

APPENDIX B

DESIGN GUIDANCE BEST PRACTICE REVIEW



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CONTENTS

1.0 Introduction.....	4
2.0 Pedestrian Zones	7
3.0 Pedestrian Facilities.....	9
Pedestrian Through Zone	12
Multi-use Trails	13
4.0 Streetscape & Pedestrian Friendly Environments	15
Benches and Seating	18
Pedestrian Wayfinding	19
5.0 Intersections & Crossing Points.....	21
Curb Ramps	22
Corner Radius	24
Curb Extensions	25
Raised Crossings and Intersections.....	26
Pedestrian Refuge Islands.....	27
Channelized Right Turns	28
Alleyways	28
Driveways.....	29
Pedestrian Scramble Intersections.....	30
6.0 Maintenance	31
Sidewalk Snow Clearing	31
Sweeping	32
Surface Conditions and Quality.....	33
Temporary and Special Event Considerations	33

1.0 INTRODUCTION

This document outlines some of the best practices in pedestrian infrastructure design. To compile these best practices and inform the direction and recommendations of the Pedestrian Master Plan, several documents and resources were reviewed. These resources included the:

- British Columbia Active Transportation Design Guide (2019 Edition);
- City of Edmonton Complete Streets Design and Construction Standards (2018);
- Transportation Association of Canada Geometric Design Guide for Canadian Roads Chapter 6 – Pedestrian Integrated Design (June 2017);
- Transportation Association of Canada and Institute of Transportation Engineers. Canadian Guide to Traffic Calming (April 2017);
- Toronto Complete Streets Guidelines (Edition 1. Volume 1. 2017);
- Ontario Traffic Manual Book 15 (June 2016);
- City of Mississauga Facility Accessibility Design Standards (FADS) (2015);
- National Association of City Transportation Officials (NACTO). Urban Street Design Guide, 2nd edition (2014);
- City of Boston Complete Streets – Design Guidelines (2013);
- Vélo Québec. Planning and Design for Pedestrians and Cyclists (2010); and
- Accessibility for Ontarians with Disabilities Act and the Integrated Accessibility Standards Regulation (2005)



Walking is the most common form of transportation. Every trip, regardless of the primary mode of transportation, begins and ends with walking or using a mobility device. The City of Mississauga is striving to provide pedestrian facilities and amenities that make walking or using a mobility device safe, convenient, pleasant and universally accessible. There are several characteristics that can help to create comfortable and desirable walking environments, these include:

- **Physically separating** pedestrians from other road users;
- Providing **direct and continuous** routes that reflect pedestrian desire lines;
- Providing a **clear width** that allows people walking or using a mobility device to pass each other;
- Ensuring **surfaces are firm, smooth and even**;
- **Orienting buildings toward the sidewalk**, helping to create a more welcoming pedestrian environment;
- Providing a **mix of land use** that provides a variety of destinations within close proximity and creates an interesting walking experience;
- Ensuring adequate **lighting** is provided to enhance safety and visibility along facilities and at intersections;
- Installing **signage and wayfinding** that make it easy for people to travel between destinations;
- Providing **benches and rest areas**;
- Providing **pedestrian amenities** including water fountains, washrooms, garbage and recycling receptacles, public art and street furniture; and
- Incorporating **street trees and vegetation** into the built environment;
- Providing **weather protection elements** to provide refuge from rain or snow; and
- Ensuring facilities are **well-maintained** in all seasons.

Providing a pedestrian network that is accessible for all residents and visitors is fundamental to creating an equitable transportation network and community. The goals of the Accessibility for Ontarians with Disabilities Act (AODA) are to identify, prevent and remove barriers to making Ontario accessible by 2025. The requirements of the AODA are applied under the Integrated Accessibility Standards Regulation (IASR). The IASR has standards specific to transportation and the design of public spaces (in addition to customer service, employment and information and communications). The Act provides guidance on exterior paths of travel and guidance on ramp design, accessible pedestrian control signals and rest areas.

The City of Mississauga also references the **Facility Accessibility Design Standards (FADS)** which outlines municipal standards to build a universally designed and accessible community for residents, visitors and employees. More information about these documents can be found in the Pedestrian Master Plan **Appendix A** (Policy, Planning and Standards Review).

The purpose of this document (Appendix B) is to provides best practice examples of pedestrian environments and design features that create comfortable, accessible and high-quality pedestrian facilities and infrastructure. It includes examples and recommendations from other jurisdictions outside of Mississauga, the intent is to highlight what others are doing and options the City can consider when implanting the Pedestrian Master Plan. This document is not intended to be a comprehensive design guide but instead provides reference to examples and other documents and examples.

2.0 PEDESTRIAN ZONES



When located within a road right-of-way in an urban context, the pedestrian environment can be divided into several functional zones. These zones are described below and can be seen in **Figure 1**.

1. The **Frontage Zone** is the area adjacent to properties, such as building entrances, front yards, vending or café seating and building-related utilities. This area may be part of the public right-of way, or private, if a building setback is present. The Frontage Zone predominantly applies to an urban street context as the Frontage Zone is typically private front yard space in a residential, suburban and rural context.
2. The **Pedestrian Through Zone** is the most important area of the road for safe, accessible and efficient movement of people walking. The width of this zone depends on the road context and the volume of pedestrian activity anticipated for the corridor or block. This area should be entirely free of permanent and temporary objects. +Providing a pedestrian through zone that is functional for people of all ages and abilities should be prioritized over other zones when planning and designing the pedestrian environment. Reducing the width of other zones should be considered before reducing the width of the pedestrian through zone. The surface materials used for the pedestrian through zone should be firm, even and slip-resistant, providing good traction in all weather conditions. Surface materials should provide a smooth rolling surface for people using mobility devices.
3. The **Furnishing Zone** is the space between the pedestrian through zone and the road that separates pedestrians from traffic or the ancillary zone and provides space for utilities, street furniture, landscaping, street trees and snow storage. It should be provided wherever sufficient right-of-way is available, as it provides a buffer between motor vehicles and people walking, and it can contribute significantly to a more functional and pleasant pedestrian environment. There is no Furnishing Zone on roads without curb and gutter.
4. The **Ancillary Zone** is a flexible on-street space that can be used for pedestrian amenities if it is not a designated motor vehicle through lane. It can be used a variety of ways including as parking for motor vehicles or bicycles, bicycle facilities, docked bike share stands, loading zones, transit stops, taxi or ride hailing zones, curb extensions, parklets, or patios.



Figure 1. Example of Pedestrian Zones

3.0 PEDESTRIAN FACILITIES

There is a spectrum of pedestrian facilities that range in level of comfort and depend on the local land use and road context to determine where they are appropriate. **Figure 2** is an image from the B.C. Active Transportation Design Guide, this guide divides pedestrian facilities into two categories, supporting facilities and all ages and abilities facilities. Below is a summary of the characteristics of the different facility types:

- **Off-Street Trails** are physically separated from the road and motor vehicles, except at intersections. They may or may not be shared with cyclists. Off-street trails are typically found adjacent to a roadway or through parks, utility corridors, along waterfronts, etc.
- **Enhanced Separated Sidewalks** are wide separated sidewalks with ample space for pedestrian movement, furniture and vegetation. They are typically found within the downtown or within a community node or neighbourhood centre.
- **Separated Sidewalks** have a furnishing zone or buffer separating the pedestrian through zone from the roadway. This buffer enhances pedestrian safety and comfort while providing space for sidewalk amenities and utilities.
- **Non-Separated Sidewalks** are facilities where the pedestrian through zone is located directly adjacent to the roadway but is physically separated from the roadway by a curb.
- **Walkable Shoulders** can be considered pedestrian facilities. If no formal sidewalk is provided, a shoulder may be provided. People walking may utilize the shoulder, with the pedestrian through zone directly adjacent to the traffic zone.

The pedestrian facility selection tool seen in **Figure 3** provides some guidance on the context where the different facility types would be the most appropriate. The tool looks at posted motor vehicle speed and the road classification/land use context to help determine the appropriateness of the different facility types. This is intended to be a tool to support the decision-making process and not replace professional judgement and experience. Generally, on streets with higher motor vehicle volumes and speeds pedestrian facilities with separation from motor vehicles are preferred, this includes off-street trails, enhanced separated sidewalks and separated sidewalks. These facilities will feel more comfortable and safe for people walking along busy streets.

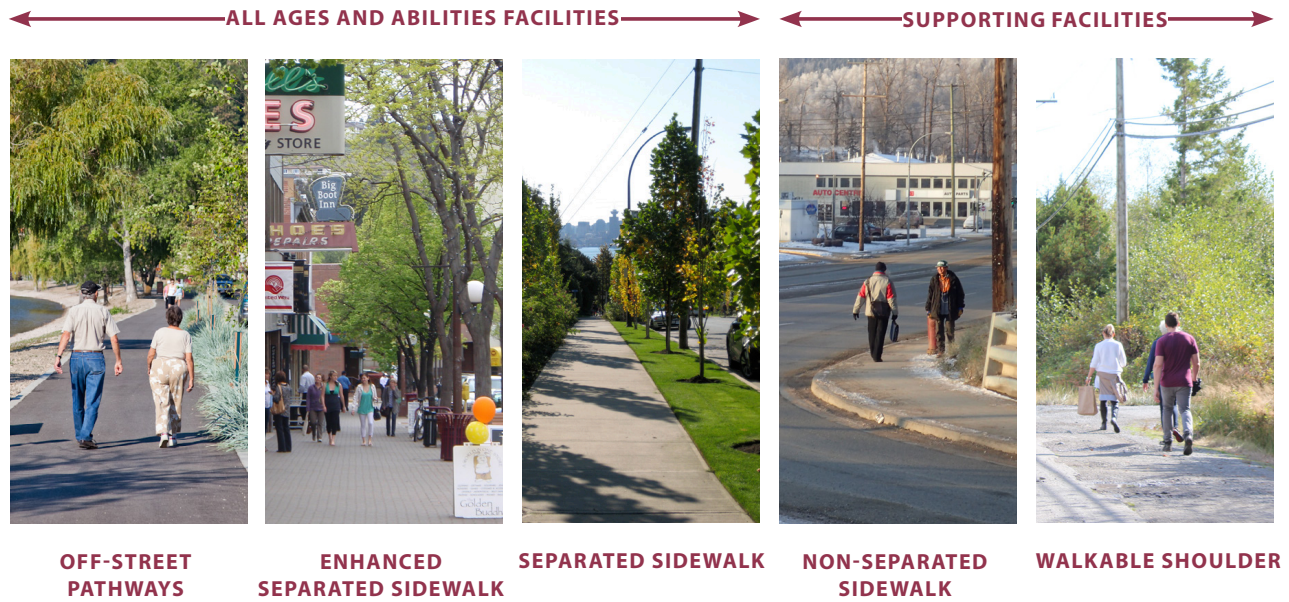


Figure 2. Pedestrian Facility Types (Image Source: B.C. Active Transportation Design Guide)

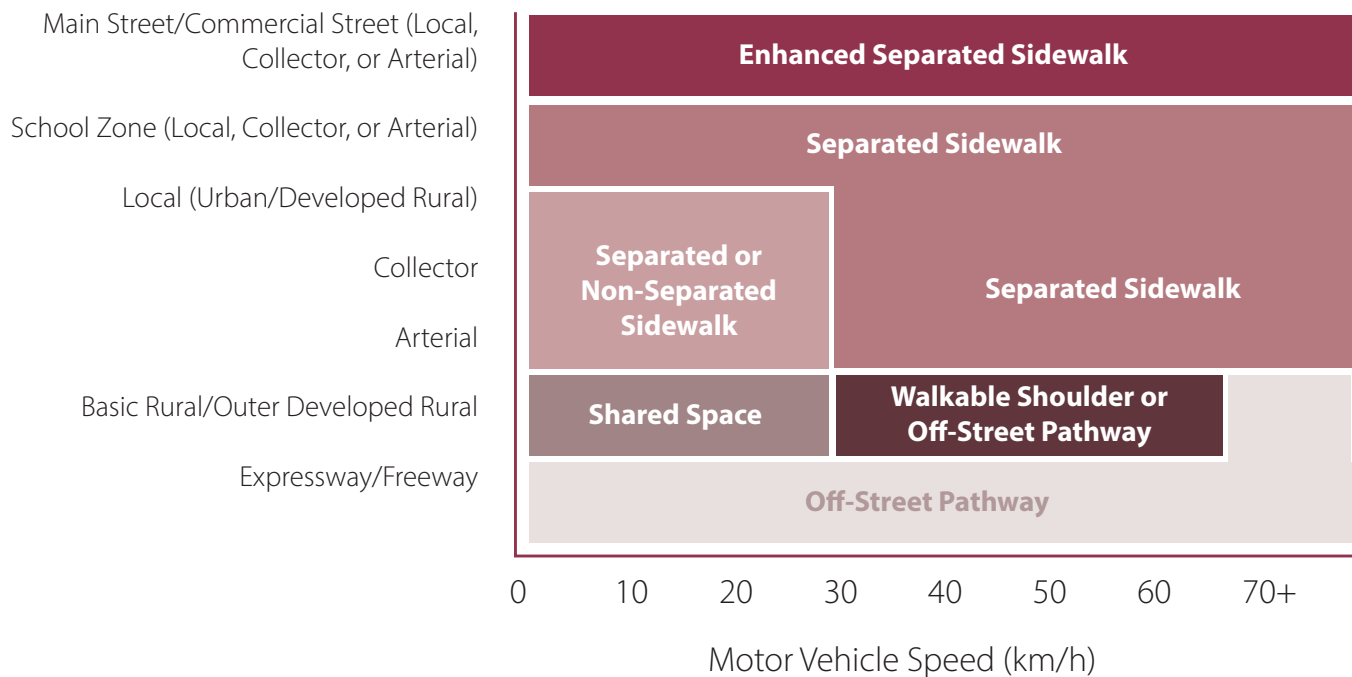


Figure 3. Pedestrian Facility Selection Tool (Image Source: B.C. Active Transportation Design Guide)

Some examples of flexible and inexpensive alternatives to a standard concrete sidewalk are presented below. These designs may be considered in rural or suburban contexts. It is important to note that when considering these facility options, pedestrian safety and accessibility must always be prioritized.



Figure 4. Examples of More Flexible and Lower Cost Pedestrian Options

PEDESTRIAN THROUGH ZONE

Below is a summary of the pedestrian through zone or sidewalk width (m) recommendations from various design guidelines in Canada (**Table 1**). Beyond the desirable width, the B.C. Active Transportation design guide provides some additional guidance on widths based on land use context and road classification (**Figure 5**).

Guidance indicates that the pedestrian through zone should have a constrained limit width of at least 1.8 metres, which allows two people using mobility devices to pass one another. A width of 1.8 metres is also recommended for snow clearing operations. Providing between 1.8 and 2.1 metres allows sufficient clearance for a pedestrian to pass someone with a service animal or another pedestrian holding a child's hand. The absolute minimum width of the pedestrian through zone is 1.5 metres, which should only be used under constrained conditions for distances under 100 metres.

Where higher pedestrian volumes are expected, such as along roads with multi-family or commercial land uses, wider pedestrian through zones are recommended.

Table 1. Recommended Pedestrian Through Zone Widths (Source: Various Guidelines)

SOURCE	LOWER LIMIT (m)	RECOMMENDED (m)	UPPER LIMIT (m)
TAC (peak ped flow rate <400 ped/15 min)	1.5	1.8	2.0
TAC (peak ped flow rate >400 ped/15 min)	2.0	2.25 – 3.0 or based on crowd capacity and maneuvering space	
Edmonton Complete Streets Guide	1.5	1.8 – 3.0	NA
Mississauga (Various guides)	1.5	1.8 – >2.0	NA
B.C. Active Transportation Design Guide	1.5	1.8 – 4.0	NA

Table 2. Pedestrian Through Zone Width (Source: B.C. Active Transportation Design Guide)

Land Use Context	Road Type	Separation	Desirable (m)	Constrained Limit (m)*
Single- Family Residential	Local	Non-Separated or Separated	1.8	1.8
	Collector/Arterial**	Separated	1.8	1.8
Multi- Family Residential	Local	Non-Separated or Separated	2.1	1.8
	Collector/Arterial**	Separated	2.4	1.8
Industrial	Any**	Separated	2.1	1.8
Commercial	Any**	Separated	2.4-3.0	2.1
Area of high pedestrian activity (including temporary, special event, or seasonal)***	Any	Separated	3.0-4.0	2.4

* The absolute minimum width of the Pedestrian Through Zone is 1.5 metres, which should only be used under constrained conditions for distances under 100 metres

** Non-separated sidewalks are not recommended on collector, arterial, or industrial roads with motor vehicle speeds greater than 30 km/h (see **Chapter C.1 of B.C. Active Transportation Design Guide**). If non-separated sidewalks cannot be avoided due to site constraints, a minimum of 0.5 metres may be added to the Pedestrian Through Zone width to provide extra separation from motor vehicles.

*** Areas of high pedestrian activity have peak pedestrian volumes of 400 pedestrians/peak 15-minute period, as per **Table 6.3.1.** in the TAC Geometric Design Guide for Canadian Roads.

MULTI-USE TRAILS

Multi-use trails are off-street trails that are physically separated from motor vehicle traffic and can be used by any nonmotorized user. This includes people walking, cycling, skateboarding, kick scootering, in-line skating and using other active modes. Typically, multi-use trails accommodate bi-directional travel for all users. Multi-use trails can be located in a variety of contexts, including rail corridors, greenway corridors, utility corridors, parks, along waterfronts and adjacent to a road or highway.

The desired width of a multi-use trail is between 3.0 to 4.0 metres. Guidance suggests that if more than 4.0 metres is available then a separated bicycle and pedestrian trail should be considered. The absolute minimum of a multi-use trail is 2.7 metres.

Separated bicycle and pedestrian trails are similar to multi-use trails. The key difference is the provision of a separation between people cycling from other users. The type of separation between users can vary from a painted line or visual separation to a vertical or horizontal feature. Separated bicycle and pedestrian trails can be located in a variety of contexts.

Each active transportation mode has different operating speeds and dimensions, which can lead to conflict between trail users when faster users attempt to pass slower users or where limited sightlines result in users unexpectedly encountering one another.

Guidance suggests that where sufficient right-of-way exists, separated trails are preferred over multi-use trails. In areas with existing high user volumes, and where there is a potential for high volumes, multi-use trails should only be considered where the right-of-way is constrained.



Figure 5. Multi-use Trail



Figure 6. Separated Bicycle and Pedestrian Trail

WHEN TO SEPARATE TRAIL USERS?

The decision to separate bicycle users from other trail users is based on a number of factors including: right-of-way width available, the total volume of current and anticipated trail users, and the ratio of pedestrians to all daily trail users. If the required space is available, it is recommended that separation is provided between bicycle users and other trail users. This can help to enhance trail safety and make the facility more comfortable for all users.

For multi-use trails that have already been constructed, the TAC Geometric Design Guide for Canadian Roads provides the following guidance for when to separate users:

- Where there is a high percentage of pedestrians (more than 20% of users) and total user volumes greater than 33 persons per hour per metre of trail width; or
- Where there is a low percentage of pedestrians (less than 20% of users) and a total user volume greater than 50 persons per hour per metre of trail width.

In locations where no trail is in place, existing and future land use should be considered as well as ridership numbers on existing facilities within a similar context to obtain an understanding of projected volumes.

More generally, communities such as the City of Vancouver and guidance from Australia suggest that if there are 1,500 daily combined users on a facility that is between 3.0 to 4.0 metres in width, and if space is available, separation of people walking and cycling is recommended. The type of separation provided can vary. Separation can involve anything from painted lines to physical separation.

4.0 STREETScape & PEDESTRIAN FRIENDLY ENVIRONMENTS

The furnishing zone, frontage zone and ancillary zone are the areas that typically contain many of the elements that make a street functional, accessible and enjoyable for people walking. This includes providing space for people to rest, socialize, shop, eat, get information, or transfer between transportation modes.

As discussed above, providing a clear, unobstructed Pedestrian Through Zone that meets accessible width requirements is the most important priority in the pedestrian realm. Once that criterion is met, then providing a Furnishing Zone, Frontage Zone, and/or Ancillary Zone that supports the needs of all pedestrians and other road users is the next step.

The Furnishing Zone is located between the Pedestrian Through Zone and the curb or pavement edge (and the Ancillary Zone if one is provided). The Furnishing Zone provides space for utilities, street furniture, landscaping, street trees and snow storage. It should be provided wherever sufficient right-of-way is available, as it provides a buffer between motor vehicles and people walking, and it can contribute significantly to a more functional and pleasant pedestrian environment.

The width of the Furnishing Zone can vary depending on the available right-of-way, land-use context, adjacent motor vehicle speeds and volumes, the amount of snow storage required, the types of utilities, street furniture and/or landscaping that is desired. Depending on the facilities included in the furnishing zone the desired width can range from 1.5 metres to 5.0 metres but can be as constrained as 0.6 metres.

The City's Facility Accessibility Design Standards notes that additional streetscape elements shall:

- Not reduce the required width of the accessible route;
- Be cane-detectable;
- Be consistently located to one side of the accessible route, entirely within an amenity strip that is hard-surfaced, at least 0.6 metres wide and is identified using a indicator surface;
- Be securely mounted within an amenity strip, minimum 0.6 metres wide, located adjoining walkways, paths of travel, sidewalks and other accessible routes;
- Incorporate pronounced colour contrast to differentiate it from the surrounding environment.

Additional streetscape elements that can be found in the pedestrian environment and typically located in the Furnishing Zone include:

- Benches, tables and chairs, other seating;
- Waste and recycling receptacles;
- Mailboxes and newspaper corrals;
- Drinking fountains;
- Bicycle Parking;
- Scooter Parking;
- Transit stops and shelters;
- Wayfinding signage;
- Public art (sculptures, murals, fountains, clocks and other decorative features);
- Road banners, flags and other graphics; and/or
- Public washrooms.

Road hardware includes elements that are required for the regular function of the road and surrounding buildings. These items may also be found the Furnishing Zone. Common items include:

- Road lighting;
- Traffic signals;
- Pedestrian and cycling push buttons;
- Traffic signage;
- Utilities;
- Fire hydrants;
- Parking metres; and/or
- Bollards, fences, or other barriers.

Pedestrian amenities and road hardware should be visually and physically integrated in a way that reduces clutter and maximizes the space available for pedestrian movement. Individual pieces of street furniture can be grouped together to save space and they can serve more than one purpose simultaneously. The placement of these elements should be consistent to make the pedestrian environment more predictable for people with visual impairments.

The Furnishing Zone provides the opportunity to add visual interest and community identity to the pedestrian environment. The choice of surface materials and the design of streetscape elements such as road hardware and pedestrian amenities should be co-ordinated to provide a consistent look and feel throughout the neighbourhood. The Furnishing Zone also provides an opportunity to highlight unique portions of a community, signalling to people that they are in a special area. This can apply to historic areas, cultural areas, or different neighbourhoods.



Figure 7. Example of Furniture Zone

Frontage Zone

The Frontage Zone is located between the Pedestrian Through Zone and the property line. It provides clearance from adjacent building fronts, architectural features and entrances. In some contexts, the Frontage Zone may also contain utilities, street furniture and street trees. The Frontage Zone can also act as an extension of the land uses along a road, containing outdoor patios, landscaping, retail displays and signage. It may contain open space that supports the adjacent land use, including space for queuing and window shopping.

The width of the Frontage Zone will vary, changing significantly based on the adjacent land use, available right-of-way and the location of property lines and building setbacks. However, some general width considerations are listed below.

- Frontage Zones upwards of 3.0 metres wide may be appropriate in urban areas with commercial land uses, such as where patio seating is desired or where large groups of people are likely to congregate.
- Frontage Zones between 1.2 and 1.5 metres provide ample space for landscaping and can provide enhanced privacy, preserve street trees, and maintain space for future road widening if necessary.
- A minimum Frontage Zone width of 0.3 metres is recommended to provide an offset between pedestrians and fences or buildings, to accommodate construction and prevent people from being hit by building doors that open outward.

The Frontage Zone can help to activate the streetscape, creating a vibrant and interesting space that attracts people. However, many of these uses require the direct involvement of private businesses and property owners.



Figure 8. Example of Frontage Zone

Ancillary Zone

The Ancillary Zone is a flexible space located on street within the roadway that is not designated for motor vehicle through traffic. Instead, it is designed to support the primary functions of either the roadway or the sidewalk. The Ancillary Zone can contain on-street motor vehicle or bicycle parking, bicycle facilities, docked bike share stands, loading zones, transit stops, taxi or ride hailing zones, curb extensions, parklets, or patios. Depending on context and local maintenance practices, the Ancillary Zone may also be used for snow storage. The Ancillary Zone use can vary along a road corridor or block face – for example, along a single block, there could be motor vehicle parking, a bicycle corral and curb extensions at corners and/or mid-block locations.

The width of the Ancillary Zone is dependent on the road context but is typically the width of a standard motor vehicle parking stall. A curbside management plan can be used to help plan for the potential use of the ancillary zone for pedestrian infrastructure.

BENCHES AND SEATING

Benches are a foundational pedestrian amenity that provide users with a place to rest, gather and take in the surrounding environment. Benches and other resting spots are crucial for people with reduced mobility, who require frequent resting spots. Benches should be:

- Stable, ergonomic in design and comfortable in use;
- Accessible to all users; this includes:
 - Full back rests;
 - Arm rests, on one side only, to allow for wheelchair transfers;
 - Kick space underneath benches; and
 - Cane stops at the base of bench.
- Contemporary in design and style to suit aesthetic and pedestrian realm landscape elements; and
- Easy to maintain, durable and vandal resistant.

Multi-level seating options can also be considered, including leaning benches, as the typical bench design may not be accessible for all users.

Benches or other types of seating should be placed:

- Next to an accessible route and with a surface that is connected and continuous with the sidewalk or trail surface;
- Outside of the Pedestrian Through Zone;
- In areas with leveled and firm surfaces;
- Where the use of that space is encouraged and the safety of users can be promoted; and

- Seating areas should have an adjacent level and firm area at least 850 x 1350 millimetres that is not part of the route of travel, which allows a person in a wheelchair to rest beside the bench.

Prioritize the placement of benches and seating in areas where pedestrian facilities and trails opens to a notable view, plaza, or park for the enjoyment of the user. View should be away from, not into, private property. Also, where possible, try to integrate seating into existing landscaping.

PEDESTRIAN WAYFINDING

Wayfinding is a decision-making process related to navigation it is important to provide simple, clear and intuitive information to help people navigate spaces effectively and intuitively. Wayfinding can include signage, maps and other trip planning tools. An important component of wayfinding specifically involves signage and pavement markings.

People walking and people cycling have very different needs when thinking about wayfinding. The size of the signage and text is an important consideration, as is the information conveyed. Pedestrian wayfinding signage should consider typical walking distances and speeds. People walking are likely more willing to stop and study information, such as maps and detailed directions than other active transportation users.

Pedestrian wayfinding systems can help residents and visitors better navigate through high activity areas of a community. This can include information kiosks with a 'finder map' that identifies key information such as transit routes, community facilities and businesses. They often provide 'you are here' information with a five and/or ten-minute walking distance. The 'finder map' can also include building footprints, local landmarks and 3D buildings.

Wayfinding materials should be simple, easy to read, accessible to all, easy to install and allow residents and visitors to locate key amenities and facilities within a neighbourhood. In addition to the detailed 'finder map', an overview map that identifies connections to the wider area can be provided. This map can also provide context of the users' location within a larger area and can help to highlight multi-modal connections if wanting to travel outside the five-minute walking distance.

All elements of pedestrian wayfinding should be designed to work for a wide range people and be inclusive to people across the spectrum of cognitive, visual and physical abilities. The height content is mounted, the colours used along with other aspects need to be considered to ensure this information can be used by all.

Pedestrian wayfinding should also try to include information on the location of accessibility aids, such as ramps and elevators, as well as obstacles that may act as a barrier. As noted, the maps can also include information about connections to other active transportation facilities including cycling and transit routes as well as transit stops. Before installing pedestrian wayfinding, it is important to develop guidelines that outline protocols for route naming and identification of destinations, as well as consistent design and application of route markings and pedestrian signage.

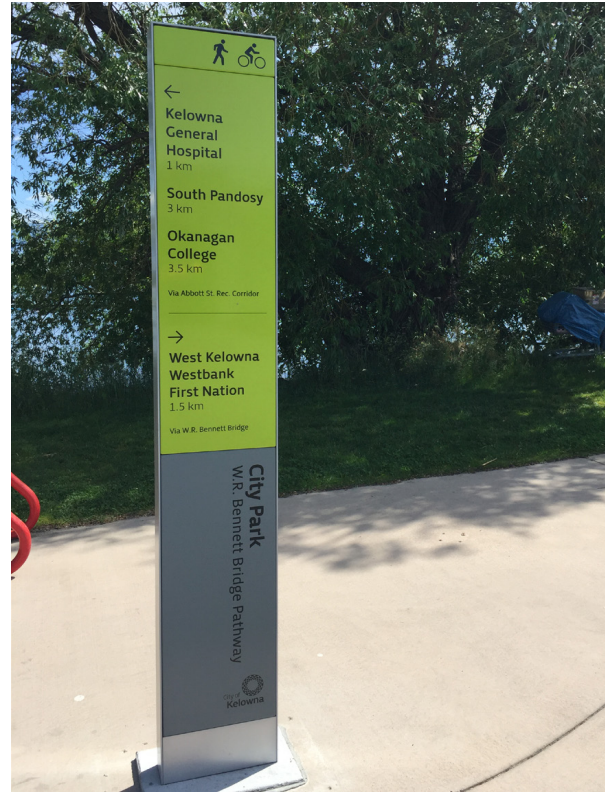


Figure 9. Examples of Pedestrian Wayfinding

5.0 INTERSECTIONS & CROSSING POINTS



Intersections and crossing points can often be the most significant real or perceived barriers for people walking or using other forms of active transportation. Even if comfortable sidewalk or multi-use trail facilities have been provided along a corridor, if there is no crossing or facility provided at an intersection or crossing point, the facility may continue to feel uncomfortable, unsafe and inconvenient for many users. Improving intersections and crossing points for people walking can allow for a reduction in the total distance travelled and make walking more attractive, accessible and safe for all.

In Ontario, the Ontario Traffic Manual (OTM) provides information and guidance for designing, implementing and maintaining traffic control devices across the province. OTM Book 15 provides guidance on the different types of pedestrian crossing treatments.

Intersections are defined as the convergence of two or more roads. Intersections are focal points for activity and multi-modal interactions. Geometric design elements and traffic controls, including signage and pavement markings, are crucial for enabling all road users to safely navigate intersections.

Mid-block crossings are often installed where there is a demand to cross a road away from an intersection. Mid-block crossings are typically used along off-street trails and can increase pedestrian network connectivity and user convenience. However, special consideration must be given to ensuring that there are adequate sightlines and yielding expectations for both motorists and trail users.

Mid-block crossing work especially well where intersections are spaced at least 100 to 200 metres apart and there are destinations on both sides of the road. Mid-block crossings are often considered where there are major pedestrian generators mid-block and at locations where there is a desire line. Some of the following factors should be considered when assessing the feasibility and appropriateness of a mid-block crossing:

- Road width
- Number of motor vehicle travel lanes
- Topography
- Sightlines
- Pedestrian volumes
- Motor vehicle speeds and volumes
- Turning conflicts and distance to the nearest intersection

The TAC Pedestrian Crossing Control Guide provides detail for conducting an engineering study that assesses the feasibility of a mid-block crossing and the type of traffic control required.

This section of the best practice review is intended to provide a high-level overview of some of the infrastructure design treatments that can be used to enhance pedestrian accessibility, comfort and safety at intersections. For detailed guidance on traffic control devices, refer to OTM Book 15.

The following design principles should be considered to provide safe, comfortable and accessible intersection and crossing treatments for all users:

- Design for all ages and abilities
- Minimize conflicts between users
- Ensure clarity of right-of-way
- Reduce speed at conflict points
- Separation between motor vehicle lanes and pedestrian facilities
- Ensure clear sightlines
- Make intersections as compact as possible

CURB RAMPS

A curb ramp is a graded and smooth transition between the sidewalk and the street. Curb ramps are required for people using wheelchairs, scooters and other mobility devices, but also benefit people with strollers, carts and baggage. They are also used as a navigational tool by people with visual impairments.

Curb ramps can consist of several components that combine to create a universally accessible crossing. Curb ramps typically include the follow design features: top landing area, bottom landing area, flares and approach. The shape and positioning of each element can vary according to geometric constraints and curb ramp type. Directional score lines should be included on the ramp and oriented to direct pedestrians in the correct crossing. Tactile attention indicators should also be provided for universal accessibility.

Two types of curb ramps are typically recommended: perpendicular curb ramps (**Figure 10**) and depressed corners (**Figure 11**). The ramp design and placement are typically influenced by elements such as the corner radius and alignment with the sidewalk/pedestrian through zone.

Perpendicular curb ramps provide a dedicated curb ramp for each individual crosswalk. They are the preferred treatment as they place pedestrians directly in the crossing area of the desired direction of travel. If space is available, perpendicular curb ramps are preferred.

Depressed corners can be used in constrained situations, where there is insufficient space for a double curb ramp due to larger corner radii, obstructions such as utility poles and/or narrow sidewalks. The depressed corners still allow people using wheelchairs to enter the crosswalk along a straight trajectory, unlike a single curb ramp that is located at an angle to the road. However, depressed corners do not provide the benefit of separating directions of pedestrian travel, and they are at risk of motor vehicle encroachment due to the lack of full height curb.

Detailed design guidance for curb ramps is included in several existing guides including, OTM Book 15, the City's FADS and the AODA.



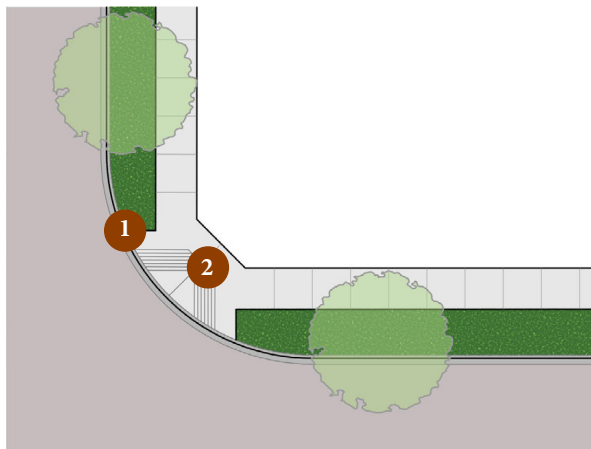
Figure 10. Perpendicular Curb Ramps



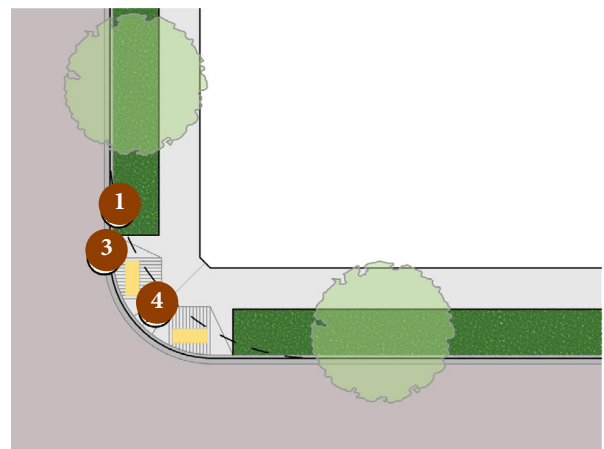
Figure 11. Depressed Curb Ramps

CORNER RADIUS

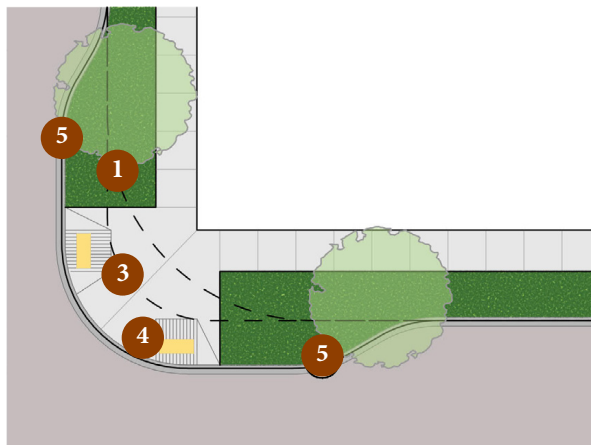
The corner radius has a direct impact on pedestrian visibility as well as the length and directness of a pedestrian crossing. The figure below (**Figure 12**) demonstrates the impact a reduced corner radius has on several pedestrian elements including, pedestrian positioning, curb ramp type, curb ramp alignment and crossing distance. By reducing the corner radius there is additional space for pedestrians, visibility is enhanced and the crossing distance is shortened. It is important to ensure that the design vehicle is accommodated when determining the corner radius.



1. Original Curb Radius with Combined Curb Letdown



2. Reduced Curb Radius with Double Curb Letdown



3. Reduced Curb Radius with Double Curb Letdown and Curb Extensions

- 1 Original 9 Metre Curb Radius
- 2 Combined Curb Letdown
- 3 4.5 Metre Curb Radii Reduction
- 4 Double Curb Letdowns
- 5 Curb Extensions

Figure 12. Hierarchy of Crossing Enhancements Based on Reduced Corner Radius (Source: BC Active Transportation Design Guide)

CURB EXTENSIONS

Curb extensions can be installed at crossings to shorten the crossing distance which results in reducing the amount of time that people are in mixed traffic conditions. They can also help to make pedestrians more visible to motor vehicle drivers, bringing pedestrian further out into the motorist's line of vision. Curb extensions can also change the corner radii of an intersection. Finally, curb extensions create extra space at the corner that can be used for pedestrian queuing, street furniture and landscaping.



Figure 13. Curb Extension Examples (Temporary Low Cost (left) and Permanent with Landscaping (right))



Figure 14. Raised Crosswalk with Curb Extensions

RAISED CROSSINGS AND INTERSECTIONS

Raised crosswalks elevate the crossing to or close to curb level. They help to improve pedestrian visibility and reducing motor vehicle speeds along a corridor. Raised crosswalks can also improve accessibility for people using mobility devices. Raised crosswalk treatments are most applicable on local and collector roads with posted motor vehicle speeds of 50 km/h or less and in school/park zones.

Raised intersections apply the same principles and design as raised crosswalks, with the key difference that they are spread across an entire intersection. This design gives pedestrians elevated priority and visibility throughout the intersection, while indicating to motor vehicle drivers that they have entered a different type of space where increased caution is required.



Figure 15. Raised Crosswalk

PEDESTRIAN REFUGE ISLANDS

Pedestrian refuge islands allow pedestrians to cross only one direction of traffic at a time and provide physical protection for waiting pedestrians. The pedestrian crossing may either be cut through a median island or raised with curb ramps on either side of the refuge island. There are also examples where planters or concrete barriers can be used to create temporary treatments.

Pedestrian refuge islands are desirable in complex intersections with irregular crossing routes, as they break the crossing into smaller segments and allow pedestrians to rest.



Figure 16. Pedestrian Refuge Island



Figure 17. Temporary Curb Extensions and Refuge Island

CHANNELIZED RIGHT TURNS

Channelized right turn lanes are typically seen at larger intersections with high motor vehicle volumes, they are used to facilitate right turn motor vehicle movements. Channelized right turn lanes can be challenging and inconvenient for pedestrians to cross due to the speed of the turning vehicles and the yield-controlled condition of the turn. They also create additional conflict points for pedestrians and space on the triangular refuge island ('pork chop island') may be limited. Several communities have been looking for opportunities to remove channelized right turns or redesign the channel as a 'high entry angle' or 'smart channel' to improve pedestrian visibility.

ALLEYWAYS

Like driveways, alleyways present conflict points between people walking and motor vehicles. Where achievable, the recommended practice is to provide a raised crosswalk across the alleyway so that the pedestrian through zone is continuous. If the pedestrian through zone is not continuous than a curb ramp should be installed.

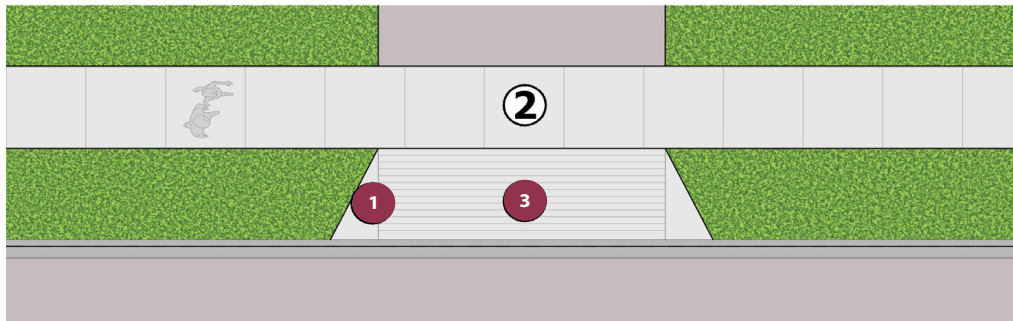
For high-use alleyways such as commercial or employment accesses, additional conflict zone markings can be applied through the crossing to increase visibility of the conflict zone. Alternatively, a different surface treatment may be used through the crossing, such as textured coloured concrete (Figure 19).



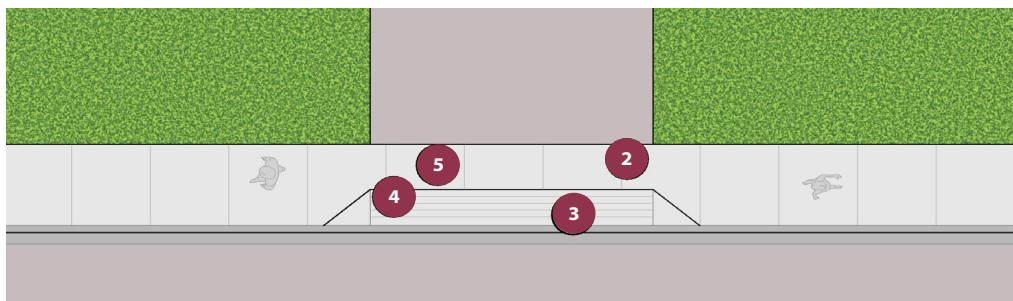
Figure 18. Alleyway Crossing of Sidewalk with Different Surface Treatment

DRIVEWAYS

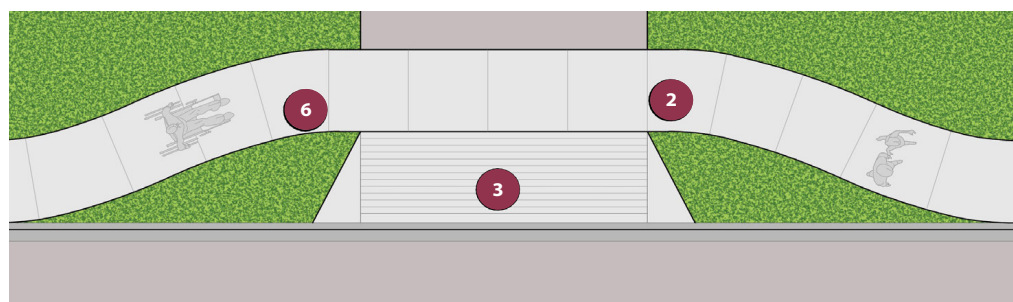
When a driveway crosses the pedestrian through zone, it can create a potential conflict point between motor vehicles and people walking. The driveway ramp that extends into the pedestrian through zone can make it challenging for people using mobility devices to maneuver. As a result, driveways across the Pedestrian Through Zone should be limited as much as possible to maintain an unobstructed pedestrian facility. Figure 20 from the BC Active Transportation Design Guide shows three examples of best practice in driveway crossings of pedestrian through zone.



Driveway crossing of Separated Sidewalk



Driveway crossing of Non-Separated Sidewalk



Driveway Crossing of Non-Separated Sidewalk (Wrapped Around Driveway)

- | | |
|--|---|
| 1 Driveway confined to Furnishing Zone | 4 Driveway located in Pedestrian Through Zone |
| 2 Maintained sidewalk cross slope | 5 Maintained sidewalk cross slope for 1.0 metre width |
| 3 Longitudinal score lines | 6 Driveway confined to Furnishing Zone due to sidewalk bend-out |

Figure 19. Driveways at Pedestrian Through Zones (Source: B.C. Active Transportation Design Guide)

PEDESTRIAN SCRAMBLE INTERSECTIONS

An exclusive pedestrian phase or "scramble" is a type of traffic signal phasing where pedestrians can use the intersection when all approaches of motor vehicle traffic is stopped. Pedestrians can make diagonal crossings (hence the term "scramble") as well as conventional crossings without coming into conflict with turning vehicles. As all motor vehicle traffic is stopped as pedestrians use the intersection there are potential safety benefits associated with pedestrian scramble intersections.

However, as both pedestrians and vehicles experience increased delays because the signal cycle length is increased, this may reduce compliance, negating the expected safety benefits of scramble phasing.



Figure 20. Example of Pedestrian Scramble Intersections

6.0 MAINTENANCE

In Ontario, the Provincial Minimum Maintenance Standards (MMS) for Municipal Highways (Ontario Regulation 239/02) regulates year-round maintenance practices. This section provides an overview of best practices for year-round maintenance of pedestrian facilities. More information about the MMS is provided in Appendix A.

SIDEWALK SNOW CLEARING

Sidewalk snow removal practices vary between communities within Ontario and nationally. In some cases, property owners are responsible for clearing the sidewalks outside their homes and businesses. In other communities, the city or jurisdiction is responsible for clearing all or most sidewalks within the community. There can be variations of this as well.

A municipal bylaw typically regulates sidewalk snow removal. The bylaw should outline responsibility, timeline for snow removal and guidance on where cleared snow should be stored to address drainage, accessibility and bus stop access. Enforcing sidewalk snow removal bylaws is an important component to ensure that people can travel safely and comfortably along sidewalks year-round. Established penalties for infractions and what steps the community will take to ensure sidewalks are kept clear need to be outlined and made transparent to all parties.

The City of Mississauga uses rock salt, or sodium chloride, to clear main roads, residential streets, sidewalks and bus stops. Other treatments can be considered, though it is important to note that they each have varying environmental and financial impacts:

- **Salt** is applied to the road and sidewalks as needed. The dissolution of the salt creates a brine that prevents ice from bonding to the sidewalk. The disadvantages of salt are that it is a highly corrosive material and salt-infused stormwater runoff can cause environmental damage.
- **Treated Salt (or Pre-Wetted Salt)** salt that is sprayed down with a brine solution. This occurs either upon application or in storage prior to being loaded into equipment. Some advantages of using prewetting over dry salt include quicker reaction times, less material and that it works better in lower temperatures (below -7 degrees Celsius). This type of treatment may require special equipment, additional labour to prepare and can cause environmental damage.
- **Sand and Gravel** are primarily used to provide traction but have little ability to melt ice. The application of sand is usually done in conjunction with other de-icing treatments. Sand, particularly if combined with salt, can also have a negative environmental impact.
- **Beet Juice Additive** has been used by some jurisdictions as an additive to other de-icing applications to reduce the number of de-icing applications required and reduce

costs. It is predominantly used on asphalt roadways and trails as the colour can stain concrete. It is an inexpensive additive that improves the adherence of salt and sand and lowers the freezing temperature of the ice. It is less corrosive than using plain road salt. Beet juice still has a negative environmental impact.

- **Cheese Brine Additive** can be used as an additive to salt. The brine helps the salt adhere to the surface and has a lower freezing temperature. Cheese brine additive is also more environmentally friendly than pure salt applications or beet brine and can provide cost savings to municipalities by reducing salt expenditures. Cost savings will vary depending on the proximity to local production sources, as transportation is a major cost factor of supplying the additive.
- **Heated walkways and trails** can help prevent the formation of ice and the accumulation of snow, resulting in cost savings from snow clearing and de-icing materials. Most common examples have an underground tubing system under city sidewalks that pump hot water to warm the sidewalk/trail surface and prevent snow accumulation. However, installation and ongoing heating costs can be relatively high.



Figure 21. Sidewalk Snow Clearing Equipment

SWEEPING

Like snow and ice, in many jurisdictions sweeping sidewalks of leaves and debris is the responsibility of the property owner and is regulated through a bylaw. This bylaw needs to be enforced by the jurisdiction to ensure compliance.

SURFACE CONDITIONS AND QUALITY

Many communities and jurisdictions do not have defined processes for assessing existing sidewalk facilities to determine when they need to be repaired or replaced. Typically, jurisdictions receive most of their input on facility quality from residents and address maintenance issues through a complaint-based system. By developing a sidewalk and trail assessment program that includes a regularly scheduled assessment and maintenance program, a more objective and systematic process can be developed to identify infrastructure improvements.

TEMPORARY AND SPECIAL EVENT CONSIDERATIONS

During times of construction, maintenance and special events, it is imperative that people walking are accommodated to ensure facilities are still accessible. To do this, communities can develop a Road Maintenance Management Plan to accommodate people walking during these events.

Route closures and major detours for people walking should be avoided wherever possible. Instead, the walking should be continued through the affected area using temporary designated facilities. It is not recommended to divert people walking to other corridors or even requiring them to cross the road. Temporary facilities should maintain the constrained limit width of the desired facility. If the affected area involves a construction site with hoarding, the hoarding structure should be constructed to accommodate people walking.

If route closures cannot be avoided, people must be warned of these closures in advance and given adequate detour information to bypass the closed section.

