HAMILTON

COMPLETE STREETS DESIGN GUIDELINES

Hamilton wsp

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DISCLAIMER

The material presented in this Design Manual has been carefully researched and presented, and is based on latest available standards, guidelines and best practices. However, street design is highly context-sensitive. The guidance presented herein is intended to be flexible so it can be adapted to the context of local conditions. Practitioners should confirm that design treatments are appropriate to a given location, with consideration of relevant site-specific features. Street design is also an evolving practice. Practitioners should confirm that designs are consistent with current legislation, regulations and by-laws before implementation.

PHOTO CREDITS

Unless otherwise specified, all photos were provided by the City of Hamilton or by members of the WSP project team.

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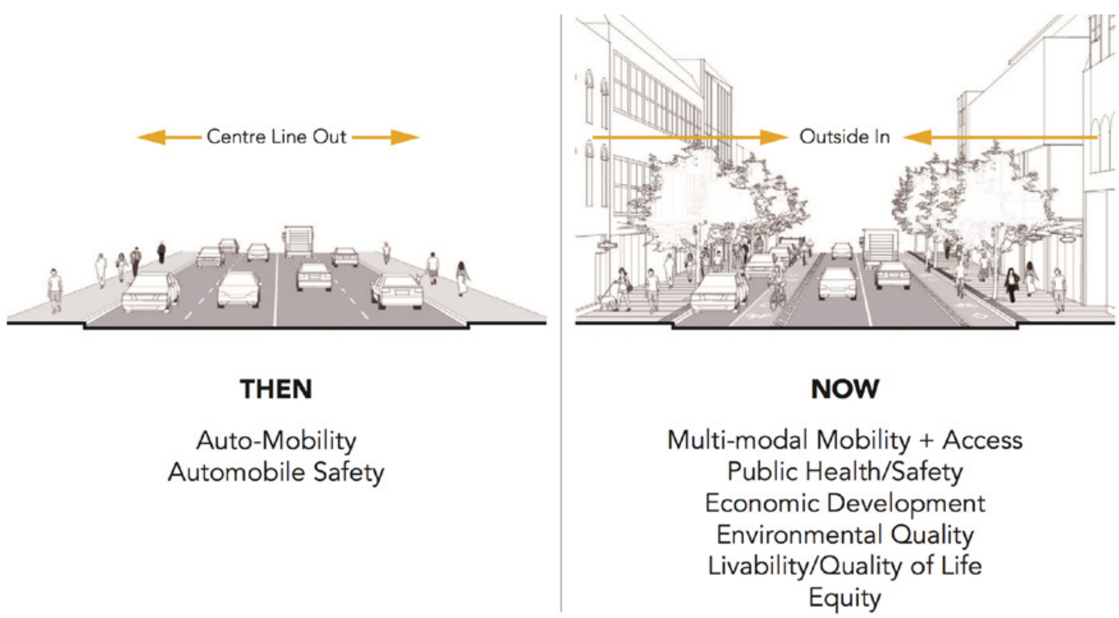
CHAPTER ONE

INTRODUCTION

1.1 WHAT ARE COMPLETE STREETS

Complete Streets are defined as roadways that are planned and designed to balance the needs of all road users. The goal of Complete Streets is to allow people to get around safely no matter their age, ability or how they choose to move. The Complete Streets concept is closely tied to the Safe Systems and Vision Zero approaches to road safety, which aim to design the transportation system to anticipate human error and accommodate human injury tolerance with the ultimate goal of eliminating death or serious injury on roadways.

The Complete Streets approach recognizes that there is no one-size-fits-all solution to street design, as different streets have different priorities, depending on the street's location, context, and role within the transportation system. In contrast to the traditional "centreline out" approach to road design, which is primarily focused on motor vehicle capacity, Complete Streets takes an "outside in" approach that equitably considers the needs of all road users and recognizes the importance of streets not only as conduits to move from one place to another, but also as public spaces and an integral component of the public realm.



Visualization of the "centreline out" and "outside in" approach to road design. Source: City of Toronto

1.1.1 EQUITABLE COMPLETE STREETS

A Complete Streets approach, when applied with a focus on equity, can help to improve the mobility, access and safety of communities who have been marginalized by previous urban infrastructure planning and design practices. Traditional automobile-centric approaches to street design perpetuate systemic inequities, prioritizing the mobility needs of those who have the means to own and operate a private automobile. A Complete Streets approach recognizes these modal inequities and aims to provide equal access for all road users.

However, an equitable Complete Streets approach requires more than simply applying Complete Streets design principles to every project in the same way. An equity-centric approach explicitly recognizes the historic ways that the benefits and harms associated with previous transportation decisions have accrued across space and time and takes defined action to rebalance how communities benefit from transportation investment. This approach recognizes that mobility has been unequally distributed depending on a person's race, gender, sexual orientation, age, income or ability, and creates policies and practices that seek to eliminate those structural barriers to mobility.

Automobile-centric street designs result in inequitable outcomes, placing those who do not have the means or the capacity to operate a private automobile at a significant disadvantage.

1.2 WHO IS THE MANUAL FOR?

This manual is a resource for everyone involved in the planning, design or maintenance of Hamilton's roadways, including local residents who support safer streets. Guidance for street design, intersection design, implementation, and general design components is covered in this manual to ensure users and practitioners are well equipped to understand and apply the principles of Complete Streets.

STANDALONE PROJECTS

- Development applications
- New sidewalks for other pedestrian links
- New bicycle infrastructure or facilities
- Roadway safety projects
- Streetscape improvements (e.g., trees, landscaping, street furniture, beautification, public art, wayfinding)
- Short-term or temporary interventions for evaluation

MAJOR STREET PROJECTS

- New Construction
- Reconstruction or revitalization, such as resurfacing
- Environmental Assessments for new and existing streets

MAINTENANCE AND OPERATIONS

- Signs, signal installations, lighting
- Utility cut repairs (where it affects a street segment)
- Various sized maintenance, operations, and emergency vehicles

PLANS & STUDIES

- Area Plans, Secondary Plans
- Transportation Master Plans, Transportation Management Plans, Road Safety Plans
- Rapid Transit Corridor Studies

Types of projects where Complete Streets design can be applied

1.3 OTHER GUIDELINES

These design guidelines should be used in conjunction with other design guidelines and standards including (but not limited to) the Ontario Traffic Manual, Forestry Guidelines, Urban Design Guidelines, Vision Zero Action Plan, Transit Stop Design Guidelines, and the City of Hamilton Comprehensive Development Guidelines.

The Complete Streets Design Manual is expected to be the go-to resource embedded in other documents. When there are conflicting policies or guidelines, they should be reviewed in tandem to find the most appropriate resolution.

1.4 SUPPORTIVE STRATEGIES AND POLICIES

An effective Complete Streets program requires policies that hold decision makers and practitioners accountable to investing and implementing these streets. While manuals and guidelines may outline processes, designs, and best practices for implementation, policies are what dictate when, how and where guidelines are applied. Policy is a planning tool which provides statutory and regulatory direction on where and how community elements are guided and implemented. Policies serve as mechanisms to enact planning direction and hold municipal staff accountable to regulatory promises established by their governing body. All municipalities are required to plan, adopt, and uphold policies ranging from topic-specific standards and guidelines to higher-order long-term visions.

Policies related to Complete Streets may be incorporated into high-level planning documents to help reinforce the importance of advancing the Complete Streets program in support of other planning objectives. The City's Transportation Master Plan, Cycling Master Plan, Truck Route Master Plan, Recreational Trails Master Plan, Pedestrian Mobility Plan, and several Street Master Plans are all examples of documents that may incorporate policies supportive of Complete Streets.

The Complete Streets Design Manual can play an important role in supporting the City's environmental plans and policies. These include Hamilton's Climate Change goal of net-zero greenhouse gas emissions by 2050 and climate change plans such as Hamilton's Community Climate Change Action Plan, Hamilton's Climate Emergency Declaration, the Draft Community Energy and Emissions Plan, and the Corporate Climate Change Task Force Corporate Goals and Areas of Focus for Climate Mitigation and Adaptation. Complete Streets can play a very important role of facilitating the design of streets that encourage people to make fewer trips by personal automobiles and that make active and sustainable modes of travel much more attractive.

When developing a design manual, it is important to understand how it must comply with existing policy and identify gaps that must be addressed by the design manual itself or by a new policy. Policy is an essential component of an effective Complete Streets program.

A street design manual does not typically serve as a standalone policy document but as a set of guidelines and best practices to operationalize the policy, related to design, implementation, and maintenance. It is therefore imperative that other planning documents and policies reference the Complete Streets Design Manual to necessitate its use in future roadway construction and reconstruction projects.

1.4.1 THE POLICY HIERARCHY

Complete Streets or Complete Streets policies have been referenced in the City of Hamilton's Urban and Rural Official Plans (OPs), and the Transportation Master Plan (TMP) Review and Update. The policies in the urban and rural OPs support the development of guidelines as implementation tools to meet the City's objectives. The TMP identifies the need for the development of a Complete Streets Design Manual and recommends policy changes to support the implementation of Complete Streets. The table below provides an overview of the relationship of the Complete Streets Design Manual with higher level policy guidance.

Examples of Hamilton's guiding planning documents

Complete Streets Design in the Policy Hierarchy

PROVINCIAL STATUTES	Provincial legislation such as the Highway Traffic Act that must be strictly upheld without deviation.
PROVINCIAL POLICIES	Provincial statutory documents such as the Provincial Policy Statement or the Growth Plan for the Greater Golden Horseshoe that outline implementable processes and actions that may be interpreted differently depending on context.
OFFICIAL PLANS	Municipal statutory documents that are required by the Provincial Planning Act and Policy Statement that outline how the City will use land, how it will allocate resources to its departments and services, and how it is planning for future growth.
TRANSPORTATION MASTER PLANS	Municipal statutory documents that reflect the objectives of the Official Plan and outline actions to implement the City's vision for transportation infrastructure and services. This includes the City-Wide Transportation Master Plan (TMP) and specific master plans such as the Ancaster TMP, Downtown TMP, Cycling Master Plan, or Truck Route Master Plan.
COMPLETE STREETS DESIGN MANUAL	A municipal document that reflects the City's street design, implementation, and maintenance objectives for Complete, Livable, Better Streets. The guidance included within this document will be flexible and may be interpreted differently depending on context.
OTHER DESIGN MANUALS AND GUIDELINES	Municipal documents that provide design guidance such as the Construction and Materials Specifications Manual, Traffic Signal and Pavement Marking Designs Drawings, Comprehensive Development Guidelines and Financial Policies, and other design guidelines and standards as identified by staff.

1.5 COMPLETE STREET DESIGN APPROACH

The following design approach is intended to establish consistent decision-making parameters that may be used across all elements of the streetscape. This approach will help guide the design process of Hamilton's future and current streets so that they may meet the Complete Streets objectives outlined in this manual.

Consider the street context. The streetscape should align with the context of the street: Where is it located? Who are the main users of this street? Is this street designed for access or movement? Design parameters for a residential local road should differ from those needed for a rural collector. As such, it is important to consider how features such as right-sizing the roadway for speed and volume, pedestrian amenities, cycling infrastructure types, and the connection between surrounding buildings and the street relate to a street's intended function and environment. Context sensitive street design ensures that a street is designed to maximize its potential as a part of Hamilton's overall transportation network.

A street in Hamilton with various multi-modal options.

Create attractive, vibrant places. Streets that attract and support pedestrians contribute to its sense of vibrancy, further encouraging future visits from residents and visitors alike. This directly relates to streets' function as points of access: streets facilitate a sense of place through people's interaction with the streetscape, appealing to people through an attractive environment built at the pedestrian scale. As such, for streets with a focus on pedestrian accommodation and movement, it is just as important to consider placemaking strategies as it is mobility and safety strategies. Doing so contributes to a healthy pedestrian realm while also supporting local economic activity.

Prioritize transit and active transportation. Crucial to sustainable mobility is the provision of transit and active transportation infrastructure. Not only does this encourage healthy and active living for Hamilton's residents, but this also aligns with Hamilton's goal to achieve net zero greenhouse gas emissions by 2050. Enhancing pedestrian and cyclist comfort along key routes helps demonstrate that these are accessible and safe options, contributing overall to fewer trips made by private vehicle. Ensuring a connective network of cycling and transit options enhances the convenience of these travel modes, further contributing to increased trips made with active modes of transportation.

Bike share options can provide opportunities for tourists or casual bike riders.

Provide safe and accessible options. To create Complete Streets that people want to use, it is important to design streets with the goal of improving safety and accessibility. This will differ depending on the specific road user in mind. Pedestrians, cyclists, transit users, and motorists must be fairly considered in the planning and design of each street classification and the associated services and utilities. While roads have historically been planned with motorists at the top of the hierarchy, Complete Streets aims to provide more consideration for pedestrians, cyclists, and transit users so that they may feel equally part of the roadway design, a vital component of Vision Zero goals. This contributes to the idea that streets do not just facilitate movement but also a sense of place. A sense of safety and ease of access contributes to a desire to casually walk and linger along certain streets, thereby contributing to a place's sense of vibrancy and attractiveness.

It is important to consider a variety of users and their levels of accessibility when designing for Complete Streets.

Account for equity. There are many effects of inequitable transportation investments, with the burden landing hardest on vulnerable members of the community including seniors, children, people with disabilities, communities of colour and low-income residents. In the past, transportation investments have prioritized the mobility of automobile owners, frequently through the construction of high-volume, high-speed roadways that travel through or adjacent to communities with a higher proportion of communities that have been marginalized. In theory, these investments provide equity of access. For example, the low-income community can use the road the same as the commuters driving through their neighbourhoods. Where they clearly fail, however, is in equity of outcome. Because low-income communities have a greater reliance on transit, walking and cycling due to the high costs to own, operate and maintain a vehicle, the high-speed road serves as a barrier to their mobility. The road, which prioritizes a mode of transportation that is less accessible to the residents of the community it intersects, brings more risk in the form of air pollution, noise pollution and elevated crash risk than it generates in benefits in the form of improved mobility.

The City of Hamilton should strive for Equity of Outcome when it is implementing this Manual, aiming to provide improved mobility for all users while also reducing the level of risk placed on communities, particularly those who have historically been at highest risk of the negative consequences of the current transportation system.

Prioritize connectivity. New Complete Streets should not be designed as standalone segments. Instead, keep in mind the role each street plays in the overall road network. By enhancing the City's overall network connectivity, this can increase utilization and encourage new active transportation users. To do so, consider emphasizing active transportation infrastructure along streets with many connections to neighbourhood amenities (retail, community spaces, green space). The effectiveness of Complete Streets infrastructure grows when coupled with the presence of destinations that are accessible within a fifteen minute walk or ride from residents.

Consider cost effectiveness. The design of Complete Streets should consider the environmental, social, and economic benefits and costs associated with their construction, operation and maintenance. Consider both the direct and indirect costs of such infrastructure. Designing streets for continued long-term use can reduce the number of costly retrofit projects needed in the future. Complete Streets design should be future-focused with resiliency built into the networks, materials, and travel modes they include.

1.6 FORMAT OF THIS MANUAL

The remainder of this manual is structured into the following chapters:

- **Chapter 2** outlines the process for planning, designing and implementing Complete Streets
- **Chapter 3** describes the major elements of complete streets, and provides design guidance on each of them
- **Chapter 4** outlines the eight street typologies that make-up Hamilton's Complete Streets Policy
- **Chapter 5** provides guidance on intersection treatment

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CHAPTER TWO

UNDERTAKING COMPLETE STREETS DESIGN

2.1 PROCESS OVERVIEW

Rethinking the City's streets from a Complete Streets lens requires a multi-stage process that spans from early planning and conceptualization stages to implementation and monitoring. The following five stage process outlines the key steps City staff should follow to incorporate Complete Streets elements into capital projects for new construction, reconstruction, and rehabilitation of the City's street network.

Process for Complete Street Planning and Design

	DEFINITION	GOAL	TOOLS
1. PLAN	• Identify and prioritize candidate projects. Begin preliminary project scoping.	• Project prioritization • Preliminary project scoping	• Complete Streets Audit Tool • Project Scope Tool
2. CONCEPTUALIZE	• Establish design priorities for the project, develop a vision for what the complete street design will look like, and engage with key internal and external stakeholders.	• Develop project scope. • Develop preliminary vision for the street including cross-sections and plan profiles. • Coordination between City divisions and agencies.	• Project Scope Tool • Chapter 3 • Chapter 4 • Chapter 5 • Checklist for Designers and Reviewers • Stakeholder Map • Complete Streets Audit Tool

	DEFINITION	GOAL	TOOLS
3. DESIGN	• Develop preliminary and detailed design of the complete street, balance trade-offs, priorities and stakeholder feedback while documenting the rationale for design decisions.	• Retain consultant, if applicable • Prepare 30%, 60%, 90%, and 100% design drawings. • Document rationale for design decisions.	• Project Scope Tool • Chapter 3 • Chapter 4 • Chapter 5 • Stakeholder Map • Desired Conditions Matrix • Street Element Decision-making Tool
4. IMPLEMENT	• Tender and construct the final complete street design and communicate with key stakeholders.	• Tender project • If applicable, build design.	• Construction management and administration plan.
5. MONITOR	• Evaluate the complete street's performance against project goals and document lessons learned for future projects.	• Monitor to optimize operations and maintenance. • Document and communicate lessons learned for future projects.	• Update the audit tool with lessons learned.

Roadway projects that are led by developers are subject to the four-stage Developer-Led review process, shown on the following page. These projects could include new public streets designed and built as part of a development, such as in a new subdivision, or could include augmentations to an existing public roadway, such as traffic calming to mitigate impacts from an in-fill project.

The process ensures that developers incorporate Complete Streets design principals in new development sites and subdivisions. The workflow for developer-led projects shown in the following table is intended to be integrated with the five-stage Complete Streets design process outlined earlier.

Open house engagement processes are an important step in the design process.

Draft Process for developer-led Complete Street Planning and Design projects

STAGE	GOALS	TOOLS
1. INITIAL PROPOSAL REPORT AND CONSULTATION	• Ensure that developer has incorporated Complete Streets design criteria in the initial proposal that reflect the goals of this design manual, the Rural or Urban Hamilton Official Plan, and any relevant Secondary Plans.	• Chapter 3 • Chapter 4 • Chapter 5 • Stakeholder Map • Street Classification Priorities Tool • Street Element Decision-making Tool
2. DRAFT APPROVAL	• Exceptions to ROW widths or design guidelines meet or exceed the requirements of this manual and the relevant Official Plan. • Ensure that the draft plan approval conditions include appropriate Complete Streets design criteria and guidelines.	• Checklist for Designers and Reviewers • Desired Conditions Matrix • Street Element Decision-making Tool
3. FOCUSED DESIGN STUDIES / CONSOLIDATED DRAWING REVIEW	• Ensure that applicable design studies and servicing plans include Complete Streets design criteria and guidelines.	• Chapter 3 • Chapter 4 • Chapter 5 • Stakeholder Map • Desired Conditions Matrix • Street Element Decision-making Tool
4. FINAL APPROVAL	• Application approved and advances to construction	• Stakeholder Map

2.2 PLANNING

Generally, street improvement projects can be initiated and prioritized through one of the following means:

- **State of good repair:** such as a planned street resurfacing or rehabilitation;
- **Performance improvement:** aimed at improving safety and road operations or upgrading existing streets such as introducing a two-way centre turn lane, improving active transportation and transit, or widening sidewalks; or
- **Greenfield development:** new street(s) constructed as part of a development.

These types of street improvement projects should be initiated with a Complete Streets lens. For example, improvements should be critically considered through multi-modal, Climate Emergency, and Vision Zero lenses, acknowledging that complete street design can help support mobility, safety, and sustainability objectives. For this reason, a vision and goal-setting exercise should be completed in the early stages of a Complete Streets project to clearly outline the City's desired outcomes for the corridor.

The following processes, tools, and strategies should also be considered at the project identification and prioritization phases. This coincides with Step 1 of the process outlined on pages 14-15.

2.2.1 NETWORK PLANNING

Network planning and gap identification involves analyzing the City's street network and identifying missing links in the pedestrian, cycling, transit, or freight networks. The City's Transportation Master Plan (TMP) and Cycling Master Plan Update (CMP), approved by City Council in 2018, were developed to guide future transportation-related studies and projects to address these gaps in the network for all modes.

2.2.2 SECONDARY PLANS

Secondary Plans are policy documents that are a part of the Official Plan and support the City-wide policies of the Official Plan by providing more detailed land use planning guidance for specific geographic areas. City staff should work to ensure that Complete Streets design principles are incorporated when Secondary Plans are developed or updated. Secondary Plans can provide policy support for area-specific TMPs and can be used to identify key planned Complete Streets improvements in policy.

2.2.3 SUBDIVISION AND SITE PLANS

Subdivision and site plans are typically part of development applications that City staff need to review and approve and are a key project input to the planning process. Since these types of plans will impact the street network for their corresponding areas, staff reviewing the plans should work to ensure that Complete Streets design principles are incorporated into the plans.

2.2.4 SETTING CORRIDOR VISION AND GOALS

A vision and set of goals for the identified corridor leveraging the existing and future planning and policy context and the Design Principles are laid out in Chapter 1. The goals should include desired outcomes for all modes and street elements.

They should also seek to engage public and private stakeholders early on to support the development of the project vision. This can help set the stage for ongoing proactive engagement throughout the project life cycle. Section 2.3.2 includes a list of common stakeholders that should be engaged for projects.

2.2.5 ENVIRONMENTAL ASSESSMENTS

The municipal Class Environment Assessment (EA) is a key tool for municipalities planning infrastructure projects such as road improvements. Municipal Class EAs ensure that governments and public organizations consider the potential environmental impacts of a project and plan mitigation strategies before the implementation.

The EA process typically aligns with the Conceptualization and Design phases of a project, while completed EAs can help staff identify and prioritize Complete Streets investments to inform the planning stage. This coincides with the steps of the process outlined on pages 14-15.

2.2.6 PLANNING FOR EQUITY

Transportation planning decisions have significant impacts on the quality of life of residents. They can impact access to housing, education and employment, determine who has access to green space and the outdoors, and define where externalities such as poor air quality are located. But these impacts are not felt equally across the spectrum of marginalization. An extra block driven by an able-bodied person in a car has much less impact than requiring a senior who uses a cane to walk an extra block to access a safe crossing. Equitable multimodal planning requires consideration of the impacts of design choices on people who have experienced marginalization and a proactive effort to remove barriers for those whose mobility is currently impeded. To accomplish this, designers should consult local demographic data to determine if there are higher concentrations of equity-deserving communities near the project, and should prioritize engagement with those communities as they are initiating the design project.

2.2.7 COORDINATION OF CAPITAL WORKS

The coordination of capital works is a critical step in the capital budget process that involves gathering information from different City divisions for various infrastructure projects. These projects provide opportunities to improve the streetscape and multi-modal performance. As such capital coordination will play a crucial role in coordinating the relevant internal stakeholders.

The key outputs of the process are asset renewal timelines that set the stage for when roads will be rehabilitated or reconstructed. These timelines will be key inputs in the planning and prioritization stage of the project.

2.2.8 PILOT PROJECTS

Many elements of Complete Streets can be tested and implemented as pilot projects with minimal civil work or construction. Pilot projects can be considered when a complete street redesign can be accommodated within the existing curb-to-curb space. Leveraging quick build materials such as paint, bollards, or planters to reconfigure the street would allow staff to test a Complete Streets design, collect data to monitor and evaluate performance, and collect stakeholder feedback to inform decision making for reconstruction projects.

The Danforth pilot project in Toronto proved successful in beautifying the street while also providing extensive active transportation infrastructure.

Pilot projects provide the public with an opportunity to interact with the street and have a tangible experience with the Complete Streets design and provide more informed feedback on the design. Pilot projects can provide the flexibility of improving the design iteratively based on monitoring and feedback.

2.2.9 TREND ANALYSIS

Monitoring trends involves collecting and tracking municipal data to identify and prioritize projects. Data such as collision data, traffic volume (AADT), transit ridership, and pedestrian and cycling activity can be used to determine high risk locations around the City for vulnerable road users that can be prioritized for Complete Streets improvements.

Data can also be used to evaluate the outcomes of a Complete Streets project. In the planning stage, practitioners should develop site-specific performance indicators to measure how the project meets the established vision and goals. Before implementation, baseline data for the relevant indicators should be collected to compare to post-installation data to evaluate the effects of the project.

2.2.10 AUDITING AND AUDIT TOOL

Auditing a corridor involves evaluating the “completeness” of specific street segments to help designers determine which Complete Streets elements should be prioritized. Input conditions for the audit can be based on public and stakeholder feedback, data analysis, or reviewing as-built designs. Auditing the candidate corridor will help guide the development of the project scope.

The Complete Streets Audit Tool evaluates and visualizes how the existing or proposed design of the street segment balances the Complete Streets elements. The tool is integrated with the Street Element Condition Definitions (**Section 2.2.10**) which defines a level of 1 (low) to 5 (high) for each street element based on the level of accommodation for that element. The corresponding Desired Conditions Matrix shows the target level for each street element by typology.

The Audit tool is an interactive tool that allows users to select the relevant typology, assess current or proposed street conditions for each street element and evaluate them based on the desired conditions for that typology. The steps to use the tool are outlined on the following pages.

1. **Input Data**: users provide information about the street being reviewed to inform the selection of the typology. Input data includes the street name, location, functional classification, land use context, right-of-way width, traffic volumes, posted speed limits, Potential for Safety Improvement (PSI) value, and whether the street is on the BLAST network.

STEP 1: INPUT DATA

Provide some information about the street you're reviewing. The functional classification and context are used to inform the Complete Streets Typology

Street name	Anywhere Street	Right-of-way width (m)	25
Location	Neighbourhood	Traffic volume (ADT)	4,000
Functional classification	Local	On BLAST network?	No
Context	Urban	PSI	2.38

2. **Select Typology:** based on the input data provided in Step 1, select the preferred typology for the street. Once the typology is selected, the tool will automatically populate the Desired Roadway Conditions for each Complete Street element for that typology.

STEP 2: SELECT TYPOLOGY

Select the preferred Complete Streets Typology, considering the information provided in Step 1. Suggested typologies are highlighted

Complete Streets Typologies
- Urban Avenue
- Transitioning Avenue
- Main Street
- Connector
- Industrial Street
- Neighbourhood Street
- Rural Road
- Rural Settlement Road

Neighbourhood streets provide direct access to residential areas. They accommodate safe and comfortable pedestrian and cycling movement, and are not intended to serve through traffic

3. **Assess Current/Proposed Street Conditions:** refer to the Street Element Condition Definitions below for definition of condition values for each street element and assign a score based on the current or potential future conditions.

STEP 3: ASSESS CURRENT / PROPOSED STREET CONDITIONS

Enter a value from 1 to 5 for each of the street elements, considering either current conditions or proposed conditions if evaluating a proposed Complete Streets design. Refer to the Condition Definitions for a description of each of the condition values.

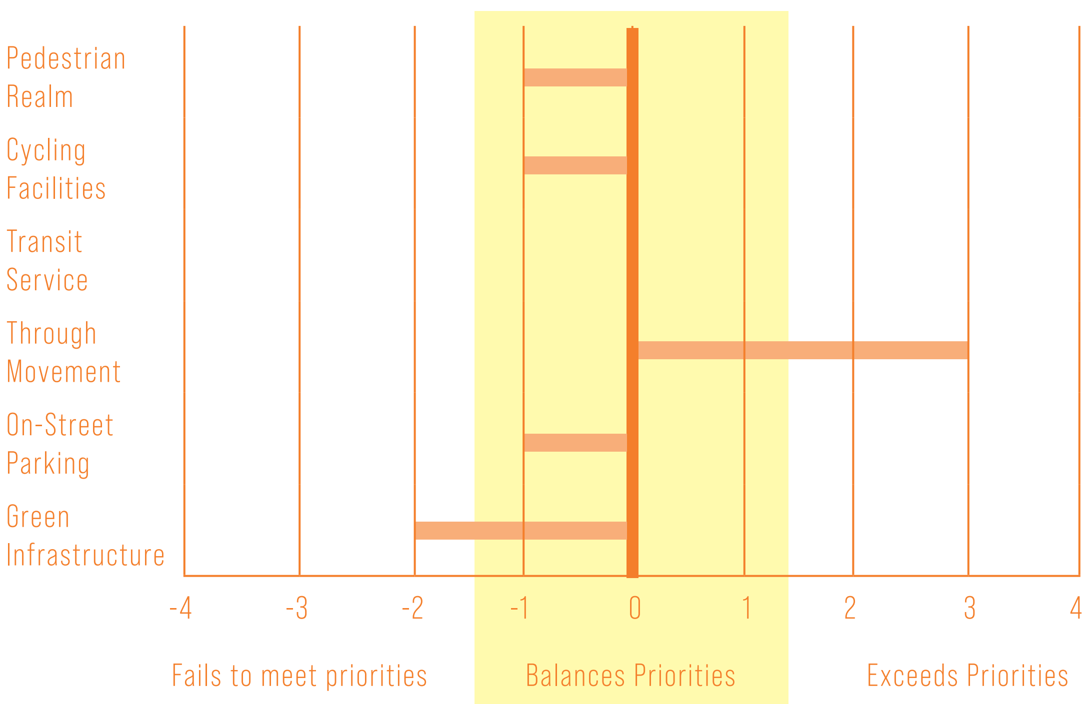
Pedestrian Realm	2	Through Movement	4
Cycling Facilities	1	On-Street Parking	2
Transit Services	1	Green Infrastructure	2

4. **Review Results:** once step 3 is completed; the table will automatically calculate the difference between desired and existing conditions. The bar graph visualizes where existing conditions exceed, meet, or fail to meet priorities for the specific typology. Priorities are considered balanced if all street elements fall within the shaded area. If some street elements exceed priorities, consider reallocating street space to improve conditions for elements that are failing to meet priorities. Return to Step 3 and adjust until a satisfactory result is achieved.

STEP 4: REVIEW RESULTS

Review the results shown below. Priorities are balanced if all street elements fall within the shaded area. If some street elements exceed priorities, consider reallocating street space to improve conditions for elements that are failing to meet priorities. Return to Step 3 and make adjustments until a satisfactory result is achieved.

	Pedestrian Realm	Cycling Facilities	Transit Service	Through Movement	On-Street Parking	Green Infrastructure
Desired Condition for CLB Typology	3	2	1	1	3	4
Current / Proposed Condition	2	1	1	4	2	2
Exceeds / Fails to Meet Priorities	-1	-1	0	3	-1	-2



This diagram demonstrates the effectiveness of various street elements in meeting conditions for Complete Streets as set out by this manual.

2.2.11 STREET ELEMENT CONDITION DEFINITIONS

The Street Element Condition Definitions below are used to describe the relevant desired conditions per typology and to audit an existing street. Ratings for each element are graded from 1 to 5. The rating reflects the level of accommodation or level of service for that street element.

Pedestrian Realm

	URBAN	RURAL
1	• **No sidewalk or multi-use path (MUP)***	• Possible granular/soft shoulder
2	• **1.5 m pedestrian clearway** (may be adjacent to curb)	• **1.2 m paved shoulder**
3	• **1.8 m pedestrian clearway** with **0.5 m edge zone** (measured from back of curb) *or* • 3.0 m MUP with 0.6 m edge zone • Street trees/furnishing zone if feasible	• **1.5 m paved shoulder**
4	• **2.0 m pedestrian clearway** with **1.0 m edge zone** *or* • 3.5 m MUP with 1.5 m edge zone • Street trees and pedestrian amenities in planting/furnishing zone	• **3.0 m MUP, physically separated** from travelled portion of roadway
5	• **2.5 m pedestrian clearway** with • **1.0 m edge zone** • Animated pedestrian corridor with street trees, pedestrian amenities, active street frontages and public art	• **3.0 m MUP, beyond clear zone** of road

** Also known as a multi-use trail (MUT)*

Cycling Facilities

	URBAN	RURAL
1	• **No cycling facilities,** sub-standard facilities, or facilities that are not contextually appropriate (based on Book 18 nomograph)	• Possible granular/soft shoulder
2	• **Shared operations,** preferably on roadway with no marked centreline. • Posted speed: Max 40 km/h (30 km/h preferred) • Volume: Max 3,000 ADT (<1,500 ADT preferred)	• **1.2 m paved shoulder**
3	• **Bike lane,** buffered bike lane, or advisory bike lane, in conditions supported by Book 18 nomograph; *or* • **Separated bike lane,** cycle track, or MUP, minimum **1.5 m** (one way)**,** **3.0 m** (two way). Separation may be semi-permeable (e.g. flex bollards or mountable curb)	• **1.5 m paved shoulder** *or* • Advisory bike lane
4	• Separated bike lane, cycle track, or MUP, minimum **1.8 m** (one way), **3.5 m** (two way) • Separation elements are non-permeable (e.g. barrier curb, low-wall concrete barrier) • Minimum **0.6 m** buffer or edge zone	• **Buffered paved shoulder** *or* • **3.0 m MUP, physically separated** from travelled portion of roadway
5	• Cycle track or MUP, minimum **2.0 m** (one way), **4.0 m** (two way) • Minimum **1.5 m** edge zone (may be reduced to 1.0 m for one-way cycle tracks on 40-50 km/h roads)	• **3.0 m MUP, beyond clear zone** of road

Transit Service

1	• **No transit service** or transit service where stop has no hard surface pad
2	• Local transit service. • Some stops have **hard surface pad** allowing passenger boarding/ alighting from all doors
3	• Frequent local transit service. • Most stops have **hard surface pads, shelters and basic amenities**
4	• Frequent local service or limited stop express service with significant **transit priority elements** (e.g. queue jump lanes, transit signal priority) • Most stops have **enhanced amenities** (e.g. interior heating, real-time arrival information, fare vending machines)
5	• Rapid transit service with **dedicated transit lanes** and comprehensive priority measures • Most stops have **enhanced amenities** consistent with category 4

Through Movement (Vehicles and Freight)

	URBAN	RURAL
1	• Design treatments promote slow speeds and divert through traffic. • No marked centreline. • Drivers may need to alternate directions, yielding to oncoming traffic.	• **Less than 6.0 m pavement** • No paved shoulder
2	• Maximum **one lane per direction**, two lanes total (mid-block). • Centreline may or may not be marked. • No continuous centre turn lane. May include auxiliary turn lane at intersections.	• 6.0 to 7.0 m pavement • Centreline may or may not be marked • **No paved shoulder**
3	• Maximum one lane per direction, three lanes total (mid-block). • May include **continuous centre turn lane**. May include auxiliary turn lanes at intersections. • Total mid-block lane width < 10 m (excluding bike lanes and dedicated parking lanes).	• Two lane roadway with marked centreline • Minimum **1.0 m paved shoulders**
4	• **Maximum two lanes per direction**, four or five lanes total (mid-block). • May include centre median or continuous centre turn lane. May include auxiliary turn lanes at intersections. • Total mid-block lane width **< 16 m**.	• Two lane roadway with marked centreline • Minimum **1.5 m paved shoulders**
5	• **More than two lanes per direction** or more than five lanes total. *or* • Two or more left turn lanes at intersections. • Total mid-block lane width **>= 16 m**	• Three or more lane roadway

On-Street Parking

1	• **On-street parking is not provided**
2	• Permanent or **off-peak** parking if there is sufficient space in the ROW and demand cannot be met with off-street supply. • Parking may be provided in **specific locations** only (where needed, or where curbside space is available), and **may not be provided on every block.** Parking may be on one or both sides of the street.
3	• Permanent or **off-peak** parking is provided. • Parking is **provided on most blocks** along the majority of the curb on one or both sides of the street.
4	• **Permanent parking on one side** of the street in dedicated parking lane, typically with curb bulb-outs at intersections and crossings. • Passenger drop-off, freight loading, and accessible parking where required
5	• **Permanent parking on both sides** of the street in dedicated parking lane with curb bulb-outs at intersections and crossings. • Passenger drop-off, freight loading, and accessible parking where required.

Green Infrastructure

1	• Street trees and stormwater management practices are not actively provided. • Tree canopy fails to meet coverage guideline. • Planting arrangement has substandard soil volumes and planting configuration
2	• Tree canopy at maturity meets coverage guideline in some locations. • Design incorporates low impact development features where possible.
3	• Tree canopy at maturity meets coverage guideline in most locations. • Species diversity is achieved. • Design incorporates low impact development features where possible
4	• Tree canopy at maturity exceeds coverage guideline. • Species diversity is achieved. • Design incorporates low impact development features
5	• Tree canopy at maturity exceeds coverage guideline • Sustainability, resilience and ecological principles are primary themes of the design. • Low impact development features incorporated in a comprehensive manner

Note: refer to any tree canopy coverage requirements during any street audits

2.2.12 DESIRED CONDITIONS MATRIX

The following matrix can be used to determine the desired conditions for each street typology. This uses a scale of 1-5, with 1 being the least and 5 being the most desired condition.

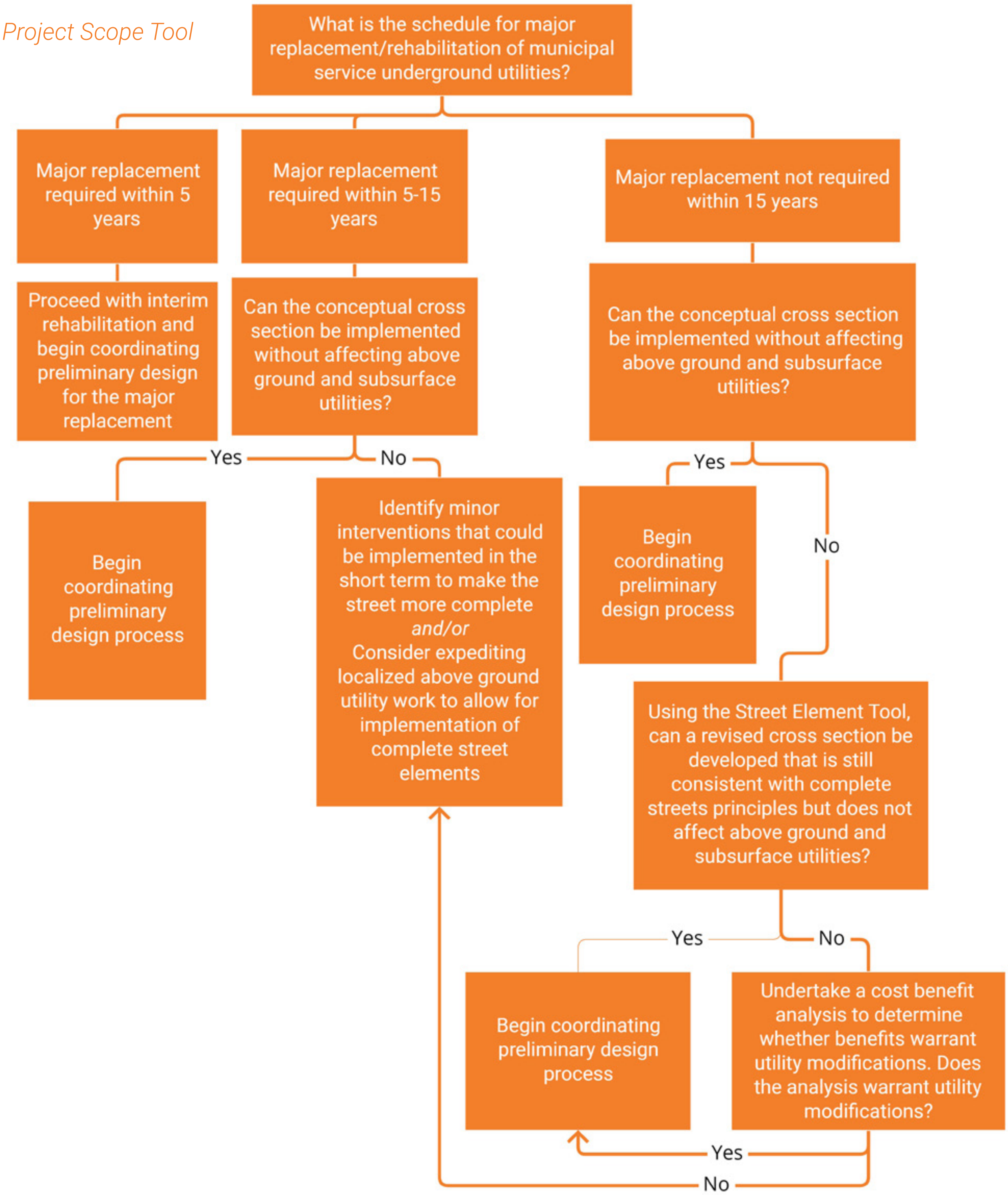
	Pedestrian Realm	Cycling Facilities	Transit Service	Transit Service (on BLAST network)	Through Movement	On-Street Parking	Green Infrastructure
Urban Avenue	4	4	4	5	3	2	3
Transitioning Avenue	5	5	4	5	4	1	3
Main Street	4	4	3	4	2	4	4
Connector	4	4	3	3	2	2	4
Industrial Street	4	4	3	3	3	1	2
Neighbourhood Street	3	2	1	1	1	3	4
Rural Road	1	4	1	3	4	1	2
Rural Settlement Road	4	3	2	3	3	3	3

2.2.13 PROJECT SCOPE TOOL

The Project Scope Tool flowchart, shown on the following page, is designed to help staff determine the appropriate project scale for a specific roadway or corridor. The key parameter of the Project Scope Tool is the schedule for major replacement of utilities and municipal services as these generally have the greatest impact on the scope of a road reconstruction project.

This tool is intended to be used for the initial planning stages of a Complete Streets project. As the project moves from planning to conceptualization and practitioners uncover more details on potential utility impacts of the project, this tool should be revisited to ensure the project is appropriately scoped.

Project Scope Tool



2.3 CONCEPTUALIZATION

Following the selection of a corridor for Complete Streets improvements, practitioners should begin to develop the conceptual design for the street. The cross sections for the relevant street typology in Chapter 4 and the corresponding intersection treatments outlined in Chapter 5 can serve as a starting point for the conceptual design. The concept should then be refined based on core design considerations such as the accommodation of user groups and services, adjacent land uses, network considerations, and relevant user considerations (e.g., cost, land requirements). The Checklist for Designers and Reviews shown below is a tool to help project managers and designers keep track of the key steps and considerations while adjusting the conceptual design for the street.

Checklist for Designers and Reviewers

1	SELECT CORRESPONDING CROSS SECTION FROM CHAPTER 4
Review design elements and target dimensions for the relevant typology and advance to step 2.	

2	SELECT CORRESPONDING INTERSECTION DESIGN EXAMPLES FROM CHAPTER 5
Review design principles and features that should be incorporated at intersections along the corridor and advance to step 3.	

3 REVIEW DESIGN CONSIDERATIONS FOR EACH STREET ELEMENT

Accommodation of the elements below are key design considerations.

- If the answer is no to any of the questions below, the project lead should provide a rationale for why the variance is being proposed and how the proposed concept design will be consistent with Complete Streets principles.
- If yes, advance to the next element in this section.

Pedestrian Realm and Placemaking

Are the pedestrian elements contained in the corresponding Chapter 4 cross section incorporated into the proposed concept design? Do they have similar size/width, distribution along the corridor, and positioning as the elements in the cross section?

Cycling Facilities
Are the cycling and multi-use facility elements contained in the corresponding Chapter 4 cross section incorporated into the proposed concept design? Do they have similar size/width, distribution along the corridor, and positioning as the elements in the cross section?

Transit Facilities
Are the transit supportive elements contained in the corresponding Chapter 4 cross section incorporated into the proposed concept design? Do they have similar size/width, distribution along the corridor, and positioning as the elements in the cross section?

Motor Vehicles
Are the motor vehicle supportive elements contained in the corresponding Chapter 4 cross section incorporated into the proposed concept design? Do they have similar size/width, distribution along the corridor, and positioning as the elements in the cross section?

Green Infrastructure
Are the green infrastructure elements contained in the corresponding Chapter 4 cross section incorporated into the proposed concept design? Do they have similar size/width, distribution along the corridor, and positioning as the elements in the cross section? Do they meet applicable guidelines in terms of soil volume and lateral placement?

Utilities and Municipal Services
Are the utilities and municipal services contained in the corresponding Chapter 4 cross section incorporated into the proposed concept design? Do they have similar depth, configuration, and positioning as the elements in the cross section and do they meet the City's guidelines?

The rationale for any no responses to the questions above should be evaluated with a combination of professional judgment and engagement with relevant stakeholders to determine if the proposed variance is acceptable. For example, if proposed planting zones have narrower widths than target values in the guideline, a Parks and Forestry representative should be consulted to determine if the soil volumes would be adequate and that the variance is acceptable in this case.

Note: Designers should review the existing conditions of the roadway. If the existing lane widths are narrower than what is prescribed in the Chapter 4 cross section and there are no traffic operations issues, consider maintaining the existing lane widths and adjusting other elements in the cross section accordingly.

4 REVIEW AND REVISE THE CONCEPTUAL CROSS SECTION BASED ON LAND USE CONSIDERATIONS

Area Specific Policies and Plans
Are there any place type provisions or Secondary Plans that would affect the design of the corridor?

☐ If yes, determine whether any modifications are appropriate based on the provisions and document the rationale for any changes.

Utilities and Municipal Services
Are any of the utilities along the corridor scheduled for replacement or construction?

☐ If yes, update inputs in the Project Scope Tool and explore opportunities to align project scopes, design parameters, and construction phasing.

Urban Design Guidelines and Streetscape Master Plans
Are there any area-specific Urban Design Guidelines or Streetscape Master Plans that may influence the design (e.g. Bayfront Industrial Area, Dundas)? Refer to the City-Wide Urban Design Guidelines and its support appendices.

☐ If yes, determine whether any modifications are appropriate based on the provisions and document the rationale for any changes.

Heritage Conservation Districts (HCDs) or Special Character Road
Are any segments of the corridor located within an HCD or been identified as a Special Character Road ?

☐ If yes, ensure a heritage planner is engaged as a stakeholder for the project and determine if any streetscaping or right-of-way related HCD or Special Character Roads policies apply.

Community Improvement Plans (CIPs)
Are any segments of the corridor located within a CIP area?

☐ If yes, ensure the appropriate contacts are involved as stakeholders. Determine if any streetscaping or right-of-way related CIP policies apply.

Conservation Authority (CA)
Are any segments of the corridor located within a Conservation Authority's regulated area?

☐ If yes, ensure the appropriate CA representative is engaged as a stakeholder and determine if any relevant watercourse or natural resource area protection policies apply.

Indigenous Communities
Are there First Nations, Métis and/or Inuit communities that have treaty rights in the project area, or whose lands will be affected?

☐ If yes, contact relevant First Nations, Métis, and/or Inuit representatives to ask about their preferences for engagement, and engage them as project partners and rightsholders.

Rail Authorities
Do any segments of the corridor intersect with railway facilities?

☐ If yes, consult with the relevant railway authority to determine if there are existing regulations or future plans that could influence design considerations.

Future Development
Is development activity anticipated along the corridor?

☐ If yes, consult with the appropriate land use planner to identify parcels with existing or expected development applications, consult with key landowners, and analyze future needs and travel patterns along the corridor.

5 REVIEW AND REVISE THE CONCEPTUAL CROSS SECTION BASED ON NETWORK CONSIDERATIONS

Cycling and Pedestrian Network
Are any segments of the corridor aligned with the planned cycling network outlined in the City's Cycling Master Plan, Recreational Trails Master Plan or major active transportation corridor?

☐ If yes, prioritize comfortable cycling facilities and associated amenities such as bicycle parking and intersection treatments, and connections to trails or major active transportation corridors.

Transit Network
Are any planned or existing transit routes or emergency transit detour routes aligned to any segment of the corridor? Whether or not the corridor is part of a current transit route, consider appropriate accommodations for Accessible Transportation Services (ATS), increased ridesharing activity, or other emerging technologies.

☐ If yes, coordinate with relevant transit agencies to review existing and forecasted routing and ridership, and provide rider amenities and transit priority treatments as appropriate. Ensure roadway geometry accommodates transit vehicles.

Freight/Truck Route Network
Are any segments of the corridor aligned with truck route network outlined in the City's Truck Route Network?

☐ If yes, review roadway geometry parameters to ensure that trucks are appropriately accommodated along the corridor.

Wildlife Corridors
Do any segments of the corridor abut or intersect with known wildlife corridors?

☐ If yes, review corridor to determine potential wildlife crossing locations.

Operational and Traffic Calming Issues
Are there known issues regarding motorist behaviour or road operations along any segments of the corridor?

☐ If yes, determine if appropriate geometric changes and / or traffic calming measures can be incorporated into the design.

6 REVIEW AND REVISE THE CONCEPTUAL CROSS SECTION BASED ON USER CONSIDERATIONS

Complete Streets should be designed to accommodate all users. However, in areas where specific users groups are anticipated to be more prevalent, it may be appropriate to adjust the design to support the user group, such as widening sidewalks near medical facilities or incorporating traffic calming measures near schools. If the groups listed below are prevalent along the corridor, they should influence the project's design considerations.

Children (i.e. proximity to a school)
☐ If yes, consider providing wider sidewalks, designated pick-up and drop-off areas, traffic calming, and in-boulevard cycling facilities.

Post-secondary students
☐ If yes, consider providing wider sidewalks, providing high capacity cycling facilities, and increasing transit priority in proximity to post-secondary institutions and student housing.

Individuals with disabilities and age-friendly considerations
☐ If yes, provide wider sidewalks, frequent seating opportunities and shaded areas, and well-designed accessible transit drop-off areas near seniors' residences, hospitals, and related facilities.

Underserved communities and equity considerations
☐ If yes, prioritize safe and comfortable links to common social, employment, and civic destinations used by low income and vulnerable communities.

Businesses without off-street parking or laneways
☐ If yes, consider providing loading zones to facilitate deliveries and pick-ups for local businesses.

2.3.2 ENGAGEMENT AND COLLABORATION

Designing streets through a Complete Streets lens requires integrating different street elements that are the responsibility of various divisions and agencies at the City. For example, adding street trees to a corridor will require consideration of utility placement, clearances from adjacent travel lanes, cycle tracks, or sidewalks, and maintaining sight lines for motorist and cyclist safety. As the design concept is being developed, staff should engage relevant stakeholders to gain an understanding of stakeholder needs, processes, availability of resources, and asset conditions. Building off the vision and goal setting from the Planning stage, practitioners should engage the public during this phase to get input on design priorities and to identify and document usage patterns and local issues.

The Stakeholder List below outlines key municipal and agency partners, and private and public stakeholders that should be involved early and continuously throughout the process. Staff should establish primary and secondary stakeholders and develop a consultation plan to address each stakeholder's needs through the duration of the project. The International Association for Public Participation's (IAP2) spectrum of public participation and the city's Public Engagement Charter should be applied to determine the appropriate approach for each stakeholder group. This list is not exhaustive; there may be other stakeholder groups that should be consulted depending on the location and context.

Engagement event in Brampton.

Stakeholder List

Internal Stakeholders

Hamilton Public Works
- ◊ Transportation Operations and Maintenance
- ◊ Engineering Services
- ◊ Infrastructure Planning
- ◊ Landscape Architecture
- ◊ Forestry and Horticulture
- ◊ Hamilton Water
- ◊ Transit (HSR & ATS)

Planning & Economic Development
- ◊ Transportation Planning and Parking
- ◊ Growth Management
- ◊ Placemaking, Public Art and Projects
- ◊ Heritage and Urban Design
- ◊ Sustainable Communities Section

Healthy and Safe Communities Departments
- ◊ Public Health Services - Healthy Environments Division
- ◊ Hamilton Fire Department, Emergency Management

Other Governing Authorities

Ontario Provincial Government
- ◊ Ministry of Transportation (MTO)
- ◊ Ministry of Infrastructure
- ◊ Ministry of Municipal Affairs and Hoursing (MMAH)

Adjacent Municipalities

Adjacent Indigenous Nations

External Stakeholders

Utilities and Railways
- ◊ Bell
- ◊ Rogers
- ◊ Telus
- ◊ Cogeco
- ◊ MTS Allstream
- ◊ Hydro One
- ◊ Alectra
- ◊ Hamilton Community Energy
- ◊ Metrolinx
- ◊ CN
- ◊ CP

Organizations and Advisory Committees of Council
- ◊ Urban Indigenous Organizations
- ◊ Cycling and Environmental Organizations
- ◊ Municipal Advisory Committees (e.g. Cycling Advisory Committee, Advisory Committee for Persons with Disabilities, Seniors Advisory Committee)
- ◊ Hamilton Bike Share
- ◊ Environmental and Social Justice Organizations
- ◊ Conservation Authorities
- ◊ Mobility Lab

Community Associations and Councils

Business Improvement Areas Chambers of Commerce

Education
- ◊ Local school boards and schools
- ◊ Post-secondary institutions
- ◊ School Travel Planning teams

2.4 DESIGNING

Following the planning and conceptualization phase, the design concept is refined further by balancing the priorities outlined in the previous phases with physical and budgetary constraints, public feedback, and other context-sensitive considerations. Collaboration among City divisions and other key stakeholders is crucial at this phase to make and document trade-offs to ensure that the designs are feasible and meet relevant technical standards.

2.4.1 DESIGN PHASES

The design process is typically split into two phases:

- **Preliminary design**: outcomes include the project scope, a preferred cross section and 30% design drawings, preliminary construction cost estimates, and documented design rationale.
- **Detailed design**: outcomes include a tender package with 100% drawings, specifications, and the final construction cost estimate.

2.4.2 PROJECT LEVELS

Projects are typically classified as one of the following three levels:

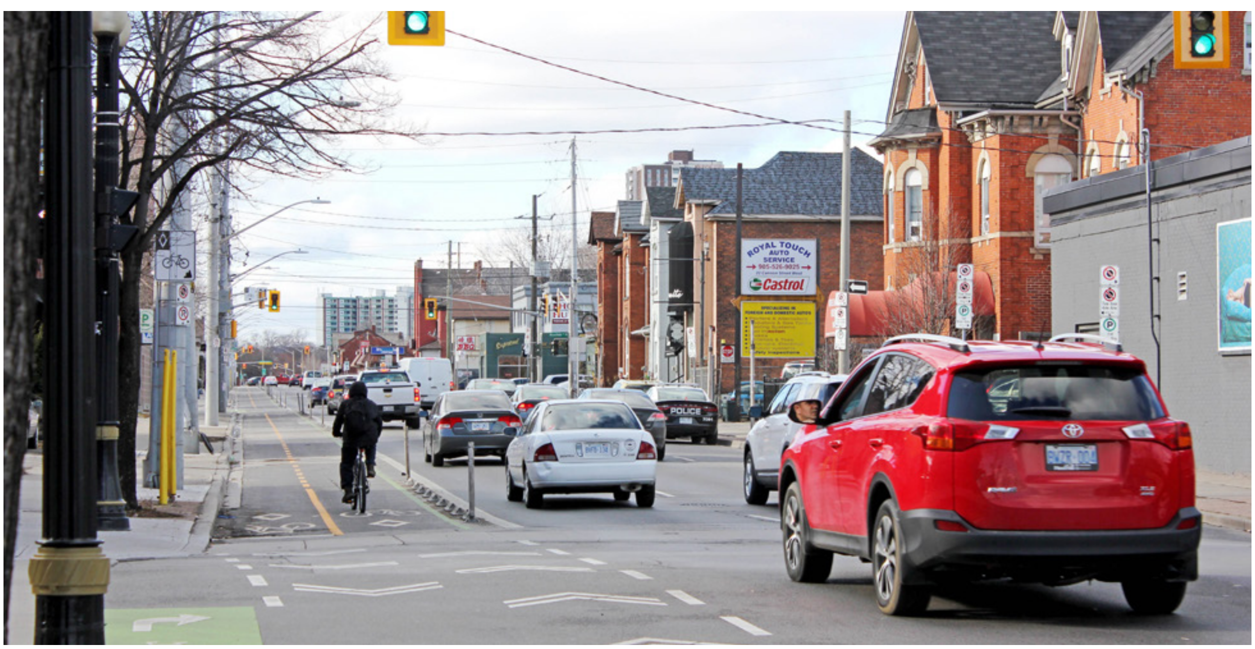
- **Rehabilitation**: involves minimal construction or civil work. Typically changes are made between the existing curbs. This can include resurfacing and reconfiguring the road platform to introduce Complete Streets elements. For these types of projects, designers should seek to minimize the impacts to existing trees and utilities as much as possible.
- **Reconstruction**: typically involves reconstruction of the road platform and may involve reconstructing the boulevard. Reconstruction presents a significant opportunity to introduce Complete Streets elements to the corridor. Designers should coordinate with relevant utility stakeholders for these types of projects to determine if any utilities should be modified or replaced as part of the project.
- **Major projects**: large-scale capital projects, for example new developments within the City that include constructing new infrastructure. These projects present the most significant opportunity to reimagine the existing streets or construct new streets with a Complete Streets lens.

2.4.3 CONSULTATION

Consultation is a key component of the design process. As described in the Conceptualization section, designers should seek to engage the public early and often throughout the design process. Designers should also note that when projects are planned in communities with a high proportion of equity-deserving groups, additional engagement will likely be required. The City should identify priority populations to be consulted, and structure plans to deliberately engage with that audience. Special care should be taken to build trust and capacity within these communities, which may require additional engagement resources, especially as the preliminary design concepts are being developed and the overall vision for the project has not yet been finalized. Having previously marginalized communities see their priorities reflected in the direction of the project will help to build trust, and is a vital step towards more equitable implementation of this Manual.

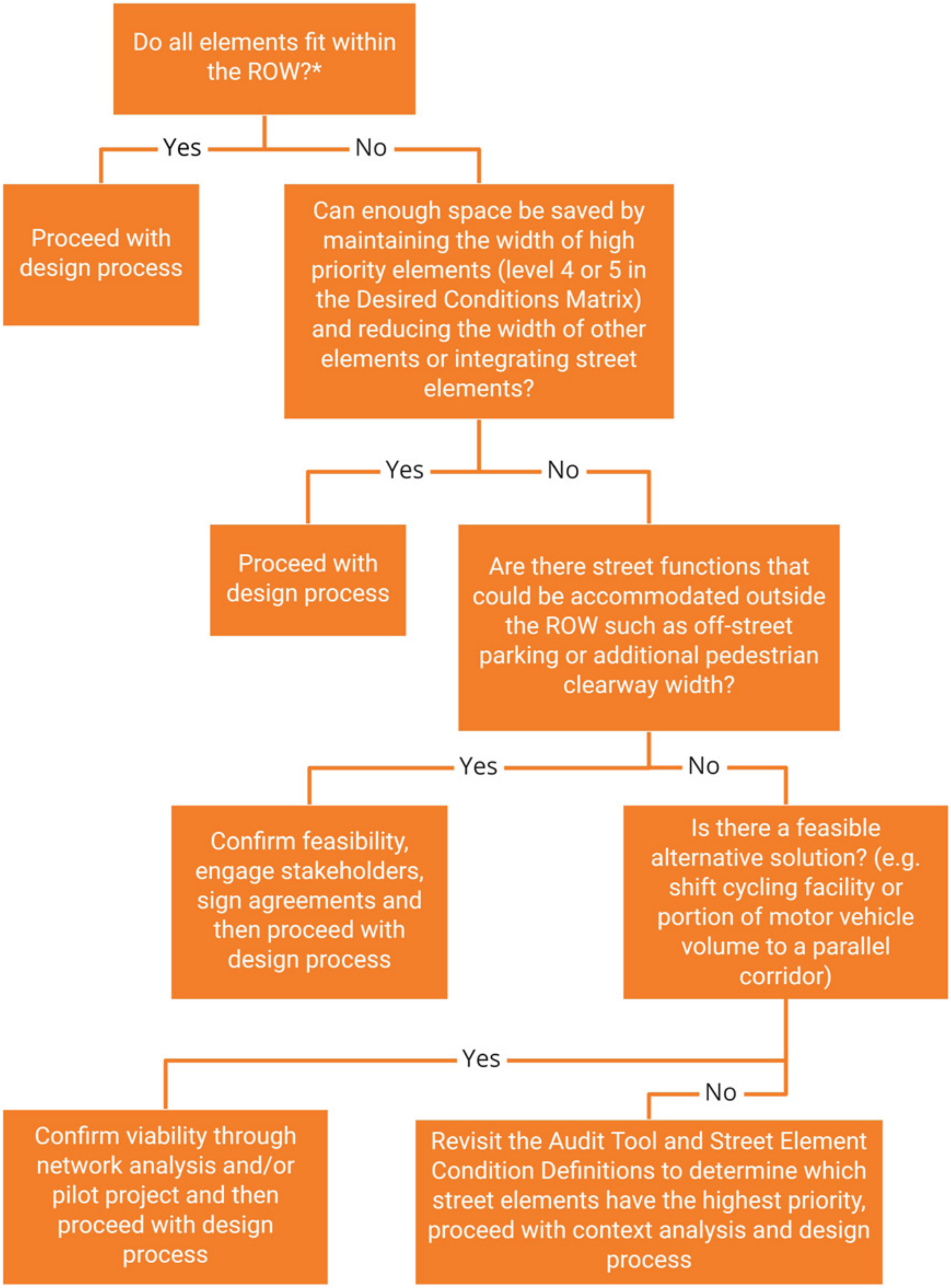
2.4.4 STREET ELEMENTS

In some cases, corridors in the City may be narrower than the right-of-way widths shown in the Chapter 4 cross sections. The following Street Element Decision-Making Tool aims to guide practitioners in balancing the Complete Streets priorities when the right-of-way is not as wide as the corresponding cross section.



Cannon Street in Hamilton.

Street Element Decision-Making Tool



*Refer to the note regarding motor vehicle lane widths in Step 3 of the Checklist for Designers and Reviewers above (section 2.3.1)

2.4.5 DIMENSIONS

Designers should seek to meet target dimensions for each element as outlined in Chapters 3 and 4, however in constrained situations, designers may have to use minimum widths for specific elements.

In this case, practitioners should keep the following in mind when designing with minimum widths:

- Anticipated user volumes
- Relative priority of each element by street classification and project objectives
- Operations and maintenance impacts
- Need for physical separation of vulnerable roads users and motorists
- Permanence of facility and ability to modify it down the line (For example: pilot projects or rehabilitation on a road scheduled for full reconstruction within a few years).

If minimum dimensions are required, designers should consider:

- Assessing whether a posted speed limit reduction is appropriate
- Alerting and guiding road users through pinch points and constrained areas through signage and pavement markings
- Maintaining appropriate sightlines to ensure safety for all road users
- Monitoring user behaviour in the area following implementation to determine if project goals are being met and re-evaluate if not

In a constrained right-of-way, integrating street elements to use the same space for multiple street functions may be necessary to avoid designing to minimum dimensions. This can include integrating elements in the same space such as the Shared Cycle Track Platform Stop described in Chapter 3. Curbside management is another approach to integrate different uses within the same zone within the ROW. For example alternating on-street parking or flex zones with curb bump outs to provide space for street tree planters or transit shelters. The cross sections in Chapter 4 show other examples on how different street elements can be integrated to maximize the use of space.

2.5 IMPLEMENTING

Once the detailed design is completed, the implementation phase begins through tendering and construction of the complete street.

2.5.1 TENDERING

Contractors should be familiar with Complete Streets design elements through the tendering process. Maintaining open lines of communication and fostering a collaborative project workflow between designers, contractors, and contract administrators will help ensure that the design is constructed to meet the vision and goals set out in the planning stage.

2.5.2 OUTREACH AND EDUCATION STRATEGY

Some design elements of Complete Streets may be new to Hamiltonians. Staff should develop a public communication strategy to educate users prior to the opening of a new facility to minimize confusion and ensure designs are used as intended by all road users. This can include online or in-person outreach events, signage along the corridor to explain the new features and their intended use, social media campaigns, and updating relevant content on the City's website.

2.5.3 MAINTENANCE STRATEGY

Plans for ongoing maintenance of the facility should be developed as part of the capital budget submission for the project. Operating costs, maintenance standards, and divisional responsibilities should be identified and included in the relevant operating budgets.

2.6 MONITORING AND REVIEW

2.6.1 AREAS OF LEARNING

Re-imagining streets through a Complete Streets lens is a relatively new approach for planning, engineering, and design. Best practices are being refined and adapted to local contexts as more jurisdictions redesign streets through a Complete Streets lens. As the City adopts these practices, lessons learned should be documented and distributed to relevant divisions and stakeholders to ensure that practitioners gain knowledge from past experiences to benefit future projects.

- **User behaviour and comprehension:** tracking the behaviour patterns of users on different facilities to determine if they are being used as intended. This can help practitioners determine whether a public education campaign is warranted or if adjustments to the design need to be made.
- **Conflict mitigation:** documenting interventions made to mitigate conflicts between different road users and tracking their impact on safety and user behaviour will help the City develop a catalogue of context appropriate interventions.
- **Operations and maintenance:** documenting any operations and maintenance issues following the construction of a complete street and identifying strategies to address them for existing and future designs.
- **Multi-modal mobility:** leveraging tools such as the Multi-Modal Level of Service (MMLOS) to evaluate the project's performance for all modes of transportation can help inform whether designs contribute to meeting the City's multi-modal goals. Refer to OTM Book 18 for more guidance on MMLOS.
- **Constructability / implementation cost and asset life cycle:** documenting project costs and any challenges throughout the project life cycle can help inform cost benefit analysis at early stages of future projects.
- **Equity and quality of life outcomes:** recording the reported changes to quality of life in the local community including improvements to roadway safety, changes to multi-modal access to public services and economic opportunities, and increased opportunities for marginalized communities.

2.6.2 MONITORING STRATEGY

As discussed in the Planning Stage, practitioners should seek to develop a monitoring strategy to understand and communicate the outcomes of Complete Streets designs and document lessons learned to apply to future projects. The flowchart below outlines the basic steps to develop a monitoring strategy for a Complete Streets project.

Determine key metrics: During the Planning stage, staff should decide which metrics will be used to evaluate the project. The metrics selected should relate to the project vision and goals. For example, collision frequency and severity can be a key metric for projects where road safety improvements are a primary goal.

Develop a baseline: Baseline data should be collected prior to any construction work to develop an understanding of the “before” conditions. Data collected after the project completion can then be compared to the baseline data to interpret the impacts of the project on each metric.

Monitor usage patterns regularly: Implementing Complete Streets across the City’s transportation network will affect overall usage patterns. Since usage patterns may not change immediately after a facility opens, it is important to consider performing monitoring activities over long periods of time to allow traffic patterns to stabilize (for example three to six months after implementation). Evaluation of operations in both the summer and winter are important to ensure the road operates adequately in all seasons. It is important to consider both existing and latent demand when observing usage patterns. Complete Streets may address latent demand that is currently unmet by the existing design such as cycling demand on roads that previously had no dedicated cycling facilities. Staff should consider leveraging survey tools throughout the project to gauge interest in the Complete Streets design and gain a better understanding of latent demand for different modes.

Communicate findings and lessons learned: Communicating the outcomes of a project to stakeholders and the public is an important step to close the engagement loop after completing the project. The findings from the monitoring stage should be presented in a way that is easy to understand and digest. Lessons learned from the project should be incorporated in the planning stages of future projects.

2.7 UPDATING POLICY

Provincial and municipal policies provide direction for the development of the Complete Streets policies. The Provincial Policy Statement and the Growth Plan for the Greater Golden Horseshoe support a Complete Streets approach to road design to achieve a multi-modal transportation system that allows for safe movement of people and goods. The City's Transportation Master Plan emphasizes the "City's interest and investment in developing streets that are safe, accessible, accommodating of multiple modes and provide an attractive public realm are consistent with best practices".[1] The TMP highlights the development of this Design Manual as a key step in the Complete-Livable-Better (CLB) Streets policy theme to provide detailed guidance to be applied during the design and implementation phases to shape the look and feel of Hamilton's network of Complete Streets.

These guidelines are meant to inform the design of Complete Streets and are meant to supplement the City's existing engineering standards. Following the publishing of this manual, the TMP outlines supplementary actions including harmonizing existing guidelines and road classifications in the Official Plans with the Complete Streets Design Manual guidelines, while also updating engineering standards, so that policy and standards follow Complete Streets principles.

Practitioners should leverage this Design Manual to implement Complete Streets throughout the City while documenting lessons learned and context-specific adjustments made for each project. The experience gained from the Complete Streets implementations will support City staff in reviewing and updating standards and policies to incorporate Complete Streets design principles.

1 City of Hamilton Transportation Master Plan: Review and Update, 2018

2.8 FINANCIAL CONSIDERATIONS

Despite a common misconception that Complete Streets always cost more than conventional streets, they are often comparable to traditionally planned roads. Many transportation projects in Hamilton are already being designed with a Complete Streets philosophy in mind, incorporating elements included in Council-approved plans and policies such as the Pedestrian Mobility Plan, Cycling Master Plan, and the Recreational Trails Master Plan, among others.

The cost of building Complete Streets is typically comparable to constructing a conventional road, given that many of the elements proposed in the manual are required today. The "missing" Complete Street elements on existing streets are typically integrated into baseline designs produced today and therefore do not necessarily represent an incremental cost compared to traditional designs. Incorporating AODA-compliant sidewalks and crossings, new cycling facilities along existing or planned bike routes, and new street trees are some of the elements that Council has previously approved that are being integrated into design work.

A study undertaken by the Charlotte Department of Transportation compared the cost of Complete Streets projects against traditional road projects over a five-year period.[2] The research found a slight increase in cost by adding sidewalks and bike lanes, which were partially offset by the lower costs of narrower lanes. However, Charlotte found that overall market fluctuations in construction costs played a more significant role in the costs of a project than the costs for incorporating complete street elements. They concluded that "considering the small percentage of project budgets required to include complete street elements and the significant fluctuation in historical project construction costs, the authors of this paper make the argument for continuing to include Complete Streets items in project scopes and budgets."

As discussed in the planning, conceptualization and design steps above, a context-specific approach is necessary to reflect unique attributes when completing existing roadways. For instance, it may not be pragmatic to relocate utilities underground or widen an existing bridge/tunnel due to their high costs. While these situations can pose unique challenges, these should not pose a barrier to implementing Complete Streets, as the Manual's cross-sections, elements, and processes are adaptable to these novel situations.

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2 Shapard, J., & Cole, M. (2013). Do Complete Streets Cost More than InComplete Streets? Transportation Research Record, 2393(1), 134–138. https://doi.org/10.3141/2393-15

3

CHAPTER THREE

ELEMENTS

3.1 PEDESTRIAN REALM AND PLACEMAKING

Walking remains the most affordable and accessible form of transportation. It promotes physical activity and social interaction, and is emissions-free, making it a climate-friendly and healthy mode of travel.

The key to promoting walkability lies in **attentive and intuitive urban design**. Streets designed at a human scale with slowed or limited vehicle traffic can naturally attract pedestrians for the comfort they provide. This largely depends on the design of the pedestrian realm: the part of the street that provides physical space for pedestrian activity, including sidewalks, street trees, and other amenities. A thriving pedestrian realm leads to a strong sense of place; cities designed for walkability are seen as attractive, vibrant, and comfortable by residents and visitors alike.

This section outlines the principles and design practices that bolster a healthy pedestrian realm and sense of place. Further guidance can be found in the Design of Public Spaces Standards under the Ontario Integrated Accessibility Standards regulations, Ontario Traffic Manual (OTM) Book 15: Pedestrian Crossing Treatments, the National Association of City Transportation Officials' (NACTO) Urban Street Design Guide, and NACTO's Designing Streets for Kids Guide.

3.1.1 DESIGN PRINCIPLES

Design for universal accessibility. "Pedestrians" are a broad group of street users, and include people of diverse abilities who may be using strollers or mobility aids such as wheelchairs, canes, or guide dogs. Many built environment standards have historically been written to accommodate the needs of able-bodied men. In reality, these users compromise a minority of the population. Women, children, seniors, and people with disabilities are all users whose needs may be overlooked in the traditional design process. Street design should remove existing accessibility barriers and avoid creating new ones.

Safe and comfortable for all ages. Pedestrians are the most vulnerable road users and especially children and seniors. Where the pedestrian realm interacts with traffic at intersections and driveways, designs need to prioritize safety for these users. Along the street, horizontal separation from live traffic lanes can enhance comfort and safety.

Create well-designed places and spaces. Pedestrians are not always in motion. Well-designed pedestrian realms encourage people to move at their own pace, with the potential for stopping and socializing or sitting to watch the world go by. Each street has its own uniqueness, and the pedestrian realm should complement those features to create a vibrant and enjoyable environment.

Complement adjacent land uses. Certain land uses and development types are more conducive to pedestrian activity. For example, a restaurant might use extra sidewalk space for a patio or an area for customers to line up, while a store might use its outdoor frontage for displaying products. In other cases, the pedestrian realm might be built to complement future anticipated land use, such as along transitioning avenues that are expected to densify.

Streetscape renewal of Gore Park.

3.1.2 PEDESTRIAN ZONES

The pedestrian realm can be organized into four defined zones: the **buffer zone,** the **street tree / furniture zone**, the **walkway zone**, and the **frontage zone**. These zones work together to support the design of Complete Streets. On some streets, some zones may be combined, or the boundaries between zones may not be formally defined. In designing the pedestrian realm, it is important to consider the function of each zone and to ensure that the zones function as a cohesive whole.

The **buffer zone** begins at the edge of the curb and provides a safety buffer between moving traffic and people walking or cycling. It may also accommodate signs, poles, and snow storage. A wider buffer zone should be considered along streets with higher traffic speeds and volumes, especially where speeds are 50 km/h or higher, or volumes exceed 4,000 vehicles per day. On streets with cycle tracks, the cycle track width acts as an additional buffer from traffic for pedestrians, but a buffer zone should still be provided between the roadway and the cycle track.

The **street tree / furniture zone** is where trees and furniture such as benches or transit shelters are placed. It can be located on either side of the walkway zone. Light poles or utilities may also be placed in this zone. When placed between the buffer zone and the walkway zone, this zone can supplement the buffer to provide additional separation between pedestrians and motor vehicle traffic.

The **walkway zone** provides a clear, unobstructed path of travel for pedestrians. Street furniture and other obstructions are not located in this zone. The target width for the walkway zone should be at least 2.0 metres or more. Width should be increased in areas with higher pedestrian traffic volumes or with higher use of power scooters and other mobility devices. In areas with limited pedestrian activity, a minimum of 1.8 metres is acceptable— the absolute minimum width of 1.5 metres should be applied in constrained cases only.

The **frontage zone** provides a transitional space between the street and the adjacent buildings. It provides a buffer to the property line, and in areas where the sidewalk is adjacent to buildings, provides a buffer from opening doors. It may be used as an extension of the public realm, such as for restaurant patios or retail displays. Note that these recommendations may vary by typology or context.

Illustration of pedestrian zones.

Pedestrian Zone Dimensions

ELEMENT	TARGET VALUE	MINIMUM VALUE
BUFFER ZONE	1.0 m	0.5 m
STREET TREE / FURNITURE ZONE	2.0 m to 3.0 m	1.75 m
WALKWAY ZONE	1.8 m to 2.0 m or more	1.8 m
FRONTAGE ZONE	Varies	0.5 m

In some cases, the pedestrian realm may extend beyond the curb into a **flex zone** that is part of the roadway and designed to be flexible in use. This space may be used for on-street parking, patio space, parklets, bike parking, pick-up / drop-off areas, and bike share stations. The flex zone should be designed to provide barrier-free access to the sidewalk, either by constructing it level with the sidewalk or by providing temporary or permanent curb ramps. The flex zone can be framed by a mountable or semi-mountable curb, depending on the context. See Section 3.5 for more details on curbside management.

An example of a flex zone, accommodating a street patio and on-street parking.

3.1.3 INTERSECTION ELEMENTS

Intersections are conflict points between different road users and should be designed to mitigate conflict and create a safe environment for all modes, especially vulnerable road users such as pedestrians. This section outlines key design elements to improve safety and comfort for pedestrians crossing the right of way.

SIGNALIZED INTERSECTIONS

Cycle Length and Signal Timing
Like other road users, pedestrians rely on signalized crossings to cross at many intersections. Signals inevitably create delays for pedestrians, and this should be considered in the planning and design process. Pedestrian delay is minimized when the intersection's cycle length is as short as possible. For example, at a compact urban intersection with a cycle length of 60 seconds, pedestrians typically have to wait an average of 15 seconds to cross. At a large suburban intersection with signalized left turns for vehicles and a cycle length of 140 seconds, that waiting time increases to approximately 50 seconds, nearly a full minute.

At urban intersections with very high volumes of pedestrians, a pedestrian scramble (also known as a pedestrian priority phase) may be considered. This provides a walk phase for pedestrians travelling in all directions while stopping motorists in all directions.

Pedestrian Crossing Time
It is also important to provide adequate pedestrian crossing time. Caregivers with children, elderly pedestrians, and people using mobility devices are all examples of users who may require more time to cross the street. Accommodating these users may involve increasing the crossing interval beyond the minimums outlined in Ontario Traffic Manual (OTM) Book 12.


A mid-block crossing

PEDESTRIAN CROSSOVER (PXO) / MIDBLOCK CROSSINGS

Crossing frequency is a key factor in the walkability of a street. In addition to signalized crossings at major intersections, midblock crossings should be placed to align with desire lines, such as between a residential tower and a park or a bus stop. Where block lengths are beyond 100–200 metres, consideration should be given for additional midblock crossings, as a lack of crossings either encourages pedestrians to incur risk and cross at potentially unsafe locations or requires them to walk extra distance to reach the nearest crossing. Refer to OTM Book 15 for the planning and design of pedestrian crossings.

On low-volume streets, rather than creating designated crossing points, it may be preferable to design the street for crossability by creating safe crossing conditions along the entire length. Low traffic volumes and speeds—brought about by traffic calming measures such as on-street parking, reducing the number of traffic lanes, or modal filters—are one way to create streets with more universal crossability. Modal filters may also be applied to help lower traffic volumes; these limit the through-journeys of certain transportation modes along a street using permanent or temporary materials.

Bollards acting as a modal filter, limiting through-traffic to pedestrians and cyclists only. Source: Cycling Embassy of Great Britain

CROSSING DISTANCE

Longer crossings, especially those longer than 30 metres, disproportionately affect vulnerable pedestrians—such as children and people with reduced stamina—as they require more energy to use and involve more exposure to traffic. All pedestrians are better off when crossing distances are minimized, which can be accomplished with curb extensions, smaller corner radii, refuge islands, fewer travel lanes, and narrower travel lanes.

3.1.4 EQUITY AND ACCESSIBILITY

NEEDS OF USERS

It is important to consider that people with disabilities do not all have the same experience. Each disability brings a nuanced way of navigating one's environment. As such, designing accessible streetscapes and roadways should take each experience into consideration:

Partially sighted or blind people may use canes or guide dogs to navigate the built environment. They rely on features such as curbs, contrasting materials, and tactile surfaces to orient themselves and identify potential hazards. Guide dogs are trained to stop at curbs and steps, avoid obstacles, and negotiate traffic, but do not have the cognitive function of a human and thus may become confused by complex designs.

People using wheelchairs or mobility devices rely on a built environment that they can physically navigate with ease. Continuously smooth and level surfaces, curb depressions and ramps at crossings points, and a sufficiently wide path of travel are all examples of physical design elements that improve the experience of wheelchair users.

Example of a depressed curb ramp at a pedestrian crossing in Washington State. Source: Pedestrian Safety Guide and Countermeasure Selection System

People with reduced stamina need places to rest more often, as they may have a harder time navigating slopes, walking longer distances, or may walk at a slower speed. Many intersections are timed for a faster walking speed which may not provide enough time for this group of people to cross the street. Consider providing frequent benches and other rest areas, minimizing intersection crossing distances, and increasing allocated pedestrian phase time to help these users.

Children undergo much of their cognitive development while navigating the built environment. They are more sensitive to traffic danger and more dependent on their caregivers at younger ages. A well-designed built environment not only provides safety for children, but also supports an active independent lifestyle and fosters their desire for spontaneous play. Examples of designs that support children include wider sidewalks and buffers from traffic, improved sightlines to roadways, longer pedestrian signal intervals, and frequent places to pause and linger.

Women tend to experience the built environment much differently than men. Whether they be caretakers or simply walking on their own, women have unique experiences that warrant specific accessibility needs. Similar to wheelchair users, dropped curbs and ramps may benefit women pushing strollers. Many of the design suggestions that would benefit children, such as traffic calming measures or more frequent places to rest, would also help women who must navigate the street with children in tow. Women may also take more frequent trips than men and tend to make more non-work related trips than men, such as transporting children to school or completing household errands.

Finally, many women cite safety concerns as a deterrent to using public transit or walking alone at night. Dark, empty spaces can come across as unsafe, leaving potentially more women vulnerable to attackers. To combat this, consider thoughtful and inclusive design elements like well-lit pathways, more walkable shared streets, and open gathering spaces with shops or vendors. The latter may help contribute to a sense of safety in numbers, or "eyes on the street", wherein the presence of others, and especially other women, can improve their sense of security in public.

DESIGN ELEMENTS

The following outline some design elements that should be considered when designing for multiple accessibility needs:

Hamilton Urban Braille. Urban Braille is a system of tactile information that uses colour and texture contrast to provide warning signals and orientation cues. The shoreline feature is used to delineate the pedestrian clearway. Generally used downtown, in Business Improvement Areas (BIAs), and designated activity areas such as campuses or hospitals. A shoreline feature may also be used to provide delineation between pedestrian and cycling operating spaces.

Attention Tactile Walking Surface Indicator (TWSI). Used to provide critical safety information to everyone at potentially dangerous locations. They should only be used to identify potential hazards. Appropriate uses in the context of streets include curb ramps and depressed curbs and entry points to vehicular routes. While attention TWSI's are typically found at crosswalks, **they do not delineate or demarcate crosswalks.** An attention TWSI may be warranted even if a crosswalk is absent, and the extents of the attention TWSI may differ from the crosswalk itself.

Directional TWSI. Used to guide people along an intended path of travel or to key points of interest such as crossings. While attention TWSI's consist of truncated domes, directional TWSI's consist of a pattern of parallel, flat-topped, elongated bars that extend in the direction of travel that are detectable both underfoot and with a long cane. They can be used to help users navigate at complex roadway environments such as roundabouts and mid-block crossings.

A guidance TWSI in grey used to guide pedestrians between a bus stop (left) and a cycle track crossing (right). Red attention TWSI's are used to identify hazards at each end. Ottawa, ON

Curb ramps and dropped curbs. These help people with wheeled mobility aids, pushing strollers, walking bikes, etc. to smoothly transition from the sidewalk to the street. TWSI's are required to warn those with visual disabilities of the traffic road ahead. A clear width of 1.2 metres is required for all curb ramps, with an additional 1.5 metre clear walkway width at the top.

Accessible pedestrian signals (APS). For those with visual disabilities, an APS provides a series of sounds to indicate when it is safe to cross an intersection.

Accessible pedestrian signals help those with visual or auditory disabilities safely cross the street. Source: CBC

Clear width. To accommodate people using wheeled mobility aids, a clear path of travel of at least 1.8 metres is recommended. Minimum clear width of 1.2 metres must be provided between bollards.

Pedestrian refuges. Intended as an intermediary space within a larger pedestrian crossing. They can be located in the middle of the roadway between two travel directions or in the boulevard as part of a setback bicycle crossing. They can also act as traffic calming measures. To be considered a refuge, a space must be at least 1.6 metres wide to allow for passing, 2.1 metres long in the direction of travel, and have attention TWSI's at each end. Refuges larger than these minimum dimensions provide additional manoeuvrability and comfort for users and should be considered, especially in moderate to high volume pedestrian areas. For signalized crossings where the above criteria cannot be met, the pedestrian clearance interval must be long enough to traverse the entire roadway.

An example of a pedestrian refuge between a cycle track and roadway crossing, denoted by attention TWSI's at each end. Ottawa, ON

3.1.5 PLACEMAKING & AMENITIES

Beyond simply considering safety, effective pedestrian design also considers the factors that contribute to a positive user experience. While pedestrians are often thought of as being constantly in motion, people benefit from places to stop, rest, and socialize. Shade, seating, interesting views and storefronts all contribute positively to the pedestrian environment. The pedestrian experience is negatively impacted by traffic noise, pollution, wind and sun exposure, steep grades, poor lighting, and frequent conflicts with vehicles. A few examples of amenities include:

- Street trees, which provide shelter from the sun, absorb some of the noise from vehicles, provide urban cooling, and add variety to the street
- Benches, which provide a place for people to rest
- Parklets and Privately Owned Publicly Accessible Spaces (POPS), which create a space for playing, eating, and socializing
- Lighting, which provides improved security for people traveling at night

Consider the context and surrounding land use when determining the placemaking elements of a street. Active surrounding land uses and building frontages are more likely to attract pedestrians and may warrant more attention to placemaking.

Changes to the traffic environment of a street can also significantly improve the pedestrian experience. For example, reducing the number of lanes or introducing traffic calming can help reduce speeds and volumes, significantly reducing noise levels. Increased buffer zones and street tree / furniture zones also help insulate pedestrians from vehicle traffic noise.

A high quality pedestrian realm including seating and trees, with active storefronts

3.2 CYCLING FACILITY AND DESIGN

Cycling is a healthy, climate-friendly, and affordable form of transportation. Cycling facilities also offer a highly efficient use of space in terms of people-movement capacity. However, many people are reluctant to cycle when faced with stressful interactions with motor vehicle traffic. Going forward, it is critical to provide low-stress conditions to make cycling an attractive option for a wide range of ages and abilities.

This section outlines the principles and features that make up cycling facility design. Detailed guidance on cycling facility design is available in Ontario Traffic Manual (OTM) Book 18.

3.2.1 DESIGN PRINCIPLES

Design for all ages and abilities. This implies designing for comfort and safety. On local streets, focus on slowing traffic and managing motorized vehicle volumes so that cyclists and motorists are travelling at similar speeds. On busy streets, focus on separating cyclists from traffic.

Provide connected cycling facilities to allow people to get to their destinations via a direct route. Work to eliminate missing links and develop a network that connects all parts of the city.

Make cycling attractive by providing well-maintained facilities along the route, such as greenery, good lighting, and smooth pavement. End-of-trip facilities like secure bike parking stations or lockers could incentivize people to switch to cycling for their daily commutes.

3.2.2 FACILITY TYPES

OTM Book 18 provides a detailed description of cycling facilities and selection criteria. Bike facilities are grouped into three categories:

Physically separated facilities, such as cycle tracks and multi-use paths. These may either be located within the roadway with physical measures to separate cyclists from motor vehicles, or above the curb in the boulevard.

This cycle track in Hamilton uses planters to separate cyclists from vehicle traffic.

Source: Canadian Consulting Engineer

Designated facilities, such as conventional bike lanes. These are delineated with pavement markings on the road but no physical separation.

A buffered bike lane demarcated by painted lines. Source: The Hamilton Spectator.

Shared facilities. These do not have separation between cyclists and motor vehicles; they must share the space instead.

A street with shared cycling facilities and vehicle space.

IMPLEMENTATION

Bike facilities should be selected based on the appropriate context and the guidance provided in OTM Book 18. In general, the following guidance should be applied in selecting an appropriate cycling facility.

On lower-speed streets where shared facilities are appropriate, **neighbourhood bikeways** may be implemented. These are a connected network of low-traffic streets that create continuous cycling routes. They often feature wayfinding signage, pavement markings, and speed management measures, and traffic diverters that prevent continuous use by motor vehicle traffic.

A neighbourhood bikeway, also known as a bicycle boulevard, sign indicating that cyclists have priority. Source: NACTO

In new construction, **cycle tracks in the boulevard** are the preferred design approach where separation is needed. They provide more comfort to cyclists and are less costly than building a wider roadway to provide an on-street cycling facility. In retrofit scenarios, consider an on-road separated or designated facility. These facilities can often be implemented cost-effectively if space between the curbs can be reallocated from other uses.

Volume management measures on a low-volume, neighbourhood greenway in Vancouver, BC

In general, **separate cycling facilities and sidewalks** should be preferred. A multi-use path may be considered in areas with low pedestrian volumes and long distances between driveways or intersections. For example, multi-use paths may be appropriate on mountain access routes or to provide longer-distance connections through rural or other lower-density parts of the City.

An urban multi-use path along the Halifax Urban Greenway. Source: City of Halifax

One-way cycling facilities on each side of the street are generally preferred over two-way facilities, especially along two-way streets. Compared to two-way cycling facilities, they usually result in safer outcomes, less complex intersections, and are supportive of providing access to destinations on both sides of the street.

Cross-section of one-way physically separated bike lanes.

Two-way cycling facilities may be appropriate on one-way streets, in situations where the right of way is constrained, where destinations are predominantly located on one side of the street, or along routes with minimal driveway or intersection conflicts —for example, along mountain access routes. When retrofitting one-way streets, it is desirable to introduce two-way cycling facilities to avoid wrong-way cycling along a one-way cycling facility. A two-way cycling facility may be placed on either the right or the left side of a one-way street. Some guidelines suggest that right-side placement may result in better safety outcomes at intersections. However, left-side placement better mitigates conflicts with transit operations along streets with bus service. When considering two-way cycling facilities, safety countermeasures should be applied at intersections and driveways to improve the visibility and safety for cyclists.

3.2.3 WIDTHS & CLEARANCES

FACILITY WIDTHS

When people ride bicycles, they tend to naturally sway back and forth. The target widths of 2.0 m for one-way cycling or 3.5 m for two-way cycling provide adequate width to allow cyclists to manoeuvre around bumps and other unexpected obstacles, and to allow faster cyclists to pass slower moving cyclists. The table below provides a summary of constrained, minimum and target widths for in-boulevard bike facilities.

The suggested minimum width is 1.8 metres for a one way facility or 3.0 metres for a two-way facility. Justification for a decreased width may include:

- Presence of single physical obstacles that are cost-prohibitive to relocate. Keep in mind that providing a facility next to these will increase the risk of bicycle crashes.
- Retrofit conditions where existing road space is being reallocated and adjacent vehicle facilities are also at the lower end of the design range. 1.5 metres is acceptable and 1.2 metres is an absolute minimum at pinch points.

CLEARANCES

Cycling facilities should provide a lateral clearance to help reduce the potential for injuries while cycling, for example due to a handlebar or a pedal striking an obstacle. When clearances are not provided, cyclists will naturally offset themselves from these obstacles, reducing the effective operating space of the facility.

For vertical obstructions between 50 millimetres and 750 millimetres in height (such as a curb), a clearance of 0.2 metres is recommended to avoid bicycle pedals striking these objects. For vertical obstructions greater than 750 millimetres in height (such as a fence or pole), a clearance of 0.5 metres is recommended to avoid bicycle handlebars striking these objects.

3.2.4 CROSS-SECTION ELEMENTS

IN-BOULEVARD FACILITIES

Universal design principles should be applied in the design of in boulevard cycle tracks. In particular, consider the needs of:

- People who are blind or who have low vision that may have difficulty distinguishing between the cycle track and sidewalk
- People using mobility devices who may have difficulty moving across the cycle track to access the curb— for example, to access parking spaces, loading spaces, or bus stops.

When a cycle track is adjacent to a sidewalk, an Urban Braille “shoreline” feature — a tactile and colour-contrasting band — may be used to provide separation between these facilities. Alternatively, a short (50–75 mm) curb may be used to separate the facilities.

Urban Braille feature separating cycle track and sidewalk

An alternative approach places a furnishing or planting zone between the sidewalk and the cycle track to offer more separation between pedestrians and cyclists.

Planting zone between cycle track and sidewalk

In areas with low pedestrian activity, a multi-use path on one or both sides of the street may be considered. The table on the following pages outlines options key considerations for selecting appropriate in-boulevard cycling facilities.

In-boulevard Facility Selection Guide

		PEDESTRIAN VOLUMES	ADDITIONAL CONSIDERATIONS
OPTION 1: SIDEWALKS AND ONE-WAY CYCLING ON BOTH SIDES	 *Both sides of the street include a sidewalk and a one-way cycle track*	Moderate to high	Preferred option when frequent destinations or driveway conflicts are present on both sides of the street.
OPTION 2: SIDEWALKS ON BOTH SIDES AND A TWO-WAY CYCLING FACILITY ON ONE SIDE	 *One side of the street has a sidewalk and a two-way cycle track. The opposite side has a sidewalk only.*		May be considered on one-way streets, or when conflicts can be minimized by placing the cycling facility on one side of the street. May also be appropriate when the two-way facility provides a network connectivity benefit. See discussion regarding one-way and two-way cycling facilities in Section 3.2.2.

OPTION 3: MULTI-USE PATH ON ONE SIDE AND SIDEWALK ON ONE SIDE	 *One side of the street has a multi-use path. The opposite side has a sidewalk.*	Low	May be considered when pedestrian volumes are low. The multi-use path should be placed on the side of the street that minimizes conflicts or that provides the greatest network connectivity benefit. See discussion regarding one-way and two-way cycling facilities in Section 3.2.2 above.
OPTION 4: MULTI-USE PATHS ON BOTH SIDES	 *Both sides of the street have a multi-use path.*		May be considered when pedestrian volumes are low and there is rationale to provide cycling connectivity on both sides of the street.

Design Parameters for In-boulevard Cycling Facilities

ELEMENT	TARGET VALUE	MINIMUM VALUE
BUFFER ZONE	1.0 m[1]	0.5 m
CYCLE TRACK (ONE-WAY)	2.0 m	1.8 m (1.5 m)[2]
CYCLE TRACK (TWO-WAY)	3.5 m	3.0 m (2.4 m)[2]
MULTI-USE PATH	3.5 to 4.0 m	3.0 m
PEDESTRIAN WALKWAY	See pedestrian realm section. When abutting a cycle track, apply shorelines (see Urban Braille standards) or separate with a short height curb.	

Notes:
1. Minimum 0.6 m where on-street parking is next to cycling facility; minimum 1.0 m to support utility poles and signage. On 60 km/h or higher streets, a wider buffer is recommended. Refer to OTM Book 18 for guidance.

2. Dimensions provided in brackets indicate widths that may be applied in constrained locations for short segments. In these cases, the City should confirm that maintenance equipment will be capable of clearing snow from narrow cycle tracks.

ON-ROAD FACILITIES

On-street cycling facilities may be physically separated (for example, through the use of bollards, planter boxes, or concrete barriers), or they may be a designated facility such as a conventional bike lane. OTM Book 18 provides guidance on selecting an appropriate facility.

Where on-street parking is present, the cycling facility may be positioned to the left or to the right of parked vehicles. On busy streets with high parking usage and high parking turnover, the cycling facility should be positioned between parked vehicles and the curb. On lower volume streets with less frequent parking turnover, the cycling facility may be positioned to the left of parked vehicles. In either case, painted buffers to separate between cyclists and parked vehicles should be provided to reduce the risk of “dooring”.

An advisory bicycle lane configuration may be considered where there is insufficient space for conventional bike lanes. In this case, motor vehicle traffic shares a two-way centre travel lane and vehicles travelling in opposite directions are required to yield to one another by temporarily entering the advisory bike lane. The installation of advisory bike lanes should be followed with an educational campaign teaching cyclists and vehicle drivers how to navigate these lanes.

Advisory Bike Lane with On-Street Parking in Victoria, BC

On low-traffic streets where shared operating space is appropriate, no centreline should be marked on the roadway. This is shown to reduce motor vehicle speeds and to cause drivers to provide greater passing distance when overtaking cyclists. A summary of design parameters for on-street bike facilities is provide in the following table.

Design Parameters for On-street Cycling Facilities

ELEMENT	TARGET VALUE	MINIMUM VALUE
PAINTED BUFFER	1.0 m	0.3 m[1]
BIKE LANE	1.8 m	1.5 m (1.2 m)[2]
CONTRAFLOW BIKE LANE	2.0 m	1.8 m (1.5 m)[2]
ADVISORY BIKE LANE	1.8 m to 2.0 m	1.5 m
TWO-WAY TRAVEL LANE	3.0 to 4.0 m or 5.0 to 5.7 m	2.7 m
RURAL PAVED SHOULDER	1.5 to 2.0 m plus 0.5 to 1.5 m buffer	1.2 m

Notes:
1 - Minimum 0.6 m when adjacent to parked vehicles. Minimum width may vary dependent on the type of physical separation used (if any); consult OTM Book 18.

2 - Widths in brackets correspond to widths that may be applied in highly constrained contexts for short segments.

3.2.5 INTERSECTIONS

A significant number of urban cyclist fatalities occur at intersections. The design for cyclists at intersections focuses on reducing the possibility of collisions and the severity of collisions. Safe intersection design requires attention to the geometric design, the vehicle speeds and turning volumes, and the degree to which cyclists are visible to turning traffic. Extra consideration is required for two-way facilities at intersections which are correlated with a higher rate of injury. Detailed information on intersection design is provided in Chapter 5.

PROTECTED INTERSECTIONS

Protected intersections include several geometric features to improve safety. The cycling facility is set back four to six metres from the motor vehicle lanes, which improves visibility of cyclists to turning motorists. Protected intersections include corner islands that extend the cycling facility's protection into the intersection and create a bicycle queuing area after the crosswalk. The design typically includes pedestrian islands that reduce pedestrian crossing distances and improve visibility. Chapter 5 provides further guidance around designing protected intersections and discusses their benefits in more detail.

A protected intersection where cyclists are protected from vehicle traffic via a setback intersection crossing, curbs, and brightly coloured bike lanes. Source: NACTO

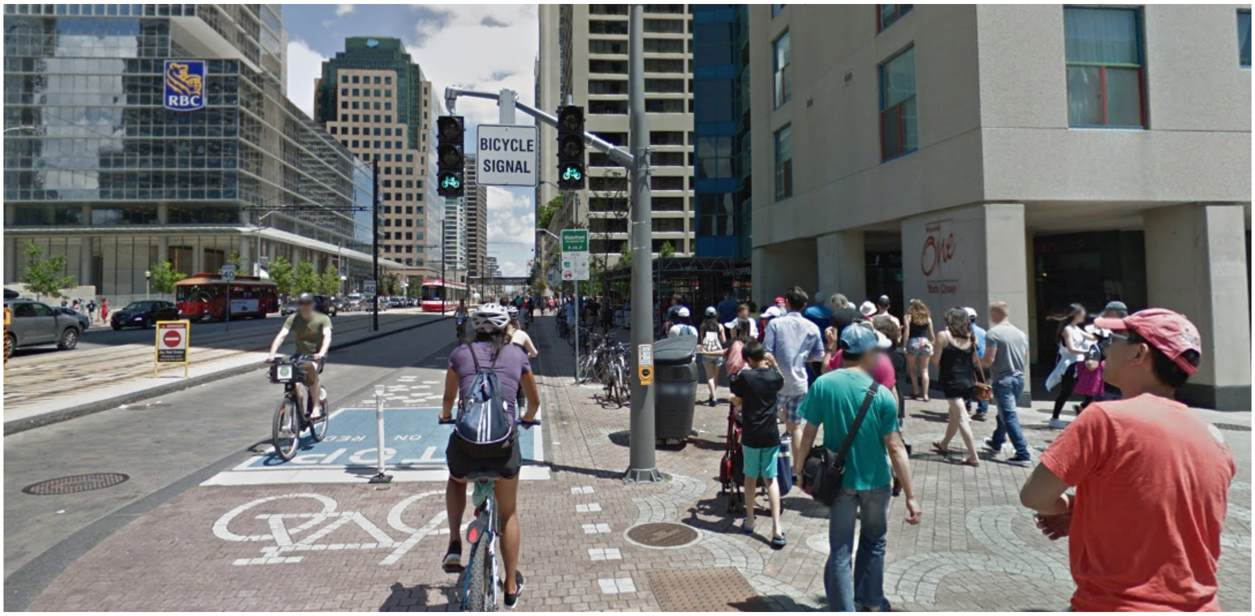
TRAFFIC SIGNAL MEASURES

Leading pedestrian and bicycle intervals give cyclists a head start on the green phase and make them more visible to turning motorists.

Right turn on red restrictions reduce conflicts between turning vehicles and cyclists.

Bicycle signals can be used to signalize bicycle-specific movements, such as leading intervals, and can also be positioned at a height that is more visible to cyclists than a standard traffic signal head. These can also be mounted near-side to further increase visibility.

Protected signal phasing can significantly reduce conflicts between users. However, delays to cyclists should be considered when implementing protected phasing. Long delays may result in poor compliance with the traffic signals.



Bicycle-specific signals, seen here in Toronto, are easier for cyclists to see when installed at the same height as pedestrian signals. Source: Google Maps

3.2.6 OTHER FACILITIES

BICYCLE PARKING

The conversion of on-street parking to bicycle or micro-mobility parking can result in significantly more efficient use of curbside space. It is recommended to provide bicycle parking at popular destinations to incentivize residents to cycle for their daily trips.

“Hammer hoop” style bicycle racks are recommended for their ease of use and level of security they provide. These are recommended to be 70 centimetres tall with a hoop diameter of 30 centimetres. These are to be installed on a 20 centimetre wide plate. Further details for bicycle parking can be found in Section 3.5.5.

Hammer hoop bicycle racks.

BIKE SHARE STATIONS

Bike share stations may occupy either sidewalk or curbside space. The provision of bike share stations allows for residents or tourists to cycle throughout Hamilton without the need for a personal bicycle. These may be useful for short trips throughout the City whether for a daily commute, running errands, or for scenic tours.

Bike share stations should be a minimum length of 8 to 10 metres and a minimum width of 1.8 metres, though 2.0 metres is desired. Refer to Section 3.5.5 for further details on bike share stations for Hamilton.

WAYFINDING

The City of Hamilton is currently looking to update its wayfinding strategies as part of the next Cycling Master Plan update. This will include cycling wayfinding features with Hamilton-specific signage. Refer to OTM Book 18 for detailed recommendations for cycling wayfinding.

Examples of cycling wayfinding signage.

3.3 TRANSIT FACILITY DESIGN

Hamilton Street Railway (HSR) provides efficient, sustainable and affordable access to employment, essential services and recreational destinations for all Hamiltonians. The transit user experience should be considered in street design from start to end of trip, including the journey to the transit stop or station, comfort and safety while waiting for transit, and the efficiency of movement between destinations. To be an attractive option for Hamiltonians, transit should be efficient, reliable, user friendly, and provide access to all major destinations in Hamilton.

3.3.1 DESIGN PRINCIPLES

Provide safe and comfortable transit facilities: Enhancing the transit user experience can help ensure that transit is an attractive option for Hamiltonians. The transit user experience begins and ends at transit facilities. Strategies to improve on the transit user experience include providing accessible, comfortable, and attractive transit stops and stations. Provision of shelters, seating, appropriate space for waiting and manoeuvring, and lighting contribute to the comfort and perceived safety at a transit stop. Transit facilities may provide users with key information about the service such as the schedule, fares, and maps to facilitate trip planning.

Accommodate multi-modal travel: Transit trips are generally multi-modal with trips beginning and ending with users walking, cycling, or driving to and from the transit stop. Enhancing cyclist access at transit stops can help increase the catchment areas of the transit system. Strategies to accommodate multi-modal travel include providing comfortable pedestrian crossings, dedicated bicycle parking or bike share stations, and wayfinding near transit facilities.

Sheltered Bicycle Parking at Hamilton Centre GO Station Source: Ontario Traffic Manual

Facilitate transit efficiency by providing transit vehicles with priority access: Ensuring efficiency of transit vehicle movements contributes to the reliability of the transit system. Strategies such as transit signal priority, dedicated transit lanes, and frequent service help minimize transit delay and improve the transit user experience.

A transit HSR bus in Hamilton.

3.3.2 STOPS

KEY DESIGN CONSIDERATIONS

Safety and Comfort: Transit stop visibility, lighting, weather protection and street furniture contribute to the level of comfort and safety passengers experience at a transit stop. Transit stop design should aim to reduce conflicts between transit users and other road users by providing clear wayfinding and adequate queueing space for passengers.

Accessibility: Accessibility treatments include tactile walking surface indicators and detectable warning surfaces along platform edges, curb cuts, and raised landing pads. Transit stop design should be in full compliance with the Accessibility for Ontarians with Disabilities Act (AODA), the City's Transit Bus Stop Accessibility Criteria & Guidelines and Section 8.17 of the City's Barrier-Free Design Guidelines.

Integration with Transit Design Vehicle: The intended vehicle type and size, as well as the service frequency will influence the geometry of transit stops. Hamilton Street Railway's Stops and Shelters Technical Manual provides details on design requirements for transit stops including landing pad dimensions for specific transit vehicle sizes, ideal shelter location, and accessibility considerations.

STOP TYPES

Centre Median Platform Stop
Centre median platform stops are positioned between a dedicated transit lane and motor vehicle lanes. This type of platform is typically installed along Bus Rapid Transit (BRT) lines where transit vehicles operate in dedicated lanes. Transit users reach the platform from signalized crossings, reducing conflicts with cyclists and motorists.

Island Boarding Stop
Island boarding stops require transit passengers to cross a cycle track to access the platform. The cycle track is channelized behind the platform, and cyclists are required to yield to pedestrians crossing to reach to the platform.

Conflicts between cyclists and pedestrians reaching the stop can be mitigated by providing dedicated pedestrian crossings across the cycling facility with tactile surface indicators, zebra crossings, sharks teeth and a Cyclists Yield to Pedestrians sign (Rb-73).

If the area has a high volume of passenger movement or cycling volumes at the adjacent cycling facility, a railing should be included to channel pedestrians to the dedicated crossing. Clear distance of 0.5m is preferred between cycling facility and vertical obstacles such as a railing or transit shelter.

Island Boarding Stop in Seattle. Source: NACTO

Island boarding stops can present some challenges for people with disabilities, especially those with visual impairments. Designers should seek to engage the accessibility community early in the design of these stop types to ensure they are accessible to all users. Refer to Section 2.2.5 Equity & Accessibility for additional guidance.

Shared Cycle Track Platform Stop

If there are right of way constraints, the transit platform can be integrated with the cycle track with tactile strips denoting the edge of the platform. In the presence of transit vehicles, cyclists are required to yield to passengers crossing the cycle track. When no transit vehicles are present, passengers wait on the sidewalk behind the cycle track while cyclists continue along the facility without stopping.

Signage and pavement markings should be used to reinforce the requirement for cyclists to yield to pedestrians. The transit shelter, if present, should open onto the sidewalk rather than the cycling facility.

Shared cycle track platform stop in Toronto. Source: NACTO

Shared Space Stop

At these stops, transit vehicles merge into a parallel cycling facility to serve the stop. Pavement markings should be used to warn cyclists that transit vehicles may enter the bike lane. Shelters and other amenities for the stop are placed on the adjacent sidewalk.

While serving the stop, buses will be partially in the motor vehicle lane and partially in the bike lane. Motorists and cyclists are expected to either wait behind the bus at the stop or merge into the adjacent travel lanes to overtake the bus.

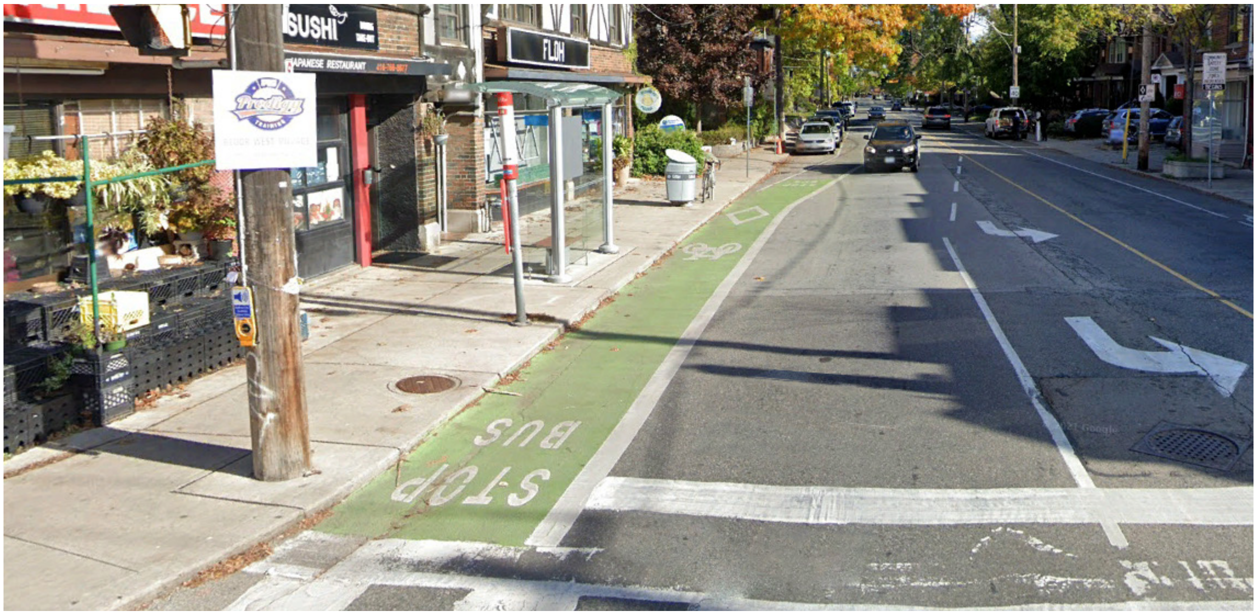
This type of stop increases complexity and reduces comfort for cyclists. It is not recommended for use on high-frequency transit routes or along high-volume cycling routes.

Bus Bay Stop

Buses merge into a lay-by or a right turning lane to reach the platform. This stop type is usually not preferred as it requires additional space in the right of way, and may result in delays as buses merge back into traffic after serving the stop.

Bus bay stops are intended for stops that operate as a layover, have high passenger boarding and alighting volumes, or have frequent boardings and alightings by passengers using mobility devices that require a ramp to board and where the bus stopping in the motor vehicle lane could have a significant impact on traffic operation.

Where on-road cycling facilities are present, transit vehicles may have to cross the facility to reach the bus bay, reducing cyclist comfort and safety.



Shared space bus stop in Toronto. Source: Google Earth

Curb Bump-outs

As outlined in Hamilton Street Railway's Stops and Shelters Technical Manual, curb bump-outs can be considered at stops along streets with high pedestrian volumes, on-street parking, and limited waiting space for transit passengers.

Curb bump-outs are an extension of the sidewalk or curb into the roadway that act as a transit landing pad. Curb bump-outs help separate waiting passengers from pedestrian traffic and reduce pedestrian crossing distances when implemented at near- and far-side stops.

This treatment eliminates the need for transit vehicles to change lanes to service a transit stop and can reduce transit delays from having to pull in and out of through lanes.

Shared space bus stop on a curb bump out in San Francisco. Source: NACTO

Design Parameters for Transit Stops

ELEMENT	TARGET VALUE	MINIMUM VALUE
PLATFORM LENGTH	9.0 to 15.0 m	9.0 m
CENTRE MEDIAN STOP WIDTH	3.2 to 3.5 m	1.5 m (plus ramp) 2.0 m (where level boarding is provided)
ISLAND BOARDING STOP WIDTH	3.0 to 3.5 m	2.5 m
TRANSIT SHELTER AND STREET FURNITURE CLEARANCE FROM BIKEWAY	0.5 m	0.3 m
CLEARANCE WIDTH ALONG TRAFFIC CURB EDGE	1.8 m	0.5 m
CURBSIDE TRANSIT STOP WIDTH	3.0 m	2.5 m

AMENITIES

A consistent look and feel is applied to Hamilton's transit stops. Consistency in amenities and stop layout contributes to the transit system's identity. At a minimum, all stops include stop signage and a clear area to accommodate boardings and alightings. Stop amenities enhance a user's experience in taking transit by making the wait experience more comfortable and convenient. Amenities that may be considered for transit stops include lighting, seating, shelters, tactile surface treatments, route and schedule information (static or digital/real time displays), litter receptacle, way finding signage and bicycle storage. Stop amenity requirements vary by typology as described in Chapter 4.

LOCATIONS

Transit stops are typically placed near intersections and pedestrian infrastructure for increased connectivity to side streets and to better facilitate transfers between routes. Near-side stops are stops located before an intersection. Near-side stops are preferred in most contexts as they promote efficient transit operations and visibility of pedestrian and fast-moving vehicles. Far-side (located after an intersection) or mid-block (between intersections) may be preferred over near-side stops to accommodate specific user or operational needs as described in the HSR Stops and Shelters Technical Manual.

3.3.3 TRANSIT LANES

Transit lane treatments can be considered for Complete Street improvements to separate transit vehicles from mixed traffic to improve efficiency and speed of service. Examples of transit lane configurations include dedicated transit lanes, reserved lanes, and queue jump lanes.

DEDICATED TRANSIT LANES

Dedicated transit lanes are marked for exclusive use by transit vehicles with diamond and "bus only" pavement markings, signage, and possibly physical barriers. Emergency and maintenance vehicles are generally permitted on dedicated transit lanes.

Dedicated transit lanes support high volume routes along corridors with high motor vehicle volumes and congestion to improve transit efficiency. This type of treatment is typically seen along Bus Rapid Transit (BRT) corridors.

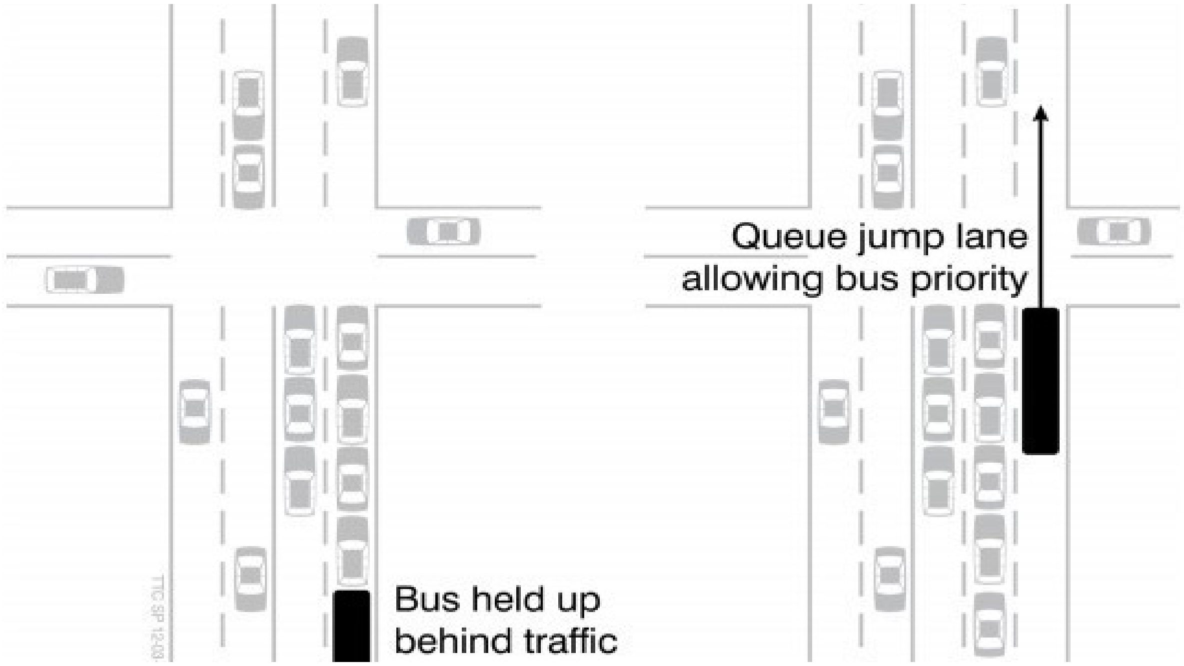
On-street bike lane adjacent to transit-only lane in Vancouver, BC.

Consideration should be given for how buses will enter and exit these facilities, especially for short-turn service or if the vehicles are expected to operate on other types of lanes along the route. Turning movements for motor vehicles across dedicated lanes should be managed to reduce transit delays.

3.3.4 INTERSECTIONS

QUEUE JUMP LANES

Queue jump lanes combine a short-dedicated transit facility with transit signal priority to provide transit vehicles opportunities to bypass queued traffic at intersections. Queue jump lanes are typically considered where motor vehicle volumes negatively impact transit efficiency. In some cases, right-turn lanes can double as queue jump lanes.



Queue Jump Lane Concept. Source: Toronto Transit Commission

Right-turn lane used as a queue jump lane for buses in Brampton, ON. Source: Google maps

TRANSIT SIGNAL PRIORITY

Transit Signal Priority (TSP) strategies can improve transit efficiency and speed by reducing dwell time at intersections. These strategies complement other interventions such as reserved lanes or queue jump lanes. TSP strategies include active and passive techniques. Active TSP techniques require hardware to detect the presence of transit vehicles and adjust the signals accordingly. Active techniques include holding green lights longer or shortening the red cycle when transit vehicles are detected. Passive techniques do not require any transit vehicle detection technology. Passive TSP involve signal timing techniques such as coordinating signals across a transit corridor to provide a wave of green lights for transit vehicles or providing a dedicated transit signal at intersections.

TSP can be implemented at individual intersections or across corridors. In the absence of transit vehicle detection technology, keeping signal cycles short at intersections can help improve transit efficiency.

3.4 ROADWAYS

The early streets of Hamilton were designed for the horse and carriage. To reduce congestion and meet the needs of a rapidly growing City, a horse-drawn streetcar service known as the Hamilton Street Railway was introduced in 1874, with electric streetcar service to follow a decade later. Today, the roadway serves many different vehicles including buses, trucks, bikes, and private automobiles.

This section of the manual relates to the portion of the street between the curbs that is generally intended for vehicle travel. Curbside uses such as parking are discussed separately in Section 3.5 Curbside Management.

The roadway serves an important role in providing for efficient goods movement and emergency response, and in allowing people to freely move about the City. Historically, roadways have been assessed using a level of service (LOS) grading systems based on a letter grade system ranging from LOS A to F. LOS A reflects operational conditions that are favourable towards speed, travel time, freedom to manoeuvre, traffic interruptions and comfort and convenience for motor vehicles. Designing towards higher levels of service for motor vehicles may result in excessive space allocated to the roadway and over-prioritization of private motor vehicle travel. This in turn can limit mobility choices, resulting in environmental and public health impacts, and in streets that are neither complete nor livable. From a street design perspective, it is important to balance the needs of all road users and to consider the context of the street within the overall road network.

3.4.1 DESIGN PRINCIPLES

Design reflects context. Streets may serve movement or access functions. Movement-oriented streets prioritize higher speeds, greater separation between road users, and limit access to the roadway. Access-oriented streets prioritize slower speeds, property access, and curbside activity. Roadways that attempt to prioritize higher-speed movement while also incorporating frequent property access are prone to high volumes of collisions.

Prioritize safety. Minimize conflict likelihood and severity through design choices to help create safer streets as a proactive preventative measure, rather than a retroactive reactionary one.

Multimodal roads. Curb to curb space dedicated for motor vehicles means less space available for other users within the overall right of way. The allocation of space should be considered for all users rather than designing a road to meet a target LOS for motor vehicles.

3.4.2 SPEED

Streets should be designed with a contextually-appropriate target speed in mind. Streets that feature interactions with vulnerable road users should be designed for slower speed operations. For example, in environments with high pedestrian activity or where cyclists are operating in a shared roadway, speeds should be no greater than 30 to 40 km/h. Where there is high potential for right-angle conflicts between motorized vehicles, speeds should be no greater than 50km/h.

Roadways designed for high-speed traffic are incompatible with a complex multi-modal environment. When drivers increase their speed, their field of vision becomes narrower, and it becomes more difficult to notice and react to events happening within or adjacent to the street. Collisions at higher speeds are more likely to result in severe injuries and fatalities. Finally, noise increases with motor vehicle speeds. This noise pollution has a negative impact on the livability of a street.

From a Complete Street perspective, the preferred approach is to start with a target speed and implement design measures that help to ensure motor vehicles will travel at those speeds. Techniques that introduce “visual friction” or that visually narrow the roadway can be highly effective in promoting slower speeds. These include on-street parking, street-oriented buildings, and elements such as trees planted close to the street. Narrow lanes and traffic calming features may also be considered.

DESIGN AND TARGET SPEEDS

- Target speeds should be selected in a context-sensitive manner.
- For urban streets with a posted speed up to and including 50 km/h, the design speed should be set equal to the target / posted speed.

3.4.3 DESIGN AND CONTROL VEHICLES

Design and control vehicles are used to inform the selection of various design elements including but not limited to, intersections, sight access configurations, vertical clearance and widths of elements within the roadways and curbside management zones. Design vehicles refer to “regular users” that reflects the largest turning radius frequently required to manoeuvre a turn at intersections. Control vehicles reflects the largest vehicle that is occasionally required to manoeuvre a turn at an intersection corner but are relatively low in frequency and may have less available space to manoeuvre. Appropriate design and control vehicles should be selected so that the roadway is not over-designed — for example, with wider lanes or curb radii than necessary.

3.4.4 LANES

Lanes provide the required amount of space for vehicles to travel along the roadway. It has consistently been found that narrower lane widths are associated with a reduction in travel speed. As such, narrower lanes, in the range of 3.0 to 3.3 metres, are preferred in most urban and suburban contexts.

Wider lanes increase the roadway crossing distance for pedestrians and consume excess cross section width, reducing available space for sidewalks, cycling facilities, landscaping, and other amenities. Even in contexts with fewer space constraints or in greenfield developments, wider lanes are still not preferred due to their impact on travel speeds and safety. The same lane width targets should be applied in both retrofit and new construction contexts.

In most contexts, 3.0 metre lanes are the target. On truck routes and on streets with regular transit service, the target width of the curb lane (or right-most travel lane) is 3.3 metres. Wider lanes are appropriate is a limited number of situations, including higher-speed rural roadways and roads with significant horizontal curvature such as mountain access roads. Note that lane widths are measured from curb to curb rather than from the edge of the gutter.

The target width for parking lanes is 2.2 to 2.5 metres, inclusive of any gutters. Additional guidance for on-street parking is provided in Section 3.5.

Lane Width Parameters

ELEMENT	TARGET VALUE	MINIMUM VALUE
THROUGH LANES AND TURN LANES	3.0 m[1]	3.0 m
CURB LANES	3.0 to 3.3 m	3.0 m
PARKING LANES	2.2 to 2.5 m	2.0 m[2]

Note:
1 – Applicable to urban, suburban, and low-volume rural contexts with a target speed less than 60 km/h. Refer to TAC Geometric Design Guide for Canadian Roads for guidance in other contexts.
2 – 3.3 m recommended on truck routes and on streets with regular transit service

Minimum 6 m clear width is required per the Ontario Building Code for emergency vehicle access

3.4.5 MEDIANS

Medians offer several benefits to the roadway:

- They reduce midblock turning conflicts by restricting access.
- They reduce the potential for head-on collisions, which are much more likely to result in serious injury or death at speeds above 70 km/h .
- They provide landscaping and associated traffic calming benefits.
- They provide a place to install signage, signal poles, and light standards.
- When used as part of a pedestrian crossing, they act as a pedestrian refuge that reduces the street crossing into two separate crossings, helping to reduce stress and improve safety.

By way of increasing the width of the roadway, medians can take away road space that could otherwise be allocated to other modes. For this reason, their benefits should be carefully weighed against their drawbacks. For example, if insufficient space is available in the boulevards to provide comfortable separation between traffic, pedestrians, and cyclists, wider boulevards should be prioritized over medians.

MEDIANS

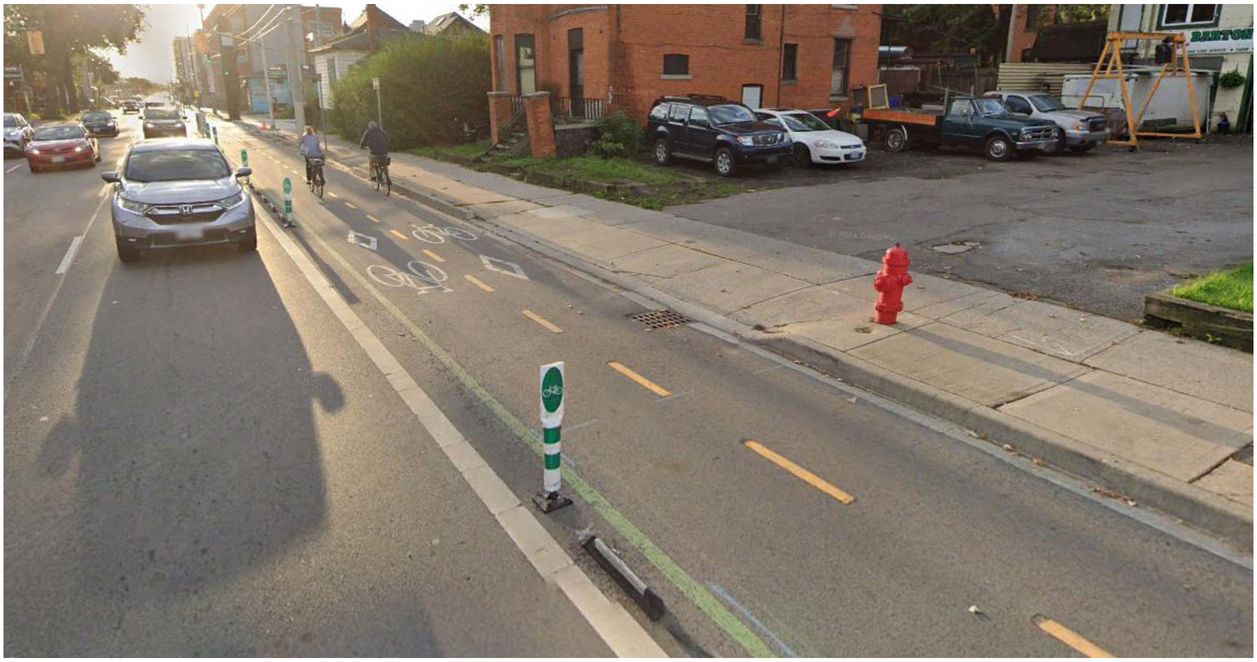
Continuous medians should generally be avoided on compact urban streets. They should be considered at pedestrian crossing locations, and may be used continuously on higher-speed mobility-oriented streets to eliminate mid-block left-turn conflicts.

3.4.6 DRIVEWAYS

Driveways, though necessary to facilitate access to and from properties, introduce conflicts on roadways.

For pedestrians and cyclists, the extra caution needed when crossing driveways can add extra stress to their travel experience. Therefore, driveways should be minimized and avoided where possible along mobility-focused streets. Instead, access should be provided via side streets.

Where driveways cannot be eliminated or shifted to side streets, their impact on the street should be minimized as much as possible. The curb cut should be no larger than necessary, with the sidewalk and cycle track continuing across the driveway rather than being discontinued.



Driveway acros Cannon Street bikeway. Source: Google Earth

3.5 CURBSIDE MANAGEMENT

Planning for curbside activities is key to designing vibrant streetscapes. Successful curbside management can help improve street access for people and businesses alike. Apart from accommodating pedestrians, cyclists, transit customers, and vehicle users, streets must also be designed to accommodate curbside uses such as snow removal, waste collection, and pickup or drop-off activities. Equitable and efficient allocation of curbside space can help to meet a street's design objectives.

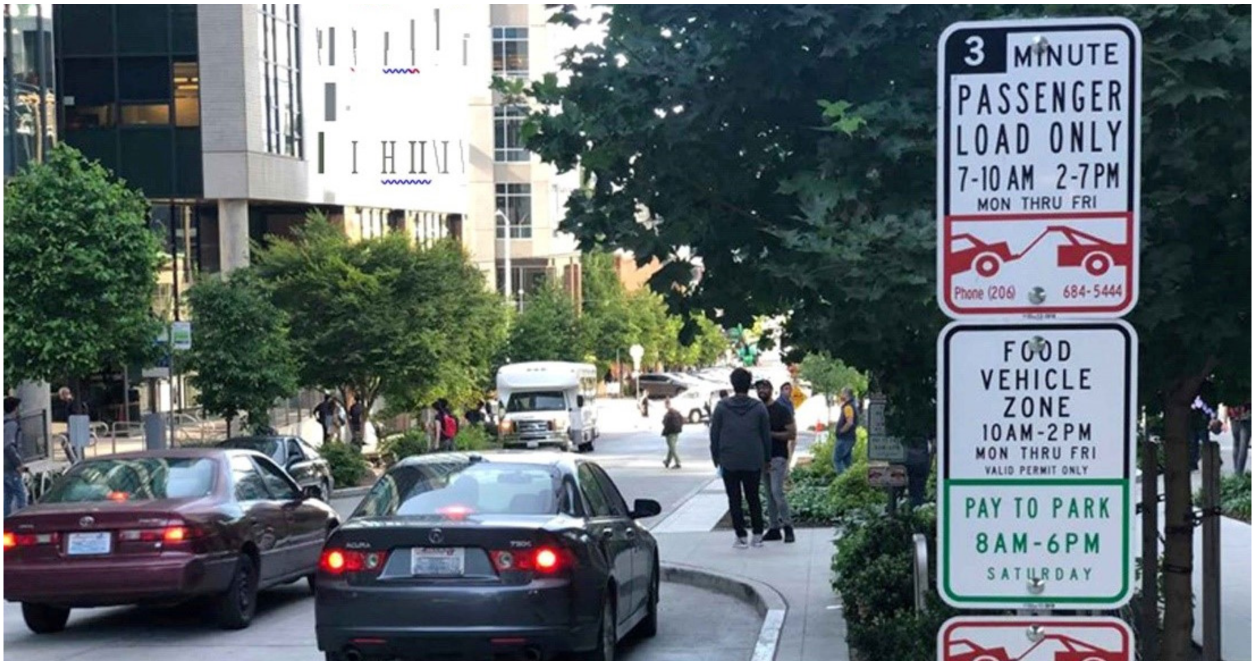
3.5.1 DESIGN PRINCIPLES

Flexible Space. Where possible, curbside space should be designed for flexible uses to allow for iterative, interactive design, or for uses that vary at different times of day or different times of the year. Temporary installations or pop-ups could help City staff test different configurations and uses for the curbside, providing an opportunity for observation and real-time feedback from residents.

Temporary seating added as part of the King Street Pilot Project in Toronto. The success of this pilot led to the permanent installation of seating and planting along the curbside. Source: City of Toronto

Ensure safety for all road users. Providing the proper space for curbside activities can contribute to increased visibility and space for various road users; transit users can benefit from designated disembarking and boarding spaces separated from live traffic, while delivery drivers would feel much safer stopping in a loading area rather than in a drive lane. Consider the context of the street when planning for safe curbside spaces.

Balance competing uses. The demands for curbside spaces have increased with ride hailing services, online retail, and micro-mobility and bike share services. Where curbside space is limited, proper curbside management, such as dedicated pickup and drop-off areas, has the potential to help reduce conflicts between competing uses and support multimodal access.



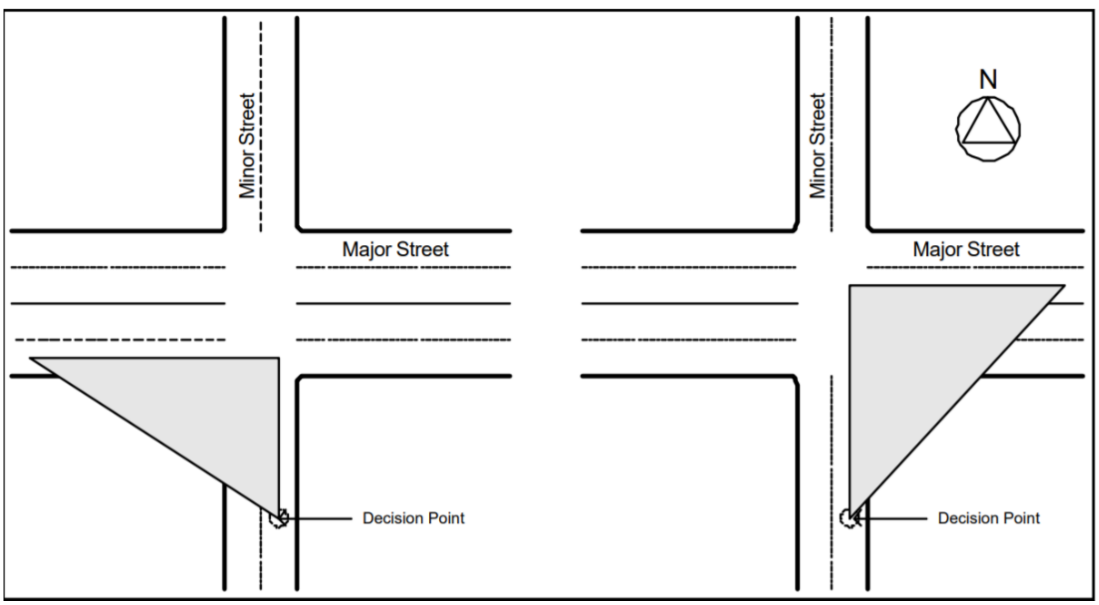
Loading signs for passenger pickup and food vehicle uses. Source: Washington State Transportation Center

3.5.2 ON-STREET PARKING

On-street parking is one of the most common uses for the curbside. Whether for private vehicles or commercial loading zones, it is important to design a roadway to allow for smooth transitions for parked or moving vehicles while minimizing disruption to other road users.

	TARGET VALUE	MINIMUM VALUE
ON-STREET PARKING WIDTH, INCLUSIVE OF GUTTER	2.2 to 2.5 m	2.0 m

In order to maintain sightlines near intersections, on-street parking should be restricted for at least 9 metres from an intersection, 6 metres from a crosswalk, or 45 cm from driveways. Angled parking is not recommended in any context.



An example of sightline triangles for motorists approaching an intersection for entry. Source: NACTO

In most cases, on-street parking should be provided within dedicated lay-by areas, framed with curb extensions at each end. This approach allows parking restrictions to be reinforced through design, reducing the number of on-street parking spaces in favour of extended space for pedestrians or street furniture. Curb extensions also results in shorter pedestrian crossing distances at intersections and crossings. The use of through lanes for off-peak parking is not recommended.

A curb extension at an intersection offers additional seating and an extended pedestrian crossing.

Available on-street parking can reduce the need for off-street parking for nearby businesses. In addition, on-street parking can act as a traffic calming tool by increasing the perceived “friction” for drivers, thereby encouraging lower travel speeds and buffering pedestrians and cyclists from traffic. However, for Complete Streets features to be added as part of retrofits, some or all on-street parking may have to be removed.

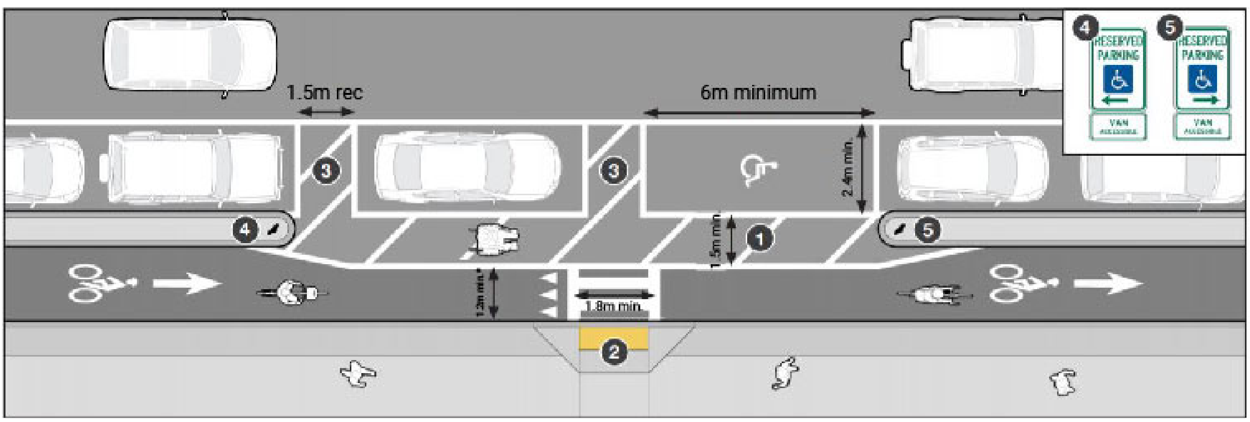
When adding on-street parking spaces it is important to first understand parking demand along a corridor. Providing more on-street parking than required could lead to empty parking lanes being perceived as an extension of motor vehicle through lanes, thus promoting increased travel speeds and reducing the overall safety of the corridor.

Conflicts may arise between drivers pulling in and out of parking spaces and other road users, such as cyclists riding in adjacent cycling facilities or drivers in adjacent through lanes. As such, on-street parking on high-speed streets with posted speed limits of 60 km/h or greater is not recommended.

3.5.3 ACCESSIBLE PARKING AND LOADING

All accessible parking and loading spaces should meet the minimum standards outlined in the Accessibility for Ontarians with Disabilities Act (AODA). As per AODA, when providing on-street accessible parking and loading spaces, the City must consult with relevant municipal accessibility advisory committees to determine the appropriate number of spaces to provide, ideal location, and design.

A buffer of 1.5 to 2.5 metres is required at both ends of an accessible parking space. Hard spaces should be provided in the adjacent boulevard and accessible curb ramps should be provided at the front or rear of the space. The location of accessible parking and loading spaces should be as close to nearby accessible residential and commercial entrances as possible.



Accessible On-Street Motor Vehicle Parking Example. Source: MassDOT

In cases where cycling facilities are adjacent to accessible parking and loading spaces, treatments such as providing additional buffer width between the parking lane and the cycling facility, narrowing the cycling facility in a constrained right of way, and clearly marking pedestrian crossing areas across the facility should be implemented.

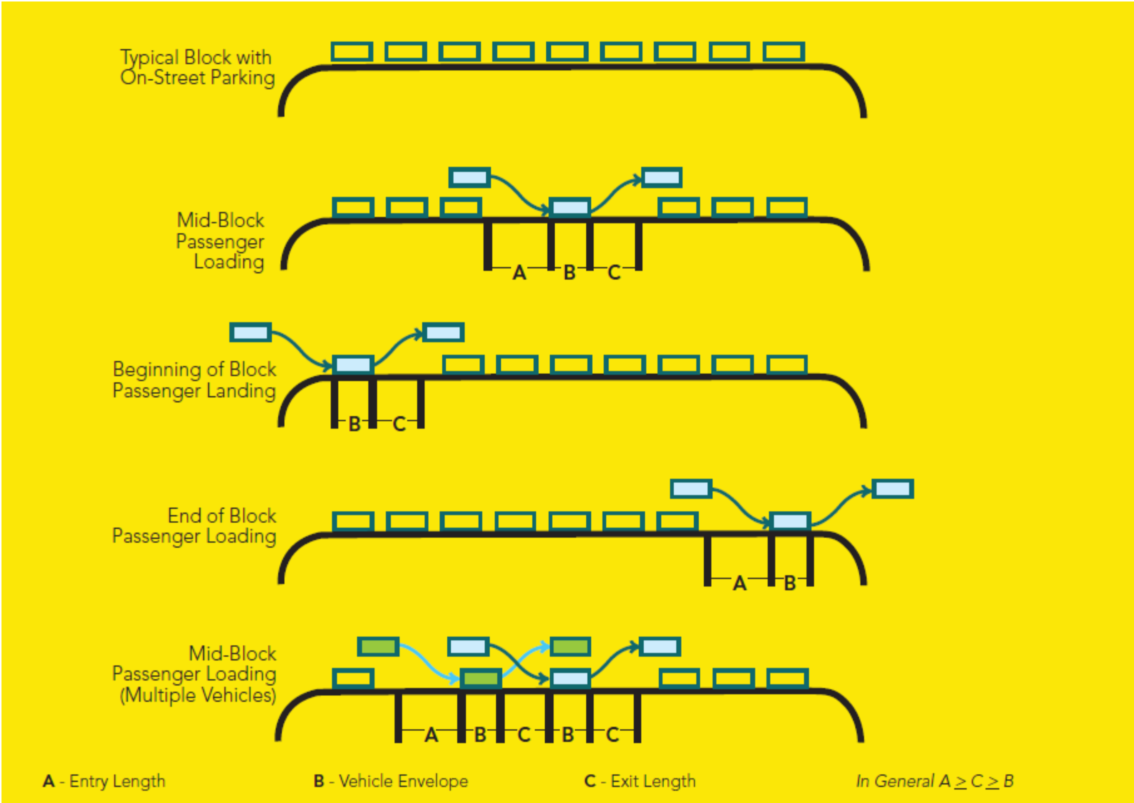
3.5.4 CURBSIDE LOADING

PASSENGER LOADING

With the growth of ride sharing services, the need for safe spaces for passenger loading and unloading is becoming more prevalent. Without dedicated pick-up or drop-off areas, rideshare vehicles or taxis are more likely to double park or cruise along streets while looking for a place to load or unload. This may lead to conflicts with other road users or unnecessarily increase vehicle kilometres travelled. Proactive provision of dedicated pick-up and drop-off zones can help mitigate conflicts between ridesharing vehicles and other road users.

Entry distances for vehicles entering a loading zone are generally longer than their exit distances. For this reason, providing passenger loading zones at the beginning of a block is generally more space efficient than providing the loading zone in the middle or at the end of a block.

Where passenger loading zones are provided adjacent to cycling facilities, consider increasing the width of the buffer between the loading zone and the cycling facility to allow pedestrians to wait within the buffer or walk along it to reach the nearest crossing. For a more detailed review of buffer widths for cycling facilities, refer to Section 3.2 of the manual.



This diagram demonstrates the curb space required for passenger loading in different configurations. Source: ITE

FREIGHT LOADING

Freight loading is typically provided for businesses in commercial areas where on-site loading or rear alleys are not available. However, with the increased demand for deliveries due to a growth in online retail, freight loading should also be considered in residential and industrial areas. These freight loading zones should be planned as a shared resource with adjacent private and public uses within a neighbourhood. Loading and curbside delivery zones would typically be designed to accommodate single-unit trucks for periods of 30 minutes or less.

Careful consideration should be made for the placement and design of freight loading zones along corridors with cycling facilities to minimize conflicts between cyclists and people loading and unloading the vehicles. Strategies include locating loading zones on intersecting streets or designing loading zones with similar features to accessible on-street parking zones

In 2017, following a recommendation by the Music Industry Working Committee (MIWC) and Hamilton Live Music Venue Alliance, the City introduced signs stating "Musicians Welcome" to be installed outside live music venues to provide space for musicians to load and unload their equipment. Loading zones in commercial areas for live music venues should continue to apply music loading zone areas.

Four of Hamilton's live music venues with nearby loading zones were provided with these signs to lend to musicians and their teams. These were to be placed in their vehicle's windshield to allow them to use the loading zones without risk of incurring a ticket.

Welcome Signs for musicians to load and unload by live music venues.

3.5.5 BICYCLE AND MICRO-MOBILITY PARKING

Curbside space may be used to support multi-modal mobility by providing on-street bike racks, bike corrals, or bike share stations. Space may also be reserved for dock-less bicycles and e-scooters so as to provide parking locations that do not obstruct the sidewalk. The conversion of on-street parking to bicycle or micro-mobility parking can result in significantly more efficient use of curbside space: typically, eight to fourteen bicycle parking spaces can fit within the area of one to two vehicle parking spaces. From a maintenance perspective, it can be desirable to re-purpose the on-street parking used for micromobility devices into poured concrete extensions.

To maximize usage, bicycle and micro-mobility parking should be located along corridors with a high volume of bicycle traffic. Locating parking along main streets has the added benefit of offering riders quick and easy access to nearby businesses and amenities. Safe and secure bicycle parking may further incentivize people to use their bicycles for everyday trips.

Bike corrals in Berkeley, CA (left) and on-street bike share station in Hamilton (right). Sources: City of Berkeley, CBC

3.5.6 PARKLETS & PATIOS

Curbside space may also be used to extend the pedestrian realm and activate the streetscape through the construction of parklets or restaurant patios. Parklets and pop-up patios gained popularity in many cities across Canada during the COVID-19 pandemic as a way to provide outdoor dining space for restaurants and cafés when indoor dining was prohibited. The City of Hamilton's On-Street Patio program, established in 2016, allows businesses to install temporary patios and seating areas in on-street parking areas within Business Improvement Areas (BIAs) and Community Improvement Plan Areas (CIPAs). These installations typically include green space, seating, dining areas, or public art installations. To maximize their usage, parklets should be considered on streets with high pedestrian volumes, such as on Main Streets.

As an extension of the public realm, parklets should also be designed with accessibility in mind. Ensuring sidewalks are regularly cleaned with minimal slope and cracks, as well as ensuring a wide, accessible route connecting the sidewalk to the parklet entry can help create accessible public parklets. Within the parklet itself, the entry should be located facing an unobstructed area with minimal slope along the sidewalk and curb. The parklet's surface should be firm, stable, and slip resistant, and additionally have adequate turning and resting space for a wheelchair, in order to accommodate those with mobility issues.

Temporary parklets installed in Hamilton. Source: Pop-Up Street Patios

Parklets are often temporary spaces that can be used seasonally and converted to parking or snow storage during the winter months. Regardless, parklets should be installed and maintained in collaboration with local Business Improvement Areas (BIAs) and neighbourhood groups to ensure their long-term viability.

3.5.7 OTHER CURBSIDE USES

FOOD TRUCKS

As a way to further activate the streetscape, consider designating curb space to allow Food Service Vehicles to operate in the right of way. The location of designated curbside spaces should follow City by-law no. 07-170 for the proper stopping distances for Food Service Vehicles.

In addition, food truck curbside areas should provide an extra 1 metre clearance in front of and behind the vehicle for fire safety and to allow for circulation.

Food trucks provide an opportunity to activate the public and pedestrian realm. Source: Food and Wine

FLEX ZONES

In addition to fixed uses, curbside space designation can be flexible to serve different uses. This can be achieved through time-of-day restrictions, by allowing multiple uses in the same space, or designating different uses along a single block face. ITE offers dynamic curbside management options such as the Curbside Management Tool to help temporally and spatially prioritize demand and allocation of the curb usage. Refer to this tool or the Curbside Management Practitioners Guide for more details.

EV CHARGING

With a rise in Electric Vehicle (EV) users over the past few years, the City may benefit from installing charging stations along the curbside. The City of Hamilton's Parking Master Plan includes recommendations to develop a comprehensive strategy for EV charging. The plan recommends considering curbside charging, a pricing strategy, and enforcement for designated EV spaces.

Siting a charger requires physical space in a location that maintains adequate clearance for other road users, particularly in constrained areas such as Business Improvement Areas, as well as electricity connections. As a result, the need for charging stations should be determined early in the scoping process.

EV charging stations along the curbside in commercial areas have the potential to incentivize current EV users to frequent those shopping areas knowing there are guaranteed charging spots. On the other hand, EV charging stations along residential curbsides could help EV users without private parking spots where they can install their own charger.

New York's first curbside electric vehicle (EV) charging station, installed in June 2021. Source: The Wall Street Journal

3.6 GREEN INFRASTRUCTURE

Green infrastructure refers to elements of streets that provide ecological and hydrological functions. These functions include mitigating urban heat island effect, improving biodiversity, air quality, energy efficiency, and stormwater management. Green infrastructure also contributes to the aesthetics of the streetscape and can improve comfort for people walking, rolling, cycling, and waiting for transit. Access to nature within the City can improve mental health outcomes for residents. Green infrastructure such as street trees and stormwater management systems within the right of way can also act as traffic calming measures.

Green infrastructure can help the City in addressing environmental objectives. Increasing vegetation and light surfaces in urban environments helps mitigate the urban heat island effect caused by surfaces that absorb solar thermal energy, such as asphalt. Paved areas with little vegetation absorb solar energy, increasing temperatures and making them less comfortable on hot summer days, thus increasing the demand for air conditioning. Introducing green infrastructure can help reflect solar energy, reducing local temperatures and thus improving outdoor comfort and the energy efficiency of nearby buildings. Street trees and other vegetation also help improve air quality and enhance biodiversity by providing habitats that support a variety of different species.

Green infrastructure can support the City in reaching its environmental and sustainability goals as outlined in the Rural and Urban Hamilton Official Plans, the Stormwater Management Master Plan, Hamilton's Design and Preservation Standards for Public Property (Draft), Hamilton's Urban Forestry Strategy (Draft), and the Hamilton Biodiversity Action Plan (Draft), Community and Energy Emissions Plan (Draft).

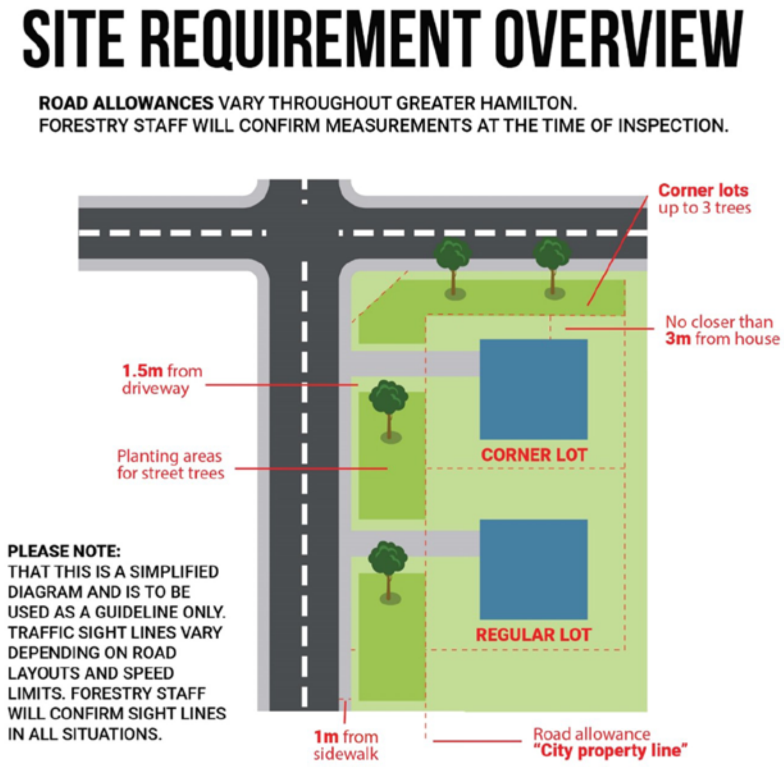
Rain garden in a parklet in Toronto. Source: City of Toronto

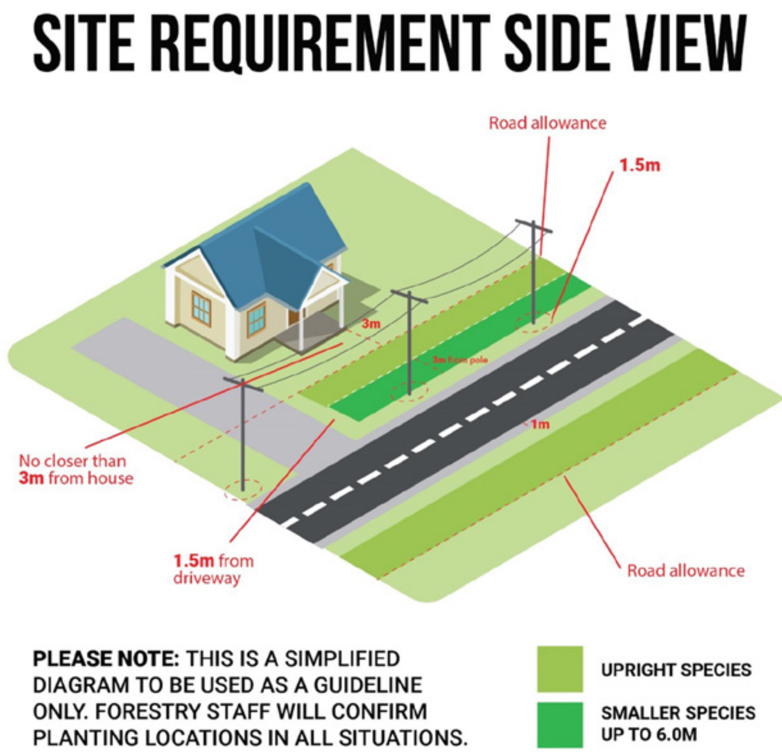
3.6.1 DESIGN PRINCIPLES

Prioritize low impact stormwater management features. Low Impact Development (LID) aims to mimic natural movement of water to manage stormwater runoff after rain or snowfall. Stormwater runoff is precipitation that does not evaporate or is not absorbed into the ground and instead runs over ground surfaces carrying pollutants into local water sheds. Unmanaged, stormwater runoff can cause erosion, flooding, and can degrade water quality of streams, lakes, and other wetlands. Green infrastructure such as rain gardens and permeable pavements complement the traditional storm sewer system by filtering, storing, and reducing runoff near the source of precipitation. Stormwater management features can help reduce the burden on the stormwater sewer system and improve water quality.

Complement sustainable and active transportation. Providing greenery in the urban landscape is important to encourage residents to walk and cycle more often. The shading, cooling, and noise reduction provided by an expanded tree canopy increases the comfort of people walking, cycling, or waiting for transit, further promoting the use of sustainable modes of transportation. Location of street trees and other green infrastructure can help reduce motor vehicles speeds, further improving road safety. The placement and maintenance of vegetation should ensure visibility and appropriate sightlines are maintained to ensure safety for all road users.

Low impact development feature separating a protected bike lane from automobile traffic, in Vancouver, BC





Setbacks and allowances for street trees. Source: City of Hamilton Design and Preservation Standards for Public Property (Draft)

3.6.2 STREET TREES

According to Hamilton's Urban Forest Strategy, the Urban Hamilton Official Plan sets a target to reach 30% canopy cover. The canopy cover in the City in 2018 was approximately 21%. Of the 5.2 million trees in Hamilton's urban forest, 168,000 (3.2%) of them are street trees. Street trees provide numerous environmental, economic, and social benefits.

ENVIRONMENTAL	ECONOMIC	SOCIAL
•Improved local air and water quality •Biodiversity conservation •Reduced flooding •Mitigate urban heat island effect •Carbon sequestrain and storage	•Reduced pressure on stormwater infrastructure •Extended pavement life •Increased residential property values •Improved visitor perception •Lower energy costs for heating and cooling •Improved climate resiliency	•Mental health benefits •Shade and cooling •Increased physical activity •Better walking environments •Noise reduction •Solace and a sense of place •Cultural heritage values

Benefits of Urban Trees from the Hamilton Urban Forestry Strategy (2020). Source: Tree Canada, Benefits of Urban Trees

The City of Hamilton's Forestry and Horticulture Draft Design and Preservation Manual for Public Property outlines details on permitting, plans, and planting guidelines for street trees and other green infrastructure. Street trees can be planted directly into the boulevard where there is continuous soft surface width of at least 1.75m. The width of the tree planting area and sufficient soil volumes contribute to the health and longevity of the street trees. The Draft Design and Preservation Standards for Public Property outline minimum requirements for soil volumes based on tree type and planting medium. The document also outlines site requirements and desired setbacks from nearest buildings, driveways, sidewalks, and adjacent utilities and municipal services.

When hard surfaces surround tree planting areas, strategies such as soil cells, soil corridors, or root bridges should be considered to ensure the health of the root system. In each case, the system should include proper drainage to mitigate the impact on nearby sub-surface utilities. Refer to the Forestry and Horticulture Draft Design and Preservation Manual for Public Property and consult with the City of Hamilton's Forestry and Horticulture department ensure designs adhere to the City's best practices and design and preservation standards.

"Right tree, right place" best practices should be used in selecting species. Local context and street typologies should be considered when selecting tree species.

According to the Urban Forestry Strategy Report, there is an overabundance of maple species making street trees more vulnerable to pest outbreaks. Ensuring species diversity can help mitigate this vulnerability.

Selection of street tree placement should include coordination with utilities early in the process to ensure root space is maximized and will not interfere with subsurface utilities. Maintenance plans for any vegetation should be developed in the preliminary design phase as well to ensure that the canopy does not interfere with overhead wires and street lighting and that the plants can thrive over many years.

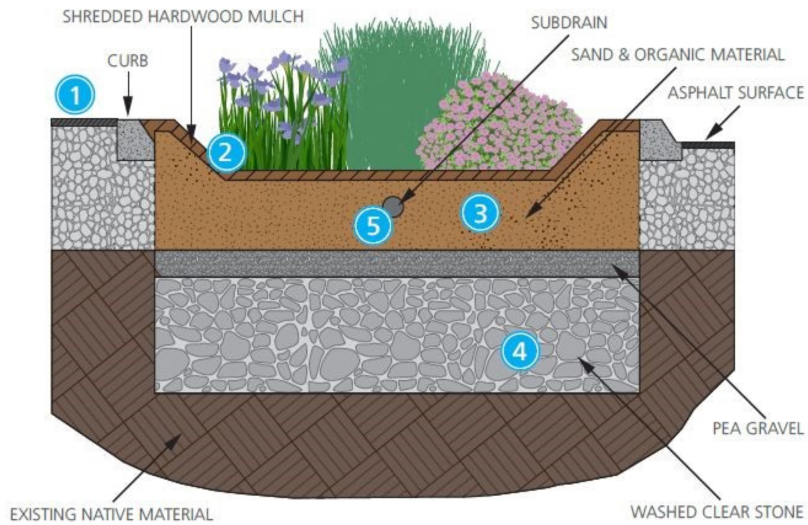
Continuous growing trench in streetscape. Source: Draft Design and Preservation Standards for Public Property

3.6.3 STORMWATER MANAGEMENT

Low-impact development (LID) features such as rain gardens, cisterns, permeable pavement, and grassed swales provide soft surfaces to collect, store, and filter stormwater runoff along roads and boulevards. Managing stormwater closer to the source can help reduce runoff volume, erosion, and flooding in the city, can reduce the burden on the City's storm sewer system. This may help the City manage operating costs and energy efficiency of the storm water system. LID features also manage stormwater runoff quality by filtering sediments and pollutants before entering Hamilton's waterways. As with other green infrastructure, LID features contribute to mitigating the urban heat island effect and increasing the attractiveness of the streetscape. Rain gardens installed as curb bump-outs in the right of way can also act as traffic calming devices.

A Rain Garden Traffic Calming Bump-out installed at the intersection of Bay Street North and Simcoe Street in Hamilton. Source: Google Maps

Many landscaped features along the right of way can be designed as rain gardens to collect runoff. Grassy surfaces, planters, and planting garden can all act as rain gardens. Consideration for grading of hard surfaces and the location of inlets near LID features should be given early in the design process to lead stormwater towards LID features.



Cross Section of Bay Street North and Simcoe Street West Traffic Calming LID Bump-Out.

Rain gardens should contain a mix of native perennials and grasses that can tolerate wet and dry conditions throughout the seasons as well as winter salt. Including plants that attract pollinators in LID features also strengthen and enhance Hamilton's biodiversity.

Rain gardens should be designed to drain within 1-3 days of heavy rainfall and should include an overflow system such as a subdrain that filters excess water into nearby stormwater sewers. Where the right of way is constrained or where raingarden maintenance is not feasible, subsurface LID systems to collect stormwater such as perforated pipes, third pipe systems or infiltration galleries can be installed.

As with street trees, maintenance plans should be developed during the preliminary design phase of stormwater management features, in consultation with Horticulture staff, to ensure that vegetation does not encroach in the pedestrian clearway, that the spaces remain attractive, and that the LID landscapes continue to provide the intended level of stormwater treatment.

LID feature incorporated into the sidewalk in Montreal.

3.7 UTILITIES AND MUNICIPAL SERVICES

Utilities and municipal services comprise essential services such as water supply, sewers, electricity and telecommunications, lighting, and gas supply the residents of Hamilton rely on every day. Utilities and municipal services are generally accommodated within the public right of way and, as such, are critical elements in the design and maintenance of Complete Streets. The design of Complete Streets should consider utility placement to maximize infrastructure investments, facilitate access for maintenance and repair, mitigate the impacts of extreme weather caused by climate change, and contribute to placemaking.

This section outlines the principles and consideration for the installation of utilities and municipal services on public roads. Further information on utility specifications, permitting, and installation can be found in the City's Comprehensive Development Guidelines and the Right-of-Way Utility Installation and Permit Manual.

3.7.1 DESIGN PRINCIPLES

Follow existing processes. Designing, installing, and maintaining utilities and municipal services are complex processes involving different stakeholders from the City to individual utility providers. The Hamilton Public Utilities Coordination Committee (HPUCC), a group that coordinates utilities work between the City and private utility companies, should be included in the design process. Utility and municipal service design should adhere to the City's engineering standards such as the Right-of-Way Utility Installation and Permit Manual and the Comprehensive Development Guidelines.

Facilitate access to underground utilities. Underground utilities should be positioned under soft surfaces wherever possible to provide easy access for maintenance and repair. Horizontal and vertical clearance between utilities should be sufficient to avoid interfering with adjacent utilities when accessing another one for maintenance or replacement. Where possible, communication and electrical utilities should be combined into a single utility trench to make effective use of space within the right of way.

Design should be driven by surface level uses, not utilities. Lateral placement of underground utilities is often more flexible than street-level elements. The needs of all road users and surface operations should be considered first when designing Complete Streets. Utility placement should be coordinated to fit into a given design unless specific constraints require consideration of utility placement first.

Aesthetic treatment. Placemaking and the public realm are key elements of Complete Streets. As such, the placement of above ground utilities should include provisions to minimize negative visual impacts to the surface level street-design to ensure an attractive streetscape.

3.7.2 SEWERS

STORM SEWERS

Storm sewers collect precipitation runoff from buildings, roadways, and other hard surfaces through drains and catch basins.

Maintenance holes and grates should be positioned outside the wheel path of motor vehicles and bicycles – for example in the centre of a lane or in between lanes – to avoid degradation of the surrounding pavement. Catch basins should be located upstream of pedestrian crosswalks and should be avoided in driveway curb depressions to keep them clear of stormwater and ice.

Careful design of catch basin grates should be considered for catch basins that fall within a cycling facility to ensure that cyclists wheels do no get caught in the gaps. Herringbone openings and similar design with gaps, such as side-inlet catch basins, that do not run parallel to the path of travel can help mitigate that risk.

SANITARY SEWERS

Sanitary sewers collect wastewater from residential, commercial, and industrial buildings to be treated at wastewater treatment facilities before being discharged into a receiving body of water.

Maintenance holes and grates should be positioned outside the wheel path of motor vehicles and bicycles – for example in the centre of a lane or in between lanes – to avoid degradation of the surrounding pavement.

Maintenance holes positioned outside the wheel path of motor vehicles and bicycles on Garth St. in Hamilton. Source: Google Maps

3.7.3 WATERMAINS AND WATER SERVICES

Watermains supply drinking water to fire hydrants and residential, commercial, and industrial buildings throughout the city.

Emergency access is an important consideration when determining the alignment of watermains. Broken watermains can result in losing water services for nearby buildings and can cause flooding. If not addressed rapidly, flooding can cause significant infrastructure damage increasing safety risks. To facilitate access, the preferred location for a watermain is below soft surface over asphalt or concrete.

3.7.4 ELECTRICAL AND COMMUNICATIONS UTILITIES

Electrical and communication wires can be installed either overhead or underground. Overhead electrical and communication utility wires allow for low cost implementation and easier access for maintenance than underground wires. Overhead wires are, however, more susceptible to weather conditions including ice, falling tree branches, and heavy wind than underground wires.

An abundance of overhead wires can also have a negative impact on the aesthetics of the public realm and can conflict with street trees. Careful considerations of these impacts should be kept in mind when evaluating the installation of utility wires. Traffic signal, street lighting, and utility pole installation should be coordinated to minimize the number of utility poles in the public right of way.

Installing electrical and communication utilities below ground can help mitigate the downsides of overhead wiring however can significantly increase the cost and complexity of implementation and maintenance. Underground wiring requires transformer boxes to be installed at surface level. Transformer boxes should be located as close to the property line as possible and away from snow storage areas. The alignment of underground wires should be consistent with the alignment of the right of way as much as possible. Wherever possible and financially feasible, the City should work to install electrical and communication wires underground.

3.7.5 STREET LIGHTING

Streetlights are crucial to enable the safe movement of pedestrians, cyclists, and motorists at night through the city. Street lighting contributes to enhancing safety and accessibility of public space. The design of street lighting should consider the pedestrian experience while balancing the City's energy and climate goals. For example, light fixtures should be dark sky compliant and focus most of the light towards the ground to minimize light pollution and energy consumption. Careful consideration should be made to minimize blind spots along the right of way that can create unsafe conditions for people walking. The location of new streetlights should be coordinated with the location of street trees to minimize light obstruction from trees.

3.7.6 GAS MAINS

Gas mains supply natural gas throughout the City as a primary source of fuel and heating for residential and commercial markets.

4

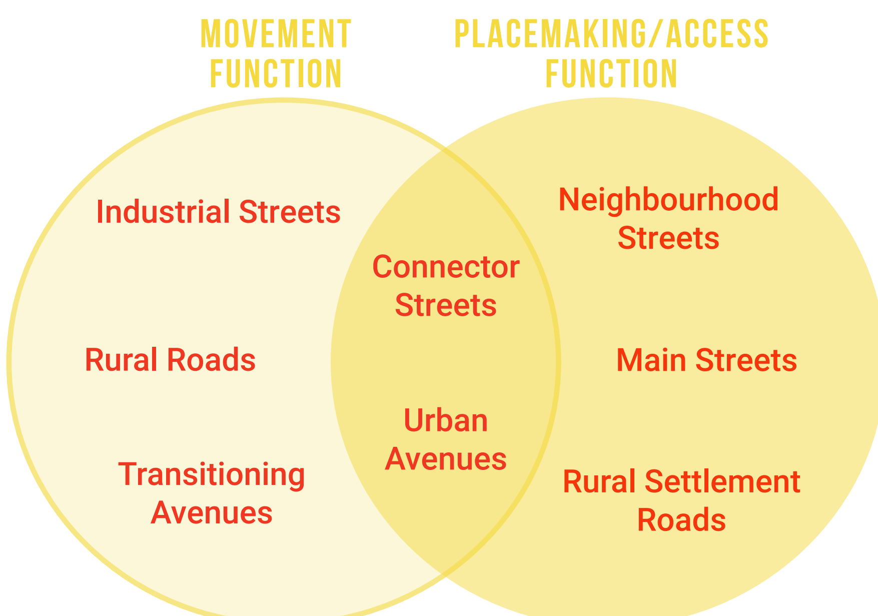
CHAPTER FOUR

TYPOLOGIES

4.1 DEFINING TYPOLOGIES

All streets serve a mobility function and placemaking function to different degrees. Mobility-focused streets prioritize safely providing a high degree of people–or goods-movement capacity. On these streets, there is greater separation between different road users, more limited access to the roadway, and higher motor vehicle operating speeds. In contrast, streets with a placemaking or a property access function prioritize the role of the street as a means of accessing destinations, and often prioritize the role of the street as an important public space with an attractive environment built at the pedestrian scale. These may take the form of quiet neighbourhood streets or vibrant main streets. On these streets, there are slower motor vehicle speeds with less separation between different road users, more frequent property access, and more curbside activity.

Defining the primary function of a street is an important principle of a Vision Zero or Sustainable Safety approach to road safety. Roadways that attempt to simultaneously provide a high degree of mobility and a high degree of property access are often prone to higher frequencies of serious collisions. Existing roads that feature high traffic volumes and frequent property accesses should be critically evaluated on a case-by-case basis to determine their desired long-term function, while temporary measures to improve safety should also be considered.



Hamilton's Complete Streets approach includes eight typologies, approved by Council in 2021, which represent the diverse range of streets found throughout the city.

Urban Avenues are vibrant pedestrian-oriented streets that provide a high amount of people-movement capacity, located in highly urban areas of the City.

Transitioning Avenues are mobility-oriented streets that extend across urban areas of the City. They are high-traffic streets and often important goods movement corridors.

Main Streets are placemaking-oriented streets, and include many historic main streets found in urban parts of the City. They are pedestrian-oriented with slow motor vehicle speeds and small–or medium-scale mixed-use buildings.

Connectors serve to link neighbourhood streets with Urban Avenues and Transitioning Avenues. They accommodate moderate volumes of vehicle traffic in a lower speed environment.

Industrial Streets provide direct land access to industrial and commercial employment areas. They are found in industrial areas of the City and may accommodate significant truck traffic.

Neighbourhood Streets provide direct access to residential dwellings. They are low-volume and low-speed streets that are not intended to serve a through traffic function for motor vehicle traffic.

Rural Roads are mobility-oriented streets within agricultural, natural, or industrial areas of the City. They provide a high motor vehicle capacity and may be important goods movement corridors.

Rural Settlement Roads are found where Rural Roads pass through small communities throughout the rural areas of Hamilton. Although through-traffic is accommodated, these road segments are focused on property access and placemaking.

The Complete Street Typologies expand upon Hamilton's existing functional road classification system, which classifies streets as arterials (major, minor, and rural), collectors (residential and rural), or local (residential and rural). The typologies consider the function of the street along with its context (for example, urban, industrial, or rural) to provide context-sensitive design guidance for each of the different categories of streets commonly found throughout the City. Chapter 2, Section 2.2.11 includes a matrix outlining the desired conditions for each street element per typology. Municipal Parkways are not included within the typology framework given their unique operating characteristics. The typologies are an overlay to the functional road classifications in the City's Rural/Urban Official Plans and are not meant to replace the existing classification.

This chapter explores the various aspects of street design for each of the eight Complete Street typologies. In each section, illustrations demonstrate the typical right of way configurations and accompanying streetscape elements that make up each typology. These illustrations are intended to demonstrate the general design features of each typology and may vary when applied to the location-specific context of each street. Note that all utilities and underground service locations are conceptual only. Depending on the specific context, it may not be possible to apply the typical cross-section due to various constraints, such as one-way or two-way traffic flow, available right of way, natural features, utilities or building setbacks. In these situations, practitioners should refer to Chapter 3, which provides design guidance.

The content shown in the following chapter is presented on two-way roadways, however the principles, space allocation, and designs are applicable to one-way streets with some modification. Ultimately, conversion of streets from one-way to two-way are subject to further study, consultation, and Council approval. Some roadways in the City have been identified for two-way conversion to improve safety outcomes. The City's Transportation Master Plan provides a framework for considering one-way to two-way conversions.

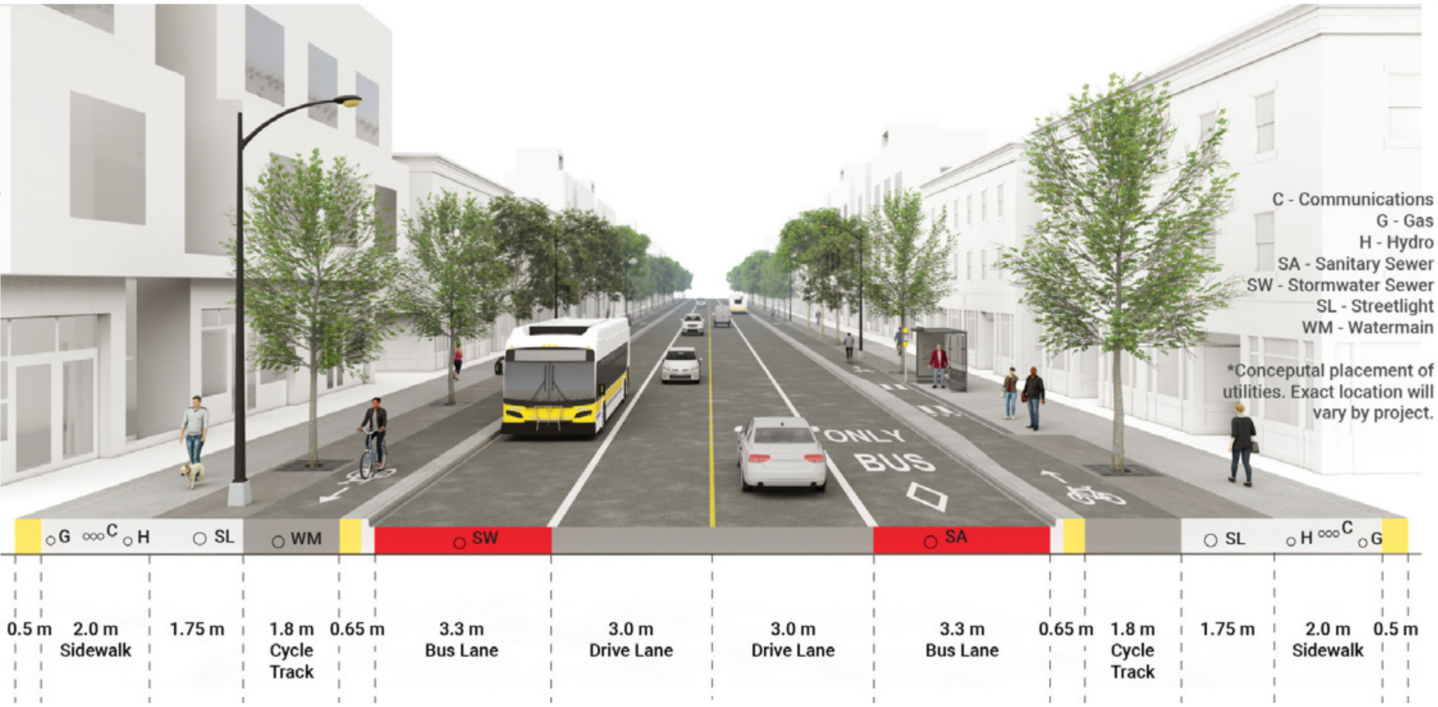
Note that examples for each typology are given as potential locations for the application of each typology but may not be representative of the desired conditions in it's current form.

	URBAN AVENUES	TRANSITIONING AVENUES	MAIN STREETS	CONNECTORS	INDUSTRIAL STREETS	NEIGHBOURHOOD STREETS	RURAL ROADS	RURAL SETTLEMENT ROADS
CONTEXT	Urban	Urban / Suburban / Industrial	Urban	Urban / Suburban	Industrial	Urban / Suburban	Rural	Rural
PRIMARY STREET FUNCTION	Mobility and place-making	Mobility	Placemaking and access	Mobility and access	Access	Access	Mobility	Access
TYPICAL RIGHT OF WAY	20–26 m	36 m	18–20 m	20–26 m	26–30 m	15–20 m urban 20–26 m rural	26–36 m	20–26 m
NUMBER OF LANES	2–4	4	2	2	3	1–2	2	2
TARGET SPEED	40–50 km/h	50–60 km/h	30–40 km/h	30–40 km/h	40–50 km/h	30–40 km/h	60–80 km/h	40–50 km/h
CYCLING FACILITIES	Cycle tracks	Cycle tracks or multi-use paths	Shared lanes	Cycle tracks	Cycle tracks or multi-use paths	Mixed traffic or contraflow lane	Shared lanes, paved shoulder, or multi-use path	Bicycle lanes, cycle tracks, or multi-use paths
WALKWAY ZONE WIDTH	2.0–3.5 m	1.8–2.5 m	2.0–3.5 m	1.8–2.0 m	2.0 m	1.8 m	n/a	1.8 m

4.2 URBAN AVENUES

Typical Urban Avenue Cross Section (20m ROW)

Urban avenues are mobility-oriented streets found in highly urban areas of the City. They provide a high volume of people-movement capacity with an emphasis on active transportation and transit service. These are vibrant pedestrian-oriented streets with frequent building entrances and commercial activity fronting onto sidewalks, and an attention to street trees and other green infrastructure elements. However, there is limited property access (for example, driveways) from the roadway, and curbside activity such as parking or loading is minimized. These may also accommodate higher-order transit corridors, particularly in the lower city.



Typical Urban Avenue Cross Section (26m ROW).

CONTEXT	Urban
STREET FUNCTION	Mobility and placemaking
RIGHT OF WAY	20–26 m
NUMBER OF LANES	2–4
TARGET SPEED	40–50 km/h
CYCLING FACILITIES	Cycle tracks, typically one-way on each side of the street
PEDESTRIAN CLEAR ZONE WIDTH	2.0 m, up to 3.5 m adjacent to high pedestrian generators

RIGHT OF WAY

The right of way (ROW) range for Urban Avenues largely depends on context. In older areas of the City, many existing streets are 20 metres wide. Through redevelopment, 26 to 30 metre ROWs can be achieved if heritage constraints and existing built form allow. Wider ROWs allow for increased capacity and more generous sidewalk, street furniture, and tree planting space. However, the core elements of an Urban Avenue can be implemented within a 20 metre ROW.

GOALS

- Prioritize transit and active transportation to maximize capacity. Dedicated bus lanes or bus queue jumps can help improve the efficiency of public transit along these avenues. Cycle tracks may be located next to the sidewalk, separated by an urban braille feature.
- In narrow corridors, maximize functionality and mobility by varying the design along the length of the corridor. For example, space that is used for a planting zone in one location may be re-purposed to provide a loading zone where needed or to allow for a turn lane to be introduced at an intersection.
- Provide frequent pedestrian crossing opportunities. Consider mid-block crossings in areas with high pedestrian traffic.
- Provide generous plantings and furnishing zones where space permits. These can help beautify and enliven the streetscape, making it more appealing for pedestrians to visit.

EXAMPLE STREETS

- John Street (St. Joseph's Drive to Cannon St.)
- Barton Street (through Barton Village)
- Cannon Street (Hess St. N. to Sherman Ave. N.)

Cannon St. W in Central Hamilton.

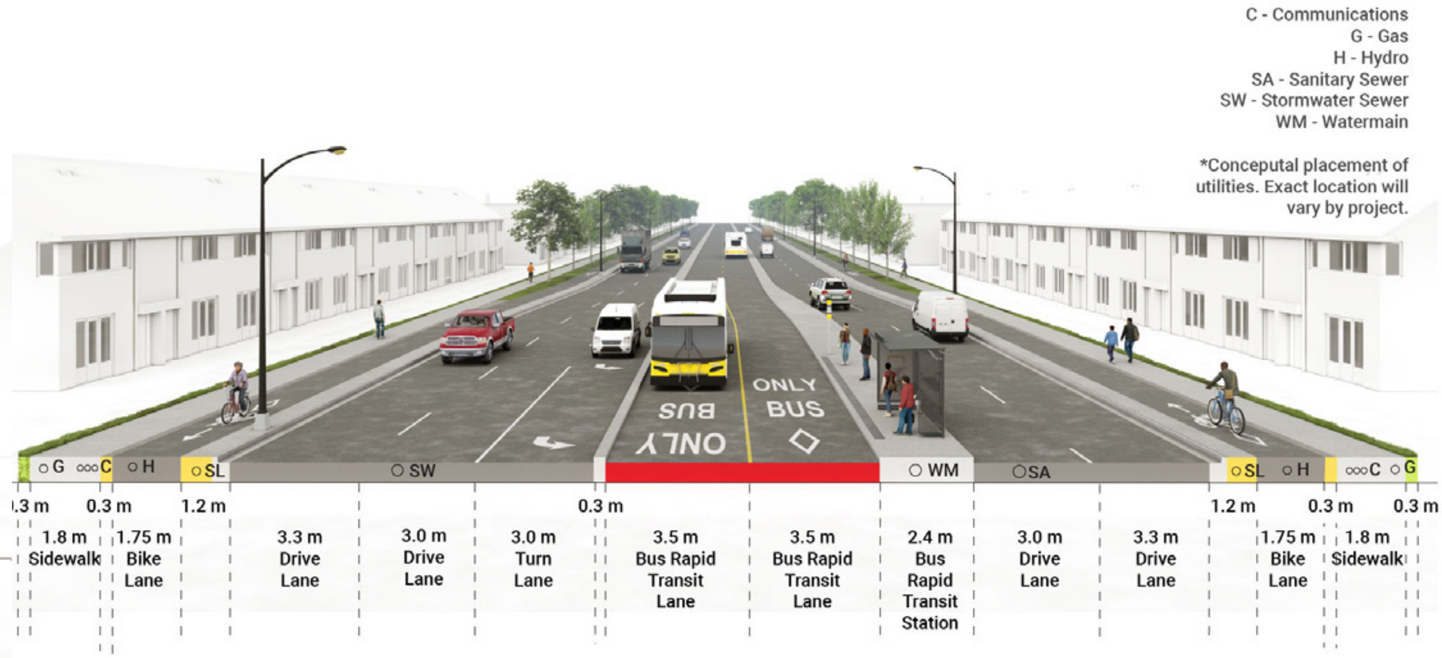
4.3 TRANSITIONING AVENUES

Typical Transitioning Avenue Cross Section (36m ROW).

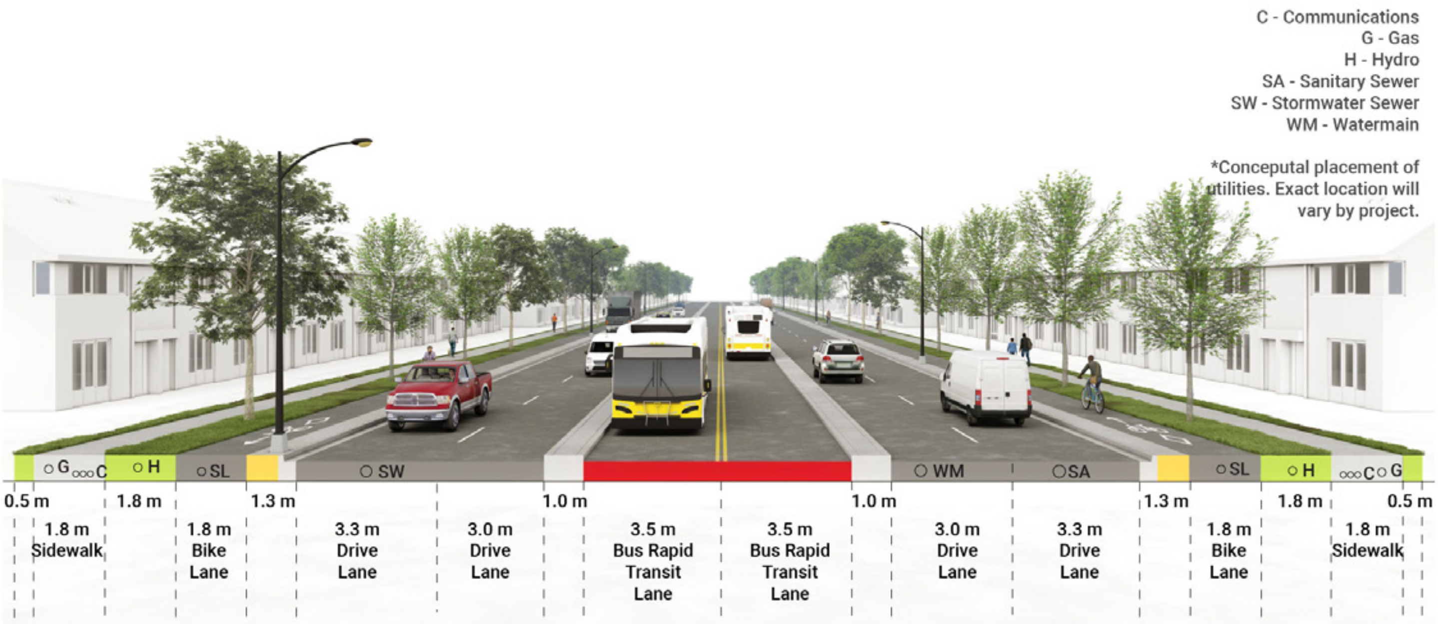
Transitioning Avenues are major streets that cross the city. They are high traffic streets that focus on mobility, whether that be people or goods movement. They are often, but not exclusively, located in areas of the City that are expected to transition to a more urbanized and mixed-use context over the coming years. This may include a transition from low-density residential and retail to medium or high-density mixed-use development. New developments are expected to be more street-oriented than in the past, with higher priority on the access and movement of pedestrians.

As these are high-capacity mobility-oriented streets, land access to these streets is limited and curbside activity is minimized. Driveways generally front onto intersecting streets, and not directly onto a Transitioning Avenue. Intersections are widely spaced and centre medians or dedicated turning lanes are used to improve safety and capacity. Some existing Transitioning Avenues feature frequent driveway accesses. Through redevelopment, efforts should be made to remove or consolidate accesses.

Any environmental assessment or feasibility studies for transitioning avenue projects along higher order transit corridors should investigate opportunities for increasing the right of way to enhance public realm and green infrastructure within the right of way.



Typical Transitioning Avenue Cross Section with centre-running BRT approaching intersection and transit stop (36m ROW).



Typical Transitioning Avenue Cross Section with centre-running BRT at mid-block (36m ROW).

Some Transitioning Avenues form part of Hamilton's higher order transit network and may eventually feature higher order transit lanes. Active transportation facilities including cycle tracks or multi-use paths are provided in a manner that facilitates network connectivity and access to destinations along these corridors.

CONTEXT	Urban/Suburban/ Industrial
STREET FUNCTION	Mobility
RIGHT OF WAY	36 m
NUMBER OF LANES	4 plus turning lanes
TARGET SPEED	50–60 km/h
CYCLING FACILITIES	Cycle tracks or multi-use paths (see Chapter 3 for selection criteria)
PEDESTRIAN CLEAR ZONE WIDTH	1.8 m, 2.5 m adjacent to high pedestrian activity generators

RIGHT OF WAY

The desired ROW for a Transitioning Avenues is 36 metres, which provides sufficient space for dedicated higher-order transit lanes and active transportation facilities. Wider right of ways may be desirable or necessary in some situations. Along higher-order transit corridors, localized widening may be considered at station locations to provide wider platforms or boulevards, or to accommodate additional turning lanes.

GOALS

- Limit vehicle accesses (e.g. driveways); consolidate accesses at controlled intersections.
- Limit on-street parking, loading, and other curbside uses.
- Use planting zones to buffer pedestrians and cyclists from motor vehicle traffic. Additional street furniture, public art or plantings in the buffer zones can also beautify the street, making the streetscape more appealing and contributing to place-making strategies.
- Provide centre-running transit in dedicated lanes on rapid transit corridors to maximize transit capacity, where planned.
- Select contextually appropriate active transportation facilities. In choosing between cycle tracks or multi-use paths, consider expected pedestrian and cyclist activity levels. In determining the placement of facilities (which side of the street), consider the frequency of conflicts, access to destinations, and network connectivity.

EXAMPLE STREETS

- Rymal Road (east of Garth Street)
- Wilson Street W (west of McClure Road)
- Upper James Street (Queensdale Avenue to Rymal Road)

Rymal Road East in October 2020. Source: Google Maps

4.4 MAIN STREETS

Typical Main Street Cross Section (20m ROW).

Main Streets are often the traditional shopping streets found in urban areas of the City. They are highly pedestrian-oriented with small-scale mixed-use buildings. They often contain heritage buildings or are designated as Heritage Conservation Districts in their own right. Development along Main Streets is heavily street-oriented and often surrounded by residential neighbourhoods. Main Streets exist in each of the former municipalities that make up Hamilton.

The Main Street typology has an urban cross-section with an emphasis on streetscaping and placemaking. Pedestrians should be prioritized with slower traffic, wide sidewalks, enhanced pedestrian amenities, and flexible curbside uses, which may include small parks (parklets) or outdoor dining. The flex zones can be framed by a mountable or non-mountable curb, depending on the context. Motor vehicle traffic is slowed through the intentional use of narrow vehicle lanes and a high intensity of curbside activity along with curb extensions at intersections. Street amenities include wide sidewalks and furnishing zones, pedestrian-oriented lighting, street trees, transit amenities, and opportunities for public art.

CONTEXT	Urban
STREET FUNCTION	Placemaking and access
RIGHT OF WAY	18–20 m
NUMBER OF LANES	2
TARGET SPEED	30–40 km/h
CYCLING FACILITIES	Shared lanes
PEDESTRIAN CLEAR ZONE WIDTH	2.0 m, 3.5 m adjacent to high pedestrian generators

RIGHT OF WAY

These roads historically have narrow ROWs which is important in maintaining pedestrian-scale street. A 20 metre ROW is desirable. However, 18 metre ROWs can be found on some streets.

GOALS

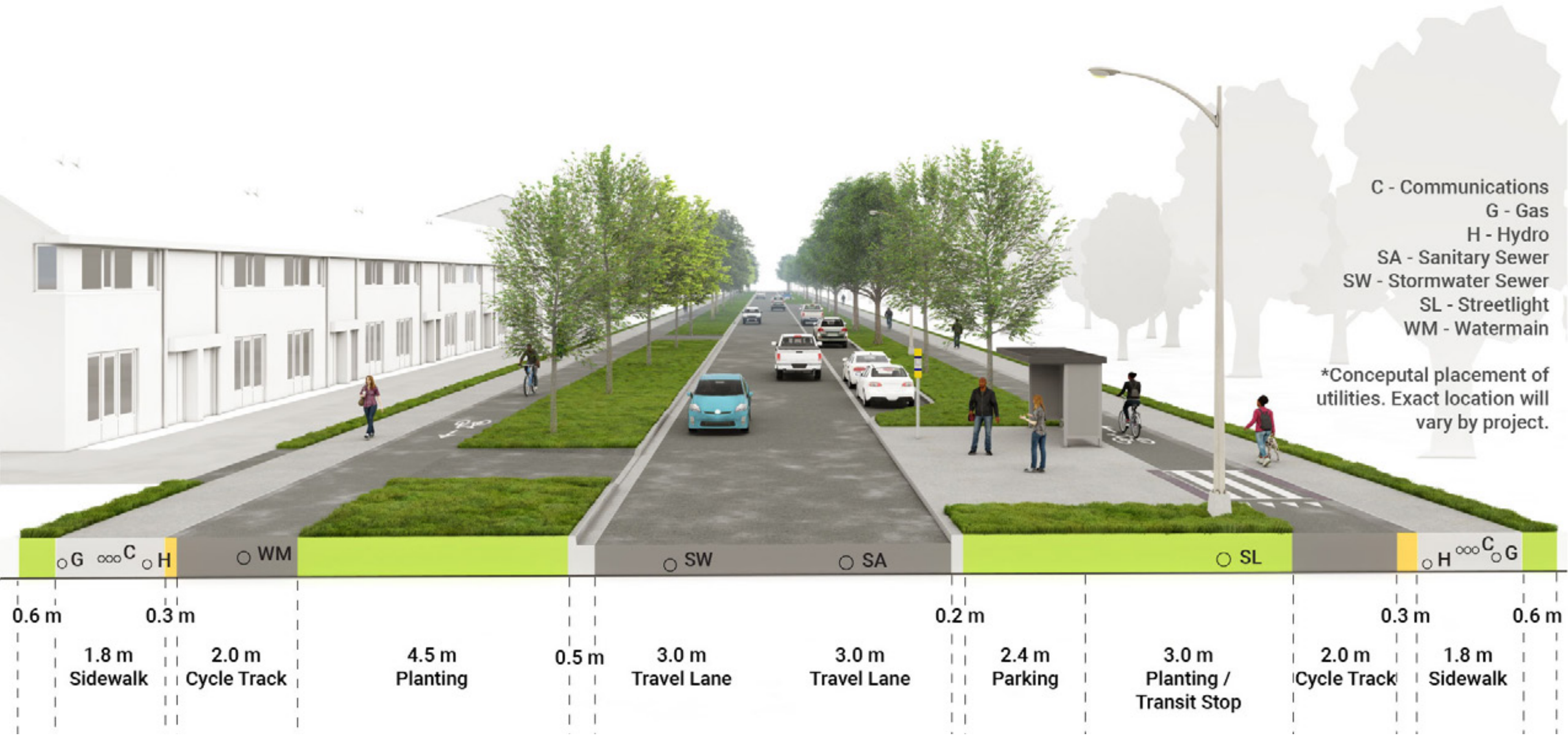
- Prioritize the pedestrian realm. Provide amenities like plantings, furniture, or creative curbside uses such as extended seating, restaurant and café patios, or parklets to attract pedestrians and encourage them to linger on the Main Street. Curb-less street sections may also be considered to provide more space for street plantings and furniture in place of parking.
- Provide street design that allows for frequent pedestrian crossing opportunities. Consider mid-block crossings with curb extensions to allow convenient crossings with minimal crossing distance.
- Apply passive traffic calming to promote slow travel speeds. This may include narrow vehicle travel lanes, on-street parking or flex zones, mid-block crossings, curb bulb-outs.
- Provide convenient and frequent bicycle parking or bike share stations to support access to destinations by bicycle.
- Collaborate with local BIAs to introduce and maintain placemaking features and activities tailored to the unique context of each street.

EXAMPLE STREETS

- Locke Street (Hunter St. to Herkimer St.)
- Kenilworth Ave North (north of Roxborough Ave.)
- Wilson Street (Rousseaux St. to Sulphur Springs Rd.)

Locke St. in Central Hamilton. Source: Google Maps

4.5 CONNECTORS

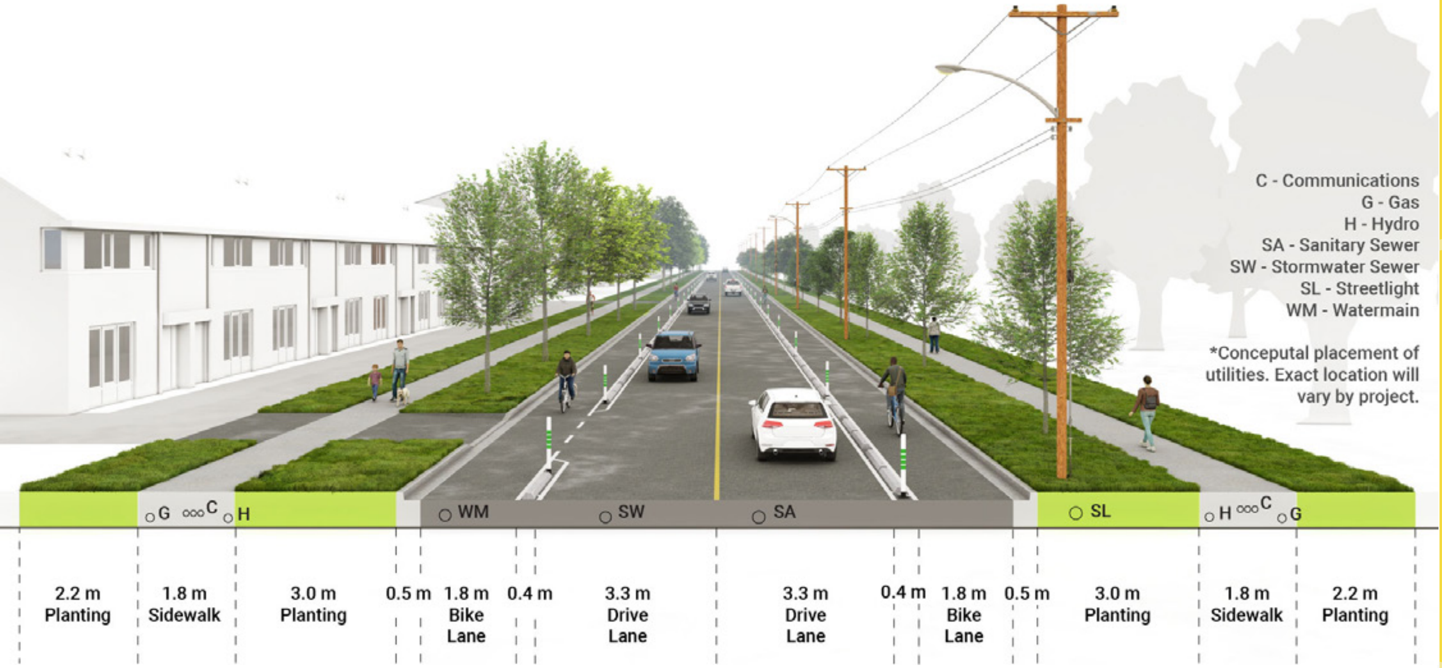


Typical Connector Cross Section (26m ROW)–New Construction.

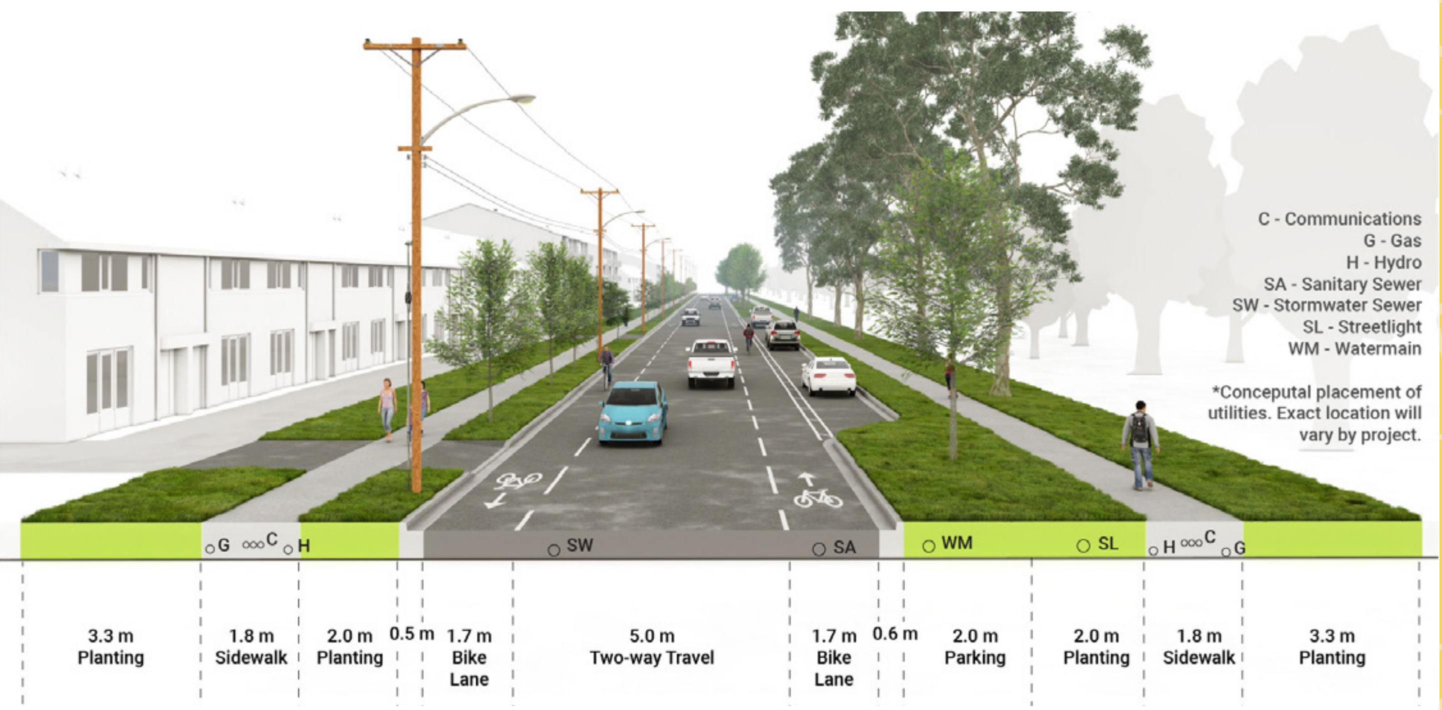
Connectors are an important component of the street network, linking residential neighbourhoods to the major street network and to other areas of the city. Connectors are commonly found in residential areas and accommodate a moderate volume of traffic. Buildings are generally set back from the street and front onto a wide boulevard.

Connectors support transit and active transportation with wide sidewalks and dedicated cycling facilities. These streets include ample soft landscaping and mature trees to create a pleasant environment for walking and cycling. Sidewalks may be more than 1.8 metres in areas with high pedestrian traffic.

Connectors typically feature one lane of traffic per direction with on-street parking on one or both sides of the street. A narrow roadway with parking in dedicated lay-bys promotes slower travel speeds. Existing streets with wider roadways may be retrofit with advisory bike lanes and curb extensions at intersections to achieve similar objectives.



Typical Connector Cross Section (26m ROW)–Retrofit Scenario.



Typical Connector Cross Section (26m ROW)–Retrofit Scenario.

CONTEXT	Urban/Suburban
STREET FUNCTION	Mobility and access
RIGHT OF WAY	20–26 m
NUMBER OF LANES	2
TARGET SPEED	30–40 km/h
CYCLING FACILITIES	Cycle tracks (on-street lanes, advisory lanes, or shared lanes may be appropriate depending on context)
PEDESTRIAN CLEAR ZONE WIDTH	1.8m, 2.0m adjacent to high pedestrian generators

RIGHT OF WAY

The preferred ROW width for Connectors is 26 metres, though it is still applicable in more constrained areas. The 26 metre ROW provides enough space for dedicated cycle tracks and on-street parking along with generous planting zones.

GOALS

- Use passive traffic calming measures to promote slower speeds. This may include narrow vehicle travel lanes, on-street parking, mid-block crossings, and curb bulb-outs. More intrusive calming measures such as speed humps or raised crosswalks may be appropriate at pedestrian crossing locations or where specific concerns exist.
- Emphasize green infrastructure. Providing space for street trees and native plantings can enable a continuous tree canopy and provide shade for people walking and cycling.

Planters or green bump-outs may also help beautify the street while acting as passive traffic calming measures and managing stormwater at the source.

- Provide separated cycling facilities. These streets often serve as cycling routes to schools and may be used by children and less experienced cyclists. Cycle tracks completely separated from traffic offer the highest degree of safety and comfort for people cycling.
- Formalize space for motor vehicle parking, where warranted. On-street parking introduces “friction” which can encourage slower driving speeds. However, a wide roadway with low parking utilization will have the opposite effect. Curb extensions should be added at the beginning and end of blocks to help frame parking areas and reduce crossing distances for pedestrians.
- Driveways should be consolidated where possible along mobility-focused streets, such as those with high pedestrian movement. Instead, provide access via side streets.

EXAMPLE STREETS

- Stonehenge Drive
- Windwood Drive
- Bendamere Avenue
- Sterling Street

Sterling Street. Source: Google Maps

4.6 NEIGHBOURHOOD STREETS

Typical Neighbourhood Street Cross Section (20m ROW).

Neighbourhood Streets provide direct access to residential areas. They have low traffic volumes and are most often used by people residing within the neighbourhood—they are not intended to serve as a through-traffic connection for motor vehicles. As Neighbourhood Streets are surrounded by residential uses, traffic calming measures and minimizing through-traffic are important considerations. Neighbourhood Streets can also double as bicycle boulevards.

Neighbourhood Streets provide comfortable and safe pedestrian and cyclist movement with sidewalks, plantings, street lighting and a low-traffic and low-speed roadway. A mature street tree canopy can add to the attractiveness of a street. Tree canopies provide shade, a sense of place, and can improve mental well-being. Neighbourhood Streets may be located in school zones where speed limits are 30 km/h.

These streets also offer the opportunity for social interactions and community activities. Yard sales, block parties, or children's play should be encouraged along Neighbourhood Streets. As such, it is important to ensure that Neighbourhood Streets are slow streets that feel comfortable and safe for travellers.

CONTEXT	Urban/Suburban
STREET FUNCTION	Access
RIGHT OF WAY	15–20 m urban 20–26 m rural
NUMBER OF LANES	1–2
TARGET SPEED	30–40 km/h
CYCLING FACILITIES	Mixed traffic or contraflow lane
PEDESTRIAN CLEAR ZONE WIDTH	1.8 m

RIGHT OF WAY

The typical ROW for a Neighbourhood Street is 20 metres, though many existing ROWs may be as narrow as 10 to 15 metres, especially in the lower city. The recommended roadway width varies depending on the demand for on-street parking, and whether it is provided on one or both sides of the road. Roads with parking on one side typically have a 6 to 7 metre curb-to-curb width, whereas roads with parking on both sides have an 8 to 8.5 metre width. Some streets may be one-way only for motor vehicle traffic, however, contraflow cycling should be allowed where beneficial for network connectivity.

It is important to understand the local context with regards to parking demand so that the roadway may be properly sized. If there is low parking demand and the on-street parking lane is largely empty, it can result in a wide roadway with excessive speeding that may require future traffic calming interventions. In areas with high demand for on-street parking, curbside parking can create friction and encourage motor vehicle traffic to proceed slowly, thus acting as a traffic-calming measure.

GOALS

- Sidewalks on both sides by default. Consider other features such as green infrastructure, landscaping, and pedestrian scaled lighting to improve the pedestrian realm.
- Consider passive traffic calming measures to keep speeds low, making the roadways safe and comfortable for pedestrians and cyclists. This may include narrow vehicle travel lanes, on-street parking, mid-block crossings, and curb bulb-outs. Refer to the TAC Canadian Guide to Traffic Calming for further details on traffic calming measures.
- Make the roadway comfortable for cycling. Consider features like barriers to reduce through traffic for vehicles, also known as modal filters. Painted dedicated cycle tracks are preferred, however shared roadways may also be encouraged if space is limited. Bike boulevards can help prioritize movement for bicycles while also limiting vehicle speed and traffic.

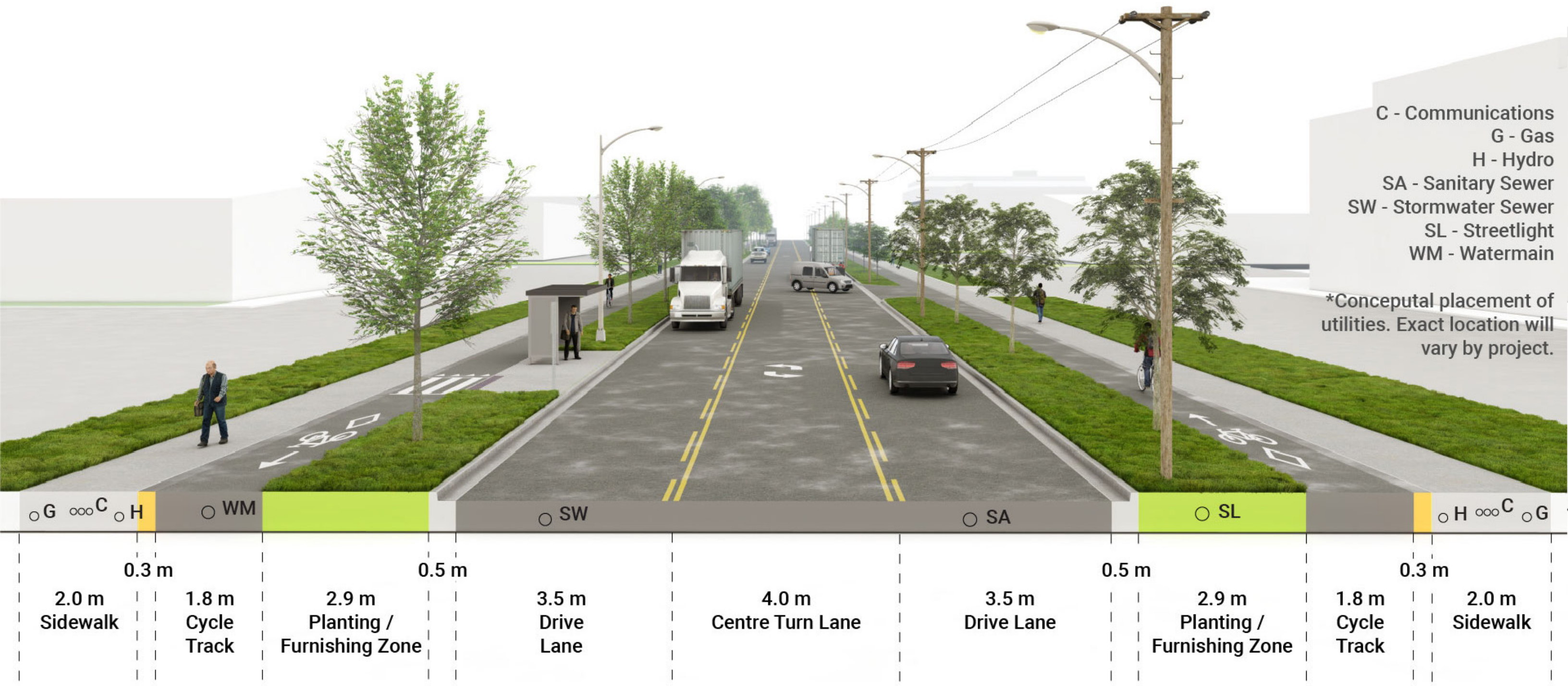
EXAMPLE STREETS

- Many residential streets
- Bay Street (north of Cannon Street)
- Pearl Street South (south of Main Street)
- South Bend Road East (east of Upper Wellington Street)

Brian Boulevard. Source: Google maps

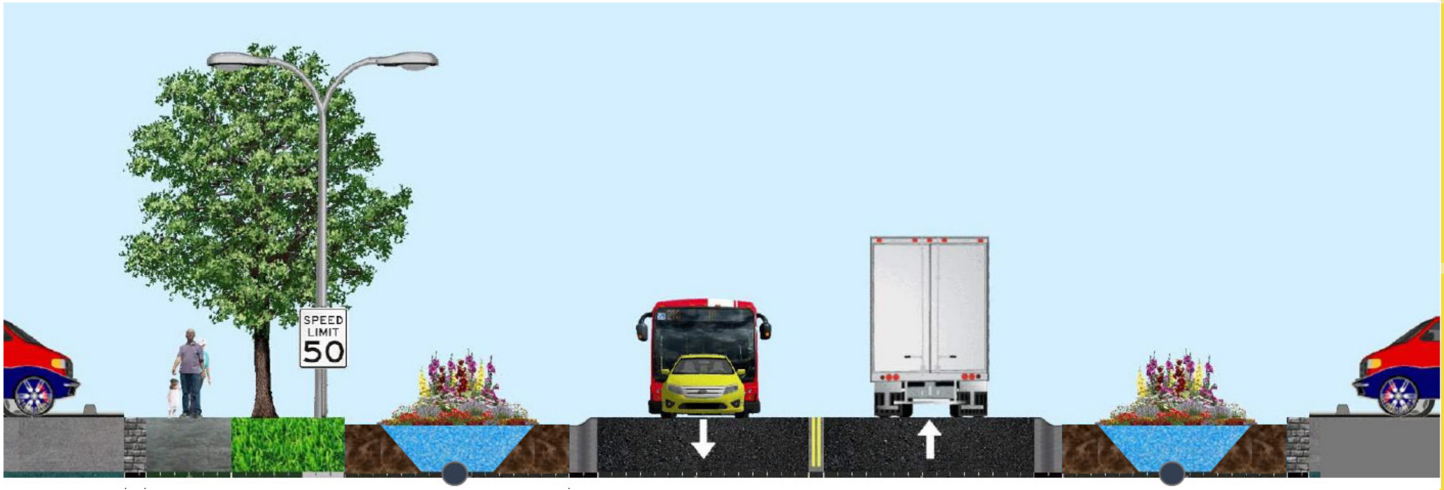
Pearl Street South. Source: Google Maps

4.7 INDUSTRIAL STREETS



Typical Industrial Street Cross Section (26m ROW).

Industrial Streets provide access to industrial and commercial employment areas. They are not through-trucking routes but are often the origin or destination of a truck trip and feature high volumes of heavy vehicles. Buildings and lots are often set back from the roadway with landscaping or parking lots separating the buildings from the street. There are many frequent and large driveways along these streets that provide access to destinations.



Emerging Industrial Road with LID features. Subject to further refinement and approvals as part of the AEGD Transportation Master Plan

Industrial Streets play a major role in supporting goods movement and employment activity. The destinations along these streets are also workplaces for significant numbers of people. As such, this typology aims to provide a range of mobility options for people travelling to work, while providing appropriate accommodation for large trucks.

Sidewalks, cycle tracks (or alternatively, multi-use paths) and transit shelters are provided on Industrial Streets. The choice of cycle tracks or multi-use paths is dependent on network connectivity considerations and the location of destinations along the corridor. The roadway consists of a three-lane cross-section with a centre turn lane to facilitate access to driveways on both sides of the street. Lane widths are appropriately sized for large trucks. On-street parking is not recommended since adjacent land uses generally provide ample surface parking.

The City is adopting standards that incorporate greater levels of LID features, such as bioswales, within the right-of-way in the Airport Employment Growth District (AEGD) and other employment areas. This can increase the right-of-way required.

CONTEXT	Industrial
STREET FUNCTION	Access
RIGHT OF WAY	26–30 m
NUMBER OF LANES	3
TARGET SPEED	40–50 km/h
CYCLING FACILITIES	Cycle tracks or multi-use path
PEDESTRIAN CLEAR ZONE WIDTH	2.0 m

RIGHT OF WAY

A 26 metre ROW is desirable for the base typology. This provides sufficient space for active transportation facilities, bus shelters, planting zones, and motor vehicle travel lanes and two-way centre turn lanes. As the City adopts LID standards in the AEGD and other employment areas, additional width may be required. This can increase the required right-of-way by up-to 10 metres for a local or collector road.

GOALS

- Appropriately sized travel lanes accommodate goods movement and transit vehicles. Transit vehicles generally operate in mixed traffic.
- Provide vehicular access to industrial and commercial driveways on both sides of the street through the use of two-way centre turn lanes.
- Provide attractive mobility options for workers. This may be through enhanced transit service, sheltered transit stops, setback sidewalks on both sides of the street, or dedicated cycling infrastructure. Cycle tracks, or multi-use paths may all be considered to improve safety and connectivity of the cycling network.
- Enhance pedestrian and cyclist comfort, especially between transit stops. Consider full protected bus shelters and benches, dedicated cycle tracks separate from traffic, street plantings, and pedestrian-oriented lighting. Where the distance between intersections is lengthy, consider mid-block pedestrian crossings, especially at transit stop locations.

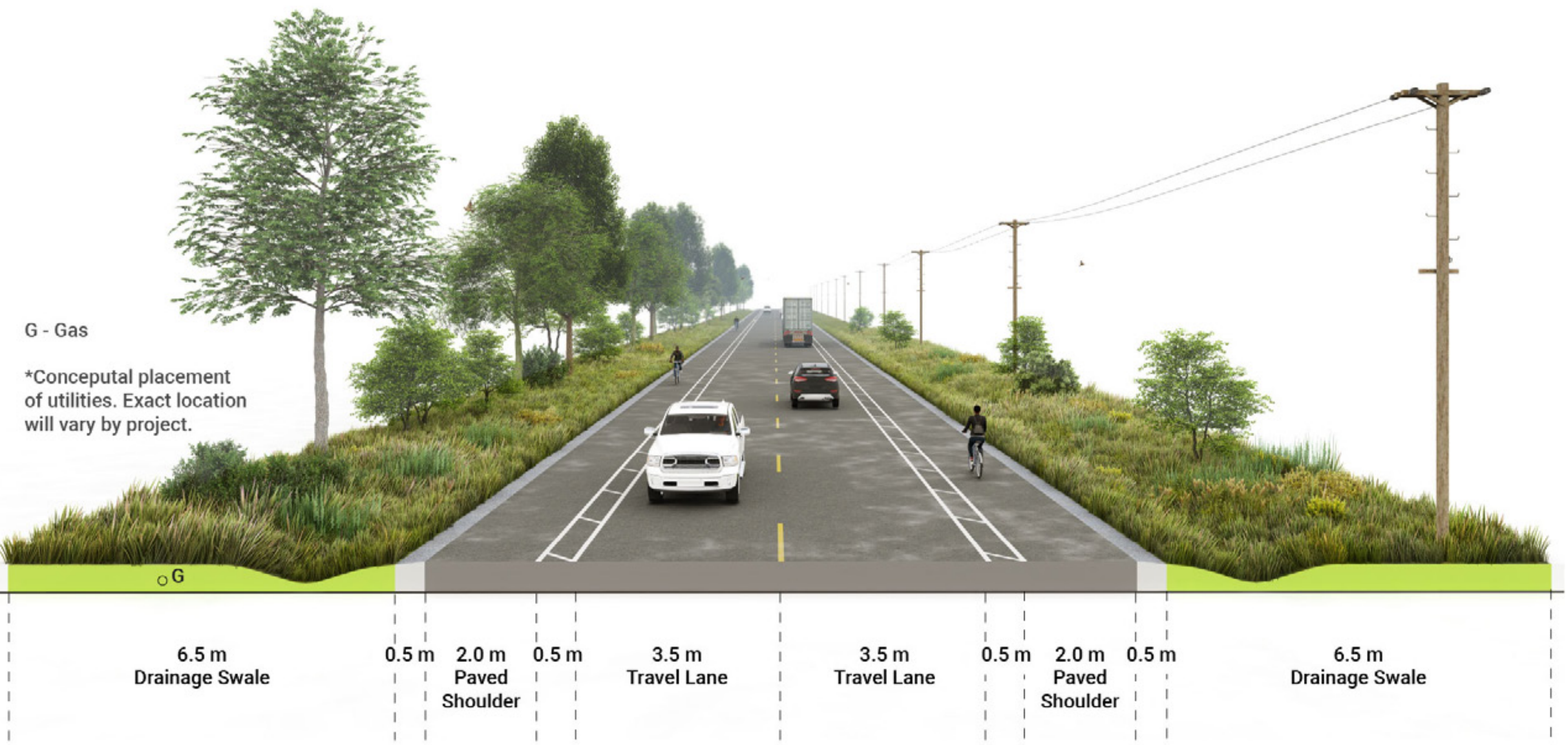
EXAMPLE STREETS

- Nebo Road (north of Rymal Road)

Nebo Road at Lansing. Source: Google Maps

Nebo Road at Rymal Road. Source: Google Maps

4.8 RURAL ROADS



Typical Rural Road Cross Section (26m ROW)

Rural Roads are located outside Hamilton's urban area, primarily in agricultural and natural areas. Their primary function is motor vehicle and goods movement. They may also serve slow-moving agricultural vehicles, people cycling for recreation or to travel to other communities, and in some cases may feature transit service.

Rural Road Cross Section–Multi-Use Path Option (26m ROW)

Paved shoulders should be appropriately sized, with consideration of motor vehicle speeds and volumes. On routes identified in the Cycling Master Plan, shoulders should be sized in accordance with OTM Book 18 guidance. These roads may be provided in a shared lane configuration (on lower speed and lower volume roads) or on a paved shoulder. Where speeds and volumes of motor vehicles are expected to be high, a multi-use path parallel to the roadway may be considered. Curbs are not provided on rural roads to allow for drainage through adjacent ditches. Where transit is provided, buses operate in mixed traffic. The edges of rural roads should also include naturalized drainage swales.

CONTEXT	Rural
STREET FUNCTION	Mobility
RIGHT OF WAY	26–36 m
NUMBER OF LANES	2
TARGET SPEED	60–80 km/h
CYCLING FACILITIES	Shared lanes, paved shoulder, or parallel multi-use path
PEDESTRIAN CLEAR ZONE WIDTH	n/a

RIGHT OF WAY

Within the Rural Official Plan, Rural Roads are classified as either Arterial or Collector Roads. Typical ROW widths range from 26 to 36 metres.

GOALS

- Prioritize the movement of people and goods.
- Ensure that road design is appropriate for vehicle speed and volume.
- Enhance environment with landscaping features such as buffer plantings and drainage swales on the edge of the roadway.
- Support active transportation and slow moving farm vehicles with wide shoulders.
- Accommodate cyclists with paved shoulders, advisory bike lanes and separated multi-use paths as appropriate.

EXAMPLE STREETS

- White Church Road East
- Fletcher Road

White Church Road. Source: Google Maps

Fletcher Road. Source: Google Maps

4.9 RURAL SETTLEMENT ROADS

Typical Rural Settlement Area Cross Section (26m ROW)

Rural Settlement Roads are portions of Rural Roads that pass through settlement areas and rural areas of Hamilton, providing services for local residents as well as through-traffic. Rural Settlement Roads are often centred around an intersection or a section of highway and may include residential frontages, a small number of commercial or other uses that serve the community.

Typical Rural Settlement Area Cross Section with a Multi-Use Path (26m ROW)

In contrast with the rest of a Rural Road, Rural Settlement Roads feature a slower speed context with a focus on property access. These roads will be designed to support the local community and calm traffic as they transition into a community setting through the use of gateway features, such as lane narrowing and signage reflecting lower speed limits. As they are associated with clusters of low density residential or commercial development, boulevards should include sidewalks, street trees, cycling facilities, on-street parking, and other amenities to support local residential and retail activity.

CONTEXT	Rural
STREET FUNCTION	Access
RIGHT OF WAY	20–26 m
NUMBER OF LANES	2
TARGET SPEED	40–50 km/h
CYCLING FACILITIES	Bike lanes, cycle tracks, or multi-use paths
PEDESTRIAN CLEAR ZONE WIDTH	1.8–2.4 m

RIGHT OF WAY

26 metres is the preferred ROW width to accommodate two vehicle lanes, on-street parking, bike lanes, and wide sidewalks. Depending on space, bike lanes may be implemented as a shared roadway configuration or dedicated cycle track. Note that this may be constrained, particularly in historic cores of these settlements.

GOALS

- Prioritize the pedestrian realm. Provide sidewalks on both sides of the road as well as mid-block and intersection pedestrian crossings. Landscaping, wide planting areas, wide sidewalks, pedestrian-scaled lighting, and other amenities can all contribute to the attractiveness of the public realm.
- Support local residential and retail activity. Ensure side streets provide connectivity to the main retail locations through the use of sidewalks and a cycling network.
- Design for slower speeds. As lanes transition from the highway to the village setting, narrow the roadway and introduce visual “friction” such as on-street parking

or planting zones. Other traffic calming measures like curb extensions and medians may also be considered to help slow traffic.

- Emphasize green infrastructure and landscaping. Planters or street trees can help beautify the public realm and provide shade for pedestrians and cyclists.
- Provide on-street parking where appropriate. It is important to consider the local demand and context for a particular street when assessing the amount of on-street parking to provide. On narrower right of ways, cycle tracks may be implemented in exchange for parking on streets with low parking demand.

EXAMPLE STREETS

- Old Highway 8, Rockton
- Binbrook Road (Southbrook Dr. to Royal Winter Drive)
- Jerseyville Road (in Jerseyville)

Old Highway 8.. Source: Google Maps


Jerseyville Rd W. Source: Google Maps

5

CHAPTER FIVE

INTERSECTIONS

5.1 STREET DESIGN FOR INTERSECTIONS

Intersections are crucial nodes in the transportation system where road users of different modes interact. Intersections are also major conflict points within the City's transportation system — in Hamilton, over 60% of all collisions and over 70% of collisions involving a pedestrian occur at an intersection.[1] This chapter outlines principles for intersection design to prioritize safety for all road users. Land use context and the intersecting road typologies will impact how intersections should be designed to promote predictable and safe movements through the intersection.

This chapter outlines five sample intersection designs to illustrate how intersection design principles can be applied at common intersection types. The sample intersections covered in this chapter represent common intersection typologies that practitioners may encounter when designing Complete Streets. The designs are not intended to cover every scenario or serve as definitive designs. Designers should apply the design principles based on local context. While the design samples shown are of intersections of two-way roads, the design principles and elements can also be applied for intersections of one-way roads.

Further guidance on intersection design can be found in:

- Ontario Traffic Manual (OTM) Book 12: Traffic Signals
- OTM Book 15: Pedestrian Crossing Treatments
- OTM Book 18: Cycling Facilities
- National Association of City Transportation Officials' (NACTO) Don't Give Up at the Intersection
- Transportation Association of Canada (TAC) Canadian Roundabout Design Guide
- National Cooperative Highway Research Program (NCHRP) Report 672
- Roundabouts: An Informational Guide
- TAC Geometric Design Guide for Canadian Roads, and
- Accessibility for Ontarians with Disabilities Act (AODA) Regulation 191/11: Integrated Accessibility Standards for Exterior Paths of Travel

1 City of Hamilton: Annual Collision Report 2020: https://www.hamilton.ca/sites/default/files/media/browser/2021-10-05/2020-annual-collision-report.pdf

Sample Intersection Designs

INTERSECTION TYPE	STREET TYPOLOGIES
Low Speed Intersection	Neighbourhood Street & Neighbourhood Street
Stop Controlled Intersection	Neighbourhood Street & Connector
Urban Roundabout	Connector & Connector
Compact Urban Intersection	Urban Avenue & Main Street
Major High-Capacity Intersection	Transitioning Avenue & Transitioning Avenue

5.2 DESIGN PRINCIPLES FOR INTERSECTION DESIGN

Prioritize Safety. Safety for all road users should be the first priority when designing intersections. People walking and cycling are more vulnerable than people riding transit or driving. As such, vulnerable road user safety should be prioritized for all intersections. Interactions between conflicting movements, such as a turning vehicle crossing the path of a pedestrian, should occur at slow speeds. Good visibility, short crossing distances, and design that encourages predictable movements all support the goal of improving safety.

When retrofitting existing intersections, safety improvements can often be implemented using quick build measures such as flexible bollards, pavement treatments, or planter boxes. A recent study found that incorporating asphalt art at intersections had a strong positive correlation with improved safety and road user behaviour.[2] Design interventions that can improve safety outcomes should be key components of intersection redesigns.

Design for Accessibility. Intersections should include curb cuts, tactile walking surface indicators (TWSI), audible signals, and other accessibility features to ensure people with visual and mobility impairments can safely and comfortably navigate the intersection.

Minimize Delay: Traffic signals operations should be designed to minimize delay for all road users. Long cycle lengths which delay pedestrians or cyclists can result in non-compliance by those users, increasing the likelihood of unpredictable movements and reducing safety. Along transit corridors, minimizing transit delay should be a priority.

2 Gates, Asphalt Art Safety Study: Historical Crash Analysis and Observational Behavior Assessment at Asphalt Art Sites, April 2022: https://assets.bbhub.io/dotorg/sites/43/2022/04/Asphalt-Art-Safety-Study.pdf

5.3 GEOMETRIC CONSIDERATIONS

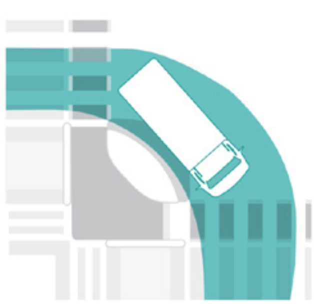
CORNER RADII

The size of corner radii has a relationship with the speed of vehicles at street intersections. The design of corner radii is determined based on design and control vehicles.

The design vehicle is the largest vehicle frequently turning at the intersection. Intersections should be designed to allow the design vehicle to turn with relative ease, typically starting from the curb lane and remaining to the right side of the centreline (or the right half of the roadway, where there is no marked centreline) on the receiving roadway.

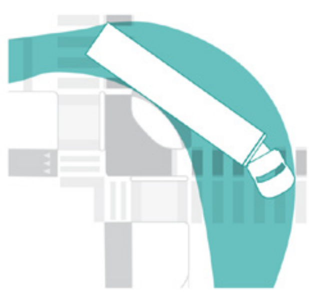
The control vehicle is the largest vehicle that infrequently turns at the intersection. Control vehicles are physically accommodated but may be required to take a wider turning path using adjacent lanes. In some cases, they may encroach into an opposing traffic lane. Control vehicles may be required to travel at a crawling speed of 5 km/h or less to negotiate the intersection.

DESIGN FOR THE DESIGN VEHICLE



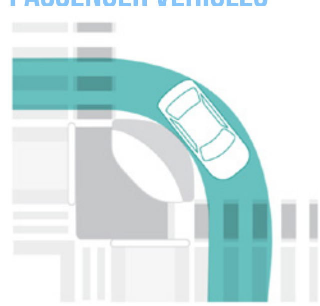
Largest frequent vehicle. Often a delivery truck (MSU), city bus (B-12), or passenger vehicle

ACCOMMODATE THE CONTROL VEHICLE



Largest infrequent vehicle. In urban areas, often a semi-trailer (WB-20). On neighbourhood streets, may be a garbage truck or fire truck

MANAGE THE SPEED OF PASSENGER VEHICLES

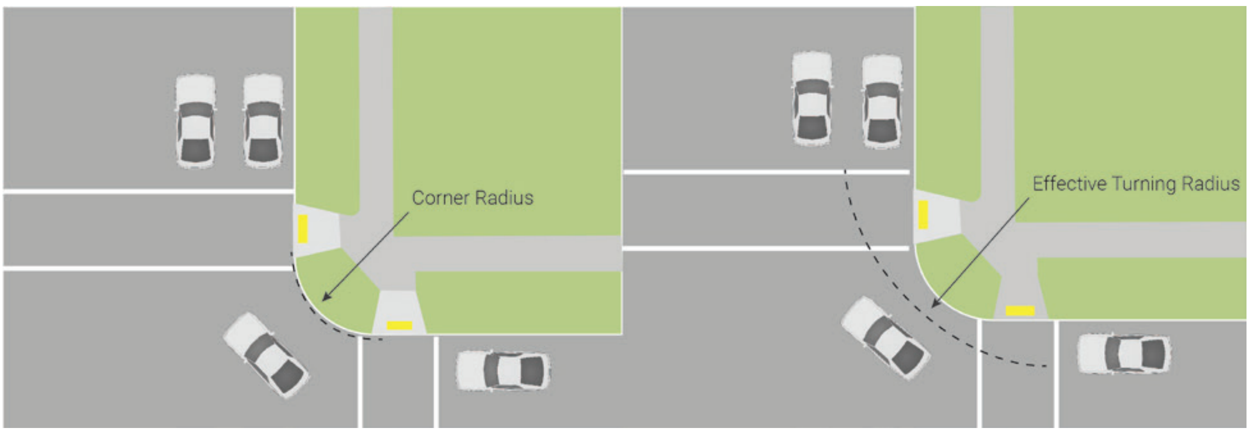


Passenger vehicles are typically the most common vehicle, and are a capable of higher, more dangerous speeds

Corners should accommodate turns made by design vehicles with relative ease. Control vehicles can be expected to encroach on adjacent lanes to complete their turns. (Adapted from NACTO, "Don't Give Up at the Intersection", 2019)

Smaller corner radii help lower vehicle turning speeds, thereby reducing the likelihood and severity of collisions with vulnerable road users at intersections. In areas of older development with small corner radii, the existing radii should generally be maintained, even if the radii do not accommodate the design/control vehicle, unless there is a history of operational concerns.

Corner radii should be selected based on an analysis of effective turning radii. The effective turning radius is based on the travel path typically used by a motor vehicle to navigate around a corner and is larger than the constructed corner radius. On-street parking, bicycle lanes and multiple receiving lanes can contribute to a larger effective turning radius which may allow the use of a substantially smaller physical corner radius.[3]



Corner Radii and Effective Turn Radii (Source: City of Edmonton Complete Streets Design and Construction Standards))

The following table provides a summary of design and control vehicles and the recommended effective turn radius by intersection type. The most restrictive condition should be applied. For example, at an intersection of a Connector Street and an Urban Avenue, the "Connector / Any Street" condition in the table should be applied. The design and control vehicles listed are defined in the TAC Geometric Design Guideline for Canadian Roads which includes typical dimensions for each vehicle:

- Passenger Cars (P)
- Light single-unit trucks (LSU)
- Medium single-unit trucks (MSU)
- WB-20 tractor / semi-trailers (WB-20)
- Standard transit buses (B-12)

3 Transportation Association of Canada. (2017). Chapter 6 – Pedestrian Integrated Design. Geometric Design Guidelines for Canadian Roads.

INTERSECTION CORNER TYPE (SELECT MOST RESTRICTIVE TYPE)	DESIGN VEHICLE	CONTROL VEHICLE[1]	EFFECTIVE TURN RADIUS TARGET RANGE
Neighbourhood Street	Passenger Vehicle	Waste collection vehicle	4.0 – 6.0 m
Connector	LSU or B-12[2]	B-12	6.0 – 8.0 m
Main Street	MSU or B-12[2]	B-12	6.0 – 8.0 m
Urban Avenue	MSU or B-12[2]	WB-20	6.0 – 10.0 m
Transitioning Avenue	MSU or WB-20[3]	WB-20	8.0 – 15.0 m[4]
Industrial Street	MSU or WB-20[3]	WB-20	8.0 – 15.0 m[4]
Rural Settlement Area Street	LSU	B-12	5.0 – 8.0 m
Rural Road	MSU or WB-20[3]	WB-20	6.0 – 15.0 m[4]

1. City of Hamilton Fire Truck is an additional control vehicles for all cases.
2. Use B-12 design vehicle if regular scheduled HSR service turns at the corner.
3. Use WB-20 design vehicle if peak hour heavy truck turning volumes are 5 or greater.
4. Use a two-centred compound curve or a smart channel channelized right turn if the WB-20 cannot be accommodated with a 15.0 m radius

Practitioners can expect a transition period for motorists to adjust their behaviour when curb radii are reduced at an intersection. Signs of vehicles mounting the curb or encroaching in adjacent lanes to complete right turns in the first weeks following the adjustment should not be viewed as a sign of failure. Redesigned intersections should be monitored over a period of time to determine how the new corner radii affect driver speeds, turning paths, and overall behaviour.

5.4 LOW SPEED INTERSECTION

This intersection of two Neighbourhood Streets may be controlled by stop or yield signs. The intersection is designed to promote slow speed operations and to minimize pedestrian crossing distances.

DESIGN VEHICLE	Passenger Vehicle
CONTROL VEHICLE	Fire Truck and Waste Collection Vehicles

Low Speed Intersection ground view, approaching the intersection.

KEY FEATURES

1. Corner radii are designed to minimize motor vehicle turning speeds while allowing occasional larger vehicles such as emergency vehicles, waste collection, and snowplows to use the entire width of the roadway to negotiate turns. Small corner radii and narrow pavement widths at the intersection reduce crossing distances for pedestrians.
2. Traffic calming measures, such as the raised intersection shown in this example, are applied to reduce motor vehicle speeds. Other measures such as curb extensions or neighbourhood traffic circles may also be considered. Traffic diverters may also be considered at these intersections to prevent cut-through traffic. Raised intersections and crosswalks can also be constructed with asphalt rather than concrete.
3. No specific accommodation for cyclists is needed as they operate in mixed traffic on low-speed Neighbourhood Streets.

Neighbourhood Traffic Circle in Vancouver.

5.5 STOP CONTROLLED INTERSECTION

This intersection between Connectors and Neighbourhood Streets serves as a gateway to the lower speed context of Neighbourhood Streets. The intersection is stop controlled on the minor leg. The design of this intersection aims to clearly convey the priority of all modes on the Connector street which includes dedicated pedestrian and cycling facilities. When designing new streets, three-leg intersections may be appropriate in some situations to help reduce cut through traffic, and reduce conflict points between road users, relative to four-leg intersections.

DESIGN VEHICLE	Passenger Vehicle
CONTROL VEHICLE	MSU, Fire Truck, and Waste Collection Vehicles

Stop Controlled Intersection ground view, approaching the intersection.

KEY FEATURES

1. Raised pedestrian and cyclist crossing with the cycle track and sidewalk continued across the local street to clearly designate pedestrian and cyclist priority across the intersection. This design narrows the entry and exit of the local street and reduces barriers for people with mobility and visual impairments. The curb is depressed at the intersection to allow vehicles to enter and exit the Neighbourhood Street. The raised crossing slows vehicles navigating the intersection, increases the visibility of vulnerable road users, and increases the likelihood of yielding by motorists. Designers should consider requiring raised intersections for these typologies wherever feasible.
2. A pedestrian crossing across the Connector Street. A pedestrian refuge island serves to calm motor vehicle traffic and reduces pedestrian exposure to motor vehicle traffic while crossing the major road. The refuge island should include a cut-through or ramp that is the same width of the crosswalk to ensure accessibility. OTM Book 15: Pedestrian Crossing Treatments provides further guidance on pedestrian crossing design.
3. A dedicated left-turn lane for motorists turning onto the minor street removes left-turning vehicles from the stream of through traffic.

5.6 URBAN ROUNDABOUT

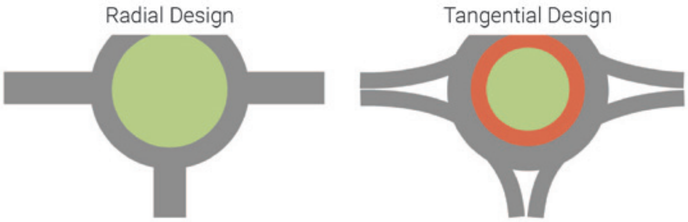
This example of a roundabout intersection between two Connector Streets draws on design guidance from OTM Book 18: Cycling Facilities, the TAC Canadian Roundabout Design Guide, and NCHRP Report 672, Roundabouts: An Informational Guide . Roundabouts typically require more right of way space than traditional intersections, as such property requirement needs should be an early consideration in the roundabout design process.

DESIGN VEHICLE	LSU (or B-12 on transit corridors)
CONTROL VEHICLE	B-12
INSCRIBED CIRCLE DIAMETER	32 - 40 m
ENTRY/EXIT DESIGN SPEED	30 km/h

Urban Roundabout ground view, approaching the intersection.

KEY FEATURES

1. Intersecting streets approach the circulatory roadway at a perpendicular angle. This approach, known as a radial design, requires vehicles to travel slowly as they enter and exit the roundabout, and in the vicinity of pedestrian and cycling crossings.



Comparison of Radial and Tangential Roundabout Designs (Source: OTM Book 18, 2021)

2. Single lane entries and exits reduce exposure to conflicts for pedestrians and cyclists crossing the legs of the roundabout.
3. Pedestrians and cyclists operate on the perimeter of the roundabout fully separated from motor vehicle traffic. Any on-road bike lanes on the intersecting streets should transition into the boulevard on the approach. Cycle tracks around the perimeter of the roundabout may operate as two-way facilities if it provides a more direct path of travel.
4. Uncontrolled crossings are provided for pedestrians and cyclists at each approach to the roundabout, approximately one or two car lengths (6–12 m) from the roundabout. Research from the Netherlands suggests better safety outcomes by assigning priority to motorists rather than cyclists at these crossings.[4] Another alternative is to implement a pedestrian crossover (PXO) at the roundabout approaches. However, in this scenario, cyclists would have to dismount to cross the PXO.

4 SWOV Institute for Road Safety Research. "Rotondes met vrijliggende fietspaden ook veilig voor fietsers?", 2005. https://www.swov.nl/sites/default/files/publicaties/rapport/r-2004-14.pdf

5.7 COMPACT URBAN INTERSECTION

This intersection is an example of a signalized compact urban intersection. The design of this intersection aims to separate and protect vulnerable road users as much as possible to minimize conflicts with motor vehicles. The design shows an intersection of an Urban Avenue and a Main Street. For intersections of two Urban Avenues, the design of the Urban Avenue approaches can be replicated on all four legs of the intersection.

DESIGN VEHICLE	MSU (or B-12 on transit corridors)
CONTROL VEHICLE	B-12

Compact Urban Intersection ground view, approaching the intersection.

KEY FEATURES

1. Raised corner islands separate cyclists from motor vehicles and prevent motor vehicles from entering the cycling facility. The corner islands create a queuing space for cyclists and allow for a setback of the crossride. The cycle track setback is introduced as close to the intersection as possible to maximize pedestrian space at the corner.
2. Small corner radii promote slow turning movements.
3. Left turn stop bar is set back to provide additional maneuvering space for buses and trucks.
4. Cyclists transition from shared on-street space to a separated cycle track on the approach to the intersection.
5. Bus stops are designed as Shared Cycle Track Platform Stops (see Chapter 3, Section 3.3.2) due to space constraints.
6. Crossing distances are minimized to support shorter traffic signal cycle lengths.

Compact urban intersection in Vancouver, BC

5.8 MAJOR HIGH CAPACITY INTERSECTION

This intersection is an example of two high-capacity Transitioning Avenues intersecting. Due to the high volumes of turning vehicles expected at these intersections, the intersection is designed with the intention that protected signal phasing will be used to minimize conflicts between turning vehicles and pedestrians or cyclists.

DESIGN VEHICLE	MSU or WB-20
CONTROL VEHICLE	WB-20

Major High Capacity Intersection ground view, approaching the intersection.

KEY FEATURES

1. Corner radii are larger than at other intersection types to allow for efficient movement of right turning vehicles. Protected signal phasing is recommended to separate high-volume right-turning movements from pedestrian and cyclist movements. For lower-volume movements, leading pedestrian intervals (LPI) and leading bicycle intervals (LBI) should be applied to give pedestrians and cyclists a head start over motor vehicles.
2. The corridor widens at the intersection to provide dedicated left and right turn lanes, which increases capacity and provides flexibility to operate turning movements on protected signal phases.
3. Corners are designed as protected intersection corners with small islands that physically separate active transportation facilities (MUPs, cycle tracks, and/or sidewalks) from turning motor vehicles.
4. The centre medians are extended into the intersection to provide refuge islands for pedestrians. The median refuges also allow flexibility for two-phase pedestrian crossings, which should be employed strategically to minimize overall pedestrian crossing delay. The median extensions also serve as a form of left turn calming to prevent motorists from making sweeping high-speed left turn movements.
5. A small sidewalk adjacent to the MUP mixing zone serves as a refuge and waiting space for pedestrians.
6. Bus stops with full amenities are provided along transit corridors.

Large protected intersection in Ottawa (Source: Google Earth)

A

APPENDIX

APPENDIX A

GLOSSARY OF TERMS, ABBREVIATIONS, AND ACRONYMS

ABBREVIATION	TERM	DEFINITION
AADT	Annual Average Daily Traffic	The average 24 hour, two way traffic on a roadway for the period from January 1st to December 31st within a single calendar year.
AODA	Accessibility for Ontarians with Disabilities Act	Provincial legislation and associated regulations that set targets and provide for the development ofstandards for making the Province accessible to all Ontarians by 2025.
APS	Accessible pedestrian signals	Auxiliary devices that supplement traffic control signals to aid pedestrians with vision losses (and those with both visual and hearing impairments) in their road crossing. Information is communicated in non-visual format such as audible tones, verbal messages, and/or vibrotactile indications to provide cues at both ends of a crossing when activated.
ATS	Accessible Transportation Services	Intended for people with physical or functional disabilities or health conditions who are unable to access fixed-route public transit. Eligibility is considered on a case-by-case basis and is not based on a particular disability, or income level.
B-12	Standard Single-Unit Buses	Typical bus size on Hamilton streets

ABBREVIATION	TERM	DEFINITION
BIA	Business Improvement Area	An association of commercial property owners and tenants within a defined area who work in partnership with the City to create thriving, competitive, and safe business areas that attract shoppers, diners, tourists, and new businesses.
BLAST Network	HSR's Planned Rapid Transit Network	A planned frequent rapid transit system in Hamilton, with a plan for five routes including one light rail transit and four bus rapid transit lines.
BRT	Bus Rapid Transit	A high-quality bus-based transit system that delivers fast and efficient service that may include dedicated lanes, busways, traffic signal priority, off-board fare collection, elevated platforms and enhanced stations.
CIPA	Community Improvement Plan Area	A Community Improvement Plans or CIP is a tool that allows a municipality to direct funds and implement policy initiatives toward a specifically defined project area (CIPA).
CMP	Cycling Master Plan	Intended to guide the development and operation of its cycling infrastructure for the next twenty years.
EA	Environmental Assessment	The environmental assessments process ensures that governments and public bodies consider potential environmental effects before an infrastructure project begins.
EV	Electric Vehicle	Vehicles that are either partially or fully powered on electric power.

ABBREVIATION	TERM	DEFINITION
HCA	Hamilton Conservation Authority	The Hamilton area's largest environmental management agency dedicated to the conservation and enjoyment of watershed lands and water resources.
HCD	Heritage Conservation District	A defined geographical area within a municipality that is protected under a local bylaw to ensure conservation of its existing heritage character.
HOT	Higher Order Transit	Transit that operates in whole or in part in a dedicated right of way, including heavy rail, light rail and buses.
HOV	High-Occupancy Vehicle	A motor vehicle carrying more than a specified minimum number of people and therefore permitted to use a traffic lane reserved for such vehicles.
HPUCC	Hamilton Public Utilities Coordination Committee	A group that coordinates utilities work between the City and private utility companies.
HSR	Hamilton Street Railway	Hamilton's public transport agency.
ITE	Institute of Transportation Engineers	An international educational and scientific association of transportation professionals who are responsible for meeting mobility and safety needs
LBI	Leading Bicycle Interval	Gives people on bikes a head start in front of turning vehicles, providing a priority position in the right of way.

ABBREVIATION	TERM	DEFINITION
LID	Low Impact Development	An innovative approach to land development that mimics the natural movement of water in order to manage stormwater (rainwater and urban runoff) close to where the rain falls.
LOS	Level of Service	A qualitative measure of traffic flow at an intersection dependent upon vehicle delay and vehicle queue lengths at the approaches. Specifically, Level of Service criteria are stated in terms of the average stopped delay per vehicle for a 15-minute analysis period.
LPI	Leading Pedestrian Interval	A form of an exclusive pedestrian phase where a walk indication (generally around 4 to 6 seconds in duration) is provided in advance of the corresponding vehicle green indications to give pedestrians a head start on parallel or turning traffic.
LSU	Light Single-Unit Trucks	Vehicle configurations designed to transport property, where the cargo carrying capability of the vehicle is integral to the body of the vehicle. LSU's typically weigh 14,000 lbs and under.
MIWC	Music Industry Working Committee	A committee designed to advise the city on the goals and priorities of the music industry, as well as on marketing strategies.
MMLOS	Multi-Modal Level of Service	Similar to LOS but also applicable to transit, bicycle, and pedestrian levels of service.

ABBREVIATION	TERM	DEFINITION
MSU	Medium Single-Unit Trucks	Vehicle configurations designed to transport property, where the cargo carrying capability of the vehicle is integral to the body of the vehicle. LSU's typically weigh between 14,000 and 26,000 lbs
MUP	Multi-Use Path	A shared pedestrian and cycling facility that is physically separated from motor vehicle traffic by a hard-surfaced splash pad or by a grass strip.It is often referred to as part of a boulevard within the roadway or highway right-of-way.
NACTO	National Association of City Transportation Officials	An association of 89 major North American cities and transit agencies formed to exchange transportation ideas, insights, and practices and cooperatively approach national transportation issues.
NCHRP	National Cooperative Highway Research Program	Conducts research in problem areas that affect highway planning, design, construction, operation, and maintenance in the United States.
OP	Official Plan	An official plan describes an upper, lower or single tier municipal council or planning board's policies on how land in a community should be used.
OTM	Ontario Traffic Manual	Publications providing information and guidance to transportation practitioners and to promote the uniformity of treatment in the design, application and operation of traffic control devices and systems across Ontario.

ABBREVIATION	TERM	DEFINITION
OTM Book 12	Ontario Traffic Manual: Book 12, Traffic Signals	Provides some elementary instructions to beginners and a reference for experienced persons for the design and operation of traffic signals.
OTM Book 15	Ontario Traffic Manual: Book 15, Pedestrian Crossing Treatments	Provides guidelines for justification, treatment system selection and treatment system design for new pedestrian crossovers on low-speed and low-volume roads.
OTM Book 18	Ontario Traffic Manual: Book 18, Cycling Facilities	Provides practical guidance on the planning, design and operation of cycling facilities in Ontario.
P	Passenger Cars	A road motor vehicle, other than a motor cycle, intended for the carriage of passengers and designed to seat no more than nine persons (including the driver).
PXO	Pedestrian Crossover	Any portion of a roadway distinctly indicated for pedestrian crossing by signs on the highway and lines or other markings on the surface of the roadway as prescribed by the regulations and the Highway Traffic Act.
ROW	Right of Way	Allocation of right of movement to a road user, in preference over other road users; The width of the road allowance from the property line on one side to the property line on the opposite side of the roadway is also known as right-of-way.

ABBREVIATION	TERM	DEFINITION
TAC	The Transportation Association of Canada	A not-for-profit, national technical association that focuses on road and highway infrastructure and urban transportation. While TAC does not set standards, it is a principle source of guidelines for planning, design, construction, management, operation, and maintenance of road, highway, and urban transportation infrastructure systems and services.
TMP	Transportation Master Plan	A comprehensive strategic planning document that defines policies, programs and infrastructure improvements required to address transportation and growth needs.
TSP	Transit Signal Priority	Transit Signal Priority (TSP) tools modify traffic signal timing or phasing when transit vehicles are present either conditionally for late runs or unconditionally for all arriving transit.

ABBREVIATION	TERM	DEFINITION
TWSI	Tactile Walking Surface Indicators	A colour contrasting and tactile surface treatment that is used for one of two purposes: 1. Tactile Attention Indicator (TAI): A TWSI comprising truncated domes that alert people to the presence of a hazard or a decision making point, such as a street crossing, impending change in elevation, or conflicts with other transportation modes. 2. Tactile Direction Indicator (TDI): A TWSI that uses elongated, flat-topped bars to facilitate wayfinding in open areas, including guiding pedestrians with vision loss or other disabilities to crosswalks or transit stops. The elongated bars indicate the travel direction. In this manual, unless otherwise specified, the term “TWSI” is used to refer to an attention indicator.
WB-20	WB-20 Tractor Semitrailers	Large tractor semi-trailer truck