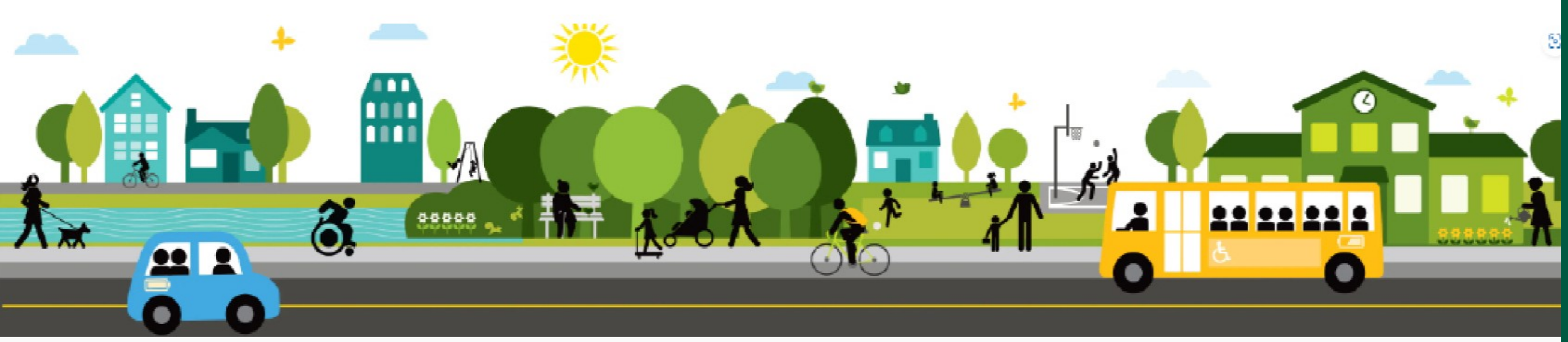
Greater Sudbury Complete Streets Design Guidelines

April 2025



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Chapter 1 Introduction to Complete Streets

1.1 Vision and principles

In recent years, Complete Streets have become increasingly popular among municipalities across Canada and the United States. The philosophy behind a Complete Streets approach is not merely to redesign streets but to broaden their ability to service local communities. Historically, streets have been planned almost exclusively to optimize the throughput of motor vehicle traffic.

While a necessary function, a road-centric perspective has neglected opportunities to accommodate other travel modes and support a wider range of roadway functions. This includes infrastructure improvements to increase access and comfort for active transportation and public transit. The Complete Streets approach encourages designs that better balance considerations for the different transportation modes that share streets, with an underlying focus on enhancing road safety.

The approach does not mandate a design of multimodal roadways for universal contexts but acknowledges that streets should be designed to address the transportation requirements and placemaking functions of adjacent land uses. Complete Streets Design Guidelines (CSDG) serve as flexible tools to assist municipalities in designing, implementing, and preserving Complete Streets on their road network.

Purpose of the guideline

The CSDG acts as a tool to implement the Complete Streets policy through new roads and road reconstruction projects. The CSDG should be used in addition to the Engineering Design Manual and other technical resources by City staff to review development applications and linear infrastructure capital projects.

The Guidelines are intended to be used by the City, the development community, and broader community. The development community are expected to apply the CSDG in the design of development driven roadway projects. The community should use the Guidelines to interpret design and provide feedback on City projects.

Users of the Guidelines are encouraged to review the entirety of the Guidelines to understand how each component fits together. The Guidelines are broken into five chapters and two appendices:

- **Chapter 1 Introduction to Complete Streets:** Provides an overview of what Complete Streets are and the role of the Guidelines.
- **Chapter 2 Elements of Complete Streets:** Describes the different Complete Streets zones, design elements and parameters.
- **Chapter 3 Street design:** Includes a summary of road typologies that apply to Greater Sudbury and example cross sections.
- **Chapter 4 Intersection and transition design:** Includes design principles that may be applied in the design of any intersection or transition and provides example designs.
- **Chapter 5 Planning for Complete Streets:** Describes the design process for implementing Complete Streets.
- **Appendix A Glossary of Terms -** Definitions are provided for key terms used throughout the Guidelines.
- **Appendix B Audit Tool -** The tool is used to support City staff in the implementation of Complete Streets as described in Chapter 5.

Definition of Complete Streets

A Complete Street is designed to consider the needs of all users, such as people who walk, roll, cycle, take transit or drive, and people of varying ages and abilities. While not every type of use or user may be accommodated on every street, the goal is to build a city with a well-functioning street network that supports and sustains our quality of life. There is no single way in which to make a street 'complete'. It depends on many factors including the character and context of each particular street.

Complete Streets have many benefits that include the following:

- Encourage people to walk, cycle and take transit,
- Better physical and mental health outcomes for people of all ages,
- Reduce the chance of injury or death,
- Support a better balance between motorized travel and other uses,
- More space for landscaping and green infrastructure, which contributes to healthier air, more shade, better stormwater management and makes our city more resilient to the effects of climate change, and,
- Desirable cities with a high quality of life. Businesses want to locate and stay where streets are attractive. Residents put down roots where they can walk and bike or socialize with fellow street users.

1.2 Greater Sudbury context

The City of Greater Sudbury is centrally located in northern Ontario situated on the Canadian Shield in the Great Lakes Basin and is composed of a rich mix of urban, suburban, rural, and wilderness environments. Greater Sudbury is 3,627 square kilometres in area, making it the geographically largest municipality in Ontario and second largest in Canada. With a 2023 population of 179,965 (Statistics Canada), Greater Sudbury is also a regional hub for many Ontario residents who live in nearby communities. These visitors come to the city to visit with family and friends, for cultural and educational experiences, such as Science North and Dynamic Earth, for entertainment, for shopping, for conducting business, and for accessing health care.

There are several unique characteristics within Greater Sudbury that impact the way Complete Streets are designed and implemented. These characteristics include a winter city, rural and urban contexts, low population density per area, and capital and operating budget constraints.

Winter city and winter maintenance

The City of Greater Sudbury may be considered a “Winter City” as a northern community with a long winter season, snowy, very cold weather, and harsh climatic conditions. Greater Sudbury receives a high volume of snowfall in winter months that impacts snow plowing and snow storage practices on its roadways.

Snow storage and maintenance practices also impact opportunities for landscaping in boulevards and medians, adjustments to lane width, application of low impact development (LID), and year-round accessibility of some active transportation facilities.

The City’s existing Winter Maintenance practice includes the use of salt and sand that must be considered in the placement of landscaped boulevard spaces or LID treatments next to the roadway. Bicycle infrastructure is also temporarily closed over the winter months.

The CSDG responds to Greater Sudbury’s winter conditions through the intentional design of streetscapes that are safe, comfortable, desirable and aesthetically pleasing throughout the winter months. Design elements such as lane widths, furnishing zones and placement of cycling facilities are considerations for Greater Sudbury’s winter design

Rural and urban contexts

Greater Sudbury includes both rural and urban contexts and cross sections. The design and function of rural and urban roadways can vary dramatically, which is reflected in the approach to designing them. Rural roadways connect communities divided by large stretches of low-density land-use. Given the distances travelled along rural roadways, motor vehicles and freight are typically prioritized modes and speed limits are often higher than urban areas. While they may be primarily used by motor vehicles, rural roadways can attract cycling and pedestrian traffic near residential communities or along scenic corridors for recreational trips. Transit may also operate on rural roadways depending on the areas serviced by local transit agencies. Urban roadways, in comparison, attract a wider range of users who navigate a denser road network with shorter distances between intersections. In urban environments, consideration must be made for the needs of different modes and curbside uses, such as parking and loading. Given the greater degree of pedestrian activity to create placemaking in urban areas, these roadways typically feature more dynamic streetscaping and urban design.

Urbanized cross sections typically refer to streets that address stormwater requirements through curbs, gutters, and catch basins and generally have buried utilities. Rural cross sections typically refer to streets with ditches on both sides and overhead utilities (hydro poles). Rural cross sections may exist in urbanized areas.

In Greater Sudbury, there are several local residential streets with rural cross sections. The CSDG includes roadway classifications that account for urban and rural contexts and cross sections that support multimodal design.

Capital and operating budget

The City of Greater Sudbury maintains 3,600 lane kilometres of municipal road network, 440 kilometres of sidewalk, 140 lane kilometres of cycling facilities (including mixed-use trails and signed bike routes), and 1,100 bus stops.

The City balances maintaining the existing road network in a good state of repair in alignment with sound asset management practices, investing in new construction and reconstruction. As a result of funding constraints due to its large physical area, the City must carefully consider where Complete Streets are implemented, and which design elements are included. The Complete Streets Guidelines provide guidance to decision makers on these trade-offs.

History of Complete Streets in Greater Sudbury

Policy backing

Complete Streets have a strong policy backing in the City of Greater Sudbury's strategic documents. The Complete Streets concept was introduced in the Transportation Study Report (TSR - a transportation master plan document) with a set of policy directions related to the planning, construction, operation, and maintenance of the transportation network to support all users. Complete Streets is woven throughout the TSR. Complete Streets was reinforced through updates to roadway classifications and cross sections, active transportation plans, and sidewalk policies in the TSR.

Ongoing development

The City has continued to develop the Complete Streets concept through the Complete Streets Policy and linear capital project investments. In 2018, the City of Greater Sudbury Council approved the Complete Streets Policy. The policy requires that the City plan, design, construct, operate, and maintain the transportation network to provide an extensive and integrated network of facilities that are safe and convenient for people of all ages and abilities travelling by foot, bicycle, public transit, or vehicle. The City implements Complete Streets through the context-sensitive design of new roadways and reconstruction or rehabilitation of existing roadways where the entirety of the roadway is being replaced within the existing road allowance and maintenance programs. The policy states that the City will enact appropriate and timely by-laws, procedures, processes, programs, guidelines, and standards that support the delivery of Complete Streets. City divisions responsible for implementing the policy include Infrastructure Capital Planning, Engineering Services, Transit Services, Linear Infrastructure Services, and Planning Services.

Implementation

Following the Complete Streets policy creation in 2018, the City successfully implemented 20 capital road projects through 2023. Project examples include:

- Kingsway Boulevard from Silver Hills Drive to Falconbridge Road
- Walford Road from Regent Street to Paris Street
- Roy Street from Wilfred Street to Renfret Street
- Second Avenue from Scarlet Road to Kenwood Drive

Vision for Complete Streets in Greater Sudbury

Safety and accessibility: To create great places and enhance the quality of life of residents, the City of Greater Sudbury will provide safe, accessible streets for all users.

Improved quality of life: Complete streets will improve quality of life for Greater Sudbury residents and attractiveness of the community over the long-term by providing a balanced and connected transportation system that enhances public health and safety, livability, equity, affordability, and that supports increased economic activity and opportunity.

1.3 Applications and limits of the guidelines

Approach

The Guidelines are intended to provide an integrated approach to inform, streamline, and better coordinate decision-making and commenting when reviewing development applications and linear infrastructure capital projects. The Guidelines also act as a unifying document that ensures a consistent approach to the design of the right-of-way and provides a means to balance competing interests at the outset of the road design process.

Application

In alignment with the Complete Streets policy, the Guidelines apply to the design of new roadways and reconstruction or rehabilitation of existing roadways where the entirety of the roadway is being replaced within the existing road allowance.

Chapter 2 Elements of Complete Streets

2.1 Overview of street design zones

The Complete Streets approach is about considering the needs of all road users including pedestrians, cyclists, transit riders, and motorists and building streets to balance these needs and prioritize road safety. Beyond the mobility of various road users, Complete Streets prioritize placemaking, the creation of places in our streets that contribute to healthy ecosystems, social inclusion, and vibrant business activity. Mobility and placemaking priorities need to be balanced with the need to accommodate critical utilities and enable efficient maintenance and operations.

This chapter outlines the elements of Complete Streets and their respective design principles and key considerations. The elements of Complete Streets include the following, as presented in **Figure 1.**

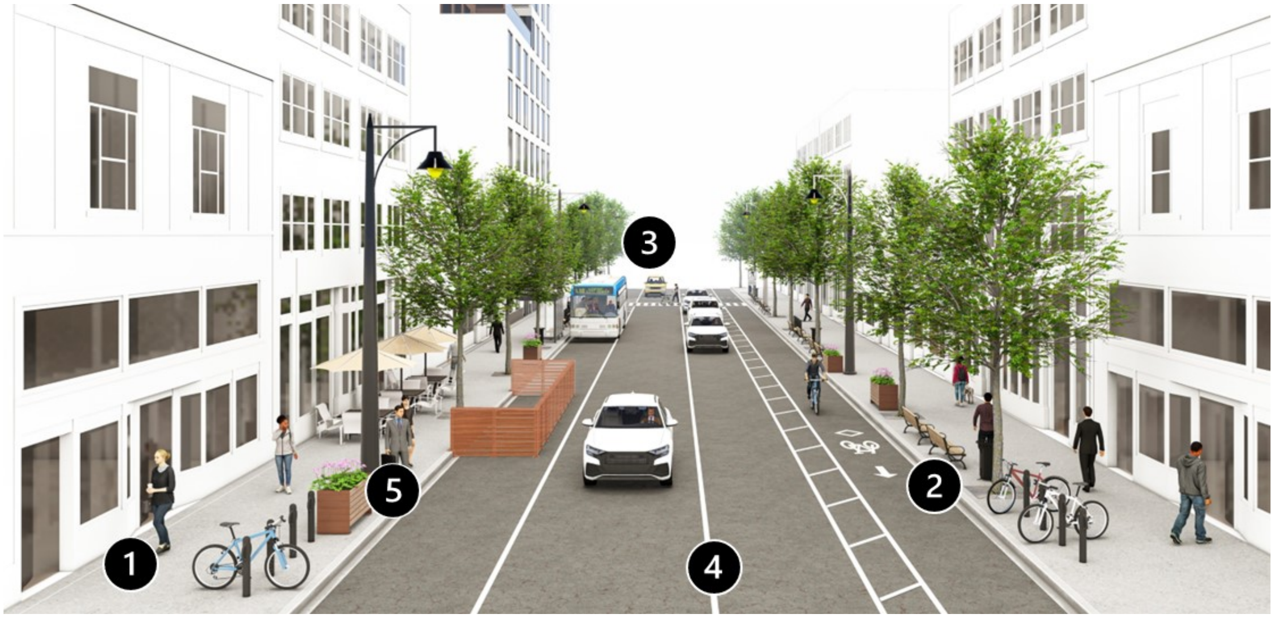


Figure 1

1. **Pedestrian realm and streetscaping:** The part of the street that provides physical space for pedestrian activity, including sidewalks, street trees, and other amenities. Designing for sufficient accessibility, comfort, safety, and connectivity contributes to a thriving pedestrian realm and a sense of place on Greater Sudbury's streets.
2. **Cycling and multi-use facilities:** Include physically separated, designated, or shared facilities to accommodate cyclists within the road right of way. Providing low-stress conditions helps make cycling an attractive option for a wide range of ages and abilities.

3 **Public transit facilities:** Cover the full range of the transit user experience from start to end of trip, including the journey to the stop or station, comfort and safety while waiting for transit, and the efficiency of movement for transit vehicles along their routes.

4 **Travelled way:** Serves an important role in providing efficient goods movement and emergency response, and in allowing people to freely move about the City. Complete streets enable the efficient movement of vehicles through the travelled way while ensuring the safety of all road users and building a sense of place.

5 **Utilities and municipal services:** Comprise essential services such as water supply, sewers, electricity and telecommunications, lighting, and gas supply. These services are generally accommodated within the public right of way and are key considerations in the design and maintenance of Complete Streets.

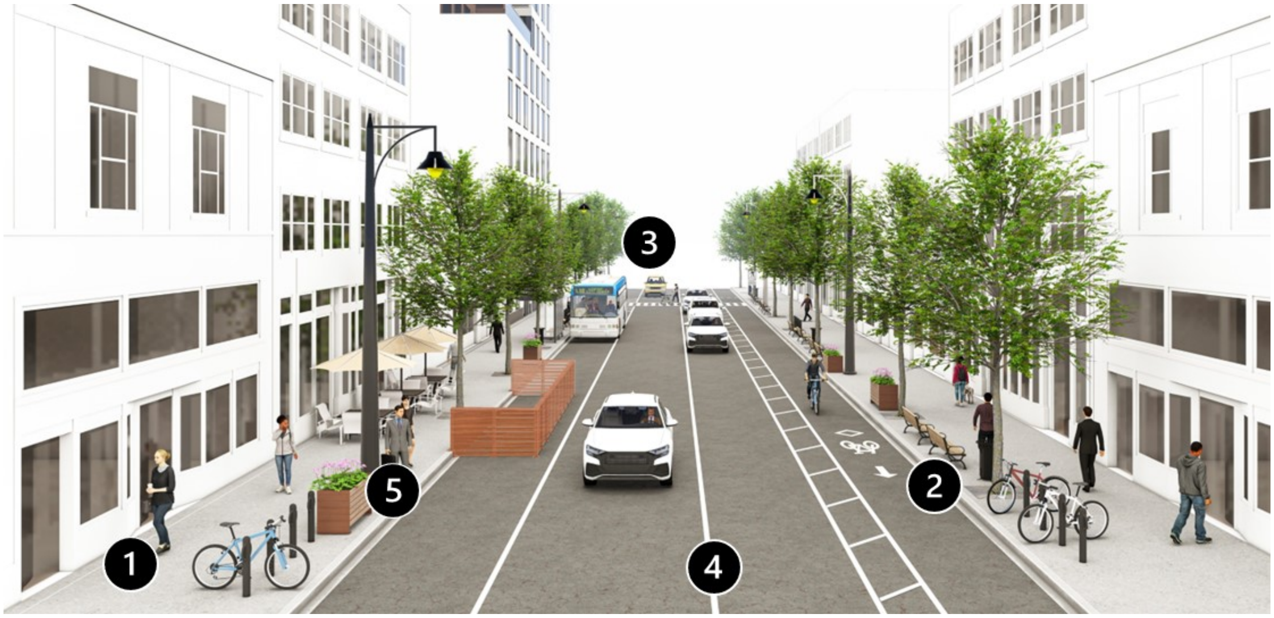


Figure 1. Street design zones

2.2 Pedestrian realm and streetscaping

The integration of pedestrian infrastructure is essential for creating a Complete Street environment that caters to the needs and preferences of all users. Walking, rolling, and other forms of human-powered transportation are not only sustainable but also promote equity by providing accessible travel options for all. Streetscape enhancements to promote pedestrian experience and safety can increase business activity, property values, and tax revenue. A well-designed pedestrian realm also supports social interactions and physical health for people.

This chapter focuses on the design principles, elements that form an inviting environment for pedestrians, and specific design considerations for Greater Sudbury's winter season.

The following resources can be referenced for more information on pedestrian realm and streetscape design:

- Design of Public Spaces Standards under the Ontario Integrated Accessibility Standards regulations
- Ontario Traffic Manual (OTM) Book 15: Pedestrian Crossing Treatments
- National Association of City Transportation Officials' (NACTO) Urban Street Design Guide

Design principles for pedestrian-oriented streets

In order to encourage pedestrian activity in Greater Sudbury, design principles and objects consider pedestrian needs and encourage pedestrian activity. **Table 1** lists out design principles for pedestrian-oriented streets.

Table 1. Complete Streets pedestrian realm design principles

Design Principle	Motivation	Desired Result
Prioritize safety	Pedestrians, especially children and seniors, are the most vulnerable road users. Complete Street design must prioritize safety for these users	Attention should be paid to areas where pedestrians may come into contact with vehicles, such as at intersections, driveways, and parking areas. Where there are dedicated pedestrian facilities, creating a physical separation between the pedestrian space and the roadway can improve feelings of security and comfort for pedestrians.
Promote accessibility	The term "pedestrians" encompasses a broad range of individuals who use the street, including those who may be using strollers or assistive devices such as wheelchairs, canes, or guide dogs. It is important to note that not all pedestrians move at the same pace, as some, such as children, seniors, or individuals with	The built environment should accommodate a wide range of mobility needs, with street design that removes existing accessibility barriers and avoid forming new ones in the process.

Design Principle	Motivation	Desired Result
	disabilities, may have slower walking speeds.	
Provide connectivity	Out of all modes, pedestrians are the most sensitive to route directness and elevation change. Street designs that do not accommodate pedestrian crossings on all legs should be discouraged in major arterial intersections.	The pedestrian realm should be designed to provide safe connectivity to key destinations via sidewalks, trails, and frequent crossing locations along a corridor. Signage to guide pedestrians to their destinations should be clear, concise, and easy to understand. Illumination on street connections can also motivate pedestrians for wayfinding and connectivity purposes.
Foster comfort and placemaking	Pedestrians move at their own pace, and well-designed pedestrian realms encourage people to interact with the land use around them. Pedestrians can choose to socialize, rest, or shop. The streetscape should be designed to complement and contribute to the character of a neighbourhood.	The pedestrian experience should be tailored in order to create a vibrant and enjoyable environment that complements the unique characteristics of the area. For example, streets with a focus on placemaking may include amenities beyond wide sidewalks such as seating, patio space, or frequent mid-block crossing opportunities.

Pedestrian realm zones

The pedestrian realm is comprised of the following zones, as presented in **Figure 2**:

1. Marketing zone
2. Clearway
3. Furnishing zone; and,
4. Edge zone.

Along some corridors such as urban arterials, an in-boulevard cycle track may be located between the edge zone and the rest of the pedestrian zones. **Table 2** defines and summarizes the design parameters for the pedestrian realm zones.

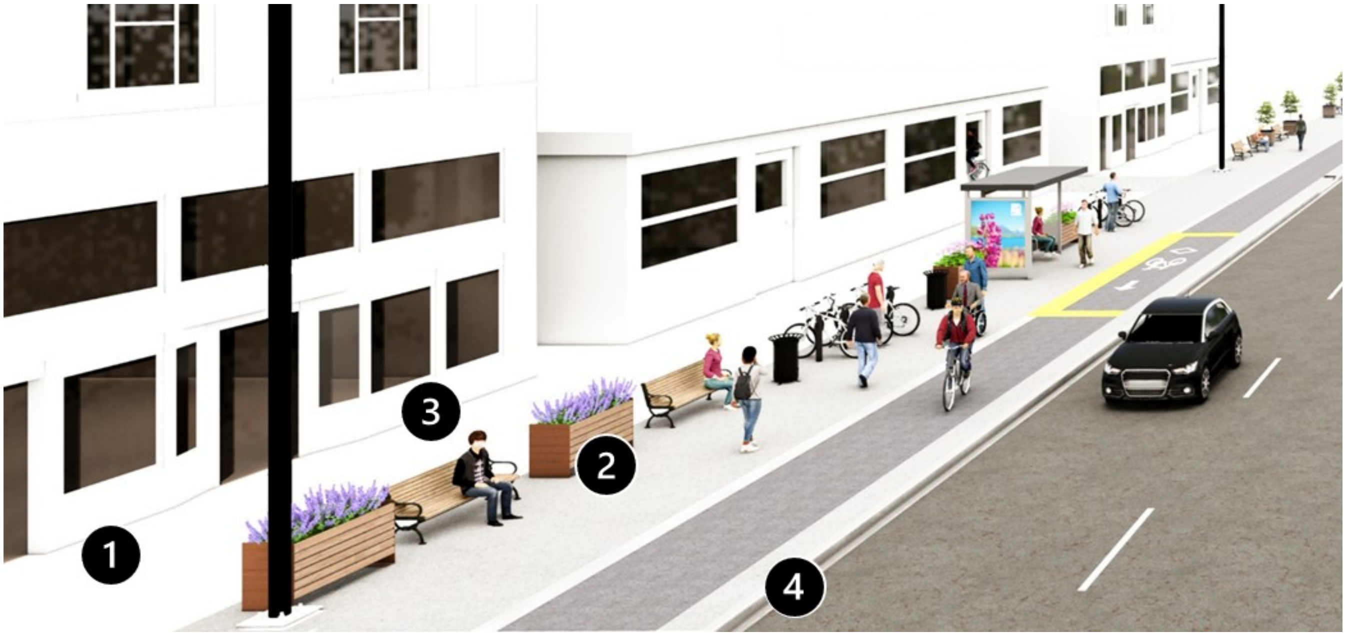


Figure 2. Pedestrian realm zones

Table 2. Pedestrian zone descriptions and design parameters

Zone	Description	Target value	Minimum value
Marketing/frontage zone	This space is allocated for advertisement and patio furniture, or signage. Also acts as a transition zone between adjacent properties and sidewalk.	Varies	0.5 m
Clearway	This space provides an unobstructed path for pedestrian traffic. The clearway width should be wider in areas with high anticipated pedestrian volumes such as along a Main Street.	1.8 – 3.0 m	1.5 m
Furnishing zone	This space enhances the aesthetic of the pedestrian zone, by placing light poles, trees, plants, patios, and other street furniture. This zone can be located on either side of the clearway. When placed between the edge zone and the walkway, it can act as an additional buffer zone between pedestrian traffic and vehicular traffic.	2.0 – 3.0 m	1.75 m
Edge Zone	This space is the zone between vehicular traffic and pedestrian and/or cycling movements, often used as snow storage. Information and regulatory signage for vehicles, drainage can all be placed within the edge zone.	Varies	0.3 m

Clearway

Widths for pedestrian clearway typically range from 1.5 metres for a traditional sidewalk to as wide as 3.0 metres in areas with high pedestrian activity. The clearway width should accommodate maximum pedestrian flow anticipated for the corridor. Thus, development projects that intensify land uses and increase pedestrians should be considered when choosing an appropriate clearway width.

Construction of clearways and placement of utilities are vital for efficient pedestrian through movement. The vertical grade of the clearway is usually the same as the roadway and should not exceed 3% for distances over 200m in best practice. In areas where grade exceeds 5%, additional design consideration is recommended to reduce the clearway's slope. As pedestrians are sensitive to route directness and comfort, reducing slope (when possible) can improve pedestrian accessibility. For cross slope, 2% is typically used for drainage. Specific thickness, slope, material, and widths should be consulted in the City's Engineering Design Guide.

Metal surfaces should be avoided in the clearway, such as maintenance holes and utility grates, due to an increase of slip hazard for pedestrians. This is especially problematic during wet and icy conditions, which are prevalent in the region. When possible, such metal surfaces should be placed on the edge zone, or adjacent to the clearway.

Furnishing zone

Amenities are extremely important for a welcoming and inclusive pedestrian realm. All components should be situated outside of the pedestrian clearway within the furnishing zone. All objects and furniture are subject to the Engineering Design Manual, and should consider local area plans, design aesthetic, and heritage. Common amenities found in or appropriate for Greater Sudbury are summarized in this chapter.

Streetlighting

The following are considerations for streetlighting:

- Usually located between the pedestrian clearway and the roadway, however, can be located between property line and pedestrian way for local road typologies.
- A pedestrian scale lighting illuminates sidewalks and is positioned lower than a typical streetlight. This can be used to illuminate the clearway in upcoming development projects.
- If located in a downtown setting, pedestrian-scaled streetlighting is most appropriate to encourage pedestrian throughfare. The streetlight pole design could include banners, hanging baskets, and other decorative elements, as shown in **Figure 3.**

Figure 3. Example of pedestrian-scaled lighting in Greater Sudbury

Seating

Seating improves accessibility and comfort for pedestrians. Often, landscaping and seating elements can be combined within the same furnishing zone **(Figure 4)**. Seating is highly recommended in areas with high pedestrian activity, and near hospitals and seniors' homes.

Figure 4. Example of seating in the pedestrian realm

Landscaping

Greenery, such as grass, shrubs and trees, improve the aesthetics of the streetscape. Trees provide shade for pedestrians, and can also reduce the urban heat island effect. Minimum requirements for trees include adequate volume and quality of soil to sustain tree health. Soil cells, which are modular structures designed to provide the necessary soil volume and aeration for tree roots to grow and thrive, may be required in constrained urban areas to support healthy tree growth.

The City's Urban Forest Master Plan provides further guidance for increasing the tree canopy within urban areas. It recommends capital work projects, such as Complete Streets road projects, as opportunities to expand the tree canopy.

Figure 5. Example of landscaping in Chelmsford

Wayfinding facilities

Pedestrian-oriented maps and wayfinding signage should be provided in tourist areas, with information and destination directional language.

Wayfinding can also incorporate cycling, trail, and roadway information.

Figure 6. Example of wayfinding signs directing pedestrians and cyclists to utilize the railway tunnel in Sudbury

Source: Google Earth

Parking metres and pay stations

Typically located between pedestrian clearway and roadway. Facilities should be regularly maintained and well-marked for ease of access.

Figure 7. An example of a parking metre in Downtown Sudbury

Frontage furniture

Sidewalk patios have gained increased popularity as they encourage outdoor dining and support commercial activity for locals and businesses.

Frontage furniture can be configured along the roadway curb (replace on-street parking), building or alleyway.

Patios can take up most of the pedestrian space, and the clearway width and alignment must be protected to ensure safe flow of pedestrian traffic.

Specific guidelines on patio widths and alignment can be found in the City's Road Occupancy By-law.

Figure 8. An example of a sidewalk patio in Downtown Sudbury

Bicycle parking and transit stops

Typically located between pedestrian clearway and roadway aligned with other street furniture such as streetlights or seating.

Figure 9. An example of a bike parking rack in Downtown Sudbury

Edge zone and snow storage

As Greater Sudbury is a winter city, space for snow storage should be allocated whenever possible. Accessibility for Ontarians with Disabilities Act (AODA) requires the City to maintain a minimum 1.5m clear width in the winter in publicly owned sidewalks. Cycling lanes can be used for snow storage if space is unavailable. Pedestrian clearway should ideally be at least 1.0m away from the curb for snow storage, or within the amenities area. However, mature trees in some neighbourhoods may prevent this design from being implemented. Furthermore, a straight clearway alignment makes snow removal easier. Deviation from a straight clearway alignment, especially at intersections, should be discouraged. Specific guidelines on snow removal and winter maintenance can be found in the City’s Active Transportation Winter Maintenance Policy.

Intersections and mid-block crossings

The location and alignment of pedestrian crossings impact how far a pedestrian must travel to reach a crossing and determined the time pedestrians are exposed to traffic while crossing the street. Pedestrian crossing distances should be minimized to accommodate for pedestrians with low mobility or with additional accessibility needs. Tactile walking surface indicators must be installed at both ends for all signalized intersections with pedestrian crossings. The crossing should also be in a straight alignment with the clearway to maximize connectivity. An intersection crossing includes many components, as follows.

Crosswalk pavement markings

Pavement markings are used to identify the pedestrian crossing area to pedestrians and to drivers. Two painted parallel lines are regularly used at intersections.

Ladder or zebra pavement markings are recommended for stop controlled, signalized intersections, roundabouts, or channelized right turns, at high pedestrian activity locations.

Figure 10. Ladder pavement marking on midblock of Elm Street.

Raised crossings and raised intersections

Raised crossings or intersections should be considered where traffic calming is desired. This design modification creates a vertical deflection in vehicles and reduces the speed of traffic. Raised crossings increase the visibility of pedestrians crossing the intersection and signal to drivers that they are entering a pedestrian zone when navigating the intersection. Implementation of raised intersections and crossings should include consultation with emergency services.

Figure 11. Example of a raised crosswalk.

Mid-block crossings

The Official Plan lists a range of minimum intersection spacing for all road classifications. Arterial roads (200 metre, or 400 metre for high-speed streets) require a much higher intersections separation distance, compared to local or collector roads (60 metre). Thus, it is important to consider the midblock distance to prevent unsafe crossings from occurring. This may include a centre median or a refuge island to divide crossing distance into smaller, acceptable distances.

OTM Book 15 outlines the criteria for ideal pedestrian crossing distances at mid-block crossings, based on existing or future crossing demand.

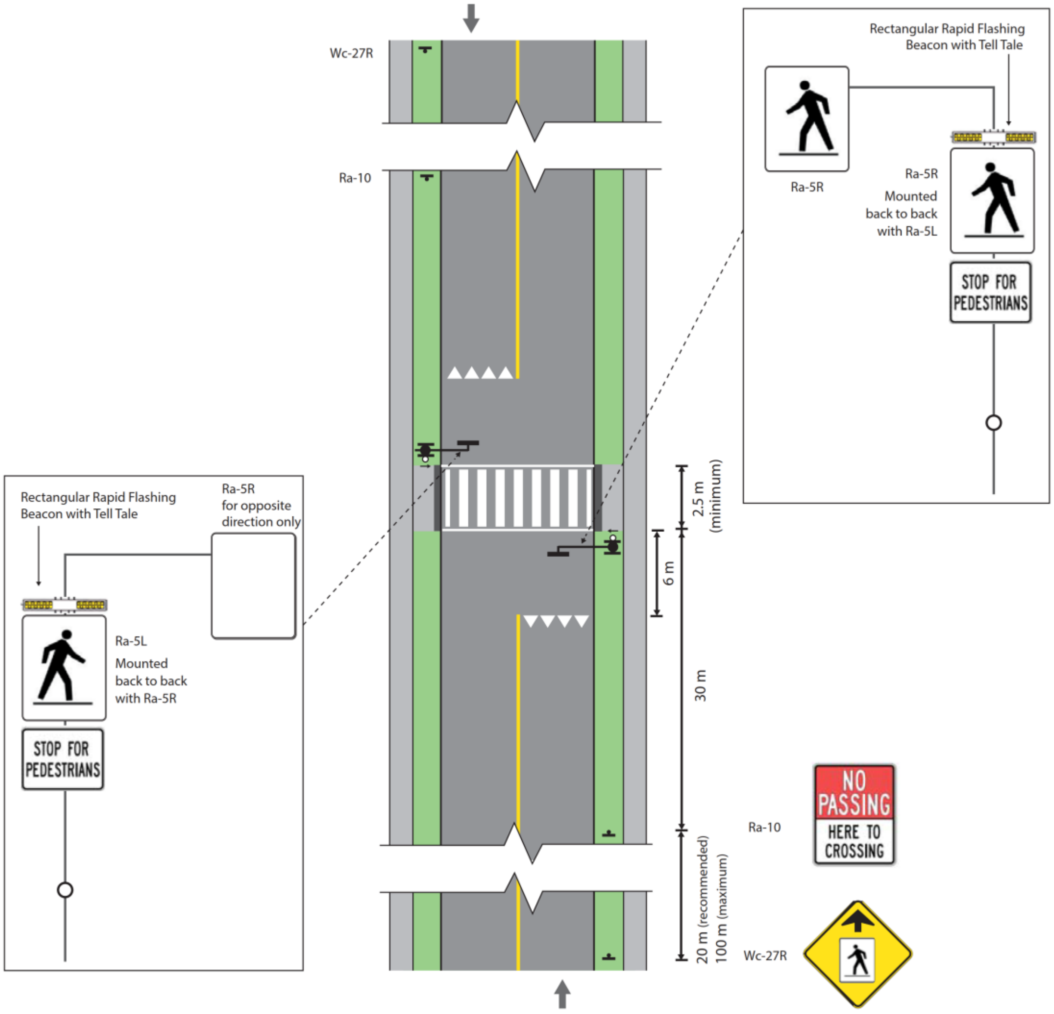


Figure 12. Example of midblock crosswalk for a two-lane roadway.

Source: OTM Book 15 (2016)

AODA compliant pushbuttons

Newly installed pushbuttons must be AODA compliant during its installation, positioning, and implementation process. Pushbuttons provide an auditory and tactile accessibility aid and trigger a walk signal.

Figure 13. An AODA-compliant pedestrian pushbutton in Sudbury.

Signalized pedestrian walk phase

A pedestrian walk phase should be incorporated in all signalized locations. This provides a safe opportunity for pedestrians to cross the street. Pedestrian signals provide the opportunity to incorporate leading pedestrian intervals, which provide a head start for pedestrians before vehicles are given the green light. This improves visibility and allows pedestrians to establish themselves in the crosswalk, increasing their safety and making it more likely for drivers to yield to them.

Figure 14. A signalized pedestrian walk phase with AODA compliant pushbuttons.

2.3 Cycling and multi-use facilities

Cycling is a healthy, low-impact, climate-friendly, and affordable form of transportation that reduces automobile dependency. Street design has a direct influence on cyclists' perceived comfort and safety while cycling.

This chapter outlines principles and design features that promote a healthy cycling environment, while recognizing and mitigating risks for all users within the road right-of-way (ROW).

The following resources can be referenced for more information on cycling facility planning and design:

- Ontario Traffic Manual (OTM) Book 18, Cycling Facilities
- National Association of City Transportation Officials (NACTO) Urban Bikeway Design Guide

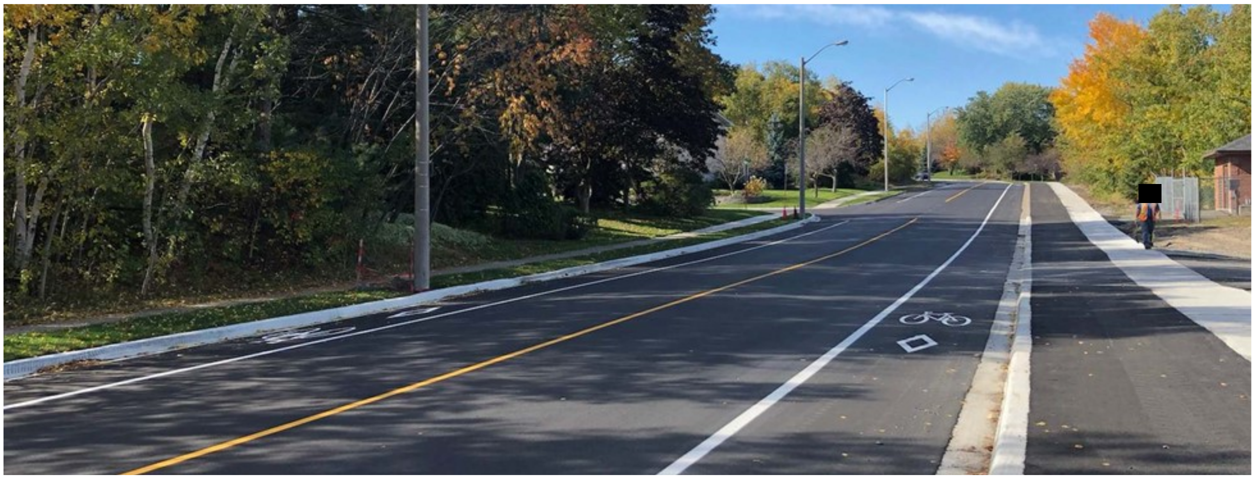
Design principles for cycling

In order to encourage cycling activity in Sudbury, design principles and objects consider cyclist needs and encourage cycling. **Table 3** lists out design principles for cyclist-oriented streets.

Table 3. Complete Streets cycling design principles

Design principles	Motivation	Desired result
Design for all ages and abilities	Designing cycling facilities for the comfort and safety of people of all ages and abilities to encourage people to cycle more often and improve safety for vulnerable road users.	Cycling facility selection and design should account for local context. On high-speed high-volume corridors, facilities should be physically separated. On lower volume corridors, the focus should be on reducing motor vehicle speeds and volumes, in order to reduce the speed differential between modes.
Promote connectivity and guidance	A connected and well signed network provides direct access to	The cycling network is fully connected with minimal gaps between facilities. Practitioners

Design principles	Motivation	Desired result
	destinations across the City making cycling an attractive way to travel.	should work towards eliminating missing links in the network. Guidance for wayfinding and directional information should be intuitive and clear to direct users to key corridors and destinations within the network and warn users of gaps and conflict zones.
Provide cycling supportive facilities	Attractive and well-maintained cycling facilities beyond cycle tracks and bike lanes such as greenery, adequate lighting, and secure bike parking and lockers help complete the cycle ecosystem and encourage bicycle use.	The design of the cycling network should consider the implementation of end-of-trip facilities such as secure parking, showers, lockers, and repair stations. Other intermodal facilities, such as bike racks on buses and indoor parking at major bus stations, can increase transit ridership and cycling within the City.



Types of facilities

Many types of cycling facilities can be incorporated onto Greater Sudbury’s streets according to the appropriate context. These include physically separated facilities such as cycle tracks, physically separated cycling lanes, and multi-use paths, conventional and buffered bicycle lanes, and shared facilities such as neighbourhood bikeways, mixed traffic operation, and paved shoulders.

Physically separated bikeways

Physically separated bikeways provide a safer riding experience for cyclists by providing horizontal and, in some cases, vertical separation from adjacent motor vehicle traffic. This is achieved through the use of physical barriers, such as curbs, bollards, or planters, to create a separation between cyclists and vehicles. These types of barriers also provide a more comfortable experience for cyclists of all ages and abilities, encouraging an increase in cycling along the corridor.

Physically separated bikeways should be considered on high-speed, high-volume corridors such as Urban Arterials and Connectors. The following facility types can be considered:

Physically separated bicycle lanes: Delineated bikeways with physically separation from the roadway with a horizontal buffer and separation elements such as flexible bollards, pre-cast or cast-in-place concrete curbs, planters, and medians.

Figure 15. An example of a physically separated bicycle lane in Toronto.

Cycle tracks: Physically separated bikeways that are both horizontally and vertically separated from the roadway by a curb and buffer. These often run parallel to the sidewalk within the boulevard and are for exclusive use of cyclists.

Figure 16. An example of a cycle track along 2nd Avenue N.

Multi-use paths: A separated pathway that allows both pedestrian and cyclist movements on the same clearway. In-boulevard multi-use paths are generally parallel to the roadway within the street boulevard whereas multi-use trails are dedicated corridors separate from the right-of-way.

Figure 17. An example of a multi-use path on Notre Dame Ave

Bicycle lanes

Bicycle lanes are designated spaces for cyclists along the roadway without any physical separation. Bike lanes are lineated from adjacent vehicle lanes with paint and may include a horizontal buffer. These facilities do not provide the level of comfort and safety for cyclists that physically separated facilities provide and are therefore appropriate on corridor with low to medium volumes and operating speeds such as Main Streets.

Conventional bicycle lanes: Marked lanes on a roadway that are designated for use by cyclists. They are typically located alongside the curb and are demarcated with painted lines and signs.

Figure 18. Example of a conventional bike lane in Greater Sudbury.

Buffered bicycle lanes: Conventional bike lanes that have a horizontal painted buffer between the bike lane and the adjacent motor vehicle lane.

Figure 19. Example of a buffered bike lane in Halton Hills.

Source: Town of Halton Hills

Shared cycling facilities

Shared cycling facilities do not provide any distinct operating space for cyclists but may include amenities such as traffic calming.

Neighbourhood bikeways: Also known as "neighborhood greenways," these are low-stress streets that prioritize cyclists and pedestrians through traffic calming measures such as speed humps and traffic circles. At intersections with arterial roads, connectivity can be promoted by installing wayfinding signage, refuge islands, and cyclist-activated actuated signals. The goal is to reduce frequent stops for cyclists and provide a comfortable cycling experience along the bikeway.

Figure 20. Modal filters on a neighbourhood bikeway in Toronto

Source: Toronto Star

Mixed traffic operation: Unless specifically prohibited, cyclists are permitted to travel on all roadways. Mixed traffic operation is suitable on low speed, low volume corridors such as Local Residential streets and may include signage along designated bike routes.

Figure 21. An example of mixed traffic operation in Brantford

Source: City of Brantford

Paved shoulders: A section of the road that runs parallel to the main travel lane, and is intended for parked motor vehicles, emergency services, pedestrians, and cyclists, as well as to provide support for the road structure. On roads with higher speeds and traffic volume, the shoulders should typically include a buffer to increase the separation between motorists and cyclists traveling in the same direction. Rural roads typically accommodate cyclists with paved shoulders.

Figure 22. Cyclist riding on a paved shoulder in Ottawa

Source: GoBiking.ca

Table 4 summarizes desired dimensions by cycling facility type. The following should also be considered:

- When buffered bike lanes are adjacent to on-street parking, include a 1.0 metre parking buffer, 1.5 metre lane, and 0.3 metre buffer.
- For paved shoulders, refer to OTM Book 18 for selection of buffer and paved shoulder widths based on motor vehicle volumes and speeds along rural roads.

Refer to OTM Book 18 Cycling Facilities for more details on facility selection and design considerations.

Table 4. Recommended cycling facility dimensions

Facility types	Desirable	Suggested minimums
Physically separated bicycle lane	1.8 metre lane + 1.0 metre buffer (one-way) 3.5 metre lane + 1.0 metre buffer (two-way)	1.5 metre lane + 0.3 metre buffer (one-way) 2.7 metre lane + 0.3 metre buffer (two-way)
Cycle tracks	2.0 – 2.5 metres (one-way) 3.5 – 4.0 metres (two-way)	1.5 metres (one-way) 3.0 metres (two-way)
Multi use paths	3.5 – 4.0 metres	3.0 metres
Conventional bike lanes	1.8 metres	1.5 metres
Buffered bike lanes	1.8 metre lane + 1.0 metre buffer	1.5 metre lane + 0.3 metre buffer
Paved shoulders	1.5 – 2.0 metres	1.2 metres

Additional supportive elements for cyclists

Bicycle parking and wayfinding are essential elements of cycling infrastructure that support cycling as a means of transportation. Bike racks, suitable for both short and long-term parking, should be provided in various styles and placed in key locations such as commercial areas, schools, and parks. These racks should be well-lit, easily accessible, and positioned in a way that allows bicycles to be locked upright. Bicycle parking should not obstruct pedestrian or cycling paths, and should be separate from travel lanes. It is important to consider peak demand and surrounding land uses when determining the appropriate amount of bicycle parking.

Clear and consistent wayfinding signage is crucial for cyclists, particularly for those who are new to the area or visiting as tourists. These signs should guide riders to important destinations and should be adjusted for bicycle-specific distances. Wayfinding signage should also remain accessible during winter by ensuring regular maintenance and snow clearing.

Bicycle and vehicular crossings

Intersections and driveways are particularly high-risk areas for collisions and conflicts between cyclists and vehicles. To mitigate these hazards, the streetscape should be designed with the appropriate considerations for cyclist safety. This includes paying attention to the geometry of cycling facilities, vehicle speeds and turning volumes, and visibility of cyclists to other road users. **Chapter 2.6** includes further discussion about bicycle parking along the street curbside.

Intersections

OTM Book 18 outlines the following four recommended options for designing intersections that incorporate cycling infrastructure:

Setback crossing: Setback crossings shift the cycling facility away from the roadway at intersections. This creates a dedicated area for motorists to yield to cyclists without disrupting through traffic, reducing the back pressure to complete the turning movement in a hurry. Setback crossings enhance the visibility of cyclists to turning motorists by increasing the angle of approach, making it more likely for a crossing cyclist to be visible to the motorist outside of their right blind spot.

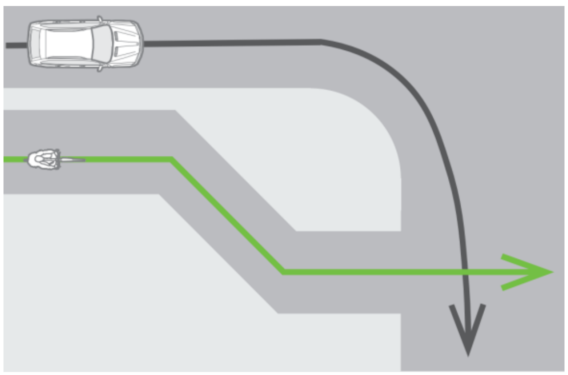


Figure 23. Setback crossing

Source: OTM Book 18

Adjacent crossing: The cycling facility crosses the intersection adjacent to, or with minimal setback from, the adjacent motor vehicle lanes. This is most suitable for on-road or in-boulevard facilities and where space for a setback crossing is limited at intersections.

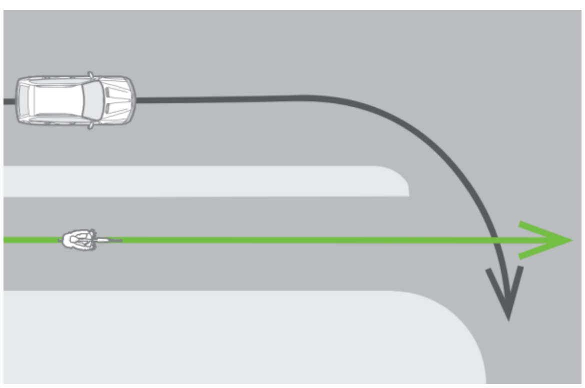


Figure 24. Adjacent crossing

Source: OTM Book 18

Bicycle lane between through lane and turn lane: The cycling facility runs between the main through lane and the dedicated turning lane at an intersection. This treatment exposes cyclists to motorists changing lanes for their turns. It is suitable for lower-speed roads with on-road cycling facilities.

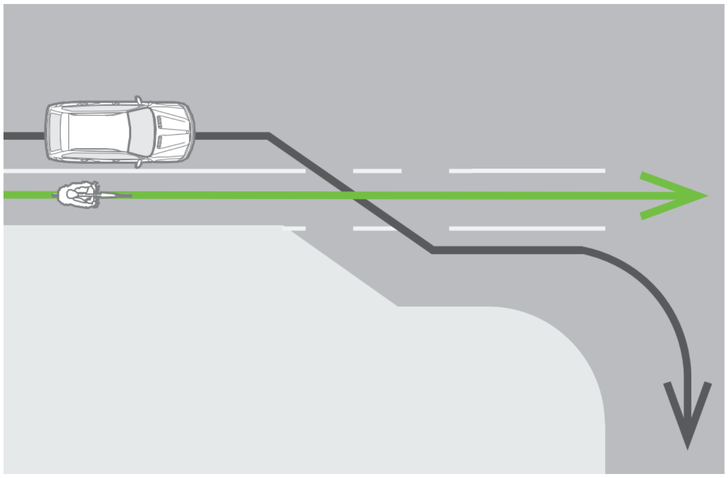


Figure 25. Bicycle lane between through and turn lane

Source: OTM Book 18

Mixing zone: The cycling facility transitions into a shared space between turning motorists and cyclists ahead of an intersection. These zones remove physical separation between the cycling facility and the motor vehicle lane. This is most suitable for lower speed environments with on-road cycling facilities.

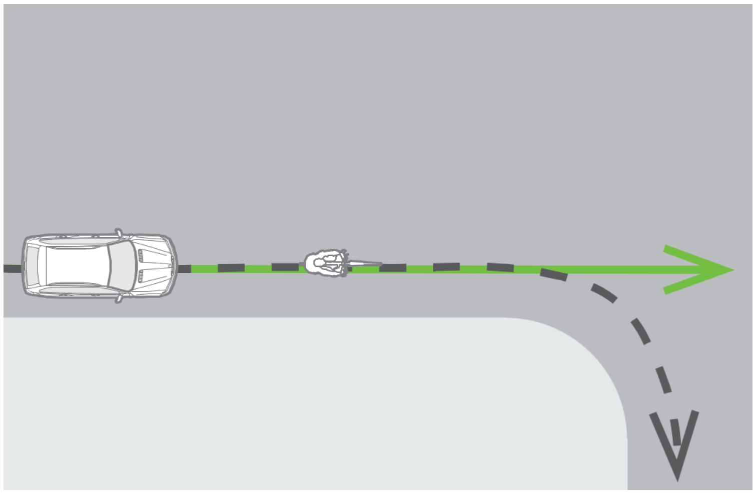


Figure 26. Mixing zone

Source: OTM Book 18

Left turns at intersections present a significant hazard for cyclists, as they can be exposed to vehicle traffic without proper design treatment. Green pavement markings can be used to identify and highlight areas of potential conflict, such as intersection crossings or other areas where increased visibility is beneficial.

OTM Book 18 recommends the following design options for left turn treatments at intersections:

Protected intersection corner: This design uses a corner safety island and setback crossing to provide physical separation between queuing cyclists and turning motorists. The configuration allows cyclists to complete left turns as two-stage turns. **Chapter 4** provides more details on protected intersection designs.

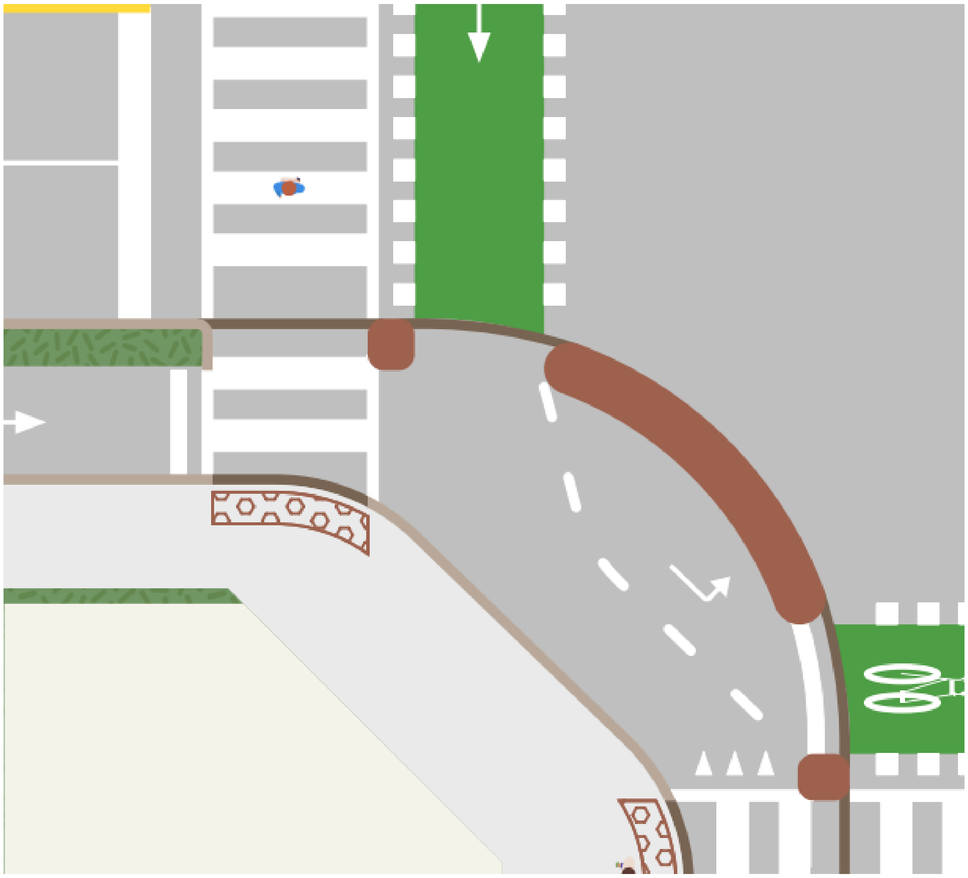


Figure 27. Example of a protected intersection corner

Source: Protected Intersection Guide, Ontario Traffic Council

Two-stage queue box: Designated space for cyclists to queue while completing an indirect left turn. This can be implemented within the boulevard or on the road.

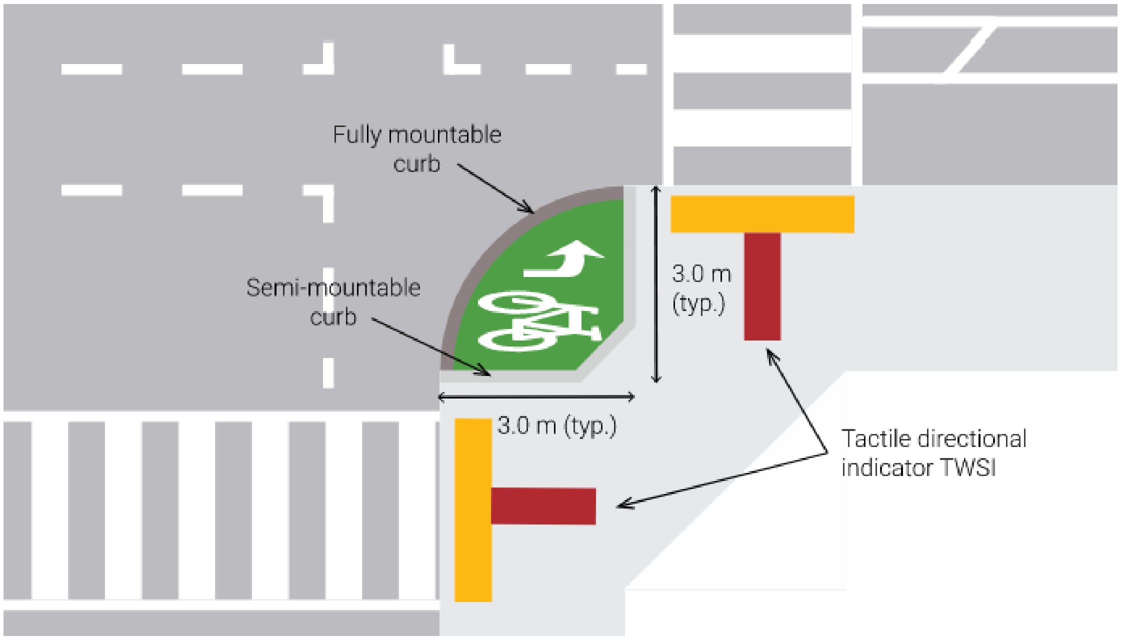


Figure 28. In-boulevard two-stage queue box

Source: OTM Book 18

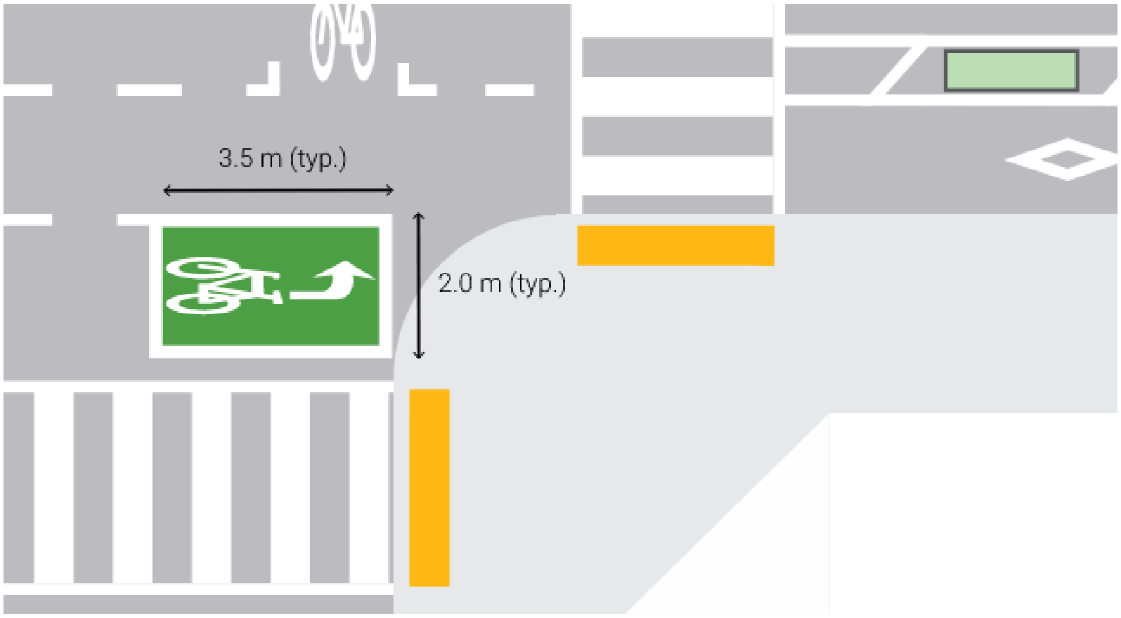


Figure 29. On-Road two-stage queue box

Source: OTM Book 18

Bike box: Designated queuing space for cyclists installed in front of the vehicle stop line, allowing for direct left turns and greater visibility of cyclists to motorists. This leaves cyclists exposed to conflicts with vehicles and should be considered on lower speed and volume roadways.

Figure 30. Bike box

Source: City of Guelph

Direct left turn with protected signal phase: This design uses a protected traffic signal phase for single-stage left turns, minimizing cyclist exposure to vehicles

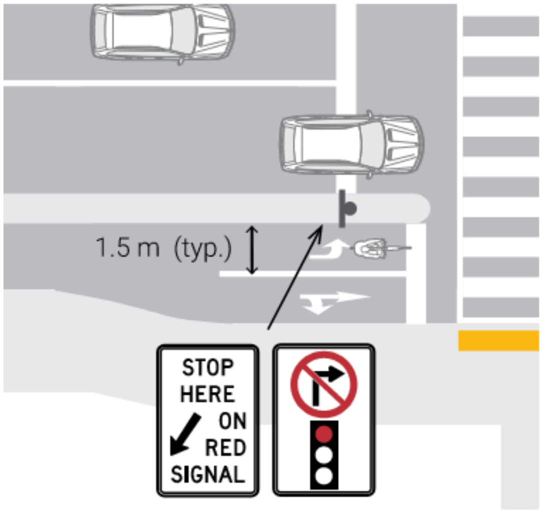


Figure 31. Direct left turn

Source: OTM Book 18

Driveways

When designing a cycling facility that crosses residential or commercial driveways, it is important to take measures to mitigate potential conflicts between cyclists and vehicles entering or exiting the property. Sample design treatments for driveway crossings are as follows:

Pavement markings: Cycling facilities crossing driveways should include bicycle stencils and directional arrows. For higher volume driveways, consider the use of green thermoplastic to highlight the conflict area.

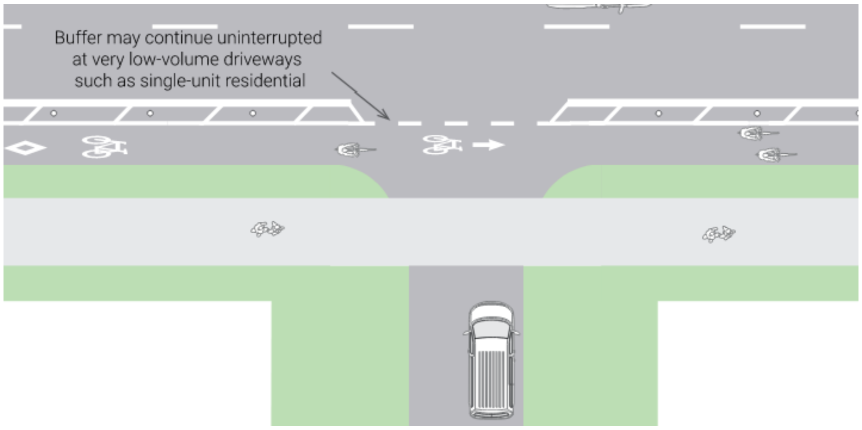


Figure 32. Low-volume driveway treatment

Source: OTM Book 18

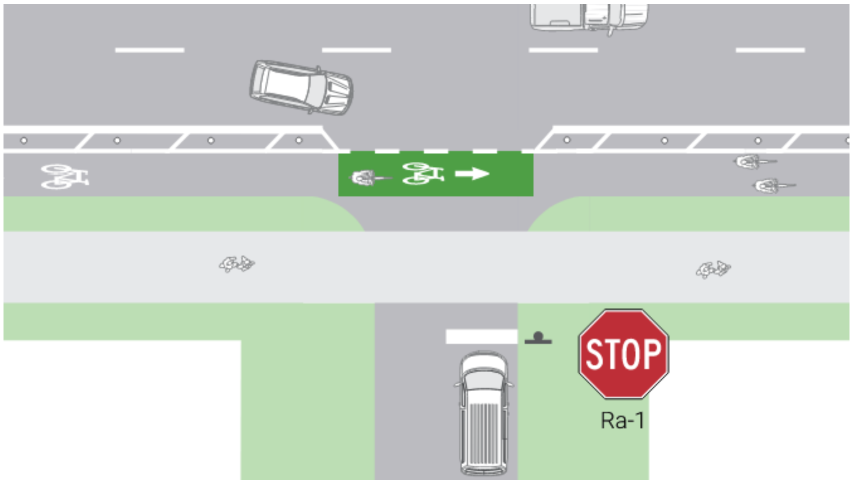


Figure 33. High-volume driveway with green thermoplastic treatment.

Source: OTM Book 18

Setback crossings: For in-boulevard cycling facilities such as cycle tracks and multi-use paths (MUP), consider setback crossings of 4-6 metres to improve visibility of vulnerable road users to turning motorists.

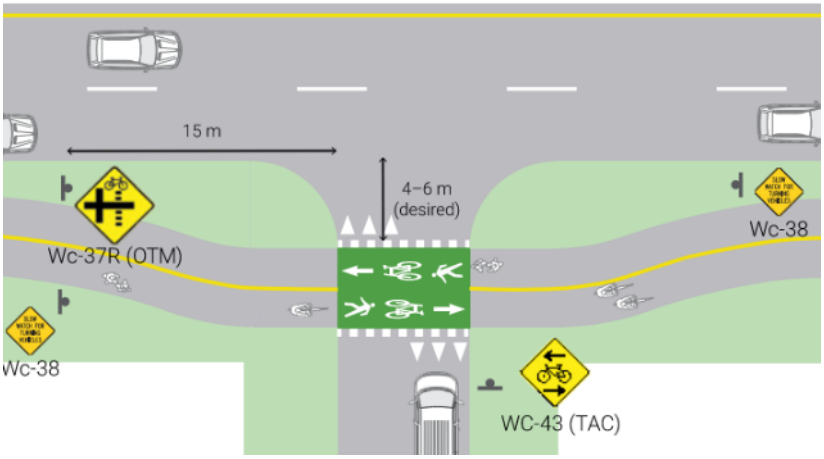


Figure 34. High-volume driveway treatment with MUP.

Source: OTM Book 18

Continuous cycle track: Both the cycle track and sidewalk maintain elevation across the driveway. This clearly conveys to motorists that they are crossing a pedestrian and cyclist zone when entering or exiting the driveway. Raising cyclist and pedestrian crossings at driveways can help reduce motor vehicle speeds and improve safety for vulnerable road users.

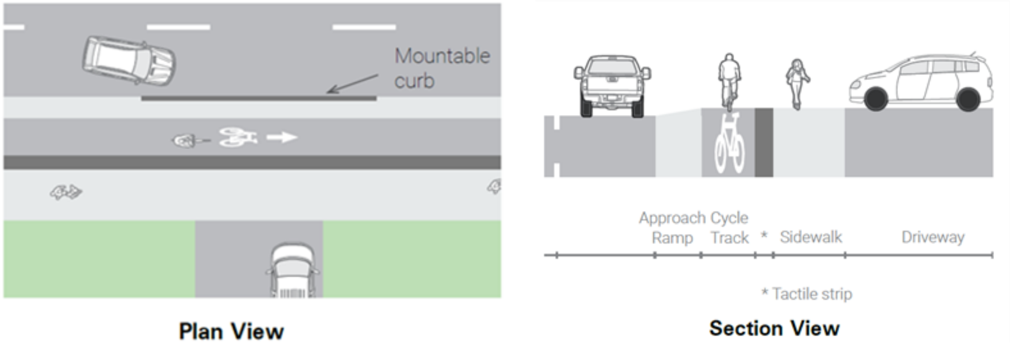


Figure 35. Continuous cycle track driveway treatment.

Source: OTM Book 18

Further information about these options and additional design principles for cycling facility intersection approaches and crossings can be found in Section 6 of OTM Book 18. **Chapter 4** of these Guidelines also provides illustrations and design considerations of common intersection designs for Greater Sudbury.

2.4 Public transit

Public transit is a viable method of transportation for people seeking to travel within Greater Sudbury. A Complete Street enhances transit service by supporting facilities that promote safety, efficiency, accessibility, and reliability. There are a variety of benefits associated with use of public transit, including the following:

1. **Accessibility:** Provides an opportunity for travel for people with disabilities and those who do not have access to a personal vehicle or bicycle
2. **Affordability:** Transit fare is relatively more affordable than traditional personal vehicle costs, thereby providing people with lower incomes an opportunity to travel
3. **Mobility:** Public transit typically provides connections to employment, essential services, shopping, and entertainment opportunities across the City

Effective transit facility design can help ensure that public transit remains safe, reliable, accessible, and efficient throughout the City's transit network. Complete Streets design principles play an important role in the experience of using public transit by providing access, safety, and design considerations.

This chapter further describes the design principles and corresponding considerations for the City. It outlines considerations to support the City's transit system facility design through the lens of Complete Streets philosophies. The term "transit facilities" refers to the physical infrastructure of the transit system, including the following key elements:

- Stop design
- Lane design
- Intersection design

The following resources can be referenced for more information:

- National Association of City Transportation Officials (NACTO) Transit Street Design Guide
- Ontario Traffic Manual (OTM) Book 18, Cycling Facilities
- Accessibility for Ontarians with Disabilities Act (AODA), Transportation Standard

GOVA transit family

With the establishment of the City of Greater Sudbury's transit system (GOVA), the City is supporting public transit as a viable mode of transportation for all ages and abilities. An accessible transit system can be made more robust by aligning the facility design with Complete Streets principles.

GOVA is comprised of the following three types of transit services:

GOVA: Provides fixed-route operations with high-frequency service. The routes provide travelers access and connections to popular destinations and mobility hubs across the City.

Figure 36. GOVA transit bus

Source: GOVA Transit

GOVA Zone: Formerly known as TransCab, the GOVA Zone service provides on-demand taxi service that connects to GOVA transit routes at local mobility hubs. This service is geared towards those residing in less populated areas of Greater Sudbury who do not have access to the conventional bus routes.

Figure 37. GOVA Zone service taxi

GOVA Plus: Provides enhanced accessibility features and vehicles for individuals with disabilities. GOVA Plus uses a specialized transit fleet and spans the same service area as other GOVA services.

Figure 38. GOVA Plus transit vehicle

Source: CBC News

Design principles

To align with Complete Streets requirements, transit improvements and new transit developments across the City should be designed in accordance with the overarching design principles summarized in **Table 5.**

Table 5. Complete Streets transit design principles

Design principles	Motivation	Desired Result
Provide safe and comfortable transit facilities	Transit facilities play a large role in the user experience of public transit, as they are located at both origin and destination of a transit trip.	Helps ensure that transit remains a safe and attractive mode of travel for city residents by enhancing the transit user experience, especially while waiting for a transit vehicle.
Accommodate multimodal travel	Multimodal travel is used to access and leave transit facilities. Access to transit stops and hubs	Enhancing access at transit stops for people walking, cycling, or driving can help improve

Design principles	Motivation	Desired Result
	should be integrated with the active transportation network to support access to and from transit vehicles by different modes.	access to the transit system and increase the catchment area of a transit stop.
Provide priority access to transit vehicles for greater transit efficiency	A reliable transit system supports customers with timely, efficient travel with minimal disruptions. Increasing transit system reliability can help support transit as a viable alternative to personal vehicles.	Helps ensure efficiency of transit vehicle movements, thereby increasing the reliability of the transit system and improving the transit user experience.

Accommodating transit on Complete Streets

As the City continues to grow, strategic transit investments will ensure a resilient and connected network. These transit developments can be accommodated by implementing specific designs for transit facilities, as described later in this chapter.

Future improvements to the City's transit network should consider several key principles and corresponding strategies. These strategies are possible treatments that can support the increase of transit mode share by addressing possible challenges to transit travel while satisfying the relevant goals of Complete Streets principles.

The strategies presented in this chapter are preliminary considerations, and further analysis would be necessary to confirm the applicability of the treatment relevant to the context and requirements of the transit system element upgrade

The key principles and corresponding strategies are as follows:

Interactions between transit vehicles and other modes

Relevant design principle: Accommodate multimodal travel

Potential challenges: Conflicts between transit vehicles and pedestrians, cyclists, or motor vehicles due to transit infrastructure.

Facility design considerations: Transit vehicle onboarding and bus shelter placement should not significantly impact cyclist movement. Bus stops should also be designed to reduce conflicts between cyclists and passengers using the pedestrian clear zone.

Other design considerations: Adequate signage should be considered along corridors with transit vehicles conflicting with other modes.

Access experience

Relevant design principle: Provide safe and comfortable transit facilities

Potential challenges: Transit facilities that have an inaccessible location or no furnishings may be a hindrance to transit users, especially in winter months.

Facility design considerations:

- Provision of shelters;
- Available seating;
- Comfortable lighting;
- Adequate space for maneuvering and waiting;
- Tactile walking surface indicators;
- Detectable warning surfaces along raised landing pads, platform edges, and curb cuts;
- Provision of comfortable pedestrian crossings; and,
- Dedicated bicycle parking or bike share stations.

Other design considerations:

- Provide information to support trip planning;
- Compliance with the Accessibility for Ontarians and Disabilities Act (AODA);
- Compliance with the Greater Sudbury Transit Action Plan (2019); and,
- Wayfinding for travellers to access nearby transit facilities.

Lanes and intersections

Relevant design principle: Provide priority access to transit vehicles for greater transit efficiency

Potential challenges: Shared travel lanes with other vehicles and frequent queueing at major intersections may result in increased travel times and reduced transit efficiency

Facility design considerations: Allocating travel lanes for transit use or introducing queue jump lanes to avoid delays due to vehicle congestion. Consider transit signal priority at high volume intersections to reduce delays at the intersection.

Other design considerations: Consider limiting parking along roads with frequent transit to ensure parked vehicle do not conflict with buses.

The accommodation of transit on Complete Streets considers the perspectives of both the transit vehicle and the transit user. These perspectives have been considered in the design options later presented in this chapter.

The result of successful transit accommodation is minimal conflict between transit vehicles, transit users, and other modes based on facility design. The various options for facility design ensure that transit remains integrated across the different typologies within the City's road network.

Table 6 provides a summary of conflicts that can be mitigated using the corresponding facilities later outlined in this chapter.

Table 6. Key challenges and corresponding facilities that can support conflict reduction

Facility design type	Transit vehicle challenges	Transit user challenges
Stops	Conflicts with cyclists	Conflicts with cyclists and motorists
Lanes	Conflicts with motorists	Transit vehicle delay
Intersections	Conflicts with motorists	Transit vehicle delay

Stop design types

Transit stops should be designed with safety, comfort, and accessibility in mind. The stop designs for consideration echo the strategies previously described in this chapter. The following should be considered for transit stops:

- Stops should be maintained in accordance with the Winter Maintenance Practices outlined in **Chapter 5.5**.
- Considered with respect to the context of the surrounding road network, traffic volumes, and projected transit usage. The features and characteristics of the lanes should also be considered when evaluating potential impacts. Further details on lane design are presented later in this chapter.

There are multiple elements involved with a transit stop. As presented in **Table 7**, Complete Streets provides both minimum and target values for the stop width. The stop width selection would be based on the surrounding road infrastructure.

Table 7. Recommended stop widths

Element	Desirable	Constrained
Platform length	9.0 m – 15.0 metres	9.0 metres
Transit shelter and street furniture clearance from bikeway	0.5 metres	0.3 metres
Clearance width along traffic curb edge	1.8 metres	0.5 metres
Curbside transit stop width	3.0 metres	2.5 metres

Further information regarding the stop design types and their intersections with adjacent cycling and pedestrian facilities can be found in the OTM Book 18, Cycling Facilities.

Shared cycle track platform

A shared cycle track platform stop **(Figure 39)** may be used by both cyclists and transit vehicles and is typically used when right-of-way constraints exist.

Figure 39. An example of a shared cycle track platform stop

Approximate length of curb affected: Bus length

Interactions between transit vehicle and other modes: As the cycle track is elevated away from the roadway, conflicts between a transit vehicle and cyclists are mitigated as they are fully separated.

Interactions between transit user and other modes: The typical elevation of cycle track is sidewalk level. Any transit shelters should be designed to open onto the sidewalk, and not the cycle track. This will help ensure pedestrians do not walk onto the cycle track when accessing the transit vehicle. The transit loading area will coincide with the cycle track, thereby requiring cyclists to stop behind the transit vehicle. This allows pedestrians to safely board or exit the transit vehicle, while mitigating conflicts between cyclists and transit vehicles.

Considerations for implementation: Due to the interplay of cyclists and pedestrians at the shared cycle track platform stop, it is important to consider an educational campaign and signage to inform travellers on how to use the facility.

Shared space stop

A shared space stop **(Figure 40)** is primarily a cycling facility that is shared with transit vehicles. The cycling facility is at road level. Unlike the shared cycle track platform, the transit vehicle temporarily merges into the bike lane to accommodate loading or unloading of passengers.

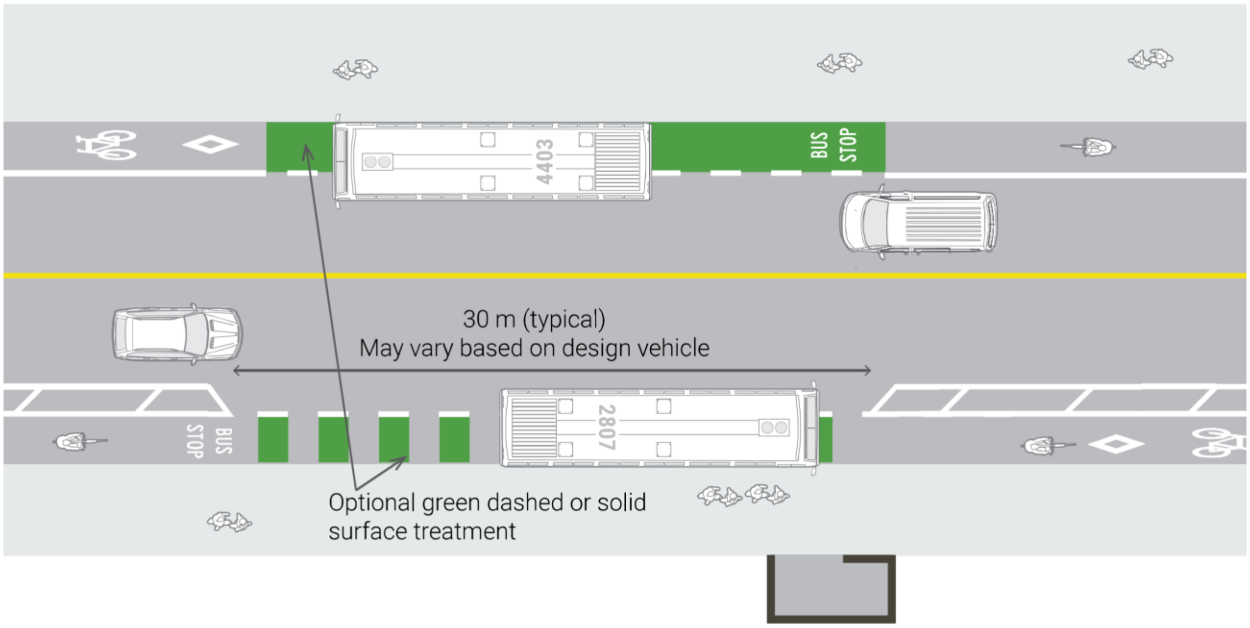


Figure 40. Typical shared space stop

Source: OTM Book 18

Approximate length of curb affected: Minimum 30 metres

Interactions between transit vehicle and other modes: During boarding, the transit vehicle will partially use both the cycle track and the adjacent motor vehicle lane. This placement allows the transit vehicle to re-enter the flow of traffic without merging. To accommodate the stopped transit vehicle, cyclists and motorists are required to stop behind the transit vehicle. Alternatively, cyclists and motorists may choose to merge into the adjacent lane to maintain their flow.

Interactions between transit user and other modes: Transit vehicles stop directly adjacent to the platform, minimizing conflicts between boarding and alighting passengers and other road users.

Considerations for implementation: Unlike the shared cycle track platform stop, the shared space stop poses increased complexity for cyclists interacting with transit vehicles. Merging into the adjacent lane with ongoing traffic flow, for example, can reduce the comfort for cyclists. Shared space stops should typically only be used in instances where transit is considered high priority, or in constrained corridors where retrofitting is necessary. It is also necessary to consider an educational campaign and signage to inform travellers on how to use the facility.

Bus bay stop

A bus bay stop **(Figure 41)** provides a designated space for transit vehicles along the edge of the road; this can be a dedicated bus bay or a right turn lane. The platform is located adjacent to the layby or right turning lane, requiring the transit vehicle to pull out of a through lane and merge prior to accessing the bus bay stop.

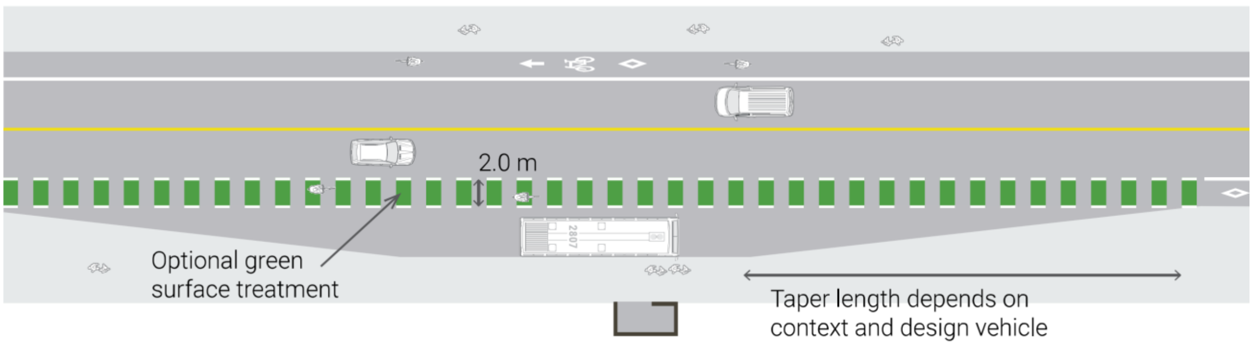


Figure 41. Typical bus bay stop

Source: OTM Book 18

Approximate length of curb affected: Minimum 30 metres

Interactions between transit vehicle and other modes: The merging of the transit vehicle into the rightmost lane to accessing the bus bay can cause the following conflicts:

- If the cross section includes an on-road cycling facility, such as a cycle track, the transit vehicle would have to cross the cycle track to access the bus bay. This would reduce cyclist comfort and safety; and
- The transit vehicle would be required to merge back into the motor vehicle lane after boarding has been completed. This maneuver is prone to delays, which in turn can reduce the efficiency of transit operations.

Interactions between transit user and other modes: Transit vehicles stop directly adjacent to the platform, minimizing conflicts between boarding and alighting passengers and other road users.

Considerations for implementation: A key consideration for the bus bay stop is that it requires additional roadway space beyond the curb lane, which may not be available for certain corridors. This type of stop is appropriate for corridors with higher speed and volumes, as it operates as a layover to accommodate high passenger volumes. Mitigation measures, such as transit signal priority and queue jump lanes, should be considered to help minimize transit vehicle delay.

Rural bus stops

A rural bus stop can be accessed along the shoulder of the road. The bus stop requires the transit vehicle to pull out of the curb lane and travel into the shoulder. When exiting the stop, the transit vehicle merges back into the adjacent traffic flow.

Figure 42. Rural bus stop in Greater Sudbury

Approximate length of curb affected: 16.5 metres

Interactions between transit vehicle and other modes: Cyclists may use the shoulder in rural areas, as there is limited access to other cycling facilities. In these cases, the cyclists would have to stop or merge into the adjacent lane to accommodate the transit vehicle. These scenarios would reduce cyclist comfort and safety.

Motor vehicles may also use the shoulder to park or pullover, in which case the transit vehicle's access to the rural bus stop may be delayed.

The transit vehicle would be required to merge back into the motor vehicle lane after boarding has been completed. This maneuver is prone to delays, which in turn can reduce the efficiency of transit operations.

Interactions between transit user and other modes: Some rural areas may not provide sidewalk facilities for pedestrians. In these cases, the pedestrians will be required to share the shoulder space with cyclists, motor vehicles, and transit vehicles. This may delay the transit vehicle and decrease the safety for pedestrians.

Considerations for implementation: This type of stop is appropriate in rural areas with lower fixed route transit frequencies. Due to higher anticipated passenger waiting times, consideration should be made to increase the comfort and safety of the bus stop. Possible design elements to improve the comfort and safety include a bus shelter, seating, and adequate lighting. Appropriate signage should also be utilized to inform road users of the upcoming transit stop.

Lane design types

In addition to the stop design types described previously in this chapter, transit lane design can also be used to design a corridor to meet the Complete Streets design principles. Lane design improvements can be implemented as part of new road construction or road improvements to ensure cost effectiveness.

This chapter further details the following three possible lane design alternatives for the City:

- Dedicated transit lanes,
- Reserved lanes, and,
- Queue jump lanes.

Consideration of these optional alternatives for future road projects could help improve transit efficiency within the City's network. Lanes must be maintained in accordance with the Winter Maintenance Practices outlined in **Chapter 5.5**.

Dedicated transit lanes

Dedicated transit lanes (are typically used along Bus Rapid Transit (BRT) corridors to accommodate the higher frequency of transit vehicles. Transit vehicles may exclusively travel on dedicated transit lanes, which are delineated using physical barriers or pavement markings. Emergency and maintenance vehicles are also typically permitted on dedicated transit lanes.

The lanes may be positioned between travel lanes and the adjacent boulevard, or alternatively in the centre of the roadway with travel lanes on either side. The pavement markings indicate “Bus Only” lettering and a corresponding diamond.

Figure 43. An example of a dedicated transit lane

Source: Metrolinx

Due to their exclusive nature, these lanes accommodate greater passenger volumes with decreased delays. The resulting increase in transit efficiency makes dedicated transit lanes an effective choice along corridors with high congestion and motor vehicle volumes.

Key considerations when evaluating the suitability of this lane design alternative include the merging of transit vehicles in and out of the dedicated transit lanes, as well as the potential conflict with motor vehicle turning movements.

Reserved lanes

Reserved lanes prioritize specific vehicles such as high-occupancy vehicles (HOV), bicycles, transit vehicles, taxis, and emergency vehicles. A reserved lane should be identified using “reserved lane” overhead signage that is installed at 100-metre intervals throughout the lane, accompanied with a diamond symbol. The signage should clearly indicate the permitted vehicles, as well as restricted days and times.

Figure 44. Reserved lane in Victoria, BC

Source: CBC News

These lanes provide greater flexibility to accommodate various modes without changing the physical lane infrastructure. The prioritization is indicated on signage for restrictions applied for certain days of the week or peak periods during the day.

Key considerations when evaluating the suitability of this lane design alternative include transit route frequency, as well as traffic volume fluctuations throughout the day. The reserved lanes should accommodate the variability in usage of different modes.

Queue jump lanes

A queue jump lane permits transit vehicles to bypass queued adjacent motor vehicle traffic at intersections. This is achieved with a dedicated transit facility that uses transit signal priority to allow transit vehicles to get a head start.

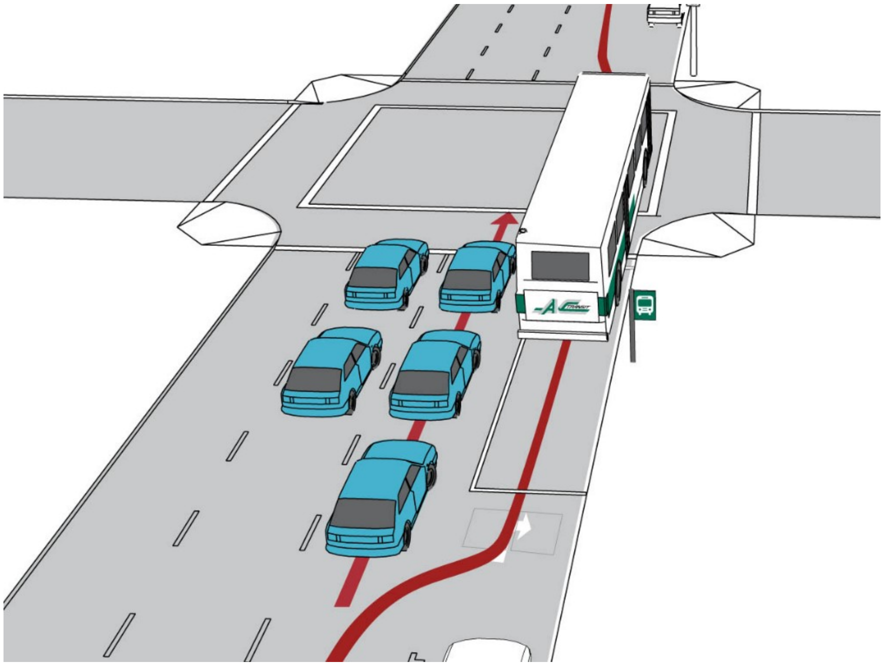


Figure 45. Typical queue jump lane design

Source: The Genesis Centre

Queue jump lanes provide an opportunity for transit vehicles to avoid the delay due to traffic congestion, thereby supporting transit network efficiency.

Queue jump lanes should be considered for corridors with higher traffic volumes that reduce transit efficiency at intersections. Transit efficiency may also be reduced by right-turning traffic, for which various signal options or a dedicated right-turn lane should be considered. The intersection design alternatives described later in this chapter can be considered for implementation to further support the transit prioritization at queue jump lanes.

Intersection design types

Intersection design is another opportunity to help align a corridor to Complete Streets principles by accommodating transit vehicles at intersections to improve the overall transit network efficiency. The alternatives described in the following sections can be used in conjunction with the lane design types previously presented in this chapter.

For further reading regarding intersection design types, please refer to the OTM Book 12, Traffic Signals.

Transit Signal Priority (TSP)

TSP strategies complement the various lane design alternatives by reducing stall time for transit vehicles at intersections. TSP alternatives are currently undergoing implementation within the City, and should continue to be considered for corridors with higher traffic volumes or higher-frequency transit.

TSP strategies for consideration include:

- Shortening of red cycle when transit vehicles are detected at the intersection;
- Coordinating signals across a transit corridor to ensure green lights for transit vehicles at each intersection;
- Shorter signal cycles at intersections for those corridors with an absence of transit vehicle detection technology; or
- Providing a dedicated transit signal.

A key benefit of TSP alternatives is that they make use of existing traffic signals, which can be understood by all road users and is a safer alternative than solely relying on signage.

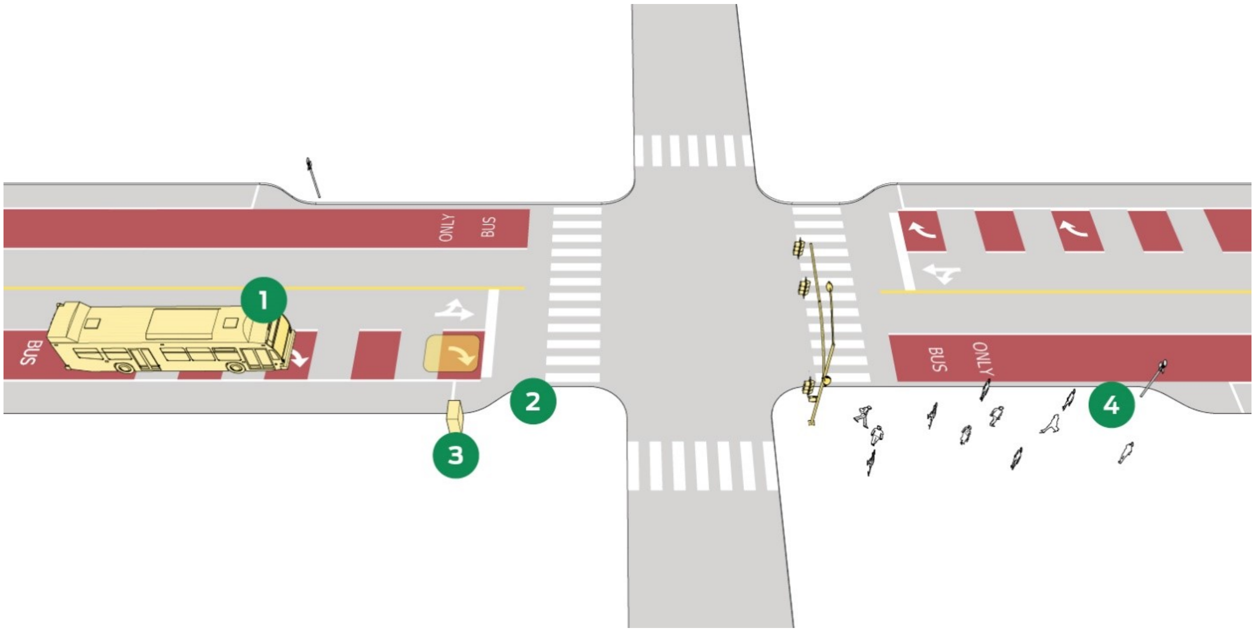


Figure 46. Example of an intersection with TSP and a dedicated bus lane

Source: NACTO Transit Street Design Guide

Curb radii and stop bars

Curb radii and stop bars are important considerations for transit vehicle accommodations at intersections along transit corridors. The curb radius is a measure of the size of the right-turn corner (refer to **Chapter 4** for more details on curb radii), and stop bars are pavement markings indicating where vehicles should queue prior to entering the intersection.

Evaluation of curb radii and stop bars is necessary at intersections along transit routes with frequently right-turning buses to ensure sufficient vehicle accommodation.

In scenarios with smaller curb radii, the right-turn would be tighter for transit vehicles. To ensure a safe and efficient maneuver, the stop bar can be placed further away from the intersection to allow the transit vehicle to oversteer using the oncoming lane without conflicting with stopped vehicles.

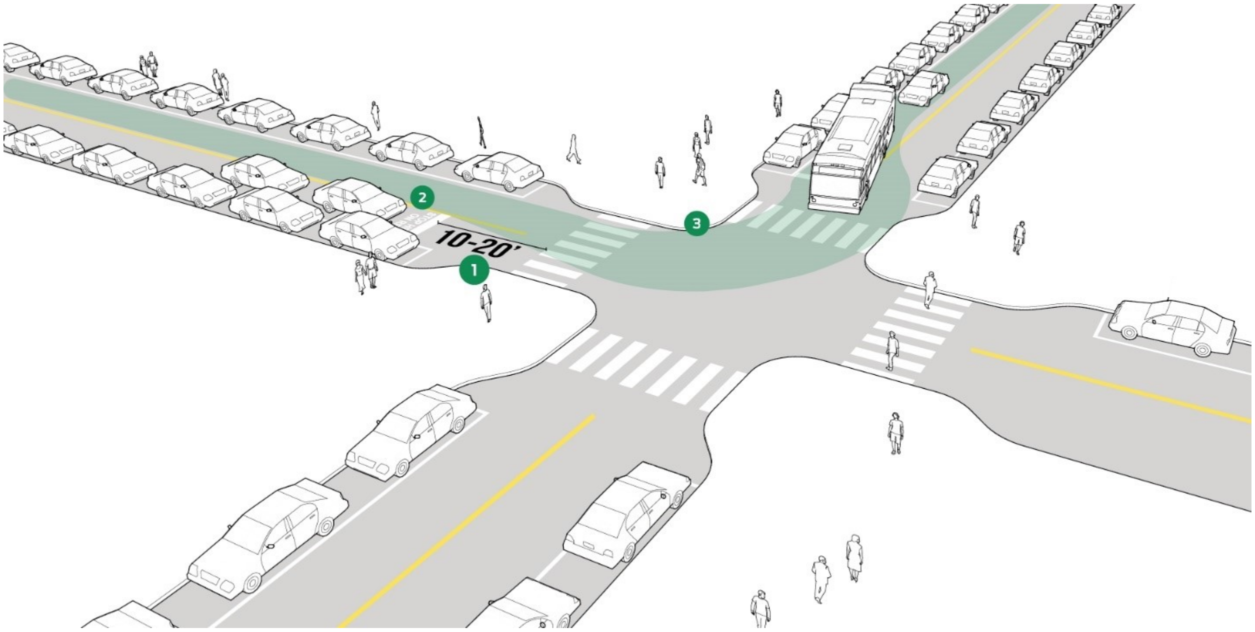


Figure 47. Example of an intersection with a stop bar setback to accommodate for a turning transit vehicle

Source: NACTO Transit Street Design Guide

2.5 Travelled way

To align with the principles of Complete Streets, it is important to balance the needs of all road users and to consider the context of the street within the overall road network.

Previously built roadways tended to allocate excessive space to vehicles, thereby limiting mobility choices and leading to an over-prioritization of private motor vehicle travel. In contrast, the Complete Streets approach supports the safe and efficient multimodal travel of goods, people, and emergency services.

This chapter describe various considerations for “travel lanes”, which refer to portions of the street between the curbs on urban roads or edge of shoulders on rural roads generally intended for vehicular travel.

For more details on Design Vehicles, Control Vehicles, and Design Speed selection, refer to the following sources:

- TAC Geometric Design Guide for Canadian Roads
- NACTO Urban Street Design Guide

Design principles

The following design principles that should be considered when evaluating a street for new construction or reconstruction:

Consider the street context: The context of a street should be considered to ensure effective design by identifying whether it primarily serves movement or access functions. A movement-oriented street prioritizes faster movement of road users with minimal disturbances by accommodating the following:

- Higher speeds;
- Greater separation between road users; and
- Prioritizing limited access to the roadway to minimize conflict.

Alternatively, access-oriented streets prioritize road user access by accommodating the following:

- Slower speeds;
- Property access; and
- Curbside activity.

Considering the street context helps ensure effective design by identifying the primary function of the street. This is achieved by reviewing the characteristics and adjacent land use context.

The design should clearly communicate the identified function of the road and encourage user behaviours supporting that function.

Prioritize safety: The goal of effective design is to create safer streets as a proactive preventative measure, rather than a retroactive reactionary one. Prioritizing safety helps minimize the severity and likelihood of conflicts between road users through careful design choices that maximize safety.

Design roadways to accommodate multimodal movement: Complete Streets philosophies highlight the importance of considering the role road design plays in accommodating and encouraging multimodal travel. Roadway design should consider the trade-offs between allocating space for motor vehicles and other Complete Street elements within the ROW.

The roadway should be designed with sufficient space available for all users within the overall ROW, and curb-to-curb space solely dedicated to high-speed movement of motor vehicles should be avoided.

Street characteristics

Effective road design considers the users of a roadway depending on frequency and vehicle size, Design vehicles are "regular" users of a given street, while control vehicles are infrequent users that should be accommodated. As presented in **Figure 48,** the vehicle type with largest turning requirements is used for both design and control vehicles to ensure sufficient turn accommodation. The following key considerations must be made when selecting the design and control vehicles:

- **Street context:** It is necessary to understand the context of a street prior to selecting the design vehicle for the road. For most urban roads, such as those in the City, a Medium Single Unit (MSU) truck or Bus (B-12) should be considered as the design vehicle.
- **Adopting standards:** Adopting a standard that accommodates both a design and a control vehicle is an important consideration when aligning with Complete Streets principles. This adopted standard supports the selection of minimum mid-block lane widths and design treatments at intersections, such as curb radii.

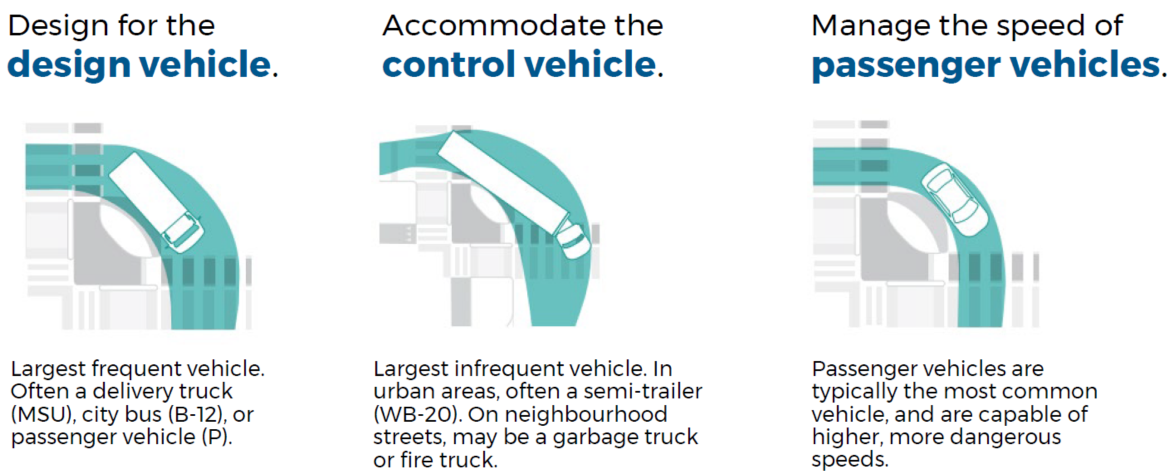


Figure 48. Design and control vehicles

Source: NACTO Don't Give Up at the Intersection Guide

Selecting the design and control vehicles helps achieve the goal of road design, which should be to accommodate the larger vehicles without being over-designed.

Complete Streets philosophies point towards accommodation of multimodal travel in all aspects of road design, including speed. The design speed of a road should consider interactions with vulnerable road users while being contextually appropriate. The design speed of a Complete Street should be equivalent to the posted speed limit. In addition, the geometric elements should discourage drivers from operating above the speed limit. Higher speeds can increase the likelihood of fatalities and severe injuries for all users of the road. The key benefits of lowering the design speed are increasing safety, reducing the likelihood of fatalities, and minimizing the risk of injury.

Road design plays a crucial role in setting the design speed, and Complete Streets philosophies provide design strategies to reduce speeds. Roadway infrastructure and streetscaping design considerations to lower design speeds in vulnerable areas include the following:

- On-street parking;
- Street-oriented buildings
- Narrow travel lanes; and
- Furnishing zone located close to the curb.

One effective technique to reduce speeds includes implementation of traffic calming measures, which are further described in this chapter. The following street characteristics may be considered for the road design. The key drawbacks and benefits of these street characteristics and their role in the Complete Street should be reviewed prior to implementation.

Lanes

Lanes accommodate vehicular travel for motor vehicles, transit buses, or trucks. Lane width is an important consideration for road design with its ability to influence travel speed. In the context of Greater Sudbury, a constant lane width of 3.5 metres typically is applied. This lane width accommodates all vehicles and typologies while also providing space as snow storage in winter months.

The following should be considered:

- Lane widths are measured from curb-to-curb for a road, inclusive of gutters.
- Minimum of 6 metre width clearance is required per the Ontario Building Code for emergency vehicle access.

Figure 49. Example of lanes with snow storage

Table 8 provides a summary of lane width parameters for consideration. Selection of a lane width should prioritize the safety of all road users, especially vulnerable populations.

Table 8. Summary of lane width parameters

Element	Desirable	Constrained
Through lanes and turning lanes	3.5 metres	3.25 metres
Curb lanes	3.5 metres	3.5 metres
On-street parking lane (inclusive of gutter)	2.4 metres	2.0 metres
Required parking lane buffer	On-street parking should be restricted for at least 2 metres from driveways, 9 metres from an intersection, and 9 metres from crosswalks.	1.5 – 2.5 metres required at both ends of an accessible parking space.

Medians

Medians serve as a continuous separation for traffic travelling in opposite directions and are placed linearly along the centre of the roadway. Medians provide several safety and streetscaping benefits to the roadway, including the following:

- Space to install signal poles, light standards, and signage;
- Reduction in potential for motor vehicle head-on collisions;
- Reduction in turning conflicts due to restricted midblock turning access; and,
- Opportunities to provide pedestrian refuges to reduce crossing distances for pedestrians.

Figure 50. An example of a median in Greater Sudbury

Several considerations for median implementation include:

- Reduction of motor vehicle access to properties on the opposite side of the street;
- Increased capital and maintenance costs; and,
- Usage of ROW space which may have otherwise been allotted to other Complete Street elements.

A cost-benefit analysis that reviews the above considerations is necessary prior to implementing a median. Goals such as the reduction of collisions can be achieved through alternate solutions such as traffic calming.

Roads with higher volumes and speeds benefit greatly from medians. Medians should typically not be used on urban streets with narrow lane widths or where access is a priority. On streets with multiple accesses, a two-way left turn

(TWLT) lane should be considered as an alternative to mitigate conflicts between through traffic and left-turning traffic.

This chapter provides a summary of median treatments and their characteristics for further consideration. Public and staff education is necessary to communicate the benefits and ongoing maintenance of medians.

Planted medians

Median depth: Raised from road surface

Infrastructure: Soft surface such as a planted boulevard, curb extension, bed, or planter.

Key benefits:

- Reduction of urban heat from paved surfaces.
- Aesthetically pleasing.
- Contributes towards natural stormwater management
- May be used as additional snow storage if width is adequate.

Key considerations:

- Short or long-term irrigation necessary. Can be semi-manual or pumped.
- Mowing may be necessary in some cases.
- Requires additional ROW space to accommodate streetscaping.

Planted Drainage

Median depth: Raised from road surface

Infrastructure: The raised edges encompass a soft surface such as an open ditch swale, rain garden, or bioswale. As a low-impact development (LID), this type of median can provide low-cost stormwater management.

Key benefits:

- Natural stormwater management.
- May be used as additional snow storage if width is adequate.

Key considerations:

- Relevant measures would need to be taken to reduce the impacts of salt saturation such as selecting salt tolerant species in the median.

- Requires additional ROW space to accommodate streetscaping and drainage.

Painted (Flush)

Median depth: Flush with road surface

Infrastructure: Painted road space that provides separation between opposing lanes and can be converted into left turn lanes. Applicable to roadways with closely spaced accesses.

Key benefits: Can be used to channelize left-turns at stop-controlled intersections, signalized intersections with limited ROW, or corridors with closely spaced commercial entrances, and rural areas.

Key considerations:

- Low maintenance requirements, typically road maintenance requirements would apply.
- Does not provide significant safety improvements compared to a physical median.

Curb (Raised)

Median depth: Raised from road surface

Infrastructure: Paved surface along high volume and high-speed roads

Key benefits: If a raised curb has sufficient width (minimum 2.1m), it can serve as a pedestrian refuge island.

- Can be used as a streetscaping opportunity if width can sufficiently accommodate trees.
- Increased motorist safety when adjacent to a turn lane.
- May be used as additional snow storage if width is adequate.

Key considerations:

- Typical road maintenance requirements would apply. If streetscaping involves vegetation, mowing or irrigation would also be necessary.
- Requires additional ROW space to accommodate paved surface.

Traffic calming

The purpose of traffic calming strategies is to reduce vehicle volumes and speeds, enabling people of all ages and abilities to safely use the road. Traffic calming is typically applied along collector and local roads.

Figure 51. Southview Drive in Sudbury with speed reductions and speed bumps

There are two types of traffic calming – horizontal and vertical deflections. Horizontal deflections require the motorist to travel horizontally to avoid the traffic calming infrastructure, while vertical deflections require the reduction of speed to maintain comfort.

Examples of horizontal deflections include:

- **Roundabouts:** The roundabout provides a circular path for motorists, requiring the reduction of speeds when circulating;
- **Chicanes:** Chicanes are curves or obstacles (such as parking) along the road that force motorists to shift laterally to avoid obstacles and reduce speeds to remain comfortable;
- **Lateral pavement markings (rural roads):** Lateral pavement markings require motorists to shift their position laterally along a road, forcing them to reduce speeds to do so; and,
- **Curb extensions:** Curb extensions result in physical and visual narrowing of the roadway which encourage motorists to reduce their speed. Curb extensions can be located at intersections or mid-block and can improve safety for crossing pedestrians by reducing crossing distances and increasing pedestrian visibility.

Examples of vertical deflections include:

- **Speed bumps or speed humps:** These vertical mounds force motorists to reduce speeds to maintain comfort;
- **Raised crosswalks:** The height of this crosswalk leads to reduction in vehicular speed, allowing pedestrians to cross safely. This type of crosswalk can be either placed at an intersection or midblock; and
- **Raised intersections:** Raised intersections meet the curb through ramps and require motorists to reduce their speeds when approaching and crossing an intersection.

Traffic calming helps support active transportation by reducing vehicle speeds and creating an environment more conducive to walking and cycling. Some of the recommended Complete Streets infrastructure is also commonly used to fulfill the purpose of traffic calming, such as medians, curb radii, and on-street parking.

For further information, please refer to the following resources:

- National Association of City Transportation Officials (NACTO) Urban Street Design Guide
- Federal Highway Administration, Traffic Calming ePrimer
- City of Greater Sudbury Traffic Calming Policy
- Transportation Association of Canada, Canadian Guide to Traffic Calming – Second Edition (2018)

Road diets

A road diet accommodates all road users by replacing motor vehicle travel lanes with other uses or space for other travel modes. Applying a road diet provides more equitable access to the road for multimodal transportation or streetscaping.

Figure 52. An example of a street with a road diet and a bike lane

The following are key considerations for road diets:

Average annual daily traffic (AADT): AADT is a high-level measure of traffic volumes along a road and may be used to determine the initial feasibility of a road diet. A road with an AADT value lower than 20,000 vehicles per day and consisting of four or more lanes may be further evaluated for implementation of a road diet, as recommended by the Federal Highway Administration.

Peak hour operations: Peak hour operations refer to the highest traffic volumes along a road, typically occurring during the early morning or evening peak periods. The feasibility of a road diet should be assessed based on the impact on peak volumes. Lower peak volumes can typically support the implementation of a road diet, subject to further technical analysis.

Turning volumes and patterns: Movement patterns, property accesses alongside the road, and the spacing between locations of turning movements should be analyzed when considering a road diet. It is necessary to confirm traffic suitability for a road diet by analyzing existing and projected movements for the road segment. Two Way Left Turn (TWLT) lanes provide additional safety along road segments with multiple property accesses by removing left turning vehicles from through traffic lanes, reducing the likelihood of rear-end collisions.

Cycling and pedestrian facilities: Existing cycling facilities, such as bike lanes or sidewalks, can help guide the placement of road diets. Published documentation, such as a Cycling or Trails Master Plan, may identify possible gaps in the active transportation network where road diets could be warranted. A road diet may improve safety outcomes for cyclists and pedestrians by reducing motor vehicle speeds through lane width reductions and by providing additional space for physical separation and buffers between modes.

For further information, please refer to the following resource:

- Road Diet Informational Guide – Safety, Federal Highway Administration

Curbside management

The curbside of a street acts as a transition between the boulevard and road platform of a Complete Street. The curbside portion of the ROW serves a variety of functions such as parking and loading, along with recreational uses such as parklets. This chapter provides further detail regarding the management of such uses.

On-street and accessible parking

Parking is an important design element to consider when developing a street in alignment with Complete Streets principles. 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.

Accessible parking facilities and loading facilities should be provided as per the minimum requirements outlined in the AODA. The AODA requires the City to consult relevant municipal accessibility advisory committees to determine the design, ideal location, and appropriate number of parking spaces to provide. Design specifications have been previously summarized in **Table 8.** Further considerations for on street and accessible parking are summarized in this chapter.

Physical infrastructure

On-street parking should typically be parallel to the curb, as angled parking can:

- Increase potential conflicts;
- Reduce sightlines for exiting drivers; and,
- Takes up a significant amount of the ROW.

In addition, parking should be framed with curb extensions at either end to discourage illegal parking and reduce pedestrian crossing distances.

For accessible parking and loading, hard spaces (such as paved or concrete) should be provided in the adjacent boulevard. Accessible curb ramps should be provided at the front or rear of the space.

Location

On-street parking should be located within dedicated lay-by areas for roads with speed limits below 60 km/h. Accessible parking and loading should be located as close to nearby accessible residential and commercial entrances as possible.

Active transportation facility accommodation

Maintaining proper sightlines is necessary for motor vehicles to accommodate active transportation. The required buffer restrictions help maintain proper sightlines, increase vulnerable user visibility, a refuge for pedestrians exiting vehicles, and protection for cyclists from opening vehicle doors. Lower speeds can also help reduce risk of collisions.

Conflicts may occur for active transportation facilities adjacent to parking and loading spaces. Mitigation strategies include marking pedestrian crossing areas across the facility, providing additional buffer width between the parking lane and cycling facilities, and narrowing cycling facilities in a constrained ROW. Refer to OTM Book 18: Cycling Facilities for more details on designing cycling facilities adjacent to parking lanes.

Key benefits

The key benefits for on-street parking are that it may reduce the need for off-street parking and can also act as a traffic calming tool. Providing accessible parking and loading spaces ensures that the street is built for all ages and abilities.

Other considerations

The use of through lanes for off-peak parking is not recommended. Excessive on-street parking may have adverse impacts due to the perception of “empty lanes”, increasing speeds and reducing overall safety of the corridor.

Loading zones

The following two types of loading zones that should be considered when designing the curb:

1. **Pedestrian loading zones:** Refer to safe spaces on the side of the road that allow passengers to mount and dismount from a vehicle. These pick-up and drop-off areas help accommodate those who choose to take taxi or ridesharing vehicles.
2. **Freight loading zones:** Although typically used in commercial settings, the prevalence of online shopping and deliveries have extended the need for freight loading zones in residential and industrial areas. These loading and curbside delivery zones should typically accommodate single-unit trucks for up to 30 minutes. Freight loading zones should be designed as a shared resource with adjacent private and public uses within a neighborhood.

Pedestrian loading zone

With ridesharing becoming increasingly accessible, the need for loading zones is becoming greater. A lack of dedicated loading zones along a road can lead to taxis or rideshare vehicles double parking, parking in bike lanes, or cruising along streets while looking for a place to load or unload. Not only would this unnecessarily increase vehicle kilometres travelled, but also increases the potential for conflicts with other road users.

This can be avoided through the proactive provision of dedicated loading zones, in accordance with the following considerations:

- Providing a loading zone at the beginning of a block is generally more space efficient than providing them in the middle or end of a block. This is due to vehicles having a longer entry distance entering the loading zone, rather than leaving it; and
- When loading zones are located adjacent to cycling facilities, one possible consideration is to increase the width of the buffer. This provides sufficient space for pedestrians to wait within the buffer or walk along it to reach the nearest crossing. Further details on buffer widths for cycling facilities are provided in **Chapter 2.3**.

Freight loading zone

Due to their size, trucks pose a significant risk to cyclists. The placement and design of freight loading zones along corridors with cycling facilities should minimize conflicts between cyclists and people loading and unloading the vehicles. This can be achieved by various strategies including:

- Designing loading zones with similar features to accessible on-street parking zones, as described earlier in **Chapter 2.5,** or,
- Locating loading zones on intersecting streets.

Parklets

Parklets and pop-up patios have grown more prevalent across Canada to support outdoor dining and commercial activity for locals and businesses. Curbside space may be used to accommodate parklets, thereby activating the streetscape and providing opportunities for temporary installations.

Physical infrastructure

Examples of temporary installations include:

- Public art installations;
- Green space;
- Seating, or dining areas.

Active transportation facility accommodation

Accessibility design considerations for parklets include:

- Ensuring a wide, accessible route connecting the sidewalk to the parklet entry;
- A firm, stable, and slip resistant parklet surface;
- A regularly cleaned sidewalk with minimal slope and cracks;
- An unobstructed and minimally sloped entrance area; and
- Adequate turning and resting space for a wheelchair.

Key benefit

Parklets can be used seasonally and converted to temporary snow storage, which can be of benefit to the City.

Other considerations

Parklets should be installed and maintained in collaboration with community groups to ensure their long-term viability.

Bike parking

To better support cyclists in alignment with Complete Streets principles, the provision of bike parking within the right-of-way should be considered.

Physical infrastructure

Curbside space may be used to support cycling by placing infrastructure including:

- On-street bike racks;
- Bike corrals; or,
- Bike share stations.

Active transportation facility accommodation

To make the most efficient use of curbside space, bike parking should be located along corridors with high volumes of cyclists. Bike parking that is located along main streets can provide access to local amenities and businesses, further incentivizing everyday cycling across the City.

Key benefit

In contrast to vehicle parking, bike parking is a far more efficient use of curbside space. The area of one to two vehicle parking spaces typically accommodates approximately eight to fourteen bike parking spaces.

Other considerations

The space may also be reserved for dock-free bicycles as to provide parking locations that do not obstruct the sidewalk.

Figure 53. An example of bike parking in Greater Sudbury

Driveways and accesses

A road network presents various types of crossings for users of all modes. Crossings should be designed to maximize safety for vulnerable populations and motor vehicles. Further details on intersections and transition design are provided in **Chapter 4.**

The following are preliminary considerations for various types of crossings identified in a road network.

Motivation

Driveways are an essential part of roadways, facilitating the access to and from properties along the side of the road. However, this access produces conflicts on roadways and reduction of safety for vulnerable users. A key impact on pedestrians and cyclists is the excess need for caution when crossing a driveway due to higher vulnerability.

Physical infrastructure

To remain in alignment with Complete Streets philosophies, driveways should be consolidated, minimized, or avoided for mobility-focused streets. Rather, driveways should be provided along side streets wherever possible.

Other considerations

In scenarios where driveways cannot be shifted or removed entirely, the design of the active transportation facilities crossing the driveway should be considered. The curb cut should be minimized as much as possible, and sidewalks or cycle tracks should be continued across the driveway. Continuation of active transportation infrastructure helps reduce the vulnerability of pedestrians and cyclists.

Figure 54. Residential driveways along a side street in Greater Sudbury

2.6 Green infrastructure

Green infrastructure refers to natural elements integrated into the streetscape that provide ecological and hydrological functions. These functions include mitigating urban heat island effect, improving biodiversity, air quality, energy efficiency, and stormwater management. Incorporating green infrastructure can improve the aesthetics of the streetscape, enhance the comfort of pedestrians, cyclists, and transit users, and contribute to the overall health and well-being of residents.

As a city that has received international recognition for achievements in regreening and municipal energy retrofits, Greater Sudbury is well-positioned to integrate green infrastructure into its streets. The City's Official Plan recognizes that urbanization increases impervious surface cover, which hinders the infiltration of stormwater and creates significant erosion, pollution, and flooding problems. The purpose of managing stormwater is to control the quantity and quality of runoff to reduce erosion and flooding and to improve the quality of runoff to streams, rivers, lakes, and groundwater. Integrating low impact development (LID) practices and green infrastructure where the conditions are appropriate into street design can help the City in addressing environmental objectives outlined in key documents such as the City's Official Plan, Biodiversity Action Plan, and Community Energy and Emissions Plan (CEEP).

This chapter outlines the design principles and best practices for implementing successful stormwater management and green infrastructure systems that align with Greater Sudbury's objectives of creating sustainable, functional, and safe streets. By integrating green infrastructure, the City can continue its regreening efforts and ensure that its natural environment remains a defining feature of its image and appeal.

For more details on the City's objectives and policies related to green infrastructure and the natural environment, please refer to:

- Part III of Greater Sudbury's Official Plan: Protecting the Natural Environment
- City of Greater Sudbury's Regreening Program
- Living Landscape: A Biodiversity Action Plan for Greater Sudbury
- Community Energy and Emissions Plan (CEEP)
- Urban Forest Master Plan

- Street Tree Policy for the City of Greater Sudbury

Design principles

Consider low impact stormwater management features

Stormwater runoff can cause erosion, flooding, and degrade water quality. Stormwater management aims to control the harms associated with runoff to protect the built and natural landscapes.

Low impact development features in complete streets are considered where conditions are appropriate to help reduce the burden on stormwater sewer system, and support the City's stormwater management objectives.

Complement active transportation

Encourage walking and cycling in the city by enhancing pedestrian and cyclist comfort level and interest through shading, foliage, flowers, and textures.

Use greenery, trees, and other vegetation to provide shading, cooling, noise reduction, and support placemaking goals. Place vegetation to ensure visibility and appropriate sightlines to ensure safety for all road users.

Further information can be found in the City's Urban Forest Master Plan.

Figure 55. Street trees planted within the right-of-way in Greater Sudbury

Select context appropriate plant species

Selecting context appropriate plant species can greatly enhance the sustainability and ecological value of the landscape. By using plant species that are well-suited to the site's specific conditions, such as climate, soil type, and water availability, the landscape can thrive with less need for maintenance and watering. Additionally, selecting native plant species and maximizing biodiversity can promote habitat creation, protect against invasive species, and improve ecological health.

Consult the City’s Forestry department for support selecting resilient, climate-adaptive plant species that respond well to typical road stressors such as heat, drought, overwatering, salt, and wind. Use local and provincially native plants whenever possible.

Focus on soil quality

Healthy soil supports the growth of roots and provides plants with essential nutrients, water, and oxygen. Additionally, healthy soil helps to retain water, reduce erosion, and sequester carbon. By prioritizing soil quality, we can support long-term environmental and agricultural sustainability.

Ensure soil type and makeup is supportive of plant growth, provide an adequate volume of soil per plant, minimize compaction, and promote a healthy root habitat.

Types of green infrastructure

The key types of green infrastructure to be included within the right-of-way of a Complete Street include street trees and other stormwater management features such as rain gardens.

Street trees

Street trees refer to trees planted with the street right-of-way, providing numerous benefits such as shade, aesthetic enhancement, environmental improvement, and support for a healthier and more vibrant community.

Key benefits

Healthier and more walkable communities: Street trees provide shade, reducing the heat island effect and creating more comfortable walking environments. The presence of street trees encourages people to walk and engage in outdoor activities, promoting a healthier and more active lifestyle.

Environmental benefits: Street trees play a vital role in mitigating the environmental impacts of urbanization. They improve air quality by absorbing pollutants, such as carbon dioxide, and releasing oxygen. Street trees also act as natural filters, capturing dust and particulate matter, thus improving overall air quality. Additionally, they help to reduce stormwater runoff by absorbing rainfall and promoting infiltration into the ground, reducing erosion and flooding risks.

Habitat for urban wildlife: Street trees provide important habitats and food sources for urban wildlife, including birds, insects, and small mammals. They contribute to urban biodiversity and support the ecological balance in cities. By integrating green spaces through street trees, the City can foster a healthier and more sustainable urban ecosystem.

Enhanced aesthetics and sense of place: Street trees enhance the visual appeal of streetscapes, making them more attractive and inviting. The presence of a vibrant tree canopy creates a pleasant pedestrian environment, softening the visual impact of buildings and infrastructure. Street trees also contribute to a sense of place, giving neighborhoods a distinctive character and identity.

Key considerations

"Right tree, right place" selection: The selection of tree species should align with best practices, considering factors such as size, native suitability, and diversity. Species that tolerate road salt, drought conditions, and have appropriate form and structure should be given priority. In cases where space is limited, small trees and shrubs in above-ground planters can be considered as alternatives. Refer to the Street Tree Policy for the City of Greater Sudbury for further details on species selection.

Soil volumes and drainage: Providing adequate soil volumes is crucial for the long-term health and vitality of street trees. Additionally, when hard surfaces surround tree planting areas, strategies such as soil cells, soil corridors, or root bridges should be considered to ensure optimal root system health. Proper drainage systems should also be implemented to minimize the impact on nearby sub-surface utilities.

Coordination with utilities: Early coordination with utility providers is crucial to ensure that the placement of street trees maximizes root space while avoiding interference with subsurface utilities. This coordination helps prevent future conflicts and ensures the long-term health of the trees.

Maintenance plans: Developing maintenance plans in consultation with the City's Tree Warden during the preliminary design phase is essential. These plans should account for potential conflicts between the tree canopy and overhead wires or street lighting. Regular maintenance and pruning should be incorporated to promote healthy growth and prevent any obstructions or safety hazards.

Preserving mature trees: When planning construction activities within or near the boulevard, efforts should be made to retain and incorporate existing mature trees. These trees contribute significantly to the character of the community and provide valuable ecosystem benefits. Their preservation should be prioritized whenever possible.

Stormwater management

Stormwater management involves implementing strategies to effectively control and mitigate the impact of stormwater runoff in urban areas. Low-impact development (LID) features, such as rain gardens, permeable pavement, cisterns, and grassed swales, are innovative techniques used to collect, store, and filter stormwater closer to its source. Integrating LID features along roads and boulevards, can help reduce runoff volume, minimize erosion and flooding, enhance water quality, and improve the overall environmental sustainability of their stormwater systems. Additionally, LID features contribute to the creation of vibrant, walkable communities that prioritize both human well-being and ecological health.

Figure 56. LID features in Greater Sudbury

Key benefits

Stormwater management: LID features, including rain gardens, help reduce the burden on the city's storm sewer system by managing stormwater runoff volume and reducing the risk of erosion and flooding. They also filter sediments and pollutants, improving the quality of water that enters the City’s waterways.

Aesthetics and streetscape enhancement: LID features contribute to the attractiveness of the streetscape, providing green spaces and landscaping. Rain gardens, in particular, can serve as traffic calming devices when designed as curb bump-outs.

Biodiversity and pollinator support: Including a mix of native perennials, grasses, and plants that attract pollinators in LID features enhances the city's biodiversity and promotes a healthier ecosystem.

Key considerations

Design and grading: When conditions for LID are appropriate proper consideration for grading of hard surfaces and the positioning of inlets near LID features should be given during the design process to effectively direct stormwater toward these features.

Plant selection: Rain gardens should be planted with native species that can tolerate wet and dry conditions, as well as winter salt. Choosing appropriate vegetative species is crucial for the success and resilience of LID features.

Maintenance: Developing maintenance plans for LID features, including rain gardens, is essential to ensure that vegetation does not encroach on pedestrian clearways, the spaces remain attractive, and the intended level of stormwater treatment is maintained.

Adaptation to space constraints: In constrained right-of-way areas or when raingarden maintenance is not feasible, alternative LID systems like subsurface infiltration galleries or third pipe systems can be considered in urban settings. In rural contexts, ditches along the roadway edges can also serve stormwater management purposes.

Coordination with the City’s Maintenance Department: Collaboration with maintenance staff is important during the preliminary design phase to ensure that stormwater management features align with best practices, remain visually appealing, and function effectively over time.

2.7 Utilities and municipal services

Utilities and municipal services should be considered in the development of Complete Streets due to their placement within the road ROW. Examples include gas supply, lighting, electricity, storm sewers, telecommunications, and water supply. Effective street design that supports the ROW functions will accommodate the safe installation of utilities and municipal services, maximize the longevity of infrastructure and investments, and mitigate the impacts of harsh climate conditions.

This chapter describes the design principles and considerations for installation of utilities and municipal services on public streets, in alignment with Complete Streets philosophies.

For more details on the City's public utility objectives, systems, programs, and placement, please refer to Section 12 of Greater Sudbury's Official Plan

Design principles

The following four design principles should be considered during new construction or reconstruction of public roads, in the context of utilities and municipal services:

Follow existing processes

Designing, installing, and maintaining utilities and municipal services are complex processes involving different stakeholders ranging from the City to individual utility providers. Following existing processes helps ensure that utility and municipal service designs adhere with:

- The requirements of Greater Sudbury Utilities Incorporated (GSU Inc.), Enbridge Gas, and other utilities. Chapter 5 includes a list of key stakeholders for Complete Streets projects, including utility providers.

Utilities should be included in the design process; and

- The City's engineering standards such as outlined in the City's Engineering Design Manual

Facilitate access to underground utilities

Underground utilities should be easy to access, with sufficient clearance between adjacent utilities to accommodate maintenance or replacement. The ROW should be used efficiently by combining and joining utilities, wherever possible. Facilitating access helps ensure utilities are accessible and efficiently placed, with the following considerations:

- Positioned underneath soft surfaces by avoiding asphalt or concrete to help facilitate easy access;
- The horizontal and vertical clearance between various utilities should be large enough to avoid interfering with adjacent utilities during maintenance or replacement;
- Effective use of space within the ROW can be achieved by combining communication and electrical utilities into a single utility trench; and
- As utilities should be greatly separated from trees, joint use trenches may be incorporated to avoid fanning or spreading of utilities.

Design driven by surface-level uses, not utilities

The design of Complete Streets should prioritize the needs of all road users and surface operations. This helps accommodate the flexibility of underground utilities placement. Underground utilities have more flexibility in terms of their lateral placement, and therefore should be typically coordinated to fit into a given Complete Streets design unless otherwise required by specific constraints.

Visual impacts

Placemaking and the public realm are key elements of Complete Streets. Considering the visual impact of utilities helps minimize negative visual impacts as much as possible for above ground utilities. For example, electrical or communication poles should be designed with consideration of the surrounding streetscape.

The following chapters describe the key considerations for underground and above-ground utilities, in alignment with the four design principles.

Considerations for underground utilities

This chapter provides a summary of the underground utilities and their corresponding considerations. The City's Engineering Design Manual should be used in all cases to guide the underground utility design.

Watermains and water services

Purpose: Supply drinking water to fire hydrants and City residents in residential, commercial, and industrial buildings

Infrastructure considerations:

- Broken watermains can result in loss of water services for nearby buildings and can cause flooding. If not addressed immediately, flooding can cause significant infrastructure damage and increase safety risks.
- To facilitate emergency access to broken watermains, the preferred location for a watermain under the boulevard.

Figure 57. Example of a fire hydrant in Greater Sudbury

Storm sewers

Purpose: Collect precipitation runoff from buildings, roadways, and other hard surfaces through drains and catch basins

Infrastructure considerations:

- Maintenance holes and grates should be positioned outside the wheel path of motor vehicles and bicycles 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.
- Catch basin grates within a cycling facility should be designed with herring bone openings or other similar design with gaps, such as side inlet catch basins, that do not run parallel to the path of travel. These designs will help ensure that cyclists wheels do not get caught in the gaps, increasing safety.

Figure 58. Example of a catch basin in Greater Sudbury

Sanitary sewers

Purpose: Collect and transport wastewater from residential, commercial, and industrial buildings to be treated at wastewater treatment facilities before being discharged into a receiving body of water

Infrastructure considerations: Maintenance holes and grates should be positioned outside the wheel path of motor vehicles and bicycles to avoid degradation of the surrounding pavement.

Figure 59. Sanitary sewer in Greater Sudbury

Electrical and communications

Purpose: Transport electricity and facilitate communication across the City

Infrastructure considerations:

- Installing electrical and communication utilities underground can help mitigate the downsides of overhead wiring. However, this is associated with a significant increase in cost, complexity, 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 City's ROW as much as possible.
- Wherever possible and financially feasible, the City should install underground electrical and communication wiring.

Gas mains

Purpose: Supply natural gas throughout the City as a primary source of fuel and heating for residential and commercial markets

Infrastructure considerations: Within the road ROW, gas mains are generally located beneath the boulevard near the property line. Natural gas is primarily supplied to the City by Sudbury Hydro and Enbridge Gas.

Considerations for above ground utilities

This chapter provides a summary of the overhead utilities and their corresponding considerations. The City's Engineering Design Manual should be used in all cases to guide the overhead utility design.

Overhead electrical and communications

Purpose: Transport electricity and facilitate communication across the City

Infrastructure considerations:

- Overhead electrical and communication utility wires allow for low-cost implementation and easier access for maintenance than underground wires. However, overhead wires are more susceptible to weather conditions including ice, falling tree branches, and heavy winds. They can also negatively impact aesthetics and conflict with street trees.
- The number of utility poles in the public ROW should be reduced to minimize the impacts on utility wires. This can be achieved by coordinating traffic signal, street lighting, and utility pole installation.

Figure 60. Overhead utility wires in Greater Sudbury

Lighting

Purpose: Contributes to enhancing the safety and accessibility of public space for pedestrians, cyclists, and motorists at night throughout the City

Infrastructure considerations: The design should consider the pedestrian experience while balancing the City’s energy and climate goals. Design should be in alignment with the following City polices:

- Light Pollution Policy, and,
- Pedestrian Lighting Standards for Roads Rights-of-Way.

Minimizing blind spots along the ROW and coordination with the location of street trees to minimize street light obstruction are two possible considerations to support pedestrian safety.

Figure 61. Decorative lighting in Greater Sudbury

Chapter 3 Street design

3.1 Complete Streets design considerations

Previous chapters of these guidelines present Complete Streets philosophies and design elements. This chapter builds on this foundation by presenting the Complete Streets designs for each street typology across Greater Sudbury's road network. Complete Street typologies are a classification framework that identify how travel modes and street uses are prioritized within Complete Streets initiatives. The design of each typology reflects the modal priority and placemaking objectives of its adjacent land-use. Furthermore, typologies should:

- Recognize common geometric/operational constraints – with the consideration that every context possible cannot be addressed; and,
- Complement but not contradict the role of functional roadway classifications. This may be achieved by describing what typologies are and their relationship to functional road classifications.

In addition to travel mode and street use priorities, mobility and placemaking functions are considered during the development of each typology. **Table 9** describes the difference between the two functions and their application in Complete Streets.

Table 9. Mobility and placemaking functions in Complete Streets

Application	Mobility	Placemaking
Definition	Through movement – ability to move people along a corridor	Pedestrian realm and urban design elements that encourage interaction with adjacent land-use
Mode considerations	Wider ROW and enhanced separation between modes may be required depending on modal priority	Increased interaction between modes and curbside activity/friction
Land use considerations	Generally, roadways with greater intersection spacing and limited land-use/curbside access (ex. roads in rural areas and thoroughfares connecting to highways)	Highest in commercial and mixed-use areas with street-facing land-uses (ex. main streets and commercial avenues)

Street typologies are split by urban and rural contexts, and reflect the differences in density and land use in terms of road design, multimodal infrastructure, and streetscaping. In addition to reflecting the existing land uses, typologies can also be used to reflect anticipated future developments and accommodate projected changes in land use. **Figure 62** summarizes the nine typologies described in this chapter, which are in alignment with the land contexts outlined in Greater Sudbury's Official Plan. **Chapter 3.2** provides general design guidance for each typology.

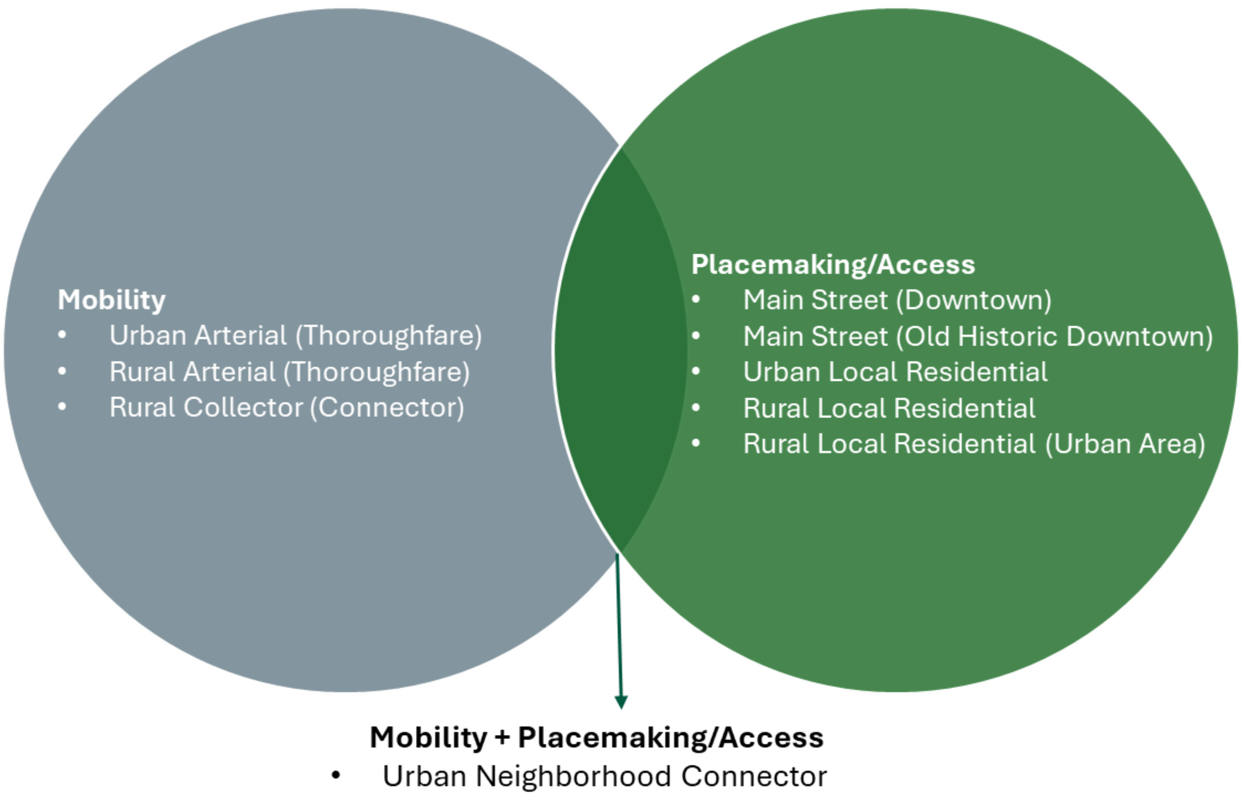


Figure 62. Complete Streets typology overview

3.2 Design guidance by street type

This section explores the design considerations for each of the nine Complete Street typologies, along with sample cross section renderings illustrating the general features as a starting point. The specific streetscaping elements and right-of-way configurations described in this chapter for each typology will be applied differently based on the surrounding context of the road. Further design guidance to support adaptation of cross sections based on contextual factors is provided in **Chapter 5**.

Urban contexts

Key defining features of urban contexts are their higher population density and a wide but concentrated variety of land uses. The typologies presented in the following sections apply to urban contexts and have been designed with the population density and land uses in mind.

Urban areas experience multimodal travel from residents as well as working commuters or tourists from across the city and beyond. The typologies presented reflect this transportation demand with a higher level of multimodal support and separated facilities for streets in mixed-use areas which would experience a higher level of travel and mobility, such as arterials. As urban areas move from a mobility focus to a placemaking focus, there is a reduction in design speed to allow for shared multimodal operations.

From a utilities perspective, all urban typologies typically have a curb and gutter. If a ditch is desired in place of a curb and gutter, a rural typology could be applied in the urban context. This typology scenario is described later in this chapter.

The following typologies are described in this chapter in an urban context:

- Arterial (Thoroughfare);
- Neighborhood Connector;
- Main Street (Downtown);
- Main Street (Old Historic Downtown); and,
- Local Residential.

Arterial (Thoroughfare)

The Arterial (Thoroughfare) typology provides efficient connections between the city and other major centres outside the city and/or separate communities/activity centres within the city. Movement is a primary consideration. Enhanced transit facilities may be provided on these streets.

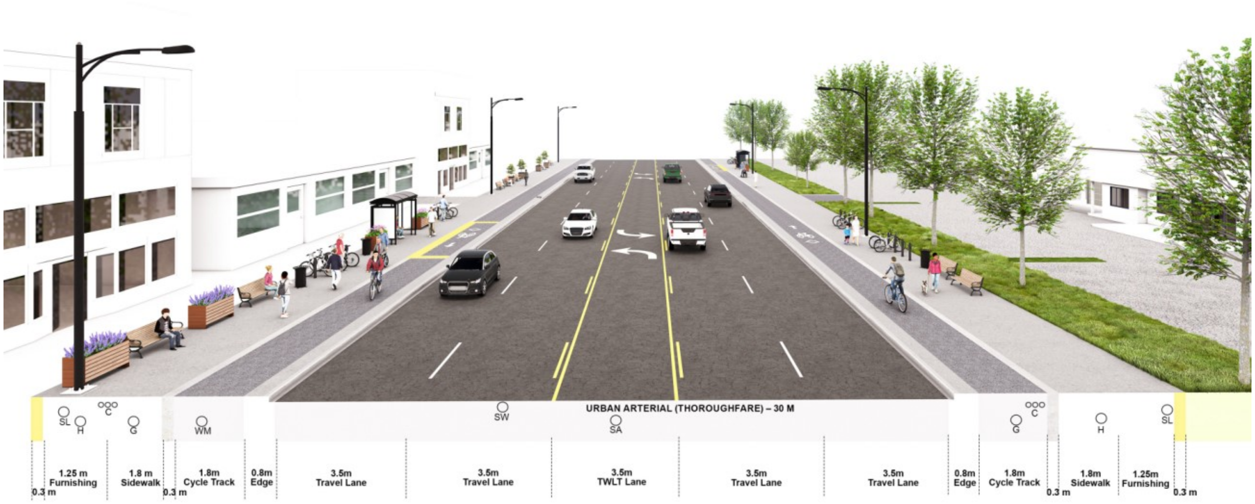


Figure 63: Urban Arterial (Thoroughfare) typology

Defining features

Corresponding functional classification(s):

- Primary Arterial
- Secondary Arterial

Typical ROW range: 30 – 45 metres

Design speed range: 50 – 60 km/h

Mobility vs placemaking: Mobility

Example streets: Lorne Street, Kingsway Boulevard

Complete Streets considerations

Design objectives/goals:

- Accommodate different modes in separated facilities
- Limit access
- Focus on pedestrian realm and transit

Pedestrian realm:

- Separated sidewalks on both sides of the street
- The furnishing zone provides placemaking features such as seating and planters

Cycling facilities:

- Physically separated cycle track with a 0.8 metres buffer from the roadway and 0.3 metres buffer delineating the cycle track and the sidewalk
- Bicycle parking provided in the furnishing zone

Transit facilities:

- Enhanced stop amenities within the furnishing zone
- Integrated bus/bike platforms within the cycle track adjacent to boulevard edge

Travelled way:

- 3.5 metres travel lanes
- 2 lanes in either direction with a TWTL if access is prioritized or a median where access should be limited to improve safety outcomes
- Parking is restricted to facilitate through movement

Utilities and municipal services:

- Bury utilities where financially feasible, use furnishing zone for streetlighting (or overhead utilities if not burying electrical or communication wires)

Neighbourhood Connector

The Neighbourhood Connector typology connects residential neighbourhoods, industrial areas, and commercial retail neighbourhoods to higher order streets. These streets have a multimodal focus and often connect residents to community activity centres. Speed and volumes are limited.

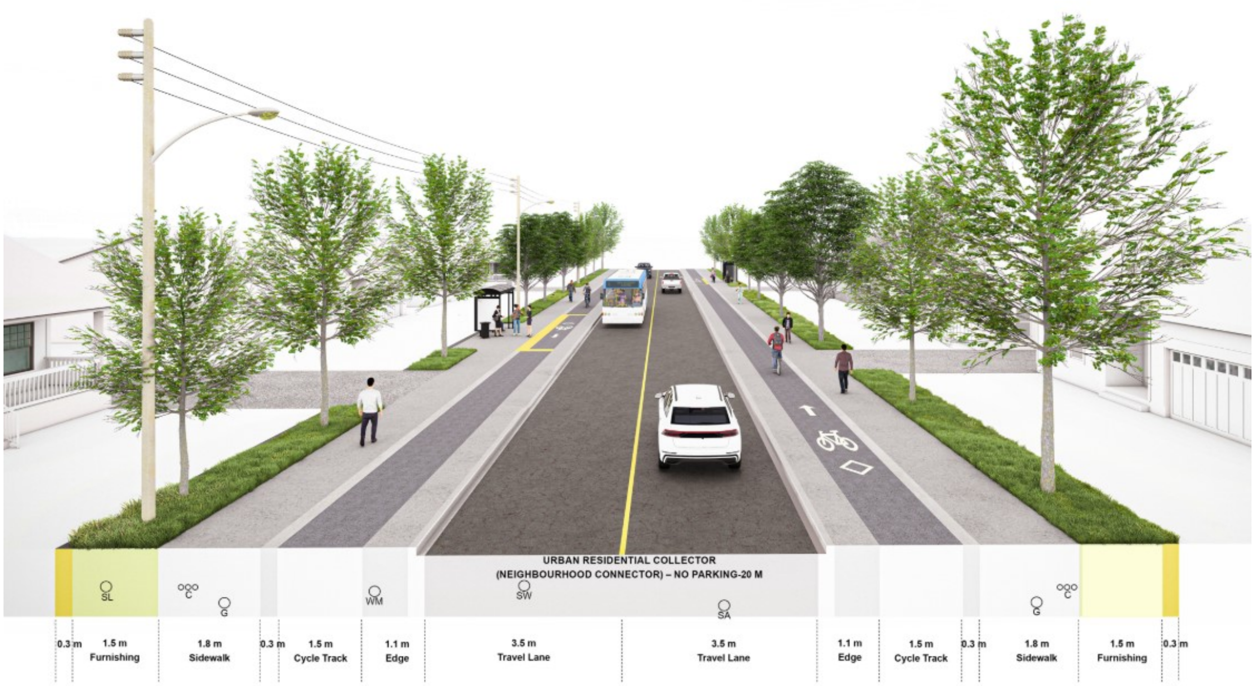


Figure 64. Urban Residential Collector (Neighbourhood Connector) typology

Defining features

Corresponding functional classification(s):

- Tertiary Arterial
- Collector

Typical row range: 20 – 30 metres

Design speed range: 40 – 50 km/h

Mobility vs placemaking: Mobility + Access

Example streets: Auger Avenue, Marcus Drive, Walford Road

Complete Streets considerations

Design objectives/goals:

- Accommodate different modes in separated facilities
- Focus on active transportation and transit

Pedestrian realm: Separated sidewalks on both sides of the road

Cycling facilities: Physically separated cycle track with a 1.1 metres buffer from the roadway and 0.3 metres buffer delineating the cycle track and the sidewalk

Transit facilities:

- Enhanced stop amenities within the furnishing zone
- Integrated bus/bike platforms within the cycle track adjacent to boulevard edge

Travelled way:

- 3.5 metres travel lanes
- Parking provision varies by context

Utilities and municipal services: Bury utilities where financially feasible, use furnishing zone for streetlighting (or overhead utilities if not burying electrical or communication wires)

Main Street (Downtown)

The Main Street (Downtown) typology connects a mixture of residential, commercial, and institutional uses. These streets are multimodal with an emphasis on public realm and streetscaping elements. Main Streets focus on prioritizing pedestrians, and intentional reduction of motor vehicle speeds. They provide amenities such as parking and placemaking features to support pedestrians.

Figure 65: Main Street (Downtown) typology

Defining features

Corresponding functional classification(s): Collector

Typical row range: 20 – 30 metres

Design speed range: 30 – 50 km/h

Mobility vs placemaking: Placemaking

Example streets: Cedar Street, Larch Street

Complete Streets considerations

Design objectives/goals:

- Accommodate different modes in separated facilities
- Focus on placemaking and active transportation
- Limit vehicular access

Pedestrian realm:

- Wide separated sidewalks on both sides of the street
- Placemaking amenities such as planters and seating
- Frequent crossing opportunities

Cycling facilities:

- Parking protected on-street bicycle lanes
- Bicycle parking provided in the furnishing zone

Transit facilities:

- Bus stop pad and signage integrated within the furnishing zone

Travelled way:

- 3.5 metres travel lanes
- 1-way street with single lane
- Parking provision on one or both sides of the street

Utilities and municipal services: Bury utilities where financially feasible, use furnishing zone for streetlighting (or overhead utilities if not burying electrical or communication wires). Further information can be found in the City's Downtown Master Plan

Main Street (Old Historic Downtown)

The Main Street (Old Historic Downtown) typology connects a mixture of residential, commercial and institutional uses located in historic townships, such as Chelmsford, Levack, or Capreol. These streets have a strong sense of place, as they are the Main Streets of towns within the former Regional Municipality of Sudbury. They are multimodal and have a pedestrian priority. These streets emphasize a placemaking function.

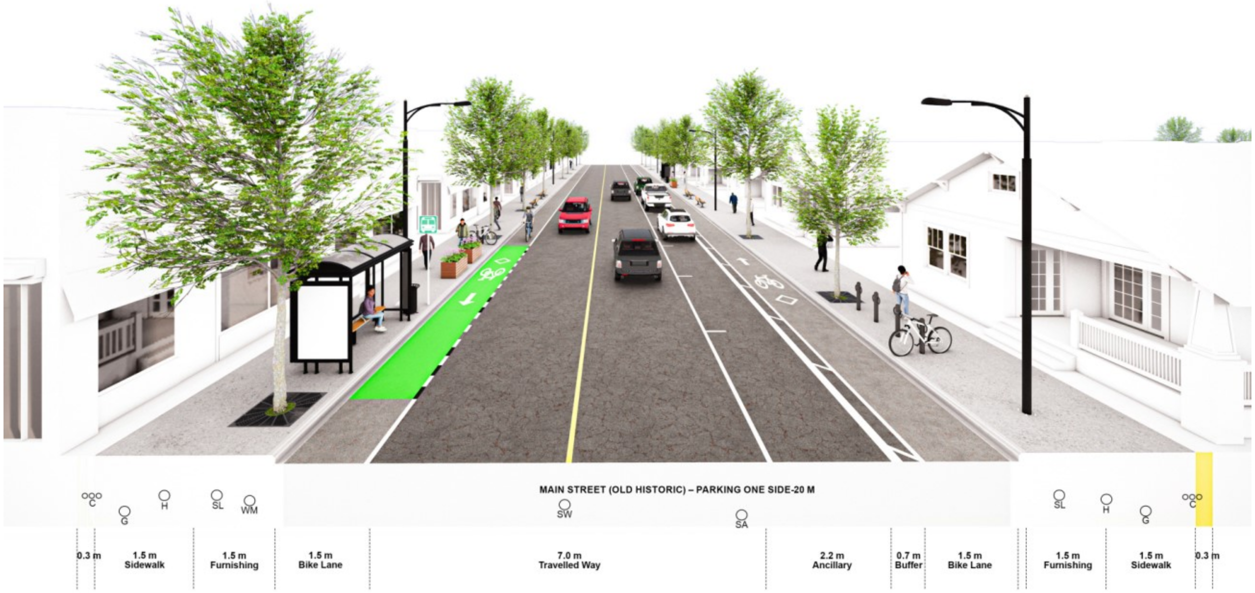


Figure 66. Main Street (Old Historic Downtown) typology

Defining features

Corresponding functional classification(s):

- Secondary Arterial
- Collector

Typical ROW range: 20 – 30 m

Design speed range: 30 – 50 km/h

Mobility vs placemaking: Placemaking

Example streets: Main Street in Chelmsford

Complete Streets considerations

Design objectives/goals:

- Accommodate different modes in separated facilities
- Focus on placemaking and pedestrians
- Limit vehicular access

Pedestrian realm:

- Separated sidewalks on both sides of the street
- Placemaking amenities such as planters
- Frequent crossing opportunities

Cycling facilities: Dedicated bicycle lanes or shared facilities (could include traffic calming for improved safety outcomes)

Transit facilities: Enhanced stop amenities within the furnishing zone

Travelled way:

- 3.5 m travel lanes
- Parking provision on one or both sides of the street

Utilities and municipal services: Bury utilities where financially feasible, use furnishing zone for streetlighting (or overhead utilities if not burying electrical or communication wires)

Local Residential

The local residential street typology are slow residential streets with low volumes that provide a sense of place for residents. These streets act as a place for neighbours to connect.

Figure 67. Urban Local Residential typology

Defining features

Corresponding functional classification(s): Local

Typical ROW range: ~20 metres

Design speed range: 30 – 60 km/h

Mobility vs placemaking: Access

Example streets: Brenda Drive, Struthers Street

Complete Streets considerations

Design objectives/goals:

- Accommodate various modes by supporting slow traffic
- Accommodate frequent accesses
- Focus on placemaking and pedestrians

Pedestrian realm: Separated sidewalks on one side of the street

Cycling facilities: Mixed traffic operation (could include traffic calming for improved safety outcomes)

Transit facilities: Generally limited transit

Travelled way:

- 7.5 metres road platform (including parking)
- Parking provision on one or both sides of the street

Utilities and municipal service: Bury utilities where financially feasible, use furnishing zone for streetlighting (or overhead utilities if not burying electrical or communication wires)

Rural contexts

Key defining features of rural contexts are their lower population density and dispersed land uses. The typologies presented in this chapter apply to rural contexts and have been designed to accommodate the lower population density and land uses in mind.

Rural areas experience multimodal travel from residents and long-distance commuters, as well as goods movement across the city and beyond. The typologies presented reflect this transportation demand with moderate multimodal support to accommodate long-distance mobility. As rural areas move from arterial to local roads, placemaking is introduced as an additional focus.

From a utilities perspective, all rural typologies have a ditch. As described earlier in this chapter, the “Rural Local Residential (Urban Area)” typology presents a unique design for streets that fall within urban contexts but make use of a ditch instead of a curb and gutter.

The following typologies are described in this chapter in a rural context:

- Arterial (Thoroughfare);
- Collector (Connector);
- Local Residential; and,
- Rural Local Residential (Urban Area).

Arterial (Thoroughfare)

The Arterial (Thoroughfare) typology are streets that connect the City with other major centres outside the City and connect rural communities within the City. Facilitates long distance person or goods movement travel with a mobility priority.

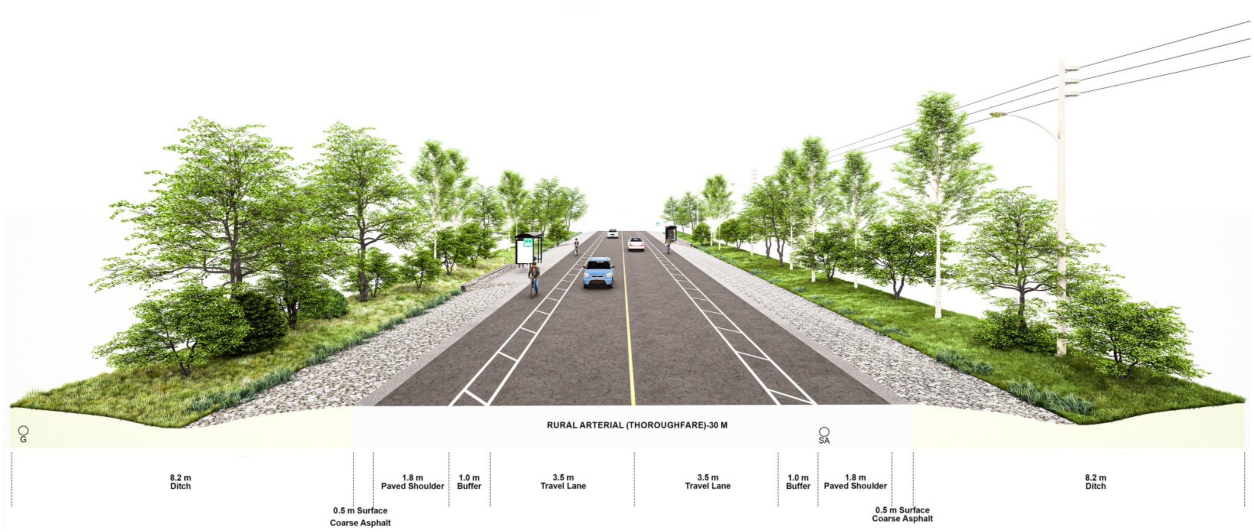


Figure 68. Rural Arterial (Thoroughfare) typology

Defining features

Corresponding functional classification(s):

- Primary Arterial
- Secondary Arterial

Typical ROW range: 30 – 45 metres

Design speed range: 50 – 60 km/h

Mobility vs placemaking: Mobility

Example streets: Capreol Road (MR 84), Municipal Road 35

Complete Streets considerations

Design objectives/goals:

- Accommodate various modes, focusing on people and goods movement
- Support active transportation and transit where volumes and demand are high
- Focus on mobility and accommodating higher speeds

Pedestrian realm:

- Buffered Paved Shoulder
- (Optional) Multi-use path behind ditch outside the clear zone

Cycling facilities:

- Buffered Paved Shoulders
- (Optional) Multi-use path behind ditch outside the clear zone can be considered where cyclist volumes are expected to be high, such as connections between trail systems or tourist destinations

Transit facilities: Generally limited transit, shelters are provided by road edge where necessary

Travelled way:

- 3.5 metres travel lanes
- Parking restricted

Utilities and municipal services:

- Stormwater management through ditches at road edge
- Overhead utilities behind ditch

Collector (Connector)

The Collector (Connector) typology connect residential neighbourhoods with major activity centres in rural areas. The distance between neighbourhoods and activity centres may be longer than in urban areas.

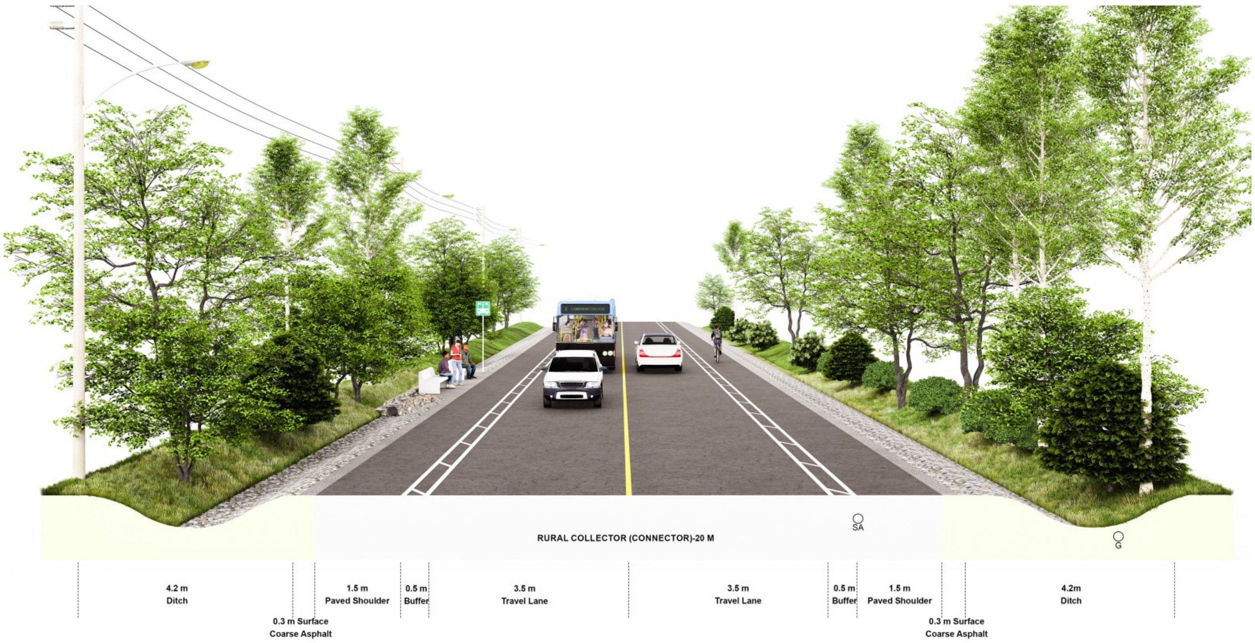


Figure 69. Rural Collector (Connector) typology

Defining features

Corresponding functional classification(s):

- Tertiary Arterial
- Collector

Typical ROW Range: 20 – 30 metres

Design Speed Range: 50 – 60 km/h

Mobility vs Placemaking: Mobility

Example Streets: Valleyview Road

Complete Streets considerations

Design objectives/goals:

- Accommodate various modes, focusing on people and goods movement
- Support active transportation
- Focus on mobility

Pedestrian realm: Buffered paved shoulders

Cycling facilities: Buffered paved shoulders

Transit facilities: Generally limited transit, shelters are provided by road edge where necessary

Travelled way:

- 3.5 metres travel lanes
- Parking on one or both sides

Utilities and municipal services

- Stormwater management through ditches at road edge
- Overhead utilities behind ditch

Local Residential

The Local Residential typology are low volume residential streets that provide access to residential and commercial properties in rural areas.

Figure 70. Rural Local Residential typology

Defining features

Corresponding functional classification(s): Local

Typical ROW range: ~20 metres

Design speed range: 30 – 50 km/h

Mobility vs placemaking: Access

Example streets: Gravel Drive (Val Therese), Bonin Street (Chelmsford)

Complete Streets considerations

Design objectives/goals:

- Accommodate slow moving traffic and active transportation
- Accommodate increased access

Pedestrian realm: No dedicated facilities

Cycling facilities: Mixed Traffic Operation (consider traffic calming)

Transit facilities: Generally limited transit

Travelled way:

- 6 metres pavement width (7 metres platform includes soft shoulder)
- 1 lane in either direction
- Parking allowed on one or both sides

Utilities and municipal services

- Stormwater management through ditches at road edge
- Overhead utilities behind ditch

Rural Local Residential (Urban Area)

The Rural Local Residential (Urban Area) typology connect residential neighbourhoods to higher order streets. These streets have a multimodal focus and often connect residents to community activity centres. Speed and volumes are limited.

Figure 71. Rural Local Residential (Urban Area) typology

Defining features

Corresponding functional classification(s): Local

Typical ROW range: ~20 metres

Design Speed range: 30 – 50 km/h

Mobility vs placemaking: Access

Example streets: Percy Avenue (Val Caron)

Complete Streets considerations

Design objectives/goals:

- Accommodate slow moving traffic and active transportation
- Accommodate increased access

Pedestrian realm: Sidewalk on one side behind ditch

Cycling facilities: Mixed Traffic Operation (consider traffic calming)

Transit facilities: No transit

Travelled way:

- 6 metres pavement width (8 metres platform includes soft shoulder)
- Parking allowed on one or both sides

Utilities and municipal services:

- Stormwater management through ditches at road edge
- Overhead utilities behind ditch

Chapter 4 Intersection and transition design

This chapter outlines the Complete Streets principles for intersection design, recognizing that land use context and intersection road typologies will impact how intersections should be designed to promote predictable and safe movements. This chapter includes six sample intersection designs to illustrate how these principles can be applied to common intersection types, with a focus on local context and design flexibility. It is important to note that these designs do not cover every scenario or serve as definitive designs, and designers should apply the principles based on the specific local context.

Further guidance can be found in:

- Global Alliance on Accessible Technologies and Environments' (GAATES) Integrated Accessibility Standards for Exterior Paths of Travel (2005)
- Ontario Traffic Manual (OTM) Book 12: Traffic Signals (2012);
- OTM Book 15: Pedestrian Crossing Treatments (2016);
- TAC Geometric Design Guide for Canadian Roads (2017);
- National Association of City Transportation Officials' (NACTO) Don't Give Up at the Intersection (2019);
- OTM Book 18: Cycling Facilities (2021);
- OTC Protected Intersection Guide (2023); and,
- Accessibility for Ontarians with Disabilities Act (AODA) Regulation 191/11 (2024).

4.1 Intersection design principles

Table 10 outlines Complete Streets intersection design principles which act as a guide for both geometric and operational design considerations. Application of these principles leads to the creation of intersections that work for all types of road users. It is important to note that the intersection's road typology and land use context will have an impact on how the intersection should be designed.

Table 10. Complete Streets Intersection Design Principles

Design principle	Motivation	Desired result
Safety first	Intersections have a higher potential for conflicts between road users than at mid-block locations. Vulnerable road user safety should be prioritized for all intersections to reduce the likelihood of injury in the event of a collision.	Design should encourage predictable movements, interactions between conflicting movements should occur at slow speeds, and good visibility and short crossing distances should be provided.
Ensure accessibility	Intersections should be accessible for people of all ages and abilities to ensure that they can safely and comfortably navigate the intersection.	Curb cuts, tactile walking surface indicators (TWSI), audible signals, and other accessibility features should be included in the design to meet AODA standards.
Minimize delay	Long cycle lengths that delay pedestrians or cyclists may 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 since long travel times can be a deterrent to transit ridership.	Traffic signal operations should be designed to minimize delay for all road users. By optimizing signal timing, prioritizing efficient movement of all modes, and incorporating pedestrian-friendly features, intersections can be designed to reduce wait times and improve travel experiences, while also enhancing safety and accessibility.

4.2 Intersection design elements

Recommended intersection design elements for the City can be classified into four categories: Geometric, Accessibility, Traffic Calming, and Traffic Controls. These categories can be broken down as follows:

- **Geometric features** help enhance safety at intersections for all modes. Examples include corner radii (curb extensions), smart channels, truck aprons, raised medians/refuges, and protected intersections
- **Accessibility features** support pedestrians with accessibility needs. Examples include Tactile Walking Surface Indicators (TWSI) and Accessible Pedestrian Signals (APS).
- **Traffic calming** helps reduce speeds at the intersection to support vulnerable users. Examples include traffic diverters, planter boxes, and pavement treatments; and,
- **Traffic controls** help provide priority to alternate modes such as transit, pedestrians, and cyclists. Examples include Transit Signal Priority (TSP), Leading Pedestrian Intervals (LPI), and Leading Bicycle Intervals (LBI).

The following chapters further describe various elements within each category.

Geometric feature: corner radii (curb extensions)

Corner radii play a crucial role in determining the speed of turning vehicles through an intersection and impact pedestrian crossing distances. Larger corner radii encourage high-speed turns and result in longer pedestrian crossing distances, which can increase the risk of conflicts with motor vehicles. On the other hand, smaller corner radii promote lower vehicle turning speeds and can help reduce the likelihood and severity of collisions with vulnerable road users at intersections. **Figure 72** shows the relationship between corner radii, crossing distance, and pedestrian path.

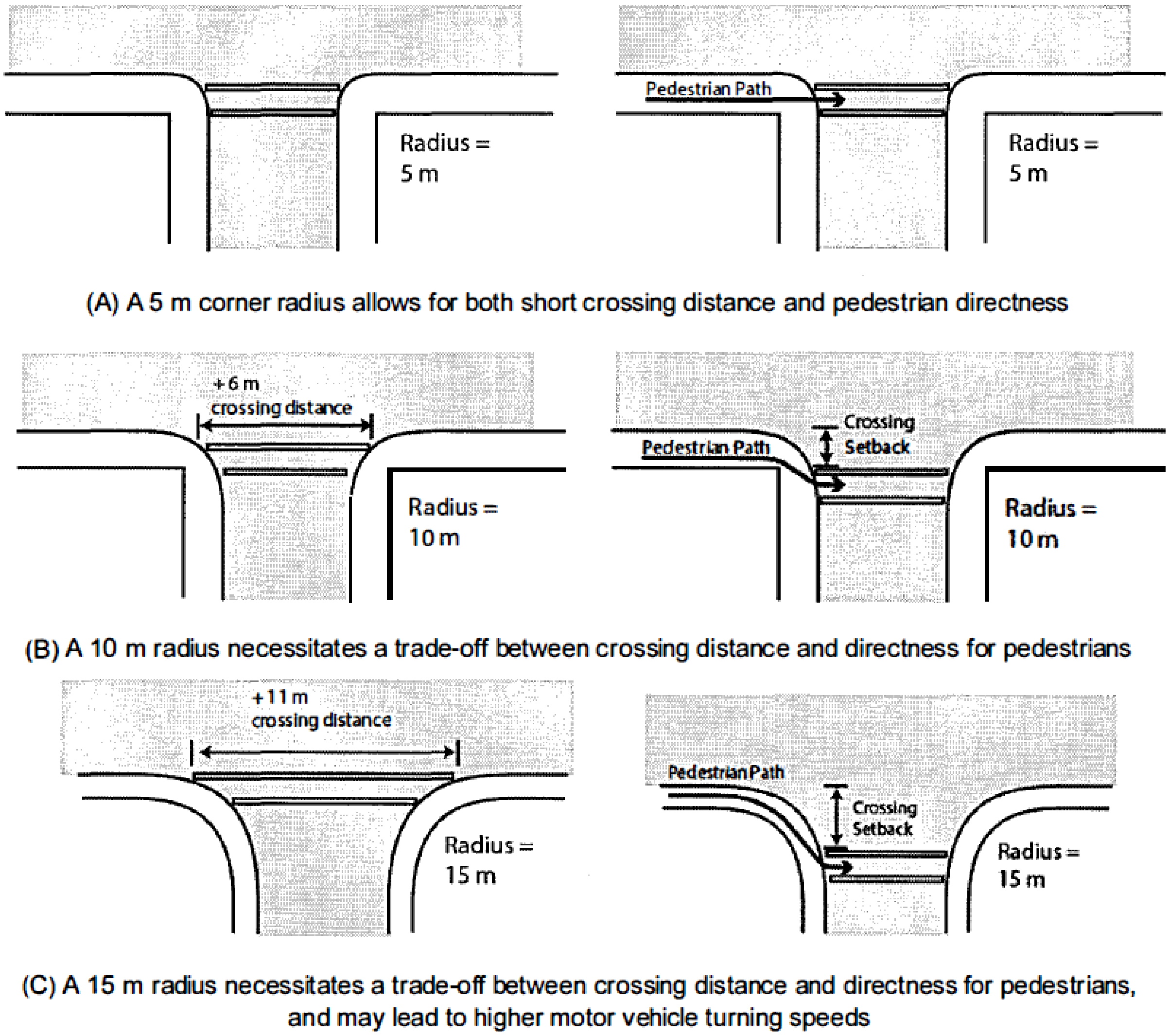


Figure 72. Relationship between corner radii, crossing distance, and pedestrian path.

Source: TAC Geometric Design Guide for Canadian Roads

Designing corner radii is dependent on both the design and control vehicles **(Chapter 2.5).** The design vehicle refers to the largest typical vehicle that frequently turns right at the intersection. Intersections should be designed to allow the design vehicle to negotiate the intersection with ease, typically starting from the curb lane and remaining to the right side of the centerline (or the right half of the roadway, where there is no marked centerline) on the receiving roadway.

The control vehicle, which is the largest vehicle that infrequently turns right at the intersection, must also be physically accommodated. However, it may be required to take a wider turning path using adjacent lanes on the approach and receiving streets.

Designing effective turning radii is critical for selecting appropriate corner radii **(Figure 73).** Effective turning radii are determined based on the typical travel path used by motor vehicles navigating around a corner, and it considers factors like on-street parking, bicycle lanes, and multiple receiving lanes. Designing for vehicles with the effective turn radius may allow the use of a substantially smaller physical corner radius, which can help reduce pedestrian crossing distances. In older areas of development with small corner radii, existing radii should generally be maintained, even if they do not accommodate the design or control vehicles, unless there is a history of operational concerns.

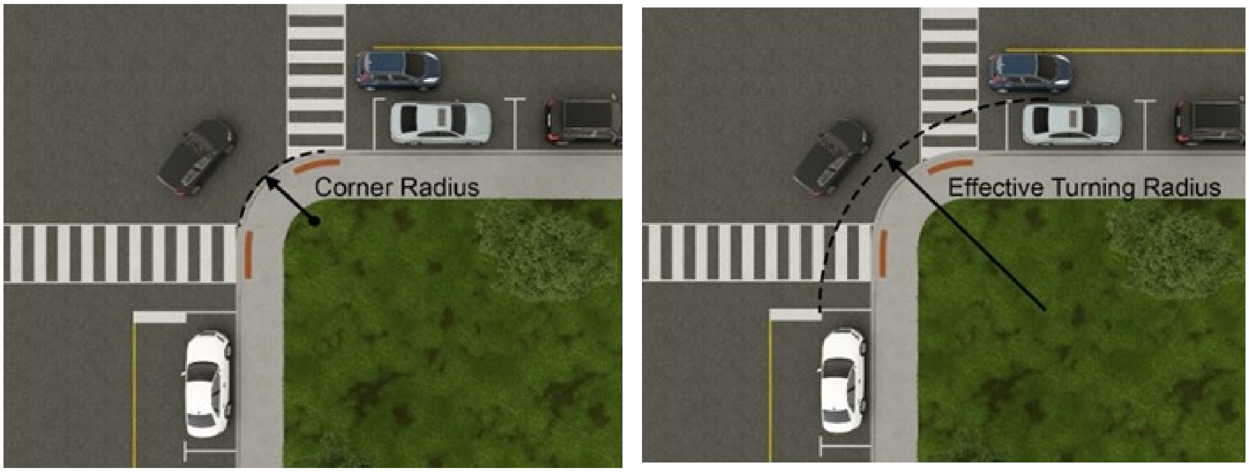


Figure 73. Corner Radii and Effective Turn Radii

Source: TAC Geometric Design Guide for Canadian Roads

It is essential to monitor redesigned intersections over time to determine how the new corner radii affect driver speeds, turning paths, and overall behavior. Practitioners should expect a transition period for motorists to adjust their behavior 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 for a period of several months to assess the impact of the new corner radii on driver speeds, turning paths, and overall behavior.

Geometric feature: smart channels

On streets where speed and mobility are prioritized, right-turn lanes are commonly used to separate turning vehicles from faster-moving through traffic, and to facilitate efficient traffic flow. However, while they can improve safety and efficiency for vehicles, they can also create challenges for pedestrians and cyclists by increasing the distance they must cross and creating conflict areas with through cycling traffic.

Where dedicated right turn lanes are warranted, a simple or compound radius right-turn lane is preferred over a right turn channel to create a safer and more efficient turning experience. In cases where this is not possible, smart channels may be applied to increase the street entry angle and decrease turning speeds, creating a more consistent yield condition for drivers as shown in **Figure 74.** Additional guidance for right-turn lane design can be found in Sections 9.14.3 and 9.14.4 of the TAC Geometric Design Guidelines for Canadian Roads.

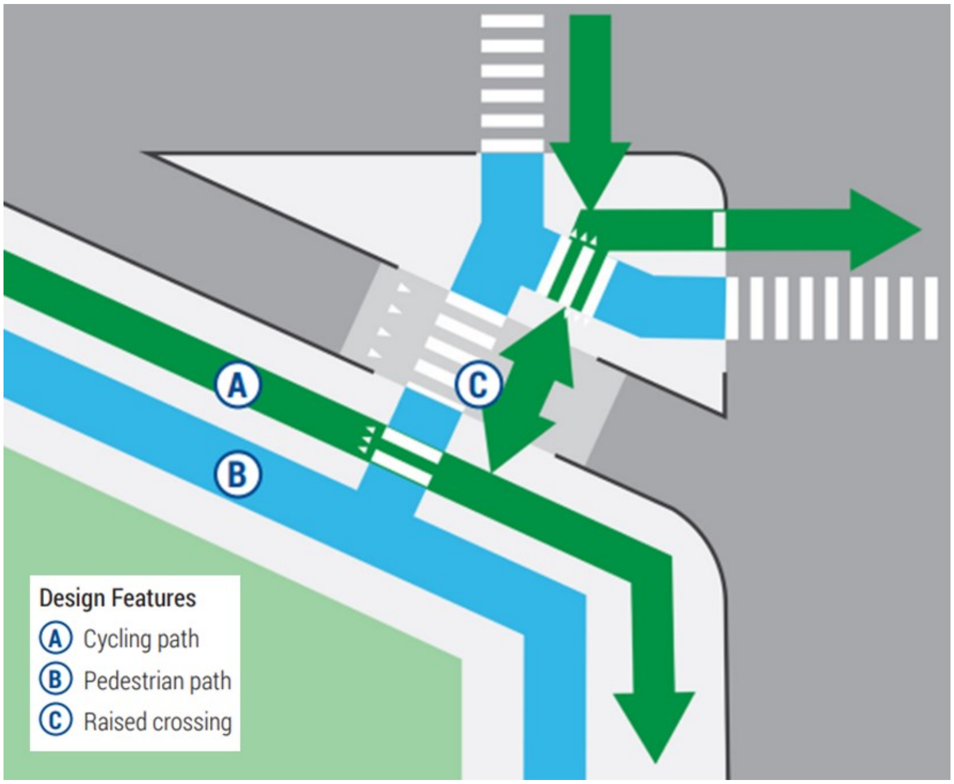


Figure 74. Smart channel protected corner

Source: Protected Intersection Design Guide, City of Ottawa

Geometric feature: truck aprons

Large vehicles require additional space to turn at the intersection safely and comfortably. A truck apron provides additional, mountable space that serves as a greater degree of separation from the curb. As shown in **Figure 75**, truck aprons can help support separation from vulnerable road users such as cyclists and pedestrians.

Left-turn traffic calming devices can also be considered at large signalized intersections to reduce the speed of left turns. The traffic calming device is mountable to support large vehicle turning requirements but helps to enforce a perpendicular approach for passenger vehicles to crosswalks to improve the visibility of people walking or cycling. **Figure 76** shows the modification to turning movements with the traffic calming measure.

Incorporating a truck apron at intersections along goods movement or waste management corridors can help accommodate trucks while reducing the corner radius for other vehicles on the road. A truck apron also serves as a speed reduction device, particularly for smaller vehicles. Further guidance can be found in NACTO's Don't Give Up at the Intersection document.

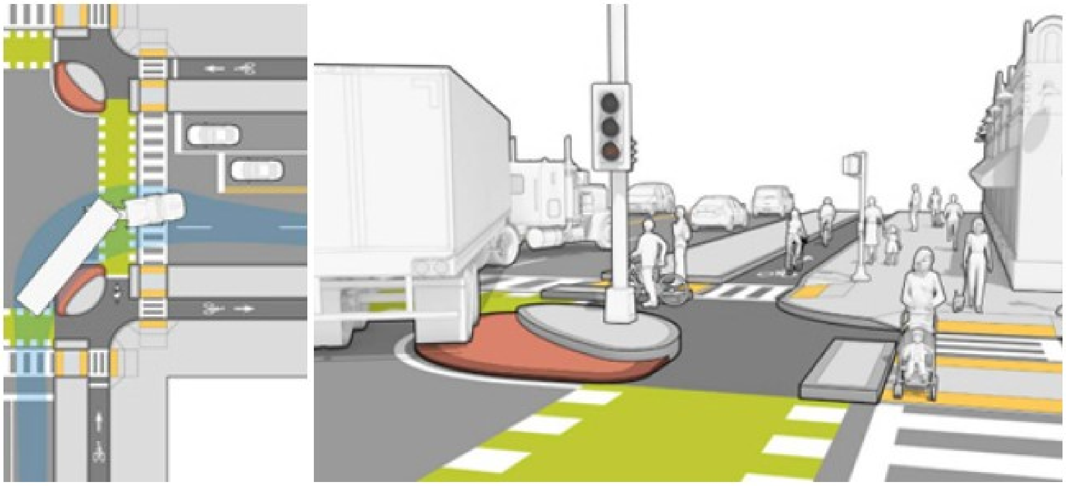


Figure 75. (Left) An overhead view of a mountable truck apron (Right) An on-street view of a truck using the mountable truck apron

Source: MassDOT Separated Bike Lane Planning & Design Guide

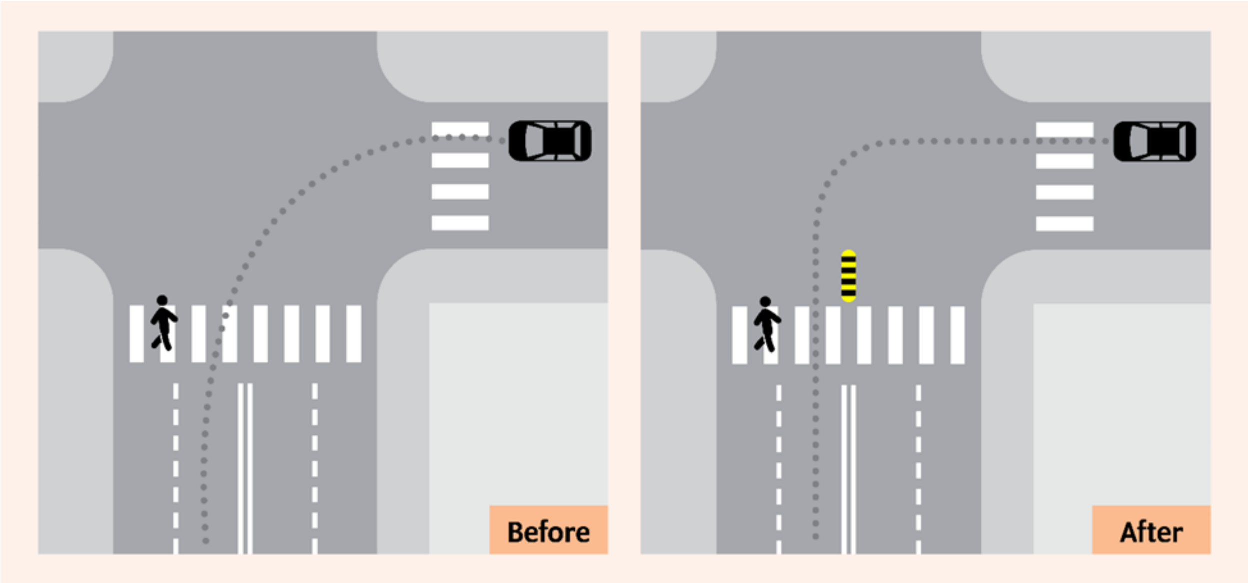


Figure 76. Left-turn traffic calming

Source: City of Toronto

Geometric feature: raised medians/refuges

Raised medians separate traffic flow and barricade opposing movements from potential conflicts. In urban settings, raised medians may have curb and gutter to improve stormwater drainage. In Complete Streets, raised medians are often added to prevent head-on collisions, and to provide refuge for pedestrians. By providing a space for pedestrians, pedestrians with mobility needs are accommodated by extending the walk time over two signal phases instead of one. This in return can improve traffic flow by providing adequate green time for specific traffic movement. Raised medians can also be used as an access management technique by limiting the number of locations where left turns can be made.

Raised medians also provide an excellent opportunity for additional streetlighting, vegetation, and banners to improve the corridor aesthetics. For instance, historical streets can have decorations along the raised median for aesthetic purposes. An example of a raised median is shown in **Figure 77**.

Figure 77. Raised median in Greater Sudbury

Geometric feature: protected intersections

Protected intersections help support vulnerable road users, such as cyclists and pedestrians, cross in a safe manner. A protected intersection supports increased pedestrian and cyclist visibility, promotes vehicle yielding, and provides shorter crossings. Further information can be found in the Ontario Traffic Council (OTC) Protected Intersection Guide.

Protected intersections have the following provisions for pedestrians, cyclists, and motorists (**Figure 78**).

Pedestrians

Pedestrian islands help reduce the crossing distance while enhancing the visibility for turning vehicles. Islands can also help increase the volume capacity of the intersection by accommodating large volumes of pedestrians. To support accessibility requirements, islands should be a minimum of 2.1 metres, with a preferred width of 2.7 metres. Lastly, accessibility features can be incorporated on pedestrian islands to improve the accessibility of the intersection for those using personal mobility devices. **Crossing markings** for pedestrians provide increased visibility.

Cyclists

Bikeway setbacks (crossride setbacks) provide larger separation between cyclists and vehicles, allowing for increased visibility. Increased visibility provides cyclists adequate time to make crossing decisions in the presence of turning vehicles. **Crossing markings** for cyclists provide a degree of separation from crossing pedestrians while serving as directional guidance. **Bike yield lines** to avoid collisions with pedestrians and signal the upcoming crossing may also be implemented, where appropriate.

Motorists

Corner islands provide motorists with adequate separation from cyclists and pedestrians while waiting to turn. Islands may be mountable if large turning vehicles are expected. Corner islands further provide the opportunity for cyclists to queue in preparation to cross, reducing the crossing distance.

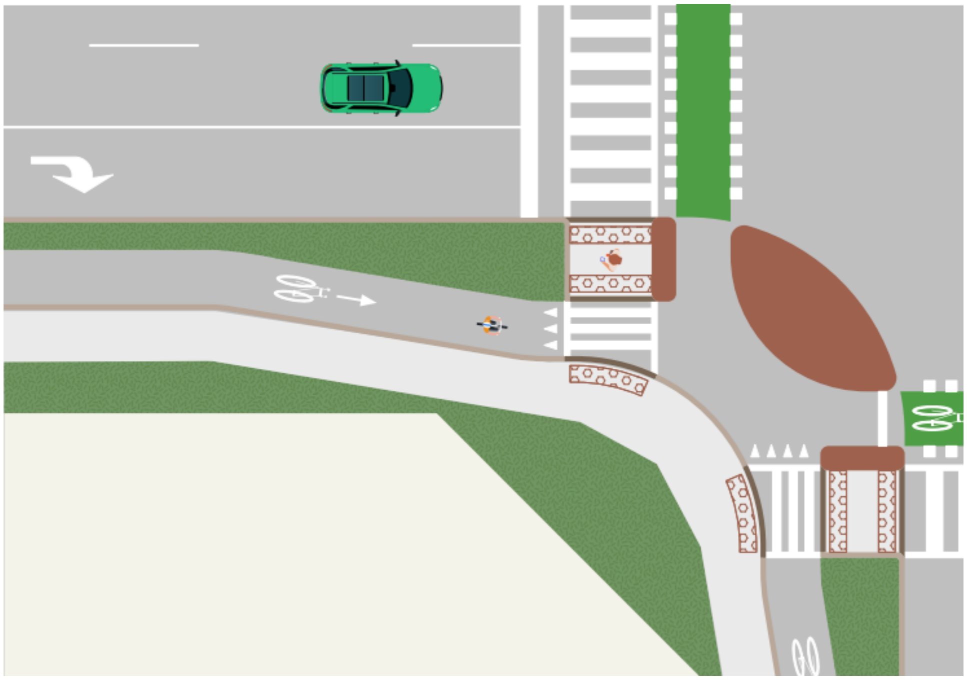


Figure 78. Design features for a protected intersection.

Source: OTC Protected Intersection Guide

Accessibility feature: Tactile Walking Surface Indicators (TWSI)

Tactile Walking Surface Indicators (TWSIs) are a high colour contrast textured surface treatment used for wayfinding or to identify hazards. They are designed to be detectable by those travelling by foot or using a cane. TWSIs can be used to direct and alert pedestrians with vision loss or other disabilities. **Figure 79** shows an example of a TWSI in Greater Sudbury.

Tactile Direction Indicators (TDIs) are used for guiding vulnerable road users towards transit stops, crosswalks, and other locations within open areas. TDIs indicate direction of travel through parallel elongated bars and crossings through perpendicular raised bars to indicate crosswalks.

Tactile Attention Indicators (TAIs) are used for identifying potential hazards and upcoming decisions to be made by the pedestrian. Through truncated domes, TAIs alert pedestrians to street crossings, conflicts with other modes (i.e. vehicles), or changes in elevation.

In Greater Sudbury, TWSIs are typically TAIs with truncated domes. They are installed on the edge of transit platforms as well as along slopes of pedestrian curb ramps/cuts, with a setback between 150-200 mm from the curb edge. Examples of conditions under which TWSIs would be installed include signalized intersections, commercial driveways, and unsignalized intersections with minor roads.

Figure 79. Example of a TWSI in Greater Sudbury

Accessibility feature: Accessible Pedestrian Signals (APS)

Accessible Pedestrian Signals (APS) support pedestrians with limited or no vison to identify when to safely cross the street based on auditory and tactile indicators (**Figure 80**). APS is activated through a pushbutton which indicates direction of crossing. Possible indicators include speech messages or a series of repeating sounds that differ based on direction of crossing.

To maintain accessibility and meet AODA requirements, the APS should be placed up to 1.5 metres away from the crosswalk with one button per pole.

Figure 80. Accessible Pedestrian Signal at an intersection

Traffic Controls

Traffic controls include both unsignalized and signalized design treatments. Signalized intersections provide an opportunity to enhance multimodal crossing. Priority can be given to alternate modes through traffic signal modifications. Leading Pedestrian Intervals (LPI) and Leading Bicycle Intervals (LBI) provide additional time and increasing safety for crossing pedestrians and cyclists. Transit service can be enhanced by using Transit Signal Priority (TSP), which helps reduce transit delays at the intersection.

Further information regarding traffic controls can be found in OTM Book 12 and the OTC Bicycle Traffic Signals Guide.

LPI: LPI can be considered for intersections with longer crossing distances or high volumes of conflicting turning movements, where pedestrians would benefit from additional crossing time. LPI can also be considered for intersections with high pedestrian volumes. The pedestrian crossing indication is provided 4 to 6 seconds in advance of green indications for motorists, helping pedestrians cover a larger distance before vehicles start crossing or turning. LPI implementation locations should be assessed in alignment with the City's Leading Pedestrian Interval Policy.

LBI: Similar to LPI, LBI can be considered for intersections where there are high volumes of conflicting turning movements. They can also be considered for intersections with dedicated cycling infrastructure, such as cycle tracks or bike lanes. The cyclist crossing indication is provided in advance of green indications for motorists, allowing cyclists to enter the intersection and conflicting areas, increasing visibility and helping cover distance.

TSP: TSP helps prioritize transit vehicle movement over all other movements at the beginning of a signal phases. If TSP is used for protected transit movements, the transit vehicle will move first while all other modes, including pedestrians, remain stopped. If the transit movement is not protected, non-conflicting movements may also be allowed alongside TSP. TSP can be considered along existing and future corridors with frequent transit service, particularly where transit vehicles experience high amounts of delay or there are a high number of turning movements.

Typical intersection design treatments

This chapter outlines six sample designs that correspond with the following six common intersections across the City. The traffic control presented in these designs is for example purposes only, and future projects are subject to the City’s all-way stop and traffic control warrant processes.

- **Urban Dedicated Intersection:** Neighborhood Connector intersecting with Downtown Main Street
- **Low Speed Intersection:** Two Local Residentials intersecting with each other
- **Large Urban Protected Intersection:** Two Urban Arterials intersecting with each other
- **2-Way Stop Controlled Intersection:** Rural Connector intersecting with Rural Arterial
- **Rural Roundabout:** Two Rural Arterials intersecting with each other
- **Stop Controlled T-Intersection:** Historic Main Street intersecting with Neighborhood Connector

Urban Dedicated intersection

This intersection between a Neighbourhood Connector and Downtown Main Street demonstrates an intersection that serves the purpose of connecting travelers to and from the Downtown. The design vehicle is MSU and the control vehicle is WB-19. The intersection is signalized and conflicting uses may be separated physically through protected signal phasing.

Figure 81. Urban Dedicated Intersection

Key features for this intersection include:

- The intersection shows two different types of bike facilities meeting including a parking protected on-street bike lane and a cycle track. A bike box supports cyclists turning left from Downtown Main Street to the Neighborhood Connector.
- The curb radius reduces the crossing distance for pedestrians and forces turning vehicles to slow down. The setback furnishing zone also allows for a large day light triangle to improve the visibility of cyclists and pedestrians that may be crossing the road.
- Pavement markings shown within the corner radii act as a truck apron for larger vehicles. This area can either include pavement markings or mountable curbs suitable for larger vehicles. Physical barriers (such as planters) or curb extensions can be considered where no large turning vehicles are anticipated.

Low Speed intersection

The Low-Speed intersection features the intersection of two urban local residential roads that is stop controlled in both directions. Pedestrians are prioritized at this intersection through features that slow cars down, reduce pedestrian crossing distances and enhance pedestrian visibility at crossings. The design vehicle is a passenger car, and the control vehicle is a garbage truck. Control vehicles are expected to oversteer and negotiate with passenger vehicles to maneuver in the intersection.

Figure 82. Low-Speed Intersection

Key features for this intersection include:

- Curb extensions or curb bulb outs are the predominant feature at this intersection. The curb extension narrows the roadway to reduce the overall crossing distance for pedestrians and provides a generous waiting area to maximize visibility of pedestrians. Curb extensions have a tight curb radius to encourage turning vehicles to slow down.
- Optional traffic calming measures may be considered with this intersection including raised intersections to support speed reduction and improve the pedestrian crossing environment.

Large Urban Protected intersection

Urban Arterial intersections are large due to the right-of-way and turning movements required to support high traffic volumes. A protected intersection that includes protected signal phasing such as protected left-turn phases and separation of users, greatly enhances the safety of pedestrians and cyclists. The goal of this design is to minimize conflicts between turning vehicles and vulnerable road users.

Figure 83. Large protected urban intersection

Key features for this intersection include:

- The corridor widens at the intersection to provide dedicated left-turn and right-turn lanes for vehicles. This increases the capacity of the intersection and allows for protected left-turn lanes. Where space is not available, the City may consider land acquisition or simplifying traffic operations to remove dedicated left or right turn lanes.
- The crossride setback from the motor vehicle lane to the bicycle crossride enables better sightlines and more time for drivers to stop for pedestrians and people on bicycles.
- A forward stop bar places people on bicycles who are waiting further ahead than motor vehicles. This improves their visibility and reduces the potential for conflicts.

- The corner safety island separates and protects the bicycle and pedestrian space and enforces the appropriate curb radii to support right-turning vehicles.
- Truck aprons are provided on all corners to support larger vehicles.

Two-Way Stop Controlled intersection

The Two-Way Stop-Controlled intersection is a simple rural intersection design example that applies to lower volume roads. This intersection features a Rural Arterial and a Rural Connector with stop control on the Rural Connector.

Figure 84. Two-Way Stop Controlled Intersection

Key features for this intersection include:

- Stop-bars are located further back from the intersection to prevent large turning vehicles from encroach on oncoming traffic.
- Paved shoulder pavement markings are extended into the intersection to enforce an appropriate turning radius.
- The paved shoulder buffer extends to the turning radius to continue separation for cyclists using the shoulder.

Rural Roundabout

The Rural Roundabout intersection is a typical intersection used for Rural Arterial roads which include buffered paved shoulders for cyclists. The roundabout addresses the safety and operations for cyclists and vehicles due to the rural context. The roundabout design is based on OTM Book 18: Cycling Facilities (2021), the TAC Canadian Roundabout Design Guide (2017) and NCHRP Report 672.

Figure 85. Rural roundabout

Key features for this intersection include:

- Pedestrians and cyclists operate on the perimeter of the roundabout fully separated from motor vehicle traffic. The paved shoulder used by cyclists 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.
- Buffered shoulders transition to raised medians through the roundabout to enforce separation between vehicles and cyclists. Yield lines, also know as shark's teeth, are included at crossing locations to indicate to cyclists and pedestrians that through vehicles have the right-of-way.
- A truck apron is provided on the central median to support large vehicle turning movements.

Stop Controlled T-intersection

The Stop-Controlled T-intersection features the intersection of the Main Street Historic and the Neighbourhood Connector. This intersection features a transition from on-street buffered bike lanes on the Main Street Historic to cycle tracks on the Neighbourhood Connector. Stop control is provided on the Neighbourhood Connector.

Figure 86. Stop-Controlled T-Intersection

Key features for this intersection include:

- Stop-bars along the south leg are located further back from the intersection to prevent large turning vehicles from encroaching on oncoming traffic.
- Bike facilities which continue through the intersection onto the near-side of the Main Street Historic, marked by elephant feet signage.
- A pedestrian crossing with a median/refuge island and signage.

Chapter 5 Planning for Complete Streets

5.1 Complete Streets design considerations

This chapter of the CSDG intends to inform and outline the planning and design process of a Complete Streets project. Complete Streets projects generally follow the steps outlined in this chapter; however, project-specific deviations may apply. Common city-specific considerations for Complete Streets, such as winter maintenance, are also highlighted in this chapter. Overall, this chapter integrates the elements from the previous chapters to facilitate the practical application of Complete Streets principles.

Constructing, operating, and maintaining a Complete Streets network is a multi-step process that involves coordination with several municipal departments, stakeholder groups, and the community at large. This process typically encompasses four distinct stages, as illustrated in **Figure 87**. These four stages are recommended for new construction or major reconstruction projects of the City's streets, including developer-led construction.

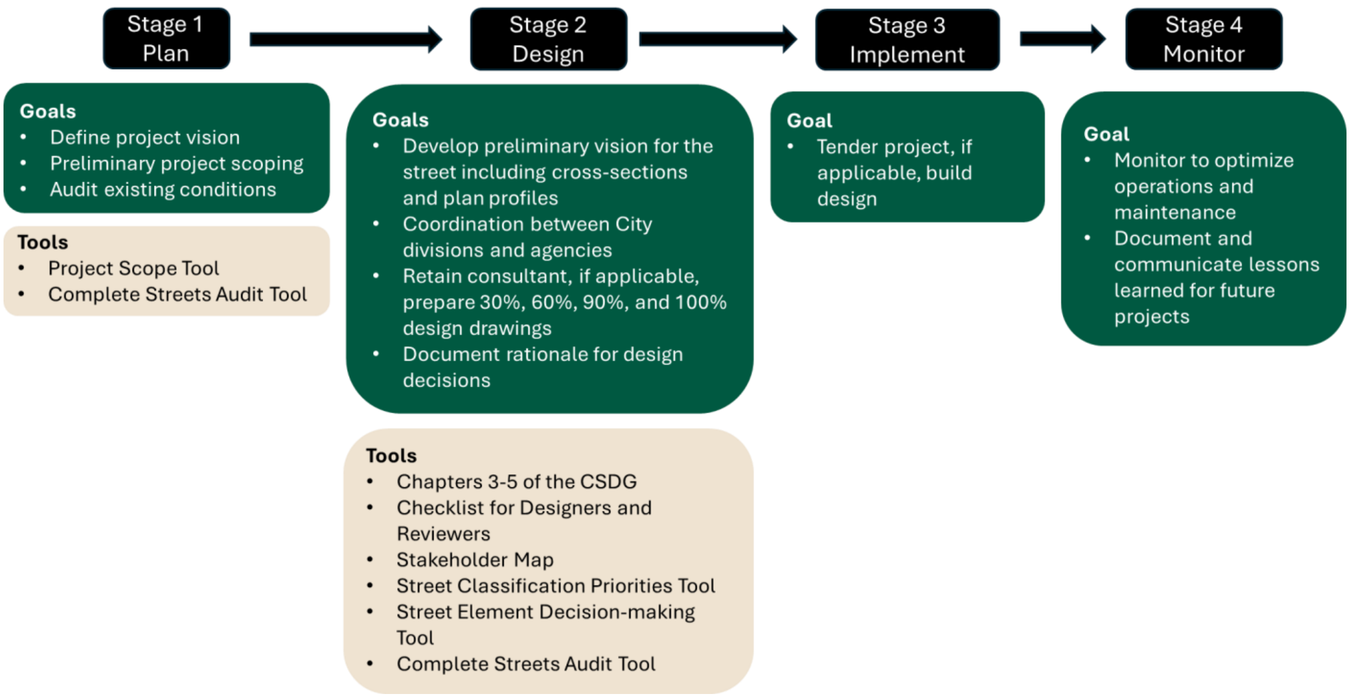


Figure 87. Complete Streets project process

5.2 Planning stage

Complete Streets design is an approach that considers the needs of all road users, including pedestrians, cyclists, public transportation users, and motorists. Typically, street improvement projects are initiated for reasons such as major reconstruction, water or wastewater replacement and rehabilitation, or greenfield development. These projects can all be approached with a Complete Streets lens, considering the needs of all road users in the design process.

Before constructing any street elements, the planning stage dictates the direction, and the purpose of the project. Depending on the budget and scope of the project, the duration and complexity of the planning involved can vary. This chapter outlines processes, tools, and strategies to be considered when applying a Complete Streets approach to a new project.

Defining street corridor vision and goals

Defining the corridor vision and goals is a crucial step in the planning stages of a Complete Streets project. It involves reviewing the existing and future planning and policy context, as well as engaging key stakeholders to ensure their involvement in developing the project vision. Practitioners should leverage the Complete Streets principles outlined in **Chapter 1** and the proposed typology of the street to guide the development of the vision and goals for the identified corridor.

The goals developed should include desired outcomes for all modes and street elements, considering multimodal transportation and sustainability objectives. Early engagement with stakeholders can set the stage for ongoing proactive engagement throughout the project life cycle. Additionally, **Chapter 5.3** includes a list of common stakeholders that should be engaged for projects to ensure that their perspectives and needs are incorporated into the vision and goals.

Monitoring

Monitoring is a crucial aspect of the Complete Streets framework. By collecting and analyzing municipal data, practitioners can identify high-risk areas and prioritize them for improvements. This can include analyzing collision data, traffic volume, transit ridership, and pedestrian and cycling activity. In addition to identifying areas for improvement, data can also be used to evaluate the effectiveness of a Complete Streets project. To do this, practitioners should develop site-specific performance indicators during the planning stage, and collect baseline data for each indicator. This will enable them to compare preand post-installation data and assess the impact of the project on the established vision and goals. By incorporating monitoring into the project life cycle, practitioners can ensure that the Complete Streets network continues to meet the needs of all road users over time. This chapter provides further details on monitoring and Complete Streets performance indicators.

Auditing

Auditing is an important process that helps to evaluate the completeness of specific street segments and determine which elements of Complete Streets should be prioritized. This evaluation can be based on various factors, such as stakeholder feedback, data analysis, or reviewing as-built designs. By auditing a corridor, areas which require enhancements can be assessed and a project scope that addresses these needs can be developed. Auditing a corridor **(Figure 88)** that is identified for road reconstruction is a helpful step in the planning process as it helps to ensure that Complete Streets projects are tailored to the specific needs of each corridor.

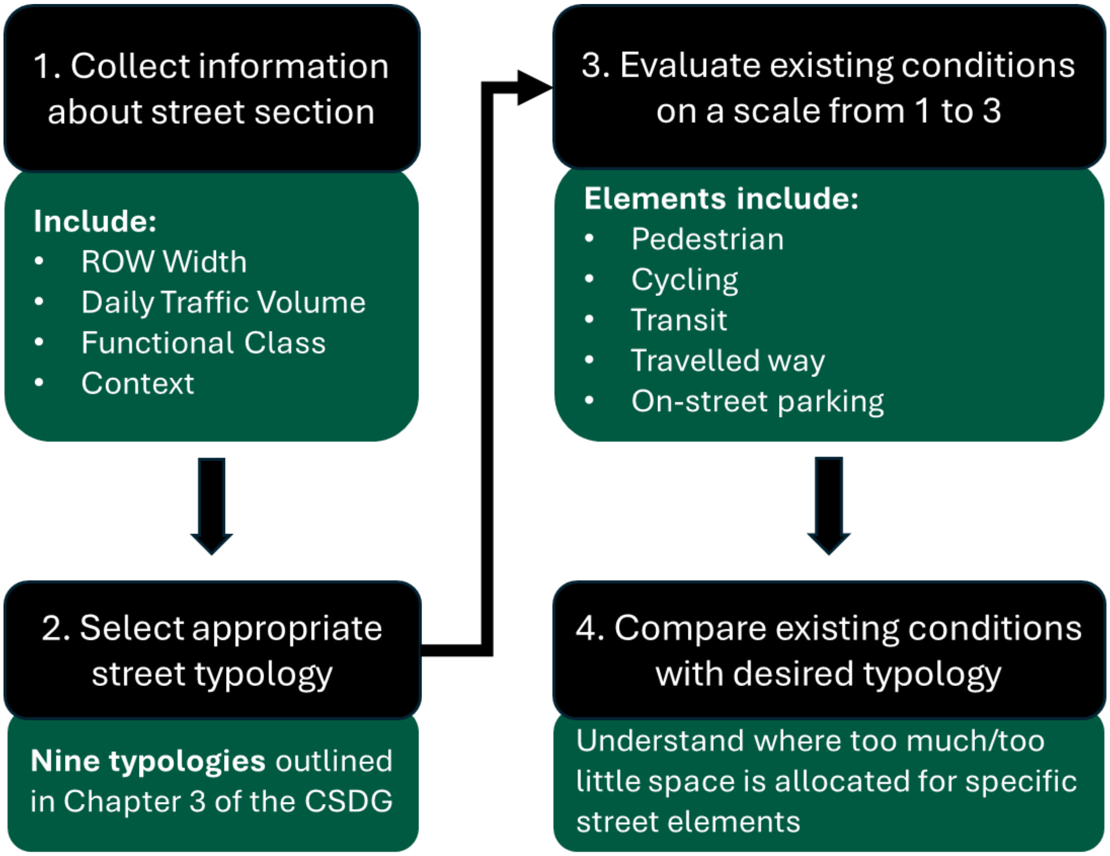


Figure 88. Auditing process for Complete Streets

Complete Streets Audit Tool

Appendix B: Audit Tool is a valuable tool for assessing the completeness of street segments and determining the appropriate project scope to enhance completeness. The tool allows for the evaluation and visualization of the existing or proposed design of a street, based on the desired balance of priorities for the relevant street typologies as defined by the Complete Streets Condition Definitions and Street Element Matrix described further in this chapter.

The tool is an interactive Excel file that allows users to input relevant information about the corridor, select the relevant typology, assess current or proposed street conditions for each Complete Streets element and evaluate them based on the desired conditions for that typology. The bar graph output indicates whether current conditions for a specific street classification surpass, align with, or fall short of the priorities for each Complete Streets element.

An example evaluation of an Urban Local Residential Typology is shown in **Figure 89**.

Step 1: Input data

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

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

Step 2: Select Typology

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

Selected CLB typology Neighbourhood Street

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.

CLB Typologies

Urban Avenue	Industrial Street
Transitioning Avenue	**Neighbourhood Street**
Main Street	Rural Road
Connector	Rural Settlement Road

Step 3: Assess Current/Proposed Street Conditions

Enter a value from 1 to 5 for each of the street elements, considering either the existing conditions or potential future conditions.
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 Service	1		

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
Desired Condition for CLB Typology	3	2	1	1	3
Current / Proposed Condition	2	1	1	3	2
Exceeds / Fails to Meet Priorities	-1	-1	0	2	-1

Figure 89. Sample evaluation of the Urban Local Residential Typology using the Audit Tool

If the value in the "Exceeds / Fails to Meet Priorities" is negative, then the Current / Proposed Condition is failing to meet the intent for that element for selected street typology. If the value is positive, the 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.

Street element condition definitions

The following tables contain the definitions for each Complete Streets element, which are used to describe the desired conditions for each typology and to assess the condition of an existing street. Each element is assigned a rating from 1 to 3, which reflects the level of accommodation or level of service for that street element.

Table 11. Level of accommodation for pedestrian realm elements

Score	Urban	Rural
1	No sidewalk or multi-use path (MUP)	No shoulder
2	Sidewalk with 1.5 metre – 1.8 metre pedestrian clearway on one side of the roadway	1.5 metre – 1.8 metre paved shoulder with 0.5 metre painted buffer
3	▪ Sidewalk with > 1.5 metre pedestrian clearway with 0.3 metre edge zone (measured from back of curb) on both sides of the roadway, **or** 3.0 metre MUP with 0.8 metre edge zone on both sides of the roadway ▪ Street trees / furnishing zone	Sidewalk with 1.5 metre – 1.8 metre pedestrian clearway on one side of the roadway

Table 12. Level of accommodation for cycling facilities

Score	Urban	Rural
1	Shared space: No dedicated cycling facilities or shared operations	Shared space
2	Bike lane, buffered bike lane, or advisory bike lane, in conditions supported by OTM Book 18 nomograph. Minimum 1.5 metre width	1.5 metre paved shoulder with 0.5 metre painted buffer

Score	Urban	Rural
3	▪ Separated facility: Physically separated bike lane, cycle track, **or**: Minimum 1.5 metre (one way), preferred 1.8 metre width ▪ MUP: 3.0 metre preferred and 2.4 metre minimum ▪ Minimum 0.6 m buffer from motor vehicle traffic	1.8 metre paved shoulder with 1.0 metre painted buffer

Table 13. Level of accommodation for transit service

Score	Urban or rural
1	▪ No transit service or transit service; or ▪ Stop has no hard surface pad
2	▪ Infrequent local transit service (less than half an hour in peak periods). ▪ Stops have hard surface pad allowing passenger boarding/alighting from all doors and include static route mapping/schedules.
3	▪ Frequent local transit service (every 15-30 minutes). ▪ Most stops have basic transit amenities such as seating, lighting, and static route mapping/schedules. All stops have hard surface pad allowing passenger boarding/alighting from all doors.

Table 14. Level of accommodation for travelled way elements

Score	Urban	Rural
1	▪ Design treatments promote slow speeds and divert through traffic. ▪ No marked centreline.	▪ Less than 6.5 metre pavement ▪ No paved shoulder

2	▪ 3.5 metre lane width ▪ Centreline may or may not be marked. ▪ No continuous centre turn lane. May include auxiliary turn lane at intersections.	▪ 7.0 metre pavement ▪ Centreline may or may not be marked ▪ No paved shoulder
3	▪ 3.5 metre lane width ▪ May include continuous centre turn lane. May include auxiliary turn lanes at intersections.	▪ Minimum 1.0 metre paved shoulders

Table 15. Level of accommodation for on-street parking

Score	Urban or rural
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 majority of the curb on one or both sides of the street.

Street Element Matrix

The matrix presented in **Figure 90** can be used to determine the desired conditions by Complete Street element for each street typology based on the Street Element condition definitions previously described from **Table 11 to Table 15.**

	Pedestrian Realm	Cycling Facilities	Transit Service	Travelled Way	On-Street Parking
Urban Arterial (Thoroughfare)	3	3	3	3	1
Main Street (Downtown)	3	2	2	2	3
Main Street (Old Historic Downtown)	3	2	3	2	2
Neighborhood Connector	3	3	3	2	1
Urban Local Residential	2	1	1	1	2
Rural Arterial (Thoroughfare)	2	3	2	3	1
Collector (Connector)	2	2	2	3	1
Rural Local Residential	1	1	1	2	2
Rural Local Residential (Urban Area)	3	1	1	2	2

Figure 90. Complete Streets Element Matrix

Project Scope Tool

The Project Scope Tool **(Figure 91)** is a flowchart designed to assist staff in determining the suitable project scope for a specific roadway or corridor. The tool considers the schedule for major replacement of utilities and municipal services, which is the key parameter that has the most significant impact on the project's scope.

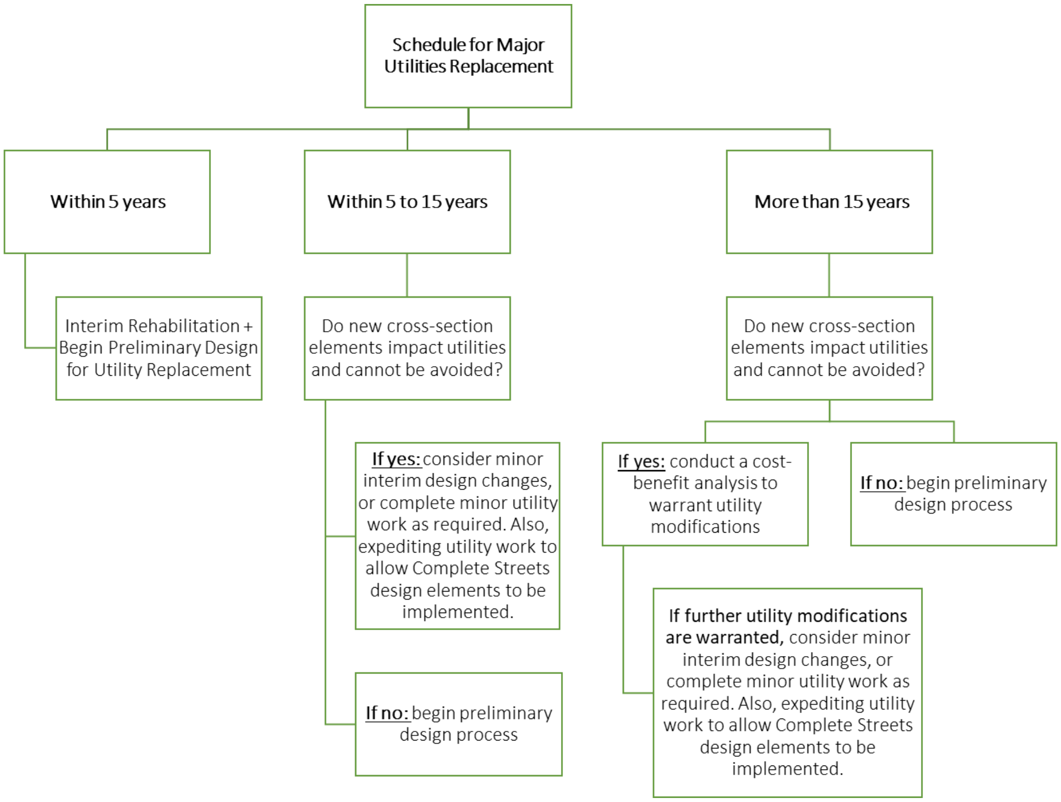


Figure 91. Complete Streets Project Scope Tool

The Project Scope Tool is recommended for use during the initial planning stages of a Complete Streets project. However, as more details are uncovered in the conceptualization stage regarding potential utility impacts, the tool should be revisited to ensure that the project is appropriately scoped. The condition and scheduled replacement of subsurface utilities are essential factors in determining the scope of a road reconstruction project. This tool can be used iteratively throughout the Planning and Design stages of the Complete Streets project.

5.3 Design stage

After the planning stage, the design stage begins by identifying the essential components of the corridor. This includes the corridor's cross section, street elements, and other specific design components. The cross sections for the relevant street typology in **Chapter 3** and the corresponding intersection treatments outlined in **Chapter 4** can serve as a solid starting point for the design. Afterward, the design should be refined based on several core design considerations, including the accommodation of user groups and services, adjacent land uses, network considerations, and relevant user considerations. To keep track of the key steps and considerations during the adjustment of the conceptual design, project managers and designers can utilize the Designer Checklist tool provided in this chapter.

Designer Checklist Tool

Step 1: Select corresponding typology from Chapter 3.

- Review design elements and target dimensions for the relevant typology and advance to Step 2.

Step 2: Select corresponding intersection design examples from Chapter 4.

- Review design principles and features that should be incorporated at intersections along the corridor and advance to Step 3.

Step 3: Review design considerations for each street element.

Accommodation of the following elements are key design considerations.

- If the answer is no to any of the following questions, 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 Step.

Pedestrian realm and placemaking

- Are the pedestrian elements contained in the corresponding cross section **(Chapter 3)** 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 cross section **(Chapter 3)** 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 cross section **(Chapter 3)** 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 cross section **(Chapter 3)** 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?

Utilities and municipal services

- Are the utilities and municipal services contained in the corresponding cross section **(Chapter 3)** 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?

Note

The rationale for any no responses to the questions in the checklist 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, any changes should be consulted to determine if the soil volumes would be adequate, and that the variance is acceptable in this case.

Designers should review the existing conditions of the roadway. If the existing lane widths are narrower than what is prescribed in **Chapter 3** and there are no traffic operations issues, consider maintaining the existing lane widths and adjusting other elements in the cross section accordingly.

Step 4: Review and revise the conceptual cross section based on land use considerations.

Place types

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 schedules 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?

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

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 Conservation Sudbury's regulated area?

- If yes, ensure that the appropriate Conservation Sudbury 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 could be impacted?

- If yes, contact relevant First Nations, Métis, and/or Inuit representatives and engage them as project partners.

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, as well as any land dedication requirements or cash contributions for sidewalks. In addition, consult with key landowners, and analyze future needs and travel patterns along the corridor.

Step 5: Review and revise the conceptual cross section based on network considerations.

Pedestrian network

Is the corridor identified as a City rehabilitation process?

- If yes, refer to the City's Sidewalk Priority Index (SPI) for the addition of pedestrian facilities and prioritize a comfortable and connected pedestrian realm, including wide sidewalks.
- If no, refer to the City's Official Plan and implement pedestrian infrastructure in alignment with the roadway classification and typology.

Cycling network

Are any segments of the corridor aligned with the planned cycling network outlined in the City's Transportation Study Report?

- 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 aligned to any segment of the corridor? Whether or not the corridor is part of a current transit route, consider appropriate accommodations for GOVA Plus, increased ridesharing activity, or other emerging technologies.

- If yes, coordinate with GOVA 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 a Designated Truck Route?

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

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.

Step 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 user 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 listed groups are prevalent along the corridor, they should influence the project's design considerations.

Children (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 accessing care

- 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.

Businesses without off-street parking or laneways

- If yes, consider providing loading zones to facilitate deliveries and pick-ups for local businesses.

Engagement, collaboration, and consultation

Consultations with the public, key stakeholders, and agencies can inform key project decisions ultimately made by the City. Consultation and coordination are important aspects of the Complete Streets design process. The public should be engaged early in the planning process to gather input on design priorities and local issues. Designing with a Complete Streets approach often requires establishing links between various uses of the right-of-way that may not be as apparent in traditional street design. For instance, including a cycling facility in the boulevard requires consideration of various factors such as the positioning of street trees, separation from the motor vehicle lane, consideration of on-street parking demand, the placement of utility poles and street furniture, separation from the sidewalk, and integration with transit stops. Responsibility for each of these elements frequently rests with different agencies, divisions, and stakeholders. Hence, cooperation among the many stakeholders is crucial to ensure that investments are optimized, and project objectives are met.

The Stakeholder and Partner List (**Table 16**) is a tool that identifies all the potentially impacted parties from various municipal departments, public and private entities, and non-profit groups. While this tool provides a starting point for engagement, the project team should prioritize key stakeholders to address specific project concerns with a tailored consultation plan. It is recommended to apply the International Association for Public Participation (IAP2) spectrum of public participation to approach stakeholder groups.

Table 16. Stakeholder and Partner List

Type	Name
Internal City divisions	▪ Linear Infrastructure Services ▪ Engineering Services ▪ Environmental Planning Initiatives ▪ Infrastructure Capital Planning ▪ Transit Services (GOVA) ▪ Leisure Services ▪ Traffic and Transportation ▪ Planning Services ▪ Economic Development ▪ Paramedic Services ▪ Fire Services ▪ Indigenous Relations Specialist
Utilities and railways	▪ Agilis Networks ▪ Bell Canada ▪ Eastlink ▪ Canada Post ▪ Greater Sudbury Hydro inc. ▪ Hydro One ▪ Canada National Railway ▪ Huron Central Railway Inc. ▪ Conservation Sudbury ▪ Ontera ▪ Toromont Energy ▪ Union Gas

Type	Name
	▪ Enbridge ▪ Vianet
Advisory and technical organizations	▪ Mobility and Cycling Organizations ▪ Environmental and Conservation Organizations ▪ Business and Community Associations ▪ Canadian National Institute for the Blind (CNIB)
Education	▪ Public and Catholic School Boards ▪ Conseil scolaire public du Grand Nord de l'Ontario ▪ Conseil scolaire catholique Nouvelon ▪ Sudbury Student Services Consortium ▪ Laurentian University ▪ Cambrian College ▪ Collège Boréal
Other governing authorities	▪ Provincial Ministries o Ministry of Transportation (MTO) o Ministry of Infrastructure o Ministry of Municipal Affairs and Housing ▪ Adjacent Indigenous Nations

Type	Name
	▪ Conservation Sudbury
Major employers or institutions	As applicable

Street elements

While balancing all elements of Complete Streets, some locations may have restricted space within the roadway's right-of-way. The Street Element Tool **(Figure 92)** assists the project team to determine options to consider when the right-of-way width is not wide enough to accommodate all the desired elements for the road typology. It is important to understand the trade-offs in a reduction of a Complete Streets element, and to ensure the ultimate design still convey the original vision of the Complete Streets project.

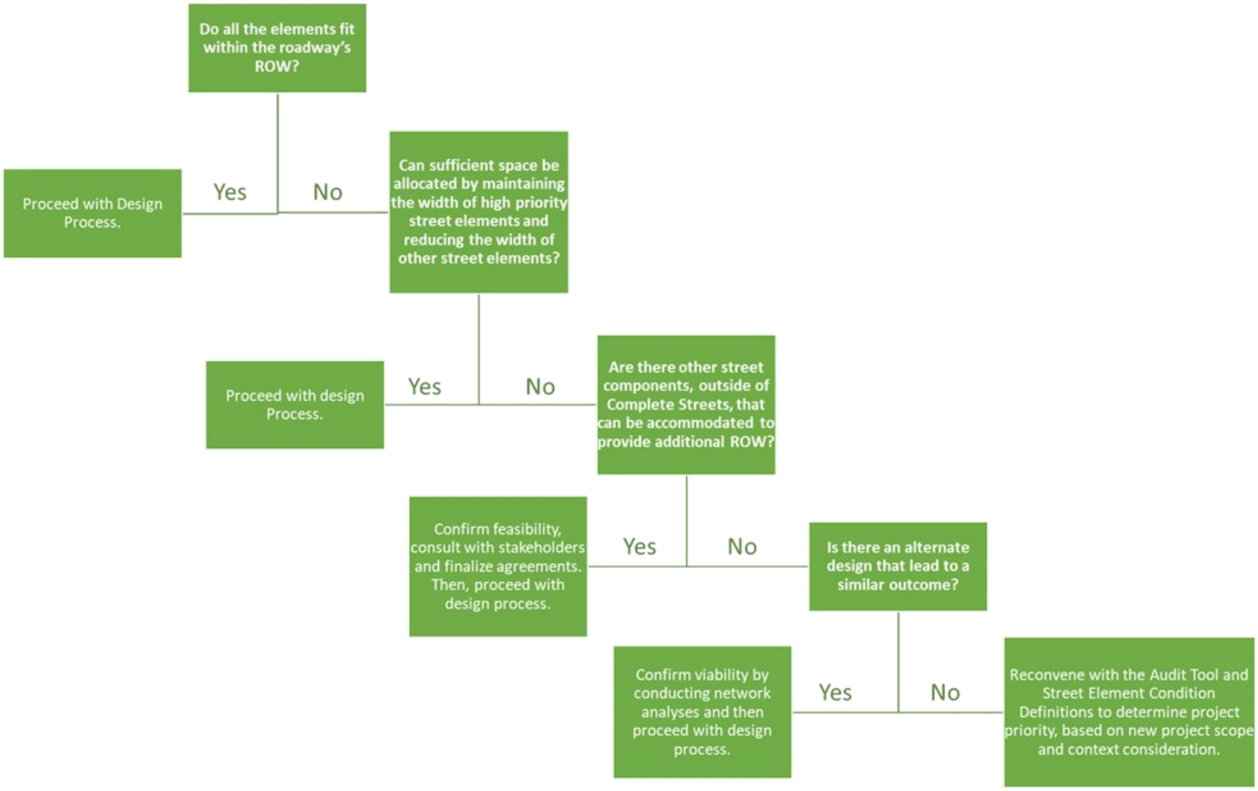


Figure 92. Street Element Tool

Minimum dimensions within ROW

In roadways with constrained ROW, the minimum widths may need to be used for some street elements. When designing with minimum widths, practitioners should consider several factors, including anticipated user volumes, the relative priority of each element based on street classification and project objectives, the impact of operations and maintenance, the need for physical separation of vulnerable road users and motorists, and the permanence of the facility. If minimum dimensions are required, designers should assess whether a posted speed limit reduction is appropriate, alert and guide road users through pinch points and constrained areas using signage and pavement markings, maintain appropriate sightlines for safety, and monitor user behavior in the area following implementation to determine if project goals are being met. In a constrained right-of-way, integrating street elements to use the same space for multiple functions may be necessary to avoid designing to minimum dimensions. This could involve integrating elements like the shared cycle track platform stop described in **Chapter 2** or using curbside management to alternate on-street parking or flex zones with curb bump outs to provide space for street tree planters or transit shelters.

5.4 Implementation stage

Implementation of a Complete Streets project involves the transition from the design stage to the construction stage. Once the design stage is completed, the tender and construction award process can begin.

Tendering

The tendering process is a critical stage in the implementation process, as it is important to ensure that the contractor selected has the appropriate experience and competency to implement all the design elements in the street design. The city or developer should identify a contractor with the necessary skills and expertise to carry out the project successfully and communicate the desired goals for the corridor defined in the Planning Stage.

During the construction process, it is crucial to maintain open lines of communication between the design staff/consultants, contract administrators, and contractors to ensure that all street elements are constructed appropriately and that trade-offs made during implementation are documented and well communicated with project stakeholders.

Outreach and initiation

The public education strategy is another important aspect of the implementation stage. Complete Streets designs may include elements that are unfamiliar to residents, and to minimize confusion and optimize operations, a public education strategy should be developed prior to opening the facility with new design features. Examples of outreach strategies include signage, billboards, online/in-person events, and project webpages.

5.5 Monitoring and maintaining stage

Monitoring multimodal project initiatives and existing infrastructure is an important step to ensuring that a Complete Street project is meeting the intended goals set out in the planning stage. It is important to establish a methodology for measuring success and integrating lessons learned into future work. To assess the outcomes of a Complete Streets project, a monitoring strategy should be employed. Creating key metrics, baseline conditions, usage patterns, and lessons learned is advisable for effective monitoring.

- **Key metrics:** Metrics should be chosen to reflect the Complete Streets vision and goals. These metrics can be used to compare before and after the implementation of Complete Streets. For example, an increased use of active transportation facilities in a specific geographical area of interest measured by counters.
- **Baseline conditions**: Data on the baseline conditions, collected prior to project construction during the planning stage, informs the project team on the street's existing conditions. This can be used to compare with the data collected after a Complete Streets project, to fully understand the impact of the project under each key metric.
- **Usage patterns:** A Complete Streets project can change travel behaviour over time, and can have patterns between each season and mode. It is important to consider performing monitoring activities for different modes over long periods of time such as 6- to 12-month intervals and during various seasons and times of day. Furthermore, Complete Streets can fulfill a latent demand for transit and active transportation that was previously not met by existing roadways, by promoting mobility for a certain mode user group. It is important to understand whether there are other locations that can be candidates for similar Complete Streets projects that may also have latent demand or underlying usage patterns.
- **Communicate and document lessons learned:** Data collected during the monitoring stage, lessons learned throughout the planning and design process, and outcomes of the project can inform future projects during the planning stage. Lessons learned should be documented and shared with relevant City departments and stakeholders to inform future Complete Streets projects and any future updates to the Complete Streets Design Guide.

Winter maintenance

Winter maintenance and street design for the City's roadways should complement each other. On urban roadways with sidewalks, snow is typically stored in the buffer zone between pedestrians and the roadway. This buffer zone may be the furnishing zone or the cycling facility along the corridor. Currently, cycling facilities are used for snow storage in Greater Sudbury. Should the City explore clearance of cycling facilities, designers should consider additional buffer space between the facility and the roadway as a potential space for snow storage.

On rural roadways without sidewalks, snow storage is typically in the shoulder or adjacent to the roadway edge. Reallocation of snow storage could be considered in future development areas, where rural roadways may be converted to urban roadways. The conversion of shoulders into parking lanes or buffer zones may impact snow storage, due to the introduction of curb and gutter and lowered storage capacity. These impacts should be documented during the design process and the winter maintenance and operations groups at the City should be included as stakeholders in the process to ensure the design will be conducive to effective snow clearance.

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 of standards 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 Canadian streets.
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

Abbreviation	Term	Definition
		shoppers, diners, tourists, and new businesses.
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.
CIP	Community Improvement Plan	A tool that allows a municipality to direct funds and implement policy initiatives toward a specifically defined project area.
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.
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.
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.
IAP2	International Association for Public Participation	An international professional organization with a mission to advance the practice of public participation.

Abbreviation	Term	Definition
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 bicycles a head start in front of turning vehicles, providing a priority position in the right of way.
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.

Abbreviation	Term	Definition
MMLOS	Multimodal Level of Service	Similar to LOS, but MMLOS seeks to measure the performance and consider the trade-off between cycling, walking, transit, and vehicular modes.
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.
MTO	Ontario Ministry of Transportation	The provincial ministry of the Government of Ontario responsible for transport infrastructure and laws.
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

Abbreviation	Term	Definition
		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.
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.
Passenger Cars	Passenger Cars	A road motor vehicle, other than a motorcycle, 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.

Abbreviation	Term	Definition
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.
SWM	Stormwater Management	The planning, design and implementation of systems that mitigate and control the impacts of storm runoff and other components of the hydrologic cycle.
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 principal 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-19	WB-19 Tractor Semitrailers	Large tractor semi-trailer truck

Appendix B: Audit Tool