be replicated in other cities with major barriers, such as highway corridors, which are generally hostile environments for people cycling.

F -Mitigating Transit Vehicle and Vulnerable Road User Conflicts

Like other large vehicles with poor visibility, transit vehicles operating in mixed traffic can pose a danger to both pedestrians and cyclists. In the first two weeks of October 2018 in Toronto, two pedestrians were killed and one more seriously injured in collisions with streetcars. Streetcar tracks in mixed traffic on Toronto streets are a particular danger for cyclists. Tescke et al (2016) found that nearly a third of emergency room visits by Toronto cyclists over an 18-month period resulted from bicycle tires becoming stuck in streetcar tracks.

An analysis by the Toronto Star found that TTC buses and streetcars had been involved in 29 fatal collisions with pedestrians or cyclists from 2007 to 2017, with half of these involving a streetcar despite streetcars travelling less than a tenth of the distance of the TTC's bus fleet.

On November 20, 2018, a 57-year old woman was struck and killed by a bus just outside Lawrence West subway station in Toronto, the second pedestrian death at the same location in four years. Lawrence West Station is located on a busy arterial road in between highway onramps, highlighting the need to create a pedestrian-friendly environment near transit facilities.

SEPTA, Philadelphia's regional transit agency, conducted a study of bike-transit vehicle conflicts (2009) that concluded that street design changes were the most effective means of mitigating bike-transit conflicts, but that cyclist education and transit operator training could also help reduce conflicts. The study proposed establishing a yield hierarchy as a formal city policy whereby buses yield to bikes and bikes to pedestrians boarding transit.

A survey of bicycle-streetcar interactions (2008) proposed that physical separation is the best solution to mitigate bicycle and streetcar conflicts, but that in cases where this was impossible, separating streetcars and cyclists by time through advanced signals could be an effective solution. The survey also recommended road treatments that allow cyclists to cross streetcar tracks at angles as close to 90 degrees as possible.

Queens Quay Redesign, Toronto

The extensive makeover of Queens Quay along Toronto's downtown waterfront included many features that eliminate potential conflict points with transit vehicles and vulnerable road users. Queens Quay was profiled in TCAT's Complete Street Transformations in the Greater Golden Horseshoe Region (2016). The street now features wide sidewalks, a two-way cycle track, a two-way dedicated streetcar right-of-way, and two general traffic lanes with turning lanes at intersections. The new street configuration fully separates cyclists from transit vehicles and motor vehicle traffic, and it allows cyclists to cross streetcar tracks at 90 degrees.

A cross-section of Queens Quay showing how the redesigned street alots space to all users (Image: Waterfront Toronto).

The new street design is one of the only sites in the GTHA to feature side boarding islands for transit users. These allow cyclists to pass in between the sidewalk and the transit boarding area. The side boarding islands on Queens Quay also provide a much larger covered waiting area for pedestrians than commonly found at transit stops in Toronto. The redesign has been very successful in terms of encouraging cycling, with ridership up nearly 900% from 2007 to 2015.

NYC Transit - Vision Zero Bus Driver Training

New York City is home to one of the most successful Vision Zero road safety plans in North America. While vulnerable road user deaths have increased or remained stable in many Canadian and American cities, New York has experienced a 26% decline in road user deaths and a 42% decline in pedestrian deaths since implementing a comprehensive Vision Zero strategy in 2014.

New York City Transit runs the largest bus fleet in North America, and began instructing all its operators in road safety starting in 2015. The 12-hour course draws heavily on footage taken from bus-mounted cameras of collisions involving buses and pedestrians. The videos are analyzed by transit operators to determine what steps could have been taken to avoid a collision. From 2015 to 2018, the rate of collisions involving a bus declined by 9%, indicating that transit operators can play a significant role in making streets safer for all users.

4. Walking and Cycling to Transit Audits

A - Introduction

Conducting an audit of a walking or cycling route can be a valuable tool to improve safe access to public transit using active transportation. Audits walks and bike rides are intended to be complimentary to data-driven approaches, such as GIS mapping and transit facility inventories. The audits here are designed to highlight specific obstacles that people may encounter walking or cycling to transit.

Several transit agencies used undertaken qualitative site visits in the area surrounding transit facilities to inform their pedestrian and cycling planning, but audit tools that are designed to be used by riders are uncommon.

One noteworthy example is a partnership between San Francisco Transit Riders, a grassroots transit advocacy organization, and Walk San Francisco, a walking advocacy organization. Guided by the principle that "Transit trips are not just stop to stop, but door to door," San Francisco Transit Riders has undertaken walking audits along several bus routes, with a focus on routes in racialized and low-income communities.

The audits consist primarily of yes/no questions and provide some space for general observations. The audits drew a large number of senior citizens, who are disproportionately the victims of fatal road collisions. Planners and engineers from the San Francisco Municipal Transit Agency have accompanied the audit walks, which serves to initiate a dialogue between agency staff and transit users, and allows transit users to actively participate in shaping their communities.

The audit walks also looked at conditions at bus stops, with bus bulb-out stops being a particularly popular approach to increase the space available for transit boarding. The audits are primarily intended to highlight obstacles or deficiencies in street and transit facility design, such as dangerous crossings and the lack of information at bus stops. They do also highlight positive aspects, such as accurate real-time transit information and comfortable boarding areas. San Francisco Transit Riders' audits demonstrate a template to bring transit advocates, transit users and transit staff together as a means of improving pedestrian access to transit.

The form of the audits here differ from what San Francisco Transit Riders has employed, but they are designed to be used in a similar manner. The cycling and walking audits are designed to identify specific locations on routes to transit and at transit facilities that need active transportation infrastructure improvements. Audit walks and bike rides can play an important role in actively involving residents in the process of simultaneously improving cycling, walking and public transit in their communities.

B. Walking to Transit Audit

A walking audit can be a valuable tool to improve safe access to public transit by highlighting obstacles and challenges that people may encounter on their way to transit. Audit walks and bike rides can play an important role in actively involving residents in the process of simultaneously improving cycling, walking and public transit in their communities.

This walking audit is designed to identify specific locations on routes to transit and at transit facilities are unsafe, inaccessible, or simply inconvenient. By completing this audit, your feedback as a pedestrian and transit user can help inform potential active transportation improvements on the way to and at transit stops and stations.

Fill out this walking audit based on your observations during your walk to transit and at the stop or station. Is the route accessible for people of all ages and abilities? Are there curb cuts, tactile paving, and ramps? How is the lighting? Is there adequate seating at the stop or station? Are there any unsafe or unmarked crossings to get to the stop or station?

Once you've completed the audit section, please fill out the final page with your suggested improvements for making the route safer and more pleasant.

Thank you for taking the time to improve walking, cycling and public transportation in your community!

General Information

Route Description: _____

_____

Type of transit facility: _____

Origin: _____

Destination: _____

Day and Time: _____

Duration of walk to/from transit: _____

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On Your Walk to Transit

1. Are there major barriers (eg. highways, busy arterial roads, rail corridors) on your route? **Y / N**

Barrier: _____ **Location:** _____

Barrier: _____ **Location:** _____

Barrier: _____ **Location:** _____

2. Are there unmarked crossings on your route? **Y / N**

Location of unmarked crossing: _____

Location of unmarked crossing: _____

Location of unmarked crossing: _____

3. How far is the bus stop/station from the nearest safe crossing?

_____

4. Is there snow clearing in the winter? **Y / N**

5. What challenges in terms of lighting, accessiblity and wayfinding do you encounter on your way to transit?

Lighting

1. _____
2. _____
3. _____

Accessibility

1. _____
2. _____
3. _____

Wayfinding

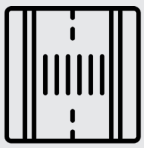
1. _____
2. _____
3. _____

At the Stop or Station

Stop/Station: _____

What challenges do you encounter at the stop/station in terms of crossings, acccessibility/barrier-free access, wayfinding in the station, shelter, seating, and travel information?

Crossings



1. _____
2. _____
3. _____

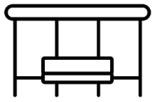
Accessibility

1. _____
2. _____
3. _____

Lighting

1. _____
2. _____
3. _____

Shelter



1. _____
2. _____
3. _____

Seating

1. _____
2. _____
3. _____

Travel Info

1. _____
2. _____
3. _____

Suggested Improvements

How could your walk to transit be improved?

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Rank your route

1	2	3	4	5
Poor				Excellent

How could the stop or station be improved?

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Rank your Stop/Station

1	2	3	4	5
Poor				Excellent

C. Cycling to Transit Audit

A cycling audit can be a valuable tool to improve safe access to public transit by highlighting obstacles and challenges that people may encounter on their way to transit. Cycling audits can play an important role in actively involving residents in improving cycling, walking and public transit in their communities.

This cycling audit is designed to identify specific locations on routes to transit and at transit facilities that are unsafe, inaccessible, or simply inconvenient. By completing this audit, your feedback can help inform potential active transportation improvements surrounding transit stops and stations.

Fill out this cycling audit based on your observations during your ride to transit and at the stop or station. Are there bike lanes, cycle tracks, or bike paths? Are there gaps in cycling infrastructure? Are there any unsafe or unmarked crossings to get to the stop or station? Is there secure and sheltered bike parking?

Once you've completed the audit section, please fill out the final page with your suggested improvements for making the route safer and more pleasant.

Thank you for taking the time to improve active and public transportation routes in your city!

General Information

Route Description: _____

_____

Type of transit facility: _____

Origin: _____

Destination: _____

Day and Time: _____

Duration of walk to/from transit: _____

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On Your Bike Ride to Transit

1. Are there bike lanes? Where are they? **Y / N**

Type of bike lane: _____ **Location:** _____

Type of bike lane: _____ **Location:** _____

Type of bike lane: _____ **Location:** _____

2. Are there gaps in cycling infrastructure? Where are they? **Y / N**

Gap: _____ **Location:** _____

Gap: _____ **Location:** _____

Gap: _____ **Location:** _____

3. Is there snow clearing in the winter? **Y / N / NA**

4. What challenges in terms of lighting, accessiblity/barrier-free access and wayfinding do you encounter on your bike ride to transit?

Lighting

1. _____
2. _____
3. _____

Accessibility

1. _____
2. _____
3. _____

Wayfinding

1. _____
2. _____
3. _____

5. When you arrive at the transit stop or station, is the bike parking easy to find? What type(s) of bike parking are present?

_____

_____

_____

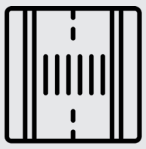
_____

At the Stop or Station

Stop/Station: _____

What challenges do you encounter at the stop/station in terms of crossings, bike parking, wayfinding in the station, lighting, shelter, and travel information?

Crossings



1. _____
2. _____
3. _____

Bike Parking

1. _____
2. _____
3. _____

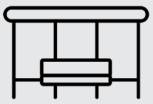
Wayfinding

1. _____
2. _____
3. _____

Lighting

1. _____
2. _____
3. _____

Shelter



1. _____
2. _____
3. _____

Travel Info

1. _____
2. _____
3. _____

Suggested Improvements

How could your bike ride to transit be improved?

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Rank your route

1	2	3	4	5
Poor				Excellent

How could the stop or station be improved to better accommodate cycling??

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

5. _____

_____

Rank your Stop/Station

1	2	3	4	5
Poor				Excellent

5. Conclusion

Conclusion

This guide highlights some of the most innovative policy and planning strategies, infrastructure, and programming that have been employed by transit agencies and planning organizations seeking to better coordinate and improve active transportation access to public transit. We outlined strategies and provided tangible guidance for how to prepare and implement dedicated plans that move beyond simply setting high-level goals. We hope it inspires municipalities and transit agencies to create better walking and cycling access to transit.

Improving active transportation and public transit integration can provide many benefits, ranging from increased ridership to safer streets, and it can generally be accomplished for far lower costs than other forms of infrastructure. Improving active transportation access to transit can also improve equitable access to transit for both low-income people and people with disabilities. While growing transit ridership is important, it is vital not to overlook simply improving conditions for current transit users, who may face dangerous conditions in their journeys to transit facilities.

Due to their scale, transit projects are capable of permanently transforming streetscapes and communities. Transit projects can easily become Complete Streets projects when active transportation infrastructure is treated as an integral element of new transit. This approach can both ensure that transit is easy to access by walking or cycling, and serve to create continuous corridors for cycling and walking.

While much of this guide has focused on "first/last mile" transit access, it has also provided examples of how public transit and active transportation can symbiotically support each other to make multi-modal journeys safe, convenient and intuitive. In particular, combining cycling and transit can make longer-distance journeys possible with sufficient planning and resources.

Ultimately, this guide is intended to serve as a prompt to shift transit planning towards including active transportation as an integral element of all transit infrastructure and operations. Canadian cities currently possess a strong foundation of growing public transit and active transportation use with many noteworthy examples of programming and infrastructure. However, they could benefit even further by developing policies and funding mechanisms to ensure that all transit facilities are easily and safely accessible by walking or cycling.

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