

Pedestrian Crossing Facilities

Pedestrian Crossing Facilities

ISBN 978-1-4435-7403-7

Copyright © 2010
Queen's Printer for Ontario

All rights reserved.

Ontario Traffic Manual

Foreword

The purpose of the Ontario Traffic Manual (OTM) is to provide information and guidance for transportation practitioners and to promote uniformity of treatment in the design, application and operation of traffic control devices and systems across Ontario. The objective is safe driving behaviour, achieved by a predictable roadway environment through the consistent, appropriate application of traffic control devices. Further purposes of the OTM are to provide a set of guidelines consistent with the intent of the Highway Traffic Act and to provide a basis for road authorities to generate or update their own guidelines and standards.

The OTM is made up of a number of Books, which are being generated over a period of time, and for which a process of continuous updating is planned. Through the updating process, it is proposed that the OTM will become more comprehensive and representative by including many traffic control devices and applications specific to municipal use. Some of the Books of the OTM are new, while others incorporate updated material from the Ontario Manual of Uniform Traffic Control Devices (MUTCD) and the King's Highway Guide Signing Policy Manual (KHGSPM).

The Ontario Traffic Manual is directed to its primary users, traffic practitioners. The OTM incorporates current best practices in the Province of Ontario. The interpretations, recommendations and guidelines in the Ontario Traffic Manual are intended to provide

an understanding of traffic operations and they cover a broad range of traffic situations encountered in practice. They are based on many factors which may determine the specific design and operational effectiveness of traffic control systems. However, no manual can cover all contingencies or all cases encountered in the field. Therefore, field experience and knowledge of application are essential in deciding what to do in the absence of specific direction from the Manual itself and in overriding any recommendations in this Manual.

The traffic practitioner's fundamental responsibility is to exercise engineering judgment and experience on technical matters in the best interests of the public and workers. Guidelines are provided in the OTM to assist in making those judgments, but they should not be used as a substitute for judgment.

Design, application and operational guidelines and procedures should be used with judicious care and proper consideration of the prevailing circumstances. In some designs, applications, or operational features, the traffic practitioner's judgement is to meet or exceed a guideline while in others a guideline might not be met for sound reasons, such as space availability, yet still produce a design or operation which may be judged to be safe. Every effort should be made to stay as close to the guidelines as possible in situations like these, and to document reasons for departures from them.

Custodial Office

Inquiries, suggestions or comments regarding the Ontario Traffic Manual may be directed to:

Ministry of Transportation, Ontario
Traffic Office
301 St. Paul Street, 2nd Floor South
St. Catharines, Ontario
L2R 7R4
Phone: (905) 704-2960
Fax: (905) 704-2888
e-mail: otm@mtg.gov.on.ca

Book 15 Acknowledgements

This latest version of the Ontario Traffic Manual Book 15 (Pedestrian Crossing Facilities) was made possible as a result of the generous contributions from a number of individuals and their organizations. It is important to recognize the contributions of the following:

Consulting Team Members

Project Manager:

Ray Bacquie, P.Eng. – Cole Engineering Group

Project Engineer:

Henry Lo, P.Eng. – HDR | iTRANS

Technical Support:

Michelle Mascarenhas, B.A.Sc. – HDR | iTRANS

Brian Yano – HDR | iTRANS

Joseph Gowrie, B.Eng. – Cole Engineering Group

Advisors:

Margaret Parkhill, P. Eng. – HDR | iTRANS

Maurice Masliah, PhD. – HDR | iTRANS

Quality Control:

Chris Philp, P.Eng – HDR | iTRANS

Project Manager

Marco D'Angelo – Ontario Traffic Council

Technical Committee:

Andrew Beal – Ministry of Transportation

Kari Fellows – Ministry of Transportation

Terry Short – Ministry of Transportation

Lance Dutchak – Ministry of Transportation

John Crass – City of Burlington

Mike Parks – City of Brampton

Stephen Jahns – Municipality of Chatham-Kent

Joe Cafarelli – Region of Durham

Jeff Pammatt – Region of Durham

David Kivi – City of Greater Sudbury

Hart Solomon – City of Hamilton

Deanna Green – City of Kingston

Maged Elmadhoon – City of London

Mark Ridley – City of London

Heide Schlegl – Town of Milton

Colin Patterson – City of Mississauga

Philippe Landry – City of Ottawa

Neal Smith – Region of Peel

Chris King – Region of Peel

Mike Brady – City of Toronto

Fiona Chapman – City of Toronto

Selma Hubjer – City of Vaughan

Bob Henderson – Region of Waterloo

Calvin Mollett – York Region

Copy edit and layout:

David Boss, Boss Communications

Table of Contents

1.	GENERAL INFORMATION	1
1.1	Introduction.....	1
1.2	Sections of this Book.....	1
1.3	Background Principles.....	2
1.3.1	Road Users	2
1.3.2	Right-of-Way Conflict Resolution	3
1.3.3	Understanding of Safety	3
1.3.4	Factors Influencing Safety	4
1.4	Walkability Consideration.....	6
1.5	Classification and Types of Pedestrian Treatments	7
1.6	Use of Terms in This Book.....	8
2.	LEGAL REQUIREMENTS.....	11
2.1	Highway Traffic Act Statutes, Regulations and Case Laws	11
2.1.1	Categories of Pedestrian Crossing.....	11
2.1.2	Pedestrians' Rights and Responsibilities	14
3.	PEDESTRIAN CROSSING DEVICES.....	15
3.1	Overview of Planning for Pedestrian Crossing Facilities	15
3.1.1	Pedestrian Crosswalk.....	16
3.1.2	Decision Process for Consideration of Traffic Control Devices	16
3.2	Controlled Crossings	18
3.2.1	Full Traffic Control Signal	20
3.2.2	Pedestrian Signals (IPS and MPS).....	27
3.2.3	Pedestrian Crossover	30
3.2.4	Stop Controlled or Yield Controlled Intersections	33
3.2.5	Aids for Pedestrian Crossings	34
3.2.5.1	<i>Pedestrian Countdown Signals.....</i>	<i>34</i>
3.2.5.2	<i>Exclusive Pedestrian Phase</i>	<i>35</i>
3.2.5.3	<i>Leading Pedestrian Interval.....</i>	<i>36</i>
3.2.5.4	<i>Audible or Accessible Pedestrian Signals.....</i>	<i>36</i>
3.2.5.5	<i>Pedestrian Delineation.....</i>	<i>37</i>
3.2.5.6	<i>Advanced Stop Bar at Crosswalk</i>	<i>39</i>
3.2.5.7	<i>Pedestrian Crossing Signs.....</i>	<i>39</i>
3.2.6	Supplementary Design Features.....	40
3.2.6.1	<i>Curb Extension.....</i>	<i>40</i>

3.2.6.2	Curb Depressions.....	41
3.2.6.3	Pedestrian Fencing and Barriers.....	41
3.2.7	School Crossings.....	42
3.3	Uncontrolled Pedestrian Crossing	45
3.3.1	Treatments at Standard Intersections or Mid-block Locations.....	48
3.3.1.1	Warning Signs.....	48
3.3.1.2	Refuge Island and Centre Medians	49
3.3.1.3	Curb Extensions.....	51
3.3.1.4	Raised Crosswalk.....	52
3.3.1.5	Courtesy Crossing	52
3.4	Treatment of Pedestrian Crossings at Roundabouts	52
3.5	Pedestrian Crossings at Right Turn Channels	54
3.6	Railway Crossing	55
3.7	Temporary Conditions	58
4.	PHYSICALLY SEPARATED FACILITIES.....	59
4.1	General.....	59
4.2	Feasibility Study	59
5.	ACCESSIBILITY	63
5.1	General.....	63
5.2	Legislative Requirements.....	63
5.3	Designing for Accessibility.....	63
	Curb Ramps.....	64
	Crosswalk Alignment.....	66
	Edge Markings.....	66
	Running Slope and Cross Slope.....	66
	Accessible Pedestrian Signals	66
6.	GLOSSARY / DEFINITIONS	69
7.	REFERENCES	81

List of Figures

Figure 1 – Life Cycle Diagram.....	7
Figure 2 – Decision Process for Pedestrian Crossing Control	17
Figure 3 – Justification 6 – Pedestrian Volume.....	19
Figure 4 – Justification 6 – Pedestrian Delay	19
Figure 5 – Hierarchical System of Control Crossings	20
Figure 6 – Crosswalk Design	22
Figure 7 – Pedestrian Signals	23
Figure 8 – Regulatory and Information Signing for Traffic Control Signals	25
Figure 9 – Intersection Pedestrian Signal (IPS).....	27
Figure 10 – Midblock Pedestrian Signal (MPS)	28
Figure 11 – Pedestrian Crossover (PXO).....	31
Figure 12 – Pedestrian Crossover Signing.....	32
Figure 13 – Pedestrian Countdown Timers Display Configuration	35
Figure 14 – Exclusive Pedestrian Phase	35
Figure 15 – Pavement Marking for Ladder Crosswalk.....	38
Figure 16 – Pedestrian Visibility with Advanced Stop Bar	39
Figure 17 – Example Curb Extension	41
Figure 18 – School Zone Signs (Regulatory).....	44
Figure 19 – School Zone Signs (Warning)	45
Figure 20 – Traffic Control Device - Justification 6 - Pedestrian Volume.....	47
Figure 21 – An example Roundabout without Pedestrian Crosswalk	53
Figure 22 – Right-turn channel – “Smart Channel” Example Configuration	56
Figure 23 – Pedestrian Direction Sign (TC-40).....	58
Figure 24 – Grade Separated Pedestrian Crossing Accessibility.....	61

List of Tables

Table 1 – Factors Influencing Safety	4
Table 2 – Walkability Considerations	6
Table 3 – Controlled and Uncontrolled Crossings	11
Table 4 – Pedestrian Right-of-way Designation at Controlled Crossings	12
Table 5 – Summary of References in Ontario Traffic Manual Book 12	26
Table 6 – Pedestrian Crossover Signs and Marking.....	30
Table 7 – References on Application Guideline for Pedestrian Crossover	32
Table 8 – Application Guideline for STOP and YIELD Controlled Intersections	33
Table 9 – Pedestrian Crossing Signs.....	40
Table 10 – Warning Signs.....	48
Table 11 – Typical Conditions for Consideration of Pedestrian Refuge Island.....	50
Table 12 – Curb Ramp Designs	64

1. General Information

1.1 Introduction

The purpose of the Ontario Traffic Manual (OTM) Book 15 is to provide practical guidance and application information on the planning, design, and operation of pedestrian roadway crossings for transportation practitioners and to promote uniformity of approaches across Ontario. Further objectives of the OTM are to provide a set of guidelines consistent with the intent of the [Highway Traffic Act](#) (HTA)¹ and to provide a basis for road authorities to generate or update their own guidelines and standards.

The OTM is a Traffic Engineering publication made up of a series of 22 Books, which are being developed over a period of time, and for which a process of continuous updating is planned. The series of Books encompasses guidelines on different traffic control devices and the *OTM Book 15 – Pedestrian Crossing Facilities* has been developed as a guideline focused on pedestrian crossing applications. The *OTM Book 15 – Pedestrian Crossing Facilities* is directed to traffic practitioners as its primary users.

The *OTM Book 15 – Pedestrian Crossing Facilities* includes consolidated references to relevant material that is provided in other OTM Books as applicable to pedestrian treatments. For newly established practices, Book 15 will supersede the *Manual of Uniform Traffic Control Devices for Ontario (MUTCD, 1995)* and update previously released OTM Books. A complete listing of the planned and currently available OTM volumes is found in Book 1. A new edition of Book 1 will be produced to coincide with the production of each new Book or Books in the OTM. This is necessary in order to have a master table of contents and indexes which are up-to-date at any given time. Book 1 should be read prior to the use and application of any of the other Books

in the OTM. The use of any of the devices and applications discussed in those Books should be considered in conjunction with the contents of other related OTM Books as appropriate.

The OTM incorporates current best practices in Ontario. The guidelines are intended to provide an understanding of traffic operations and they cover a broad range of traffic situations encountered in practice. They are based on many factors which may determine the specific design and operational effectiveness of traffic control systems. However, no manual can cover all contingencies or all cases encountered in the field. Therefore, field experience and knowledge of application are essential in deciding what to do in the absence of specific direction from the Manual itself and in overriding any recommendations in the Manual. Similarly, municipalities may need to adopt policies that reflect local conditions. The traffic practitioner's fundamental responsibility is to exercise engineering judgment on technical matters in the best interests of the public and workers. Guidelines are provided in the OTM to supplement professional experience and assist in making those judgments.

This manual also refers to various publications produced by the Ministry of Transportation Ontario (MTO) and other agencies such as the Institute of Transportation Engineers (ITE), the Transportation Association of Canada (TAC) and the Ontario Traffic Council (OTC). Links to the current official web sites are listed in the printed version of this manual.

1.2 Sections of this Book

This manual is organized in the following order:

- **Section 1, General Information** — this section provides the background information about this manual as it relates to pedestrian crossings. This includes an overview of basic principles important to understanding and meeting the fundamental objectives of traffic control devices; the broader walkability

consideration in the planning process of pedestrian facilities; the classification and types of pedestrian treatments available; and an introduction on the specific use of terms when reading this book.

- **Section 2, Legal Requirements** — this section outlines the relevant legal requirements and interpretations as they pertain to pedestrian crossings, specifically the rules of the road governing motorists' and pedestrians' movements at different forms of controlled crossing and uncontrolled crossing locations. This section further highlights pedestrians' right-of-way and responsibilities.
- **Section 3, Pedestrian Crossing Devices** — this section provides guidance on the recommended practice for pedestrian crossing controls. Guiding principles for the planning and decision process are introduced for considering different methods of crossing options. Each crossing type is further described and organized based on a hierarchical system of controlled crossing options, namely traffic control signals, pedestrian signals, pedestrian crossovers, and stop controlled or yield controlled intersections. Other crossing conditions addressed include school crossings, uncontrolled crossings, crossings at roundabouts, crossings at right turn channels and railway crossings.
- **Section 4, Physically Separated Facilities** — this section provides guidelines and recommended practice for the application of physically separated facilities.
- **Section 5, Accessibility** — this section provides guidelines and recommended practice for accessibility consideration, and identifies the specific requirements for pedestrian crossings according to the [Accessibility for Ontarians with Disabilities Act, 2005](#).

1.3 Background Principles

Traffic control and management relies on a system of traffic control devices for conveying messages to the road users. The objective of these messages is to advise road users (see **Section 1.3.1**) of traffic regulations to enable observance of the law, warn them of roadway characteristics or road hazards, and provide them the necessary tools and information for informed decision-making. Meeting these objectives improves safety and convenience for road users, and promotes the efficient movement of people and goods and the orderly flow of traffic.

The underlying fundamental principles encompass understanding of the intent of the pedestrian / vehicle right-of-way rules as set out in the [Highway Traffic Act](#), safety and human factors considerations of different road users such as pedestrians and motorists, including pedestrian groups requiring special needs (e.g., school children, the elderly, persons with a mobility limitation), and design consistency (see **Section 1.3.1** – **Section 1.3.4**).

1.3.1 Road Users

A road user may include a pedestrian, a driver or a passenger of a vehicle, a rider of a motor bike or bicycle, a ridden or herded animal, or an animal-drawn vehicle; wherein for the purposes of this book the following definitions apply:

1. A **pedestrian** includes:
 - a) A person who is not in or upon a vehicle, motorized or otherwise propelled
 - b) A person in a non-motorized wheelchair
 - c) A person in a motorized wheelchair that cannot travel at over 10 kilometres per hour
 - d) A person pushing a bicycle, motorized or non-motorized wheelchair

2. A **vehicle** includes a motor vehicle, trailer, traction engine, farm tractor, road-building machine, bicycle, scooter, and any vehicle drawn, propelled or driven by any kind of power, including muscular power, but does not include a motorized snow vehicle or streetcar.

Traffic is comprised of all road users as defined in **Section 6 Glossary / Definitions.**

1.3.2 Right-of-Way Conflict Resolution

Pedestrian crossing control includes various types of signs, devices and pavement markings designed to regulate the flow of vehicles and pedestrians and to minimize risks associated with conflicting traffic movements, on different classes of roads, including bicycle paths, local roads, urban and rural arterial and collector roads, highways and expressways. Applications of pedestrian crossing control must be consistent with the [Highway Traffic Act](#)ⁱ that governs the control and the rules of the road for right-of-way determination. The legal requirements within the context of pedestrian crossing facilities and right-of-way conflict resolution can be referred to in **Section 2.**

1.3.3 Understanding of Safety

Within the context of traffic operations, safety is defined as the degree to which road users are free from the occurrence of danger, loss or injury (real or perceived).

Safety in the Transportation Environment: In the road transportation environment, the probability of harm exists primarily from motor vehicle conflicts and collisions. The three elements that comprise the transportation system are: the road user, the vehicle and the road environment. Any or all of these elements can contribute to conflicts and collisions. Collisions occur as a result of an error or fault that can be attributed to one or more of the contributing elements.

Quantifying Safety: Safety of any transportation facility is typically measured by the collision history over time. Traffic safety practitioners have developed statistically reliable methods for quantifying the safety of various transportation facilities. For example, the safety of a specific facility, such as an intersection, pedestrian crossing or roadway section can be measured by comparing the average collision frequency to the statistically estimated collision frequency for that type of facility for a given time period. In simple terms, an existing facility is considered to have a lower potential for safety improvement if the average number of collisions is lower or equal to the frequency expected. Because collisions are relatively unpredictable events, proxy measures of safety may be used, such as the number of conflicts observed during a fixed period of time. A conflict is defined as a traffic event involving the interaction of two or more road users where an evasive action such as braking or swerving occurs to avoid a collision.ⁱⁱ

Qualifying Security: Security is the perception of how safe a road user feels in the road environment, as opposed to the actual level of safety. Road users' perception that a facility is "safe" or "safer" is based on their experience and knowledge. For a given state, the road environment and vehicle generally behave in a repeatable, predictable fashion. However, for a given situation, the human element in the system has a wide range of responses, some unexpected. Driver and pedestrian behaviour is at least partly based on their perception of risk, and road users do not always evaluate risk consistently. Therefore, road users' actions can be attributed to their acceptance of perceived level of risk.

Influencing Safety and Security: The installation or modification of a transportation facility may or may not yield the desired change in either safety or security. It is up to practitioners to use their best engineering judgment to understand the environment and the road users and to predict

as accurately as possible the effects of the modification. Practitioners should also consider that improving safety may still not improve the sense of security for the user and vice versa.

Higher levels of safety occur where there is the proper level of right-of-way control for the road type, roadside environment, volume of pedestrians, age / type of pedestrians, volume of vehicles, and related factors. It also occurs when pedestrians and drivers have a clear understanding of what they are supposed to do and what other road users are likely to do, enough information (including clear sight lines and appropriate guidance) to make safe decisions, and the ability to make those decisions and execute them.

It is imperative that practitioners have a full understanding of the details of available research in order to assess the applicability of research findings to their roadway environment. Alternatively, jurisdictions can develop their own quantifiable before and after study processes to quantify safety impacts.

1.3.4 Factors Influencing Safety

Contributing factors that influence the level of safety within the context of pedestrian roadway operations may include:

- The degree of pedestrian-vehicle interaction
- Vehicle speeds
- Road users' expectancy
- Road users' perception
- Road users' awareness
- Road users' ability (mobility, vision, hearing and cognition)
- Road users' understanding of the rules of the road

Each factor contributes to the overall level of safety of a crossing location and represents part of the consideration for pedestrian crossing treatments. These factors are shown in **Table 1**.

Table 1 – Factors Influencing Safety

Factors Influencing Safety	Related Impacts and Considerations for Treatment of Pedestrian Crossings
Degree of pedestrian-vehicle interaction	The potential for conflicts and collisions is directly affected by the level of interaction between road users. A higher exposure of pedestrians interacting with vehicles (from higher vehicle or pedestrian volumes) will generally result in a higher potential for pedestrian collisions.
Vehicular speed	The higher the vehicular speed at the time of impact, the higher the probability of fatality of pedestrians. Relatively small changes in speed can have a large impact on the severity of a pedestrian crash (particularly between 40 km/h and 60 km/h). ⁱⁱⁱ
Driver and pedestrian expectancy	Expectancy influences the speed and accuracy of information processing; and conditions that meet or reinforce expectancies help drivers and pedestrians to respond quickly, efficiently and without error. Violations of expectancy increase the chance of inappropriate decisions that lead to conflicts or inability to control vehicles safely.

Factors Influencing Safety	Related Impacts and Considerations for Treatment of Pedestrian Crossings
Perception (visual acuity and visual contrast)	<p>There is an inherent limitation in drivers' or pedestrians' ability to detect objects, especially under low visibility conditions. The amount of sight distance available is not the same as the distance at which the driver or pedestrian can detect and identify a conflicting object. Furthermore, the difference between visual acuity and visual contrast should also be considered. Visual acuity is a measure of the ability to identify black symbols on a white background at a standardized distance. The common threshold of "20/20 vision" translates to the ability to read text at 17 metres away for every 2.5 centimetres of text height. Visual contrast on the other hand is the ability to distinguish between various shades of gray. At night, a driver's visual contrast is much more important for detecting pedestrians than visual acuity. Both visual acuity and visual contrast decline continuously with age. In particular vision performance begins to worsen at age 20. The decline in visual acuity increases most rapidly after age 40 for objects perceived while in relative motion to the target (driving), and after age 60 for static objects.ⁱⁱⁱ</p>
Level of awareness (positive guidance and driver workload)	<p>Humans behave as a single channel processor, which means they are able to conduct one task consciously at a time. A more complex driving environment will therefore require a higher level of mental effort and reduce one's ability to focus upon the driving tasks. Positive guidance considers a driver's workload and reduce the occurrence of multiple potential conflicts. As defined in OTM Book 1C, "Positive Guidance is provided when that information is presented unequivocally, unambiguously and conspicuously enough to meet decision sight distance criteria and enhances the probability of drivers making appropriate speed and path decisions."</p>
Comprehension of crossing requirements	<p>Ambiguity in the form of crossing features can affect the consistency of driver and pedestrian behaviour in yielding right of way. An inconsistency in road user behaviour can lead to reduced safety.</p>
Pedestrian ability	<p>Pedestrians differ in terms of their mobility, their speed, and their ability to perceive and react to potential conflicts, and recognize and understand traffic control devices. Designs for crossing devices should have regard for the needs of all pedestrians (i.e., the elderly, the young, and persons with a disability).</p> <p>It is also important to note that under the Accessibility for Ontarians with Disabilities Act, 2005, design elements as part of pedestrian crossings must meet the mandatory accessibility standards (see Section 5.3).</p>
Rules of the road	<p>The rules of the road under the Highway Traffic Actⁱ provide the basis that governs and manages competing traffic movements; however, inconsistent interpretation, ignorance, or disregard of the law leads to potential for conflicting actions. A balance of continuous education and enforcement contributes to the general population's awareness and understanding, which contributes to the overall safety.</p>

1.4 Walkability Consideration

Walkability is a measure of the level of integration of pedestrian facilities (such as sidewalks, trails and crossings) into the urban environment. It considers the ease in which pedestrians can move through the transportation network enjoyably and safely. A walkable environment serves to encourage a healthier lifestyle by promoting walking or the use of non-motorized means of transportation.

Pedestrian crossings are a critical element among the many factors that influence the overall walkability of an environment. The factors that can affect walkability are shown in **Table 2** and include, but are not limited to, distance of the trip, perceived safety and security of the route, and the comfort and convenience of walking versus the alternative modes of transportation.^{iv, v}

Table 2 – Walkability Considerations

Distance of the trip	Most people are willing to walk 5 to 10 minutes at a comfortable pace to reach a destination with walking trips averaging a distance of 0.4 km. The threshold for walking trips is approximately 1.6 km in distance. ^{vi} As a result, land-use patterns, community design and population density are great determinants in trip distance and ultimately determine whether a community is walkable.
Perceived safety and security of the route	<p>Walkway design can impact the perceived safety and security by pedestrians. The following are examples of elements that directly impact the perceived and actual safety of pedestrians:^{vi}</p> <ul style="list-style-type: none"> • Sidewalks that are too narrow and / or adjacent to vehicular traffic • Pedestrian crossings that have confusing signal indications • Pedestrian crossings that have excessive crossing distances • Pedestrian crossings with fast-turning vehicles • Presence of other pedestrians • Inadequate illumination (poorly lit areas) • Excessive vehicular speeds adjacent to the pedestrian walkway • Passage through secluded areas
Comfort and Convenience	<p>The decision to walk is also influenced by comfort, convenience, visual interest and the existence of potential destinations along the route. Unlike motorists, the slower speed of pedestrians results in a preference for more rather than less environmental stimuli. Some factors that create a visually interesting environment that is conducive to walking include:</p> <ul style="list-style-type: none"> • A good mix of land use • Continuous and connected pedestrian facilities • Ample separation of pedestrian facilities from high-speed vehicular traffic • Safe, convenient and unambiguous street crossings • Streetscaping and street furniture • Air quality • Shade or sun in appropriate seasons • Proper maintenance of facilities • Access to mass transit

While Book 15 serves to provide guidance focused on pedestrian crossings, the overall planning of pedestrian facilities should take into consideration all factors influencing walkability and with an overarching view of developing a system of network elements through an integrated planning approach.

1.5 Classification and Types of Pedestrian Treatments

The appropriate selection of facility and treatment options for pedestrian crossings is governed by the existing or anticipated conditions and by the complexity of the surrounding environment. The complexity of the environment may encompass

a range of influencing factors such as pedestrian and vehicle volumes and their level of interaction (exposure), vehicle speeds (type of exposure), the crossing distance (length of exposure), road users characteristics (age, ability, understanding, expectation and behaviour), and visibility conditions. In general, the more complex the condition, the more sophisticated the treatment measures that may be required.

Pedestrian crossings may be classified by a hierarchy of pedestrian treatment options in relation to the complexity of the environmental conditions (see **Figure 1**).

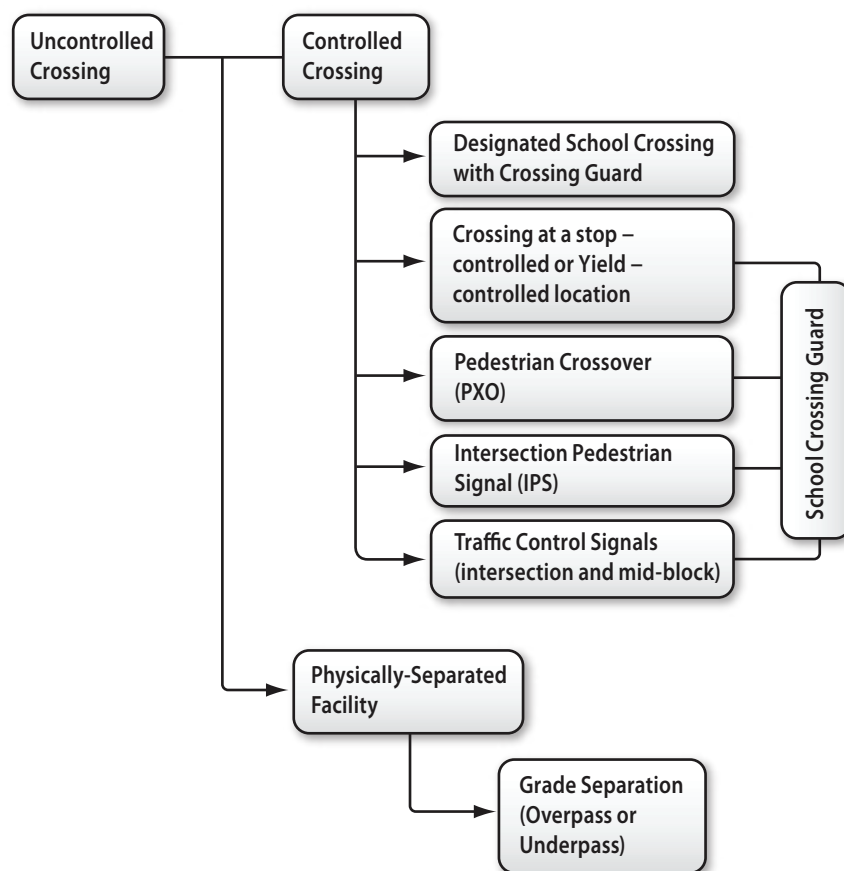


Figure 1 – Life Cycle Diagram

Uncontrolled crossings are locations where pedestrians cross without the aid of traffic control measures and a dedicated pedestrian right-of-way. At these locations, pedestrians need to wait for safe gaps in traffic before attempting to cross on the roadway while drivers must always be in control of their vehicle and have due concern for the safety of other road users, including pedestrians. At an uncontrolled location, the pedestrian must not enter the roadway if vehicles are not able to stop and drivers must make every effort to avoid a collision. This dual responsibility puts the onus on both road users for each other's safety as there is no prescribed right-of-way. As pedestrians are the more vulnerable road user, they must take extra care to ensure that all approaching drivers have seen them and have or will be able to stop safely, before considering entering the roadway.

Under more complex conditions, traffic control measures may be used to provide pedestrians added protection when crossing. Controlled crossings, in order of increasing complexity, may include locations that are controlled by stop or yield signs, pedestrian crossovers (PXO), intersection pedestrian signals (IPS or half signals), mid-block pedestrian signals (MPS) or full traffic control signals. The use of adult school crossing guards is also considered to be a form of pedestrian control at designated crossings during school periods. The crossing guard ensures opportunities for children and other pedestrians to cross in safety. School crossing guards are normally stationed at marked school crossings but may be stationed at locations that are controlled intersections.

Physically-separated facilities are grade-separated crossings either in the form of an overpass or an underpass. They provide for the highest form of pedestrian protection by physically separating vehicular and pedestrian traffic. Grade separation may be considered if other forms of controlled crossings are not appropriate or when there are insufficient gaps and obvious safety concerns with at-grade pedestrian crossings where sufficient property exists to build the structures.

1.6 Use of Terms in This Book

In Ontario, many aspects of traffic control devices are specified in law (for example, the meaning of specific signal indications or traffic signs). Others are based on standards intended to establish consistency throughout the province, while other aspects are founded on recommendations established through experience. In this publication, specific terms are adopted to convey intended differences in meaning. These terms and the corresponding meanings are as follows:

“Legal Requirement(s)”, “Legally Required”, “Legal” and equivalent terms mean that the requirement is the law of Ontario as established under the [Highway Traffic Act](#)ⁱ and its Regulations, or is a legal requirement under the municipal by-laws. The requirement is typically described by the use of “shall” or “must”. **“Must”** or **“Shall”** indicates that the requirements of the design or application of the device as described in this manual are mandatory.

“Interpretation” means the interpretations and emphasis of the legal requirements. The interpretations are not necessarily the precise wording of the [Highway Traffic Act](#)ⁱ and its Regulations. Interpretations are given in lay language and may include some industry jargon.

“Recommended Practice” suggests a consistent manner in which the legal requirements and interpretations are applied using the typical procedures and equipment in use in Ontario. The recommended practices are not necessarily the only practices available based on the interpretation of the legal requirements or the selection of equipment or methods of operation. The recommendation is typically described by the use of “should”. **“Should”** indicates that the action is advised; recommended but not mandatory.

“Guideline” suggests a method of practical application of the legal requirements and interpretations using the typical procedures, equipment and methods of operation in use in Ontario. The guidelines are meant to provide guidance to those road authorities that may be unsure of the methods of application. A guideline has no legal connotation and several alternate methods of achieving the same result may be available. A guideline is typically described by the use of “may”. **“May”** indicates a permissive condition. No requirement for design or application is intended.

“Standards” is a prescribed value for a specific design feature, which practice or theory has shown to be appropriate for a specific set of circumstances and where no unusual constraints influence the design.^{vi} Standards are based on prevailing and predicted vehicle performance, pedestrian and driver behaviour and performance, and current technologies. Because these factors will vary with time and location, standards must be revised and updated periodically. How they are applied depends on agency policies, and local transportation characteristics^{vii}. *OTM Book 15 – Pedestrian Crossing Facilities* is intended to be a guideline and not a standard for road authorities.

2. Legal Requirements

2.1 Highway Traffic Act Statutes, Regulations and Case Laws

The Ontario [Highway Traffic Act](#)ⁱ defines the rules of the road, including conditions under which pedestrians can cross a road and walk within the roadway. The [Highway Traffic Act](#)ⁱ identifies the responsibilities and rights of pedestrians and drivers for different forms of pedestrian crossings. This section provides an overall synopsis of the rules of the road as defined and interpreted in the latest version of the [Highway Traffic Act](#)ⁱ at the time of this publication.

2.1.1 Categories of Pedestrian Crossing

The [Highway Traffic Act](#)ⁱ rules of the road indicate that when a pedestrian is about to step from the side of the road onto the roadway, there are fundamentally two distinct categories of pedestrian crossings. The crossing may be either:

1. A controlled crossing — where vehicles are required to stop or yield to traffic legally in the intersection, which includes pedestrians, or

2. An uncontrolled crossing — where pedestrians must wait for safe gaps in traffic, sufficient for them to cross the roadway, prior to attempting to enter the roadway.

An uncontrolled crossing is a crossing that does not have any traffic control measure to provide a dedicated pedestrian right-of-way. Pedestrians must wait for a safe gap sufficient to fully cross the roadway or for vehicles to stop before crossing. In accordance with Ontario's [Highway Traffic Act](#)ⁱ, protected pedestrian crossings in the Province of Ontario are only at locations where vehicles are controlled by any of the following: traffic signals, intersection pedestrian signals, mid-block pedestrian signals, pedestrian crossovers, stop signs, yield signs or school crossings when an adult school crossing guard is supervising the crossing.

Table 3 summarizes those conditions where there are controlled crossings and those that are uncontrolled. The types of controlled crossing and the pertinent right-of-way rules as proclaimed in the [Highway Traffic Act](#)ⁱ are referenced in **Table 4**.

Table 3 – Controlled and Uncontrolled Crossings

Controlled Crossings	Uncontrolled Crossings
<ul style="list-style-type: none"> • Traffic Control Signals • Intersection Pedestrian Signals • Pedestrian Crossover • STOP Sign • YIELD Sign • Designated School Crossing with Crossing Guard 	<ul style="list-style-type: none"> • Midblock Crossings (in the absence of traffic control signals, intersection pedestrian signals or pedestrian crossover) • Designated School Crossing (in the absence of a crossing guard and without other forms of control such as traffic control signals, intersection pedestrian signals, pedestrian crossover, STOP signs or YIELD signs) • Marked Crossing (at intersection in the absence of STOP or YIELD signs)

Table 4 – Pedestrian Right-of-way Designation at Controlled Crossings

Controlled Crossing	Pedestrian Right-of-Way
<p>Traffic Control Signals or Intersection Pedestrian Signals where Pedestrian Control Indications are installed.</p>	<p>According to the Highway Traffic Act Section 144 – Traffic Control Signals and Pedestrian Control Signals, a pedestrian crossing is controlled by the WALK, FLASHING DON'T WALK and the DON'T WALK indicators:</p> <p>Pedestrian Crossing (22) Where portions of a roadway are marked for pedestrian use, no pedestrian shall cross the roadway except within a portion so marked. R.S.O. 1990, c. H.8, s. 144 (22).</p> <p>Pedestrian Control Signals - Walk (26) Where pedestrian control signals are installed and show a “walk” indication, every pedestrian facing the indication may cross the roadway in the direction of the indication despite subsections (24) and (25). R.S.O. 1990, c. H.8, s. 144 (26).</p> <p>Pedestrian Control Signals – Don’t Walk (27) No pedestrian approaching pedestrian control signals and facing a solid or flashing “don’t walk” indication shall enter the roadway. R.S.O. 1990, c. H.8, s. 144 (27).</p> <p>Pedestrian Right of Way (28) Every pedestrian who lawfully enters a roadway in order to cross may continue the crossing as quickly as reasonably possible despite a change in the indication he or she is facing and, for purposes of the crossing, has the right of way over vehicles. R.S.O. 1990, c. H.8, s. 144 (28).</p>
<p>Pedestrian Crossover</p>	<p>According to the Highway Traffic Act Section 140 – Pedestrian crossover, duties of driver:</p> <p>(1) Subject to subsection (2), when a pedestrian or a person in a wheelchair crossing a roadway within a pedestrian crossover,</p> <ul style="list-style-type: none"> (a) is upon the half of the roadway upon which a vehicle or street car is travelling; or (b) is upon half of the roadway and is approaching the other half of the roadway on which a vehicle or street car is approaching so closely to the pedestrian crossover as to endanger him or her, <p>the driver of the vehicle or street car shall yield the right of way to the pedestrian or a person in a wheelchair by slowing down or stopping if necessary. R.S.O. 1990, c. H.8, s. 140 (1).</p>

Controlled Crossing	Pedestrian Right-of-Way
STOP Signs	<p>According to the Highway Traffic Act Section 136 – Stop at through highway:</p> <p>(1) Every driver or street car operator approaching a stop sign at an intersection,</p> <p>(a) shall stop his or her vehicle or street car at a marked stop line or, if none, then immediately before entering the nearest crosswalk or, if none, then immediately before entering the intersection; and</p> <p>(b) shall yield the right of way to traffic in the intersection or approaching the intersection on another highway so closely that to proceed would constitute an immediate hazard and, having so yielded the right of way, may proceed. R.S.O. 1990, c. H.8, s. 136 (1).</p> <p><u>Interpretation</u> Traffic includes pedestrians, ridden or herded animals, vehicles, bicycles, inline skaters, scooters and other conveyances, either singly or together, while using a highway for purposes of travel.</p>
Yield Right-of-Way Signs	<p>According to the Highway Traffic Act Section 138 – Yield right-of-way signs:</p> <p>(1) The driver or operator of a vehicle or street car approaching a yield right-of-way sign shall slow down to a speed reasonable for the existing conditions or shall stop if necessary as provided in clause 136 (1) (a) and shall yield the right of way to traffic in the intersection or approaching on the intersecting highway so closely that it constitutes an immediate hazard and having so yielded may proceed with caution. R.S.O. 1990, c. H.8, s. 138 (1).</p> <p><u>Interpretation</u> Traffic includes pedestrians, ridden or herded animals, vehicles, bicycles, inline skaters, scooters and other conveyances, either singly or together, while using a highway for purposes of travel.</p>
School Crossing Guard	<p>Adult school crossing guards may also provide a designated right-of-way for school children as vehicles must yield to a crossing guard. According to the Highway Traffic Act Section 176 – School crossings:</p> <p>School crossing guard shall display sign</p> <p>(2) A school crossing guard about to direct persons across a highway with a speed limit not in excess of 60 kilometres per hour shall, prior to entering the roadway, display a school crossing stop sign in an upright position so that it is visible to vehicles approaching from each direction and shall continue to so display the school crossing stop sign until all persons, including the school crossing guard, have cleared the roadway. 2005, c. 26, Sched. A, s. 29 (1).</p> <p>Vehicles approaching guard displaying sign</p> <p>(3) Where a school crossing guard displays a school crossing stop sign as provided in subsection (2), the driver of any vehicle or street car approaching the school crossing guard shall stop before reaching the crossing and shall remain stopped until all persons, including the school crossing guard, have cleared the half of the roadway upon which the vehicle or street car is travelling and it is safe to proceed. 2005, c. 26, Sched. A, s. 29 (1).</p>

The rules of the road are distinct between a controlled crossing and an uncontrolled crossing. Although crossing at an uncontrolled crossing is not illegal, pedestrians do not have the right-of-way. Both forms of crossing may be appropriate given the governing conditions and measured or anticipated pedestrian demand.

2.1.2 Pedestrians' Rights and Responsibilities

Notwithstanding the distinction between controlled and uncontrolled crossings, the rights and responsibilities for pedestrians are recognized in the [Highway Traffic Act](#):

1. In the absence of statutory provisions or by-law, a pedestrian is not confined to a street crossing or intersection and is entitled to cross at any point, although greater care may then be required of him or her in crossing. However, pedestrians crossing the highway must look to ensure the crossing can be made safely or possibly be held responsible for any ensuing collision.
2. Pedestrians must exercise due care even when they are lawfully within a crossing and have right-of-way. It is not an absolute right and they must still exercise care to avoid a collision with a vehicle.
3. If there is a crosswalk at a signalized intersection, pedestrians have to walk within the crosswalk:

Section 144 (22) – Duty at Traffic Lights — Pedestrian Crossing – where portions of a roadway are marked for pedestrian use, no pedestrian shall cross the roadway except within a portion so marked.

3. Pedestrian Crossing Devices

3.1 Overview of Planning for Pedestrian Crossing Facilities

Pedestrian attractors / generators include such facilities as transit stops, schools, malls, buildings, trail links, and sidewalk connections. There can be multiple pedestrian attractors / generators alongside any given road and the interaction and linkage between these facilities naturally leads to pedestrian crossing demands. The multiple points of origin and destination, and the arbitrary tendency of pedestrian crossing behaviour, can result in multiple desired paths of crossing and conflict points with vehicular traffic at midblock and/or at intersection locations.

In spite of the natural tendencies of pedestrians, their decisions on where, when or whether to cross are influenced by a number of factors. These include:

- **Pedestrian behaviour and comfort level** in terms of their perception of safety, the pleasantness of where they are walking, and their understanding of the rules of the road.
 - **Availability, proximity and quality of nearby pedestrian facilities** — pedestrians may choose to cross at a nearby pedestrian facility where controlled crossing is provided.
- Implementing pedestrian crossing control under the appropriate condition could potentially facilitate crossings and increase safety by:
- Consolidating and delineating the desired paths of pedestrian crossings, thereby reducing the number of conflict points on the roadway
 - Managing gaps and controlling flow of traffic through the use of standard signs, devices and pavement markings to minimize risks associated with conflicting movements
- **The frequency and nature of gaps in streams of vehicles** as it relates to the level of traffic volume, speed of traffic and the overall platoon effect. At crossing locations without traffic control, the higher the traffic volume and speed, the higher the exposure and the more difficult it is to find a vehicle gap to cross. High vehicular volumes and speeds can also inhibit a perception of safety.
 - **Pedestrians' physical ability** — persons with a disability, seniors or young children will proceed to cross at a slower speed and therefore will take longer to complete a crossing.

Nevertheless, there are inherent limitations to which pedestrian crossings can be implemented on a road. These limitations include the practical spacing requirements, cost and cost effectiveness of implementation, operation / maintenance requirements of crossings, and the possibility of decreased safety for vehicle occupants and decreased air quality. A proactive approach is ideally recommended such that the feasibility of pedestrian crossing facilities be considered as early in the planning and design process of new roads as possible to enable greater flexibility in managing the potential locations for a crossing — in a manner that could be more feasible, efficient, desirable, and safe; and at the same time, well-integrated with the overall network. The planning should commence in the land-use decision-making process and involve all stakeholders in the consultation.

Conversely, it is recognized that while it is desirable to adopt a proactive and integrated approach to pedestrian facilities planning early in the process, decisions on pedestrian facilities are often dictated by pre-existing conditions. This may at times limit the options available to practitioners. Nevertheless, the purpose of this section is to provide a guideline on the consideration of different types of pedestrian crossings for different conditions and to describe the type of supplementary features that may be used to enhance the overall quality of pedestrian crossings.

3.1.1 Pedestrian Crosswalk

According to the Ontario [Highway Traffic Act R.S.O. 1990 c.H.8 Section 1 \(1\)](#), a “crosswalk” means,

- a) that part of a highway at an intersection that is included within the connections of the lateral lines of the sidewalks on opposite sides of the highway, measured from the curbs or, in the absence of curbs, from the edges of the roadway, or
- b) any portion of a roadway at an intersection or elsewhere distinctly indicated for pedestrian crossing by signs or by lines or other markings on the surface.

In Ontario, the [Highway Traffic Act](#)ⁱ defines crosswalks without distinction between controlled and uncontrolled crossing locations. In spite of this, the rules of the road are distinct as noted in **Section 2.1.1**. In the absence of stop/yield signs, pedestrian crossover, or half or full traffic control signals, pedestrians at an uncontrolled crossing location are required to wait for gaps in vehicular traffic before crossing. Options for pedestrian crossings may be classified by a hierarchy of pedestrian treatment options in relation to the complexity of the environmental conditions (see **Section 1.5, Figure 1**). These options are further described in the subsequent sections.

3.1.2 Decision Process for Consideration of Traffic Control Devices

The need for traffic control devices stems from the necessity to manage the interaction between flows of conflicting road users. Since the mix of road users will vary by location, the need and justification for these traffic control measures may or may not be directly attributed to pedestrian demands. Regardless, considerations for pedestrians are a requirement in the planning and implementation of traffic control devices such that:

- In assessing pedestrian crossing needs, consideration should be given to the warrants for traffic control devices that include provisions for controlled crossings.
- Where traffic control devices are implemented, measures for pedestrian crossings must be assessed and incorporated as part of the traffic control while encouraging the overall continuity and connectivity of the road network.

Figure 2 illustrates an example of a decision process for planning of traffic control devices within the context of pedestrian crossings. The reasoning behind the process is based on the following:

1. A preliminary assessment of the traffic condition should be conducted based on field-generated data that includes vehicle volumes, pedestrian volumes, delays to pedestrians to cross the road, adjacent land use / site generators, road geometry, roadway speed and collision data. Field-generated data are assessed to facilitate selecting an appropriate control device for further evaluation and assessment. Field data also provides insight into potential operational or safety issues that may arise subsequent to the implementation of traffic control devices.

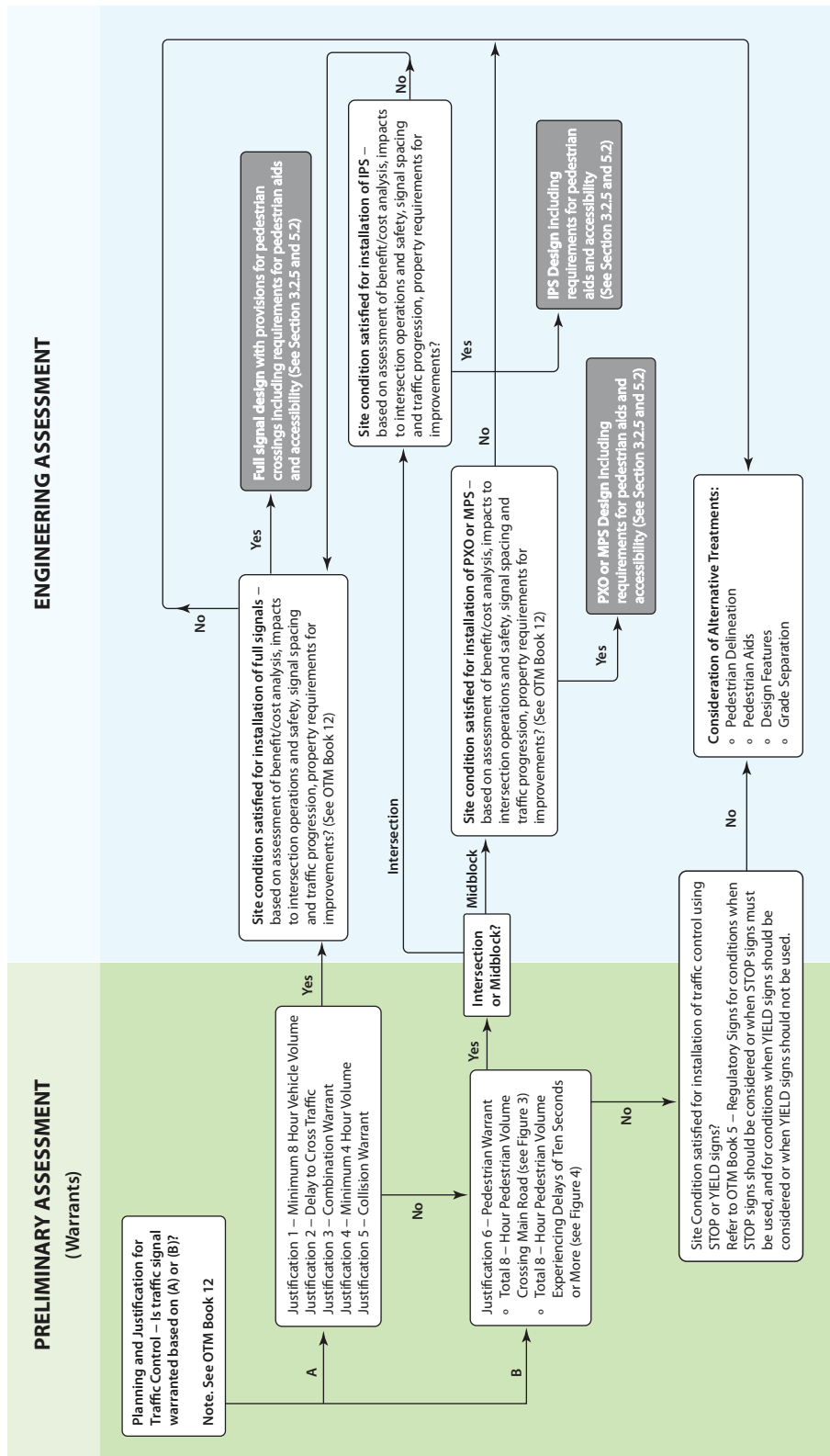


Figure 2 – Decision Process for Pedestrian Crossing Control

2. In the preliminary assessment, a full traffic signal may be warranted such that the thresholds in the [OTM Book 12 – Traffic Signals](#) are met (see **Figure 3** and **Figure 4**). The varying thresholds in Book 12 are expressed in Justifications 1 to 6:
 - a) If any of Justifications 1 to 5 is met, further engineering assessment will be required to ensure satisfactory conditions for the installation of traffic control signals. Though pedestrian needs may not be the predominant factor in these warrant justifications, the design and implementation of traffic control signals will include requirements for pedestrian accommodation, pedestrian aids as appropriate and accessibility features.
 - b) If only Justification 6 is met, further engineering assessment will be required to determine the appropriate pedestrian crossing control device alternative, namely intersection pedestrian signals or pedestrian crossovers for crossings at intersections, and midblock pedestrian signals or pedestrian crossovers for crossings at midblock. If Justification 6 is met and any of Justifications 1 to 5 warrants is approaching 100%, consideration can be given to installing a traffic control signal in lieu of an IPS.
3. The condition at an intersection may be such that none of Justifications 1-6 can be met. As such, traffic control using STOP or YIELD signs may be required at intersections with conflicting traffic movements if satisfactory conditions are met according to [OTM Book 5 – Regulatory Signs](#). While not a pedestrian crossing control device, vehicular traffic facing a STOP or YIELD sign is required to yield to crossing traffic including pedestrians.
4. The condition at an intersection or midblock may be such that none of the traffic control devices are appropriate. Alternative treatments will then need to be considered under this scenario.

In summary, at a location where a pedestrian crossing is being considered, the need for traffic control signals may be assessed and warranted based on volume thresholds being met for vehicle traffic or for pedestrian traffic or for both. **Section 3.2** provides further context with respect to available control device and the associated elements used for accommodating pedestrian needs.

Note: Consideration for school crossings follows a different process. This is further discussed in **Section 3.2.7**.

3.2 Controlled Crossings

Controlled crossings manage the interaction between pedestrians and vehicles, and present operational benefits to pedestrians by providing priority over vehicles either at all times or for allocated periods of time. This priority can provide a sense of security for pedestrians, encourage pedestrians to cross at the controlled location and limit the number of locations where pedestrian crossings occur.

Note: Where full traffic signals are justified, some municipalities may require that the feasibility of roundabouts be considered as an alternative, especially if potential collision pattern or poor level of service is anticipated.

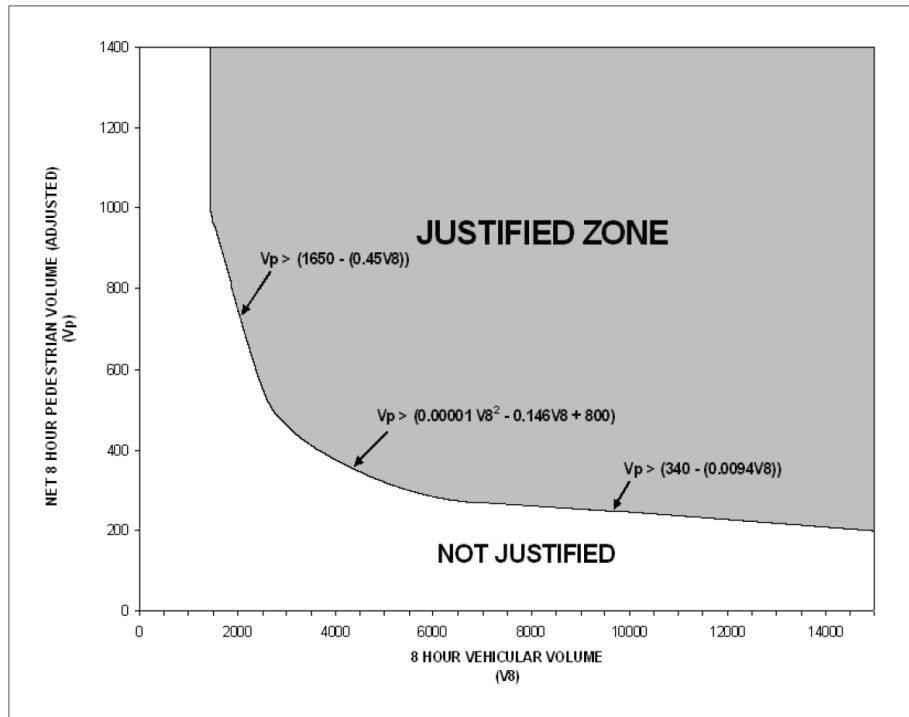


Figure 3 – Justification 6 – Pedestrian Volume



Figure 4 – Justification 6 – Pedestrian Delay

This section provides an overview of the hierarchy of control devices within the context of addressing pedestrian needs (as shown in **Figure 5**). The types of control devices include:

- Full Traffic Control Signals [see **Section 3.2.1**]
- Pedestrian Signals (Intersection Pedestrian Signals or Midblock) [see **Section 3.2.2**]
- Pedestrian Crossovers [see **Section 3.2.3**]
- STOP or YIELD Signs [see **Section 3.2.4**]
- School Crossings [see **Section 3.2.7**]

3.2.1 Full Traffic Control Signal

The function of a traffic control signal is to alternate the right-of-way between conflicting streams of vehicular traffic, or conflicting movements between vehicular traffic and pedestrians crossing a road, safely and efficiently. Traffic control signals assign right-of-way to road users by displaying instructions through light-emitted indications using standard colour and signal as regulated in the [Highway Traffic Act](#). Traffic is alternately directed to stop and proceed through a sequence of indications in each cycle. In this process, dedicated time is allotted to specific movements of traffic, or to modes of traffic that include motor vehicles, transit vehicles, pedestrians and cyclists.

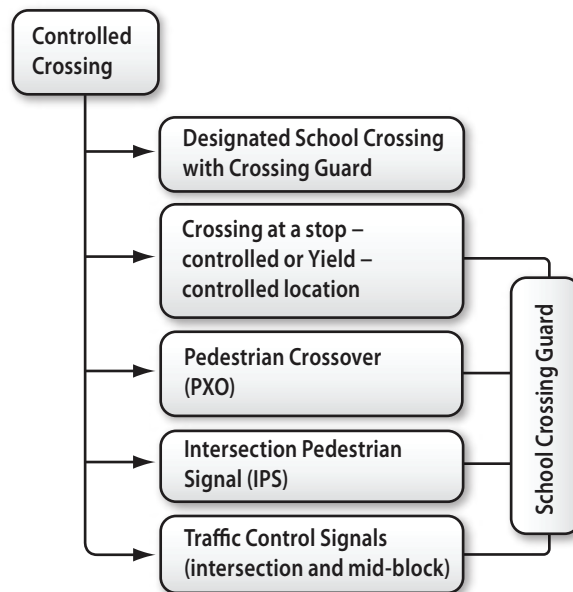


Figure 5 – Hierarchical System of Control Crossings

The decision to implement traffic control signals is based upon a number of variables relating to the different road users; including pedestrian crossing demand (See **Section 3.1.2**). This is reflected in the numeric thresholds of the planning justifications (in [OTM Book 12 – Traffic Signals](#)). The varying thresholds include:

- **Justification 1 – Minimum 8-Hour Vehicle Volume:** Intended for applications where the principal reason to consider the installation of a traffic signal is the cumulative delay produced by a large amount of intersecting traffic at an unsignalized intersection.
- **Justification 2 – Delay to Cross Traffic:** Intended for application where the traffic volume on the main road is sufficiently heavy that traffic on the minor road suffers excessive delay or hazard in entering or crossing the main road.
- **Justification 3 – Combination Warrant:** Signals may occasionally be justified where neither of Justifications 1 or 2 are 100% satisfied, but both are satisfied to the extent of 80% or more of the stated values.
- **Justification 4 – Minimum 4-Hour Volume:** Intended for applications where the intersection experiences excessive delays for four or more peak hours of the day, but do not have the prolonged demands throughout the day to meet an eight hour warrant.
- **Justification 5 – Collision Warrant:** Signals may be considered as one means of improving intersection safety where an unsignalized intersection has an unusually high collision history.
- **Justification 6 – Pedestrian Warrant:** Intended for application where traffic volume on a main road is so heavy that pedestrians experience excessive delay or hazard in crossing the main road, or where high pedestrian crossing volumes produce the likelihood of such delays.

Traffic control signals may be installed provided any of Justifications 1 to 6 are met and it is determined that conditions are satisfactory for the installation of traffic control signals (see [OTM Book 12 – Traffic Signals](#) for details). Where traffic control signals are installed, provisions for pedestrian crossings must be considered. Elements of pedestrian crossings at traffic control signals may include:

- Pedestrian crosswalks to delineate the pedestrian crossing
- Pedestrian displays to instruct pedestrians of the appropriate time to proceed onto the crossing and/or to use the pedestrian pushbuttons to activate a walk display
- Accessible pedestrian indicators to assist persons with a visual impairment pedestrians with the crossing
- Curb side treatments at crosswalks to assist pedestrians with mobility needs
- Applicable regulatory and information signing for pedestrians and drivers to assist, restrict and prohibit select vehicular or pedestrian movements
- Assistive devices to facilitate pedestrians to cross and to enhance the safety of the crossing, such as countdown timers, special crosswalk treatments, leading pedestrian intervals and/or exclusive pedestrian phasing

These elements are further outlined below:

1. **Pedestrian crosswalk** markings define and delineate the path for pedestrians to cross the roadway and serve to reduce the potential for conflicts with motor vehicles. Crosswalks at signalized crossings are generally marked with solid white parallel retro-reflective lines 10 cm to 20 cm wide, extending across the entire width of pavement. The width of the crosswalk between the lines is usually determined by the widths of the connected sidewalks and the

expected two-way pedestrian flows utilizing the crossing at the peak time. The crosswalk must be at least 2.5 m wide while widths of 3 m to 4 m are typical of urban areas with significant pedestrian activity. In general, the design of pedestrian crosswalk is based on the following principles (see **Figure 6**):

- Crosswalks should line up with proposed sidewalks or dropped curbs.
- The outer edge of the crosswalk is normally 1.0 m from the edge of the stop line. The stop line location can vary if necessary.
- The inner edge of the crosswalk should be a minimum of 0.5 m from the through edge of pavement of the parallel roadway for roadways posted under 80 km/h and 1.0 to 1.5 m for roadways posted at 80 km/h and above.
- It is preferred to have each crosswalk reach the far curb without intersecting with the other crosswalk across the cross-street. This directs pedestrians to the far sidewalk to await a crossing of a second leg of the intersection instead of waiting near the curb in the travelled portion of the roadway.
- Where intersecting roadways are skewed (i.e., not close to 90 degrees) or the configuration of the lanes result in crosswalks that tend to intersect in the turning flare, it is better to have the inner edges of the crosswalk intersect at the curb than to carry each set of lines through each other.
- Where existing geometry is used, the edges of crosswalks should line up with existing poles to improve pedestrian signal head visibility and pushbutton accessibility.

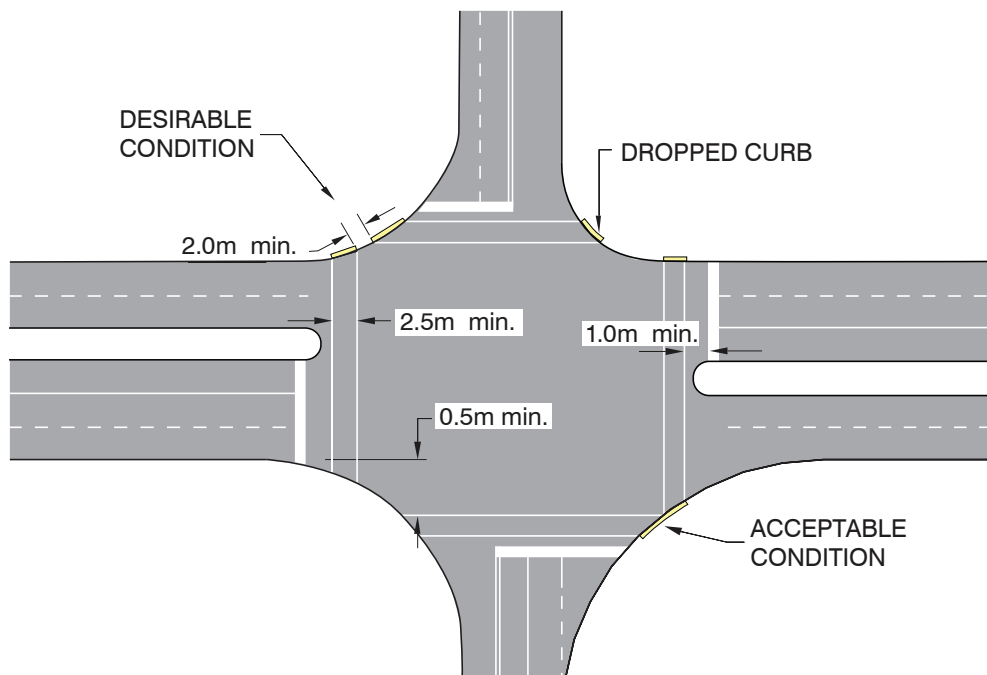


Figure 6 – Crosswalk Design

- Crosswalks should not cross over the centre median where the median is not equipped with wheelchair ramps or at-grade depressions.
 - Consideration should be given to snow covered roadways where crosswalk lines may not be visible. Wherever possible, the crosswalk lines should be within the most direct route from sidewalk to sidewalk.
 - Crosswalks should be as short as possible without compromising other design factors.
 - Pedestrian signal heads should be positioned within the extension of the crosswalk if possible.
 - Crosswalks should be laid out such that pedestrians (specifically a person with a mobility device) are not forced outside of the lines of the crosswalk due to the angle of the curb ramps.
2. **Pedestrian control indicators** are symbols of “don’t walk” and “walk” displays provided in controlled sequence to regulate intervals for pedestrian crossings. As prescribed in the [Highway Traffic Act Regulation 626^{vii}](#), the pedestrian control indications shall be square in shape and shall not be less than thirty centimetres in height or width. Pedestrian control indicators must also conform to the [Highway Traffic Act Regulation 626^{vii}](#) such that:
- A “don’t walk” pedestrian symbol indication shall consist of an orange silhouette of a hand on an opaque background as illustrated in **Figure 7**.
 - A “walk” pedestrian symbol indication shall consist of an outlined or solid symbol of a walking pedestrian in lunar white on an opaque background as illustrated in **Figure 7**.

Pavement markings for pedestrian crosswalks are prescribed in [OTM Book 11 – Pavement, Hazard and Delineation Markings](#).

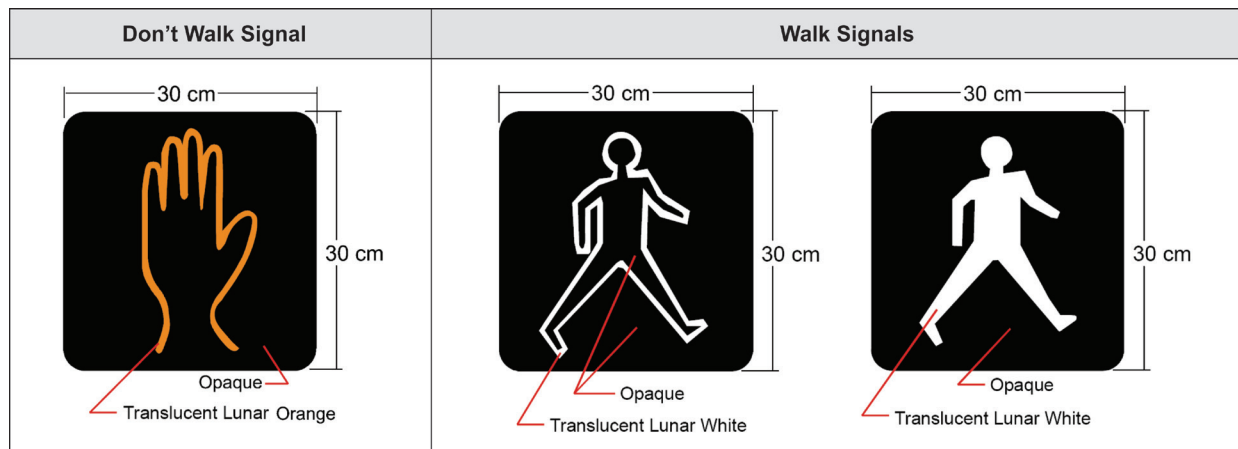


Figure 7 – Pedestrian Signals

Pedestrian control indications shall be mounted so as to be visible along the crosswalk from the opposite side of the roadway at an intersection and shall not be mounted over the travelled portions of roads. The pedestrian control signal shall be mounted at a minimum height of 2.75 m or higher from the finished grade to the bottom of the housing (clearance distance) if in a single housing or a minimum height of 2.75 m from the finished grade to the bottom of the “walk” section of the head where used independently or as part two-section pedestrian head. (Note: Practitioners should refer to [OTM Book 12 – Traffic Signals](#) for details with respect to the design guideline on the installation and layout of pedestrian signal heads, poles, crosswalk and pushbuttons.)

The sequencing of pedestrian indicators is as follows:

- **Walking Pedestrian** (“Walk”) shall be displayed only when the corresponding through movement green indications are displayed or during an all-red period if special pedestrian phasing is used (such as leading pedestrian intervals or exclusive pedestrian phases). The Walking Pedestrian indication does not necessarily have to be displayed with the green at actuated intersections (where a pushbutton actuation is used) as this allows for the use of less vehicular green time during cycles when no pedestrians are waiting to cross. The walking pedestrian symbol must not be displayed at any time during which the orange hand (“Don’t Walk”) or flashing orange hand (Flashing Don’t Walk), also known as the Pedestrian Clearance Interval, is displayed.
- **Flashing Hand** (“Flashing Don’t Walk”, FDW) should be displayed after every Walking Pedestrian indication as this is a clearance interval required to warn pedestrians of an upcoming solid hand

outline indication. Most agencies terminate the flashing hand at the beginning of the amber but it is permissible to continue the FDW through the amber or all-red clearance intervals as this may provide additional information or reassurance to crossing pedestrians.

- **Solid Hand Outline** (“Don’t Walk”) shall be displayed with any conflicting phases. This indication may also be displayed during the amber and all-red displays.

The calculation of pedestrian timing is based on crossing distance and pedestrian walking speed assumptions (that may vary between 0.9 m/s and 1.25 m/s). Overall, pedestrian timing must be sufficient to meet the minimum safe crossing needs, and at the same time be balanced with the operational needs of vehicular traffic.

One suggested method for the calculation of pedestrian timing at traffic signals is further detailed in [OTM Book 12 – Traffic Signals](#) (*Section 3.6 Timing*).

3. **Accessible Pedestrian Signals** (APS) are auxiliary devices that supplement traffic control signals to aid pedestrians with vision limitations (and those with both visual and hearing impairments) to cross the road. APS devices communicate information 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 (see **Section 5.3.5** for further details). APS are included as part of a new standard being considered for a future regulation under the [Accessibility for Ontarians with Disabilities Act, 2005](#) (AODA).
4. **Curb side treatments** such as curb ramps and curb depressions provide access for people on wheelchairs at crossings where there is an elevation change between the sidewalk and the street level crossing. A curb ramp is included

as part of a new standard being considered for a future regulation under the [Accessibility for Ontarians with Disabilities Act, 2005](#).

5. **Regulatory and information signing** for pedestrians and drivers may serve to assist, restrict and prohibit selected vehicular or pedestrian movements to reduce noted potential conflicts. This includes supplementary traffic signal control signs (NO RIGHT TURN ON RED sign, NO LEFT TURN ON RED sign,

and STOP HERE ON RED SIGNAL sign) and pedestrian control signs (CROSS ON GREEN LIGHT ONLY sign, CROSS ON WALK SIGNAL ONLY sign, CROSS OTHER SIDE sign and PEDESTRIAN MUST PUSH BUTTON TO RECEIVE WALK SIGNAL Symbol sign). These signs are shown in **Figure 8**. For a complete listing, see [OTM Book 5 – Regulatory Signs](#) and [OTM Book 6 – Warning Signs](#).









Traffic Control Signs	Pedestrian Control Signs	
 <p>Rb-79R NO RIGHT TURN ON RED</p>	 <p>Ra-6 CROSS ON GREEN LIGHT ONLY</p>	 <p>Ra-7 CROSS ON WALK SIGNAL ONLY</p>
 <p>Rb-79L NO LEFT TURN ON RED</p>	 <p>Ra-9 CROSS OTHER SIDE</p>	 <p>Ra-13 PEDESTRIAN MUST PUSH BUTTON TO RECEIVE WALK SIGNAL</p>
 <p>Rb-78 STOP HERE ON RED SIGNAL</p>	 <p>Ra-9a DO NOT CROSS HERE</p>	

Figure 8 – Regulatory and Information Signing for Traffic Control Signals

6. **Traffic control signals** may include other assistive devices to facilitate pedestrian crossing and enhance the safety of the crossings. These supplementary features include pedestrian countdown signals, exclusive pedestrian phasing, leading pedestrian interval, enhanced pedestrian delineation, pedestrian signs, advanced stop bar, curb extension and pedestrian fencing (for additional details see **Section 3.2.5** and **Section 3.2.6**).
7. In addition to elements of a pedestrian crossing previously listed, practitioners are to refer to [OTM Book 12 – Traffic Signals](#) for guidance on the full spectrum of planning justification, operation, design and implementation of traffic control signals, including guidance on the treatment of pedestrian crossings. Key aspects covered in [OTM Book 12 – Traffic Signals](#) are in **Table 5**.

Table 5 – Summary of References in Ontario Traffic Manual Book 12

Sections	Content	Reference – OTM Book 12
Legal Requirements	The legal requirements, interpretation, and recommended practice are outlined for: <ul style="list-style-type: none"> • Pedestrian Walk & Don't Walk Phase • Mounting of Pedestrian Indications 	Section 2.3
Operational Practice	Signal Operations for Pedestrians: <ul style="list-style-type: none"> • Pedestrian Phasing – sequence of indications (walk – flashing don't walk – don't walk) • Exclusive Pedestrian Phases • Calculation of Pedestrian Timing (in order to estimate the timing required for intervals and phases) • Signal spacing (consideration of new signalized intersections) 	Section 3.5 Section 3.6 Section 3.7
	Operation of Miscellaneous Signals: <ul style="list-style-type: none"> • Accessible Pedestrian Indicators • Countdown Pedestrian Signals 	Section 3.10
Planning and Justification	Traffic Signal Justification: <ul style="list-style-type: none"> • Calculation of Pedestrian Volume • Justification 6 – Pedestrian Volume and Delay 	Section 4.2 & Section 4.9
Design Layout	Design Guideline: <ul style="list-style-type: none"> • Pedestrian Signal Heads Installation • Pedestrian Push Buttons • Mounting Height and Location • Accessible Pedestrian Signal • Pedestrian Countdown Displays • Mid-block Pedestrian Signals • Layout of crosswalks at signals • Layout of Pedestrian Heads and Poles 	Section 5.7 Section 5.8 Section 5.12

3.2.2 Pedestrian Signals (IPS and MPS)

Traffic control signal systems that are dedicated primarily to providing traffic gaps for pedestrian right-of-way may be installed as pedestrian signals (See **Section 3.1.2**) either at intersections (Intersection Pedestrian Signals) or between intersections (Midblock Pedestrian Signals). The control of pedestrian signals is by pedestrian

actuated two phase operation; pedestrian signal indications are used for crossing the main street and regular traffic control signals on main roadway approaches. Both control types require that main road traffic be fully signalized, while for IPS crossings, the side road must be controlled with stop signs, as illustrated in **Figure 9** ([Highway Traffic Act Regulation 626^{viii}](#)). **Figure 10** illustrates an MPS.

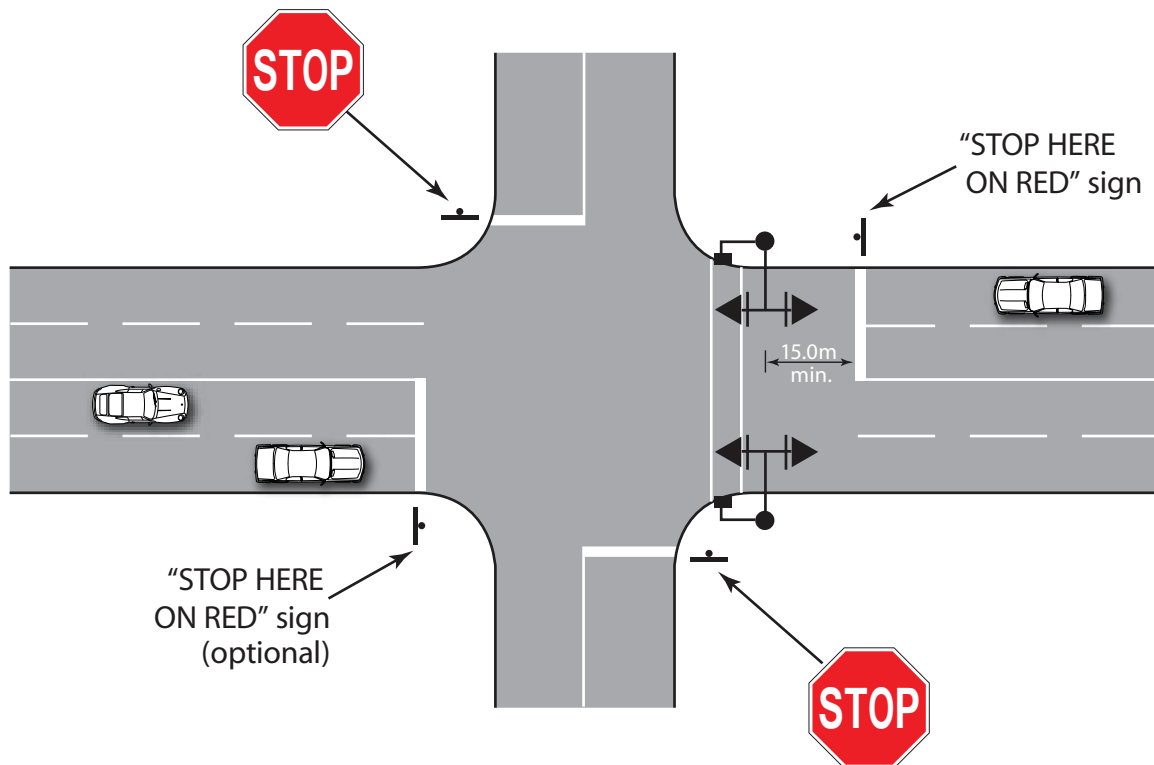


Figure 9 – Intersection Pedestrian Signal (IPS)

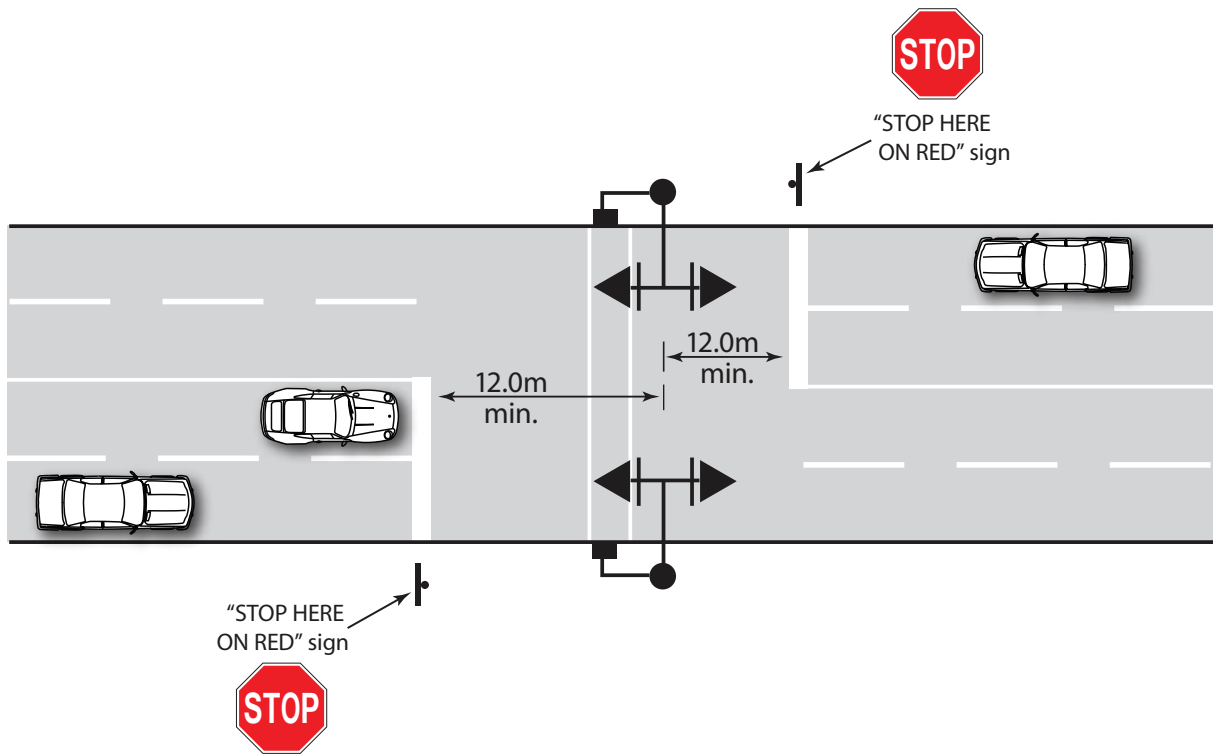


Figure 10 – Midblock Pedestrian Signal (MPS)

Planning justification for IPS and MPS may be made on the basis of pedestrian volume meeting the thresholds of the pedestrian warrant in accordance to Justification 6 in [OTM Book 12 – Traffic Signals](#), and provided that:

- Appropriate signal spacing (as discussed in the Section on signal spacing in [OTM Book 12 – Traffic Signals](#)) can be maintained in consideration of human factors (visibility of signals in close proximity), system co-ordination and traffic progression between signals, operational delays, pedestrian crossing opportunities.
- If at an intersection, the side street vehicular traffic is sufficiently light as to not meet one of the other justifications (1 through 5) in [OTM Book 12 – Traffic Signals](#), under which full traffic control signals may be installed.

Note. MPS should be used in lieu of PXOs (an alternate pedestrian crossing device also based on the pedestrian warrant in accordance to Justification 6 in [OTM Book 12 – Traffic Signals](#)) at locations where the posted speed exceeds 60 km/h, where there are more than four lanes of traffic or where other PXO criteria are not met. As noted in OTM Book 12, MPS crossings are applied to roadways posted at less than 80 km/h.

The key elements of the pedestrian crossing on the main road for IPS and MPS are the same as full traffic control signals (see **Section 3.2.1**), which may include:

- Pedestrian crosswalk to delineate the pedestrian crossing
- Pedestrian indicator displays to instruct pedestrians of the appropriate time to proceed on the crossing
- Pedestrian pushbuttons
- Accessible pedestrian indicators to assist visually impaired pedestrians with crossing
- Curb side treatments at the crosswalk to assist pedestrians with mobility needs
- Applicable regulatory and information signing for pedestrians and drivers to assist, restrict and prohibit certain vehicular or pedestrian movements
- Assistive devices to facilitate pedestrian crossing and enhance the visibility and safety of the crossings such as countdown timers, special crosswalk treatments, leading pedestrian interval, and exclusive pedestrian phasing
- Type 12 signal heads (300 mm red / amber / green)
- Tertiary low-mounted signal head (no backboard) for approaches with setback stopbars

IPS and MPS applications require that the normal crosswalk be marked in accordance to standardized practice for traffic signals. The driver's vertical vision is limited by the top of the windshield, resulting in a need for overhead indicators to be placed at least 15 metres from the stop bar. The minimum separation between the signal indicators and the

vehicle stop bar at IPS is 15 metres and at MPS is 12 metres (although 15 metres is the recommended practice). The minimum separation between the vehicle stop line and the crosswalk outside edge for IPS and MPS is substantially higher than the typical 1 metre spacing requirement adopted for a full signalized intersection. The purpose is to provide the appropriate viewing angle for the traffic signal indications for drivers approaching the crossing in the absence visual cues of crossroads.

Practitioners are to refer to [OTM Book 12 – Traffic Signals](#) for guidance on the full spectrum of planning justification, operation, design and implementation of MPS and IPS applications, including guidance on the treatment of pedestrian crossings. As summarized in **Table 5**, key aspects covered in [OTM Book 12 – Traffic Signals](#) include:

- Legal requirements with respect to the specifications of the pedestrian indicator displays as specified in the [Highway Traffic Act Regulation 626](#)^{viii}
- The signal operation requirements for pedestrian phasing, pedestrian timing calculations (walk and flashing don't walk), signal spacing, and supplementary signals
- Numeric warrant thresholds considered as part of Planning and Justification for traffic control signals
- Design guidelines for the overall layout and placement of pedestrian crossing devices, signal heads, pushbuttons and crosswalks

TAC documents or standards may be referred to in the absence of guidance from the OTM Books, MUTCD and / or the HTA. For further information regarding IPS see the *TAC MUTCDC, 1998 (updated 2008)*.

3.2.3 Pedestrian Crossover

Pedestrian Crossovers are “any portion of a roadway, designated by by-law of a municipality, at an intersection or elsewhere, 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 *Highway Traffic Act* regulations.”^{viii} Accordingly, PXO crossings

are distinctly defined by the prescribed use of regulatory and warning signs, flashing amber beacons and pavement marking as summarized in **Table 6** and depicted in **Figure 11**. PXOs provide pedestrians with protected crossing opportunity by requiring motorists to yield to pedestrians within the crosswalk. The presence of a pedestrian in the crossing or approaching their half of the road is what triggers the motorist’s requirement to yield.

Table 6 – Pedestrian Crossover Signs and Marking

PEDESTRIAN X Sign (Ra-4)	Ground-mounted signs with a large “X” below the “PEDESTRIAN” legend indicating the presence of a pedestrian crossover to all road users. (See OTM Book 5 – Regulatory Signs for more details on the use of PEDESTRIAN X sign.)
OVERHEAD X Sign (Wc-20, Wc-120)	Double-sided, internally illuminated overhead sign with a large “X” legend on yellow reflective background erected over the roadway to alert drivers to the presence of pedestrian crossover and to indicate to them the exact crossover location. The OVERHEAD X sign must also provide continuous downward illumination over the entire pedestrian crossover, from curb to curb. Four pedestrian-actuated flashing amber beacons (two per direction) must be installed in conjunction with the OVERHEAD X signs as visual warning. Pedestrian actuation of the flashing amber beacons must be by pushbutton. The actuation must not be delayed. (See OTM Book 6 – Warning Signs for more details on the use of OVERHEAD X signs.)
PEDESTRIAN PUSHBUTTON sign (Ra-11)	Sign provides pedestrians instructions on what they should do if they wish to cross at the pedestrian crossover. (See OTM Book 5 – Regulatory Signs for more details.)
STOP FOR PEDESTRIANS Tab Sign (Ra-4t)	A mandatory tab sign that must be attached below the PEDESTRIAN X (Crossover) sign to indicate to drivers that they must stop. (See OTM Book 5 – Regulatory Signs for more details on the application of the STOP FOR PEDESTRIANS tab sign.)
NO PASSING HERE TO CROSSING sign (Ra-10)	Sign to indicate that passing within a 30 m stretch upstream of the pedestrian crossover is prohibited.
PAVEMENT MARKING	A PXO designated by by-law of a municipality that is at an intersection on the highway shall be distinctly indicated on the surface of the roadway by markings having the dimensions and being the distance from each other prescribed in OTM Book 11 – Pavement, Hazard and Delineation Markings .

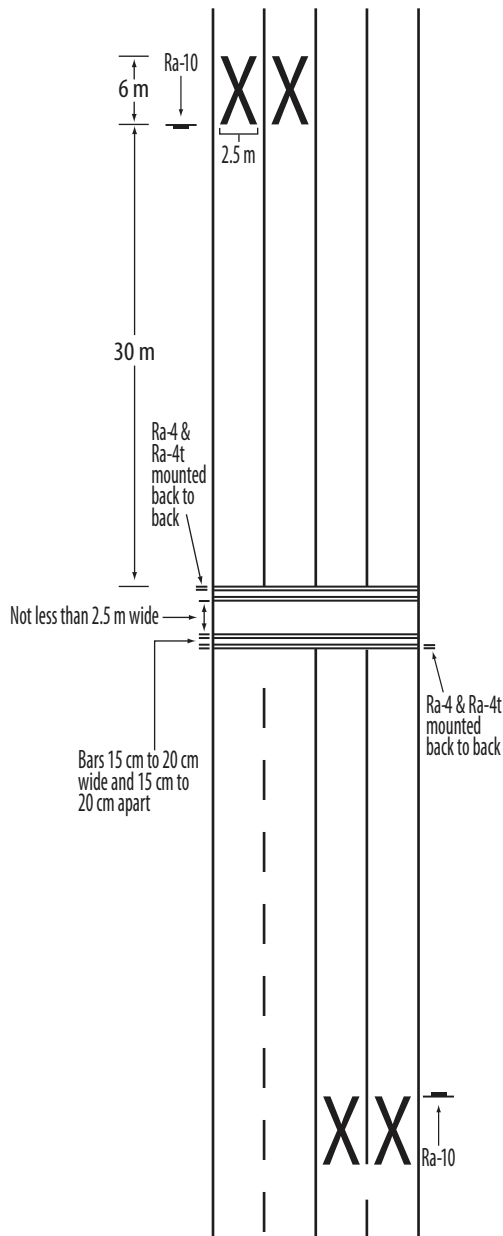


Figure 11 – Pedestrian Crossover (PXO)

Figure 12 illustrates the signage applied to the pedestrian crossover.

A PXO may be installed on the basis that pedestrian volumes meet the thresholds of the pedestrian warrant specified in Justification 6 in [OTM Book 12 – Traffic Signals](#), and provided that:

- The PXO is intended to serve pedestrian traffic crossing low speed roadways (60 km/h or less posted speed) with low to moderate vehicular volume (not exceeding 35,000 AADT).
- The PXO is not within 200 metres of other signal-protected pedestrian crossings.
- There are not more than four lanes of two-way traffic or three lanes of one-way traffic.
- Parking and other sight obstructions are prohibited within at least 30 metres of the crossings.
- If, at an intersection, the side street vehicular traffic is sufficiently light as to not meet one of the other justifications (1 through 5) in [OTM Book 12 – Traffic Signals](#), under which full traffic control signals may be installed.

Note: MPS should be used in lieu of PXOs (an alternate pedestrian crossing device based on the pedestrian warrant in accordance with Justification 6 in [OTM Book 12 – Traffic Signals](#)) at locations where the posted speed exceeds 60 km/h, where there are more than four lanes of traffic or where other PXO criteria are not met.

PXO applications are prescribed by the [Highway Traffic Act](#) and the application guidelines are prescribed in the [OTM Book 5 – Regulatory Signs](#), [OTM Book 6 – Warning Signs](#), [OTM Book 11 – Pavement, Hazard and Delineation Markings](#), and [OTM Book 12 – Traffic Signals](#) (The relevant references are summarized in **Table 7**).

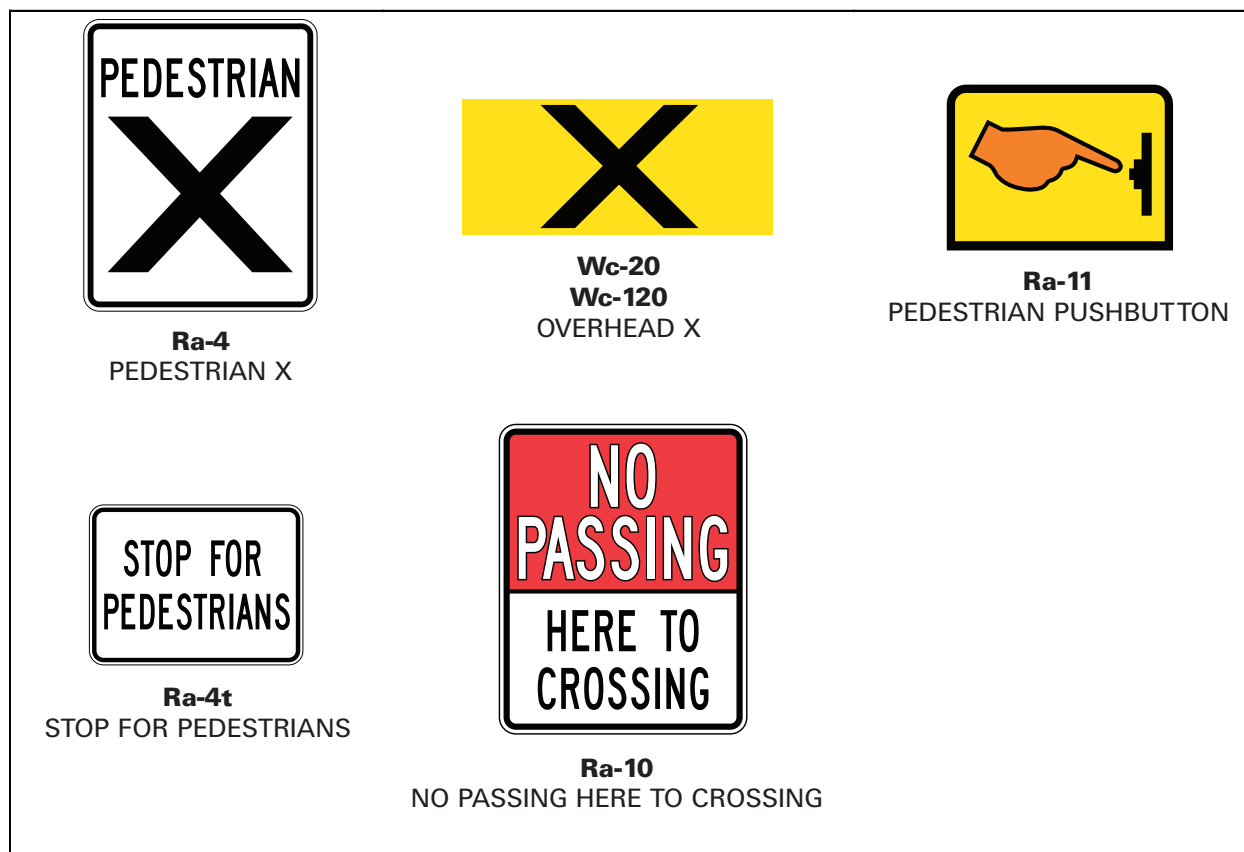


Figure 12 – Pedestrian Crossover Signing

Table 7 – References on Application Guideline for Pedestrian Crossover

Sections	Reference
Legal Requirements	Highway Traffic Act: <ul style="list-style-type: none"> • R.S.O. 1990 Chapter H.8, Section 140 • Regulation 615 (R.R.O. 1990), Section 20.1-20.3, 20.7-20.10
Planning and Justification	OTM Book 12 – Traffic Signals
Design Layout	Refer to: <ul style="list-style-type: none"> • OTM Book 5 – Regulatory Signs • OTM Book 6 – Warning Signs • OTM Book 11 – Pavement, Hazard and Delineation Markings

3.2.4 Stop Controlled or Yield Controlled Intersections

STOP and YIELD signs are erected as a form of traffic control to assign and regulate right-of-way at intersections with the potential for conflict. However, vehicles approaching a STOP or a YIELD sign in advance of a crosswalk are required to stop at the stop bar if present or before the sidewalk, and if neither the stop bar nor sidewalk is present then prior to entering the intersecting roadway, yielding to pedestrians before proceeding.

The purpose of the STOP sign is to clearly assign right-of-way between vehicles approaching an intersection from different directions when traffic signals are not warranted or not yet installed. The STOP sign requires the driver to stop the vehicle before entering the intersection, yield to any traffic in or approaching an intersection, and then proceed when safe to do so.^{viii} Under such circumstances, especially where there is a marked crosswalk or sidewalk, the driver of the vehicle is required to yield to pedestrians crossing on the minor street approach of a one-way or two-way stop-controlled intersection, or on any approach of an all-way stop-controlled intersection.

The purpose of a YIELD sign is to regulate right-of-way control. Vehicles approaching the sign must yield the right-of-way at the intersection to any oncoming traffic on the priority road, and stop if necessary.^x As such, vehicular traffic is required to yield to pedestrian crossing on the approach, especially where there is a marked crosswalk or sidewalk.

Applications for STOP and YIELD signs are prescribed in the [Highway Traffic Act](#), [OTM Book 5 – Regulatory Signs](#) and the [OTM Book 11 – Pavement, Hazard and Delineation Markings](#) (references as summarized in **Table 8**). In [OTM Book 5 – Regulatory Signs](#), the installation conditions and location criteria for the consideration of STOP-controlled and YIELD-controlled intersections are prescribed. Applicable numerical warrants for STOP signs are also included.

Crosswalks should be marked at all intersections where there is substantial conflict between motor vehicle and pedestrian movements (see [OTM Book 11 – Pavement, Hazard and Delineation Markings](#) for additional information).

Table 8 – Application Guideline for STOP and YIELD Controlled Intersections

Section	References
Legal Requirements	<p>Rules of the Road</p> <ul style="list-style-type: none"> Highway Traffic Act R.S.O., 1990 Chapter H.8, Section 136 & 137 (STOP Sign) Highway Traffic Act R.S.O., 1990 Chapter H.8, Section 138 (YIELD sign) <p>Sign Regulations</p> <ul style="list-style-type: none"> Highway Traffic Act R.R.O 1990, Regulation 615, Sections 6 to 8 (STOP Sign) Highway Traffic Act R.R.O 1990, Regulation 615, Sections 16-19 (YIELD sign)
Planning and Justification	OTM Book 5 – Regulatory Signs : Prescribes conditions for the consideration of STOP-controlled and YIELD-controlled intersections. For STOP-controlled intersections, guideline includes collision-based and numerical warrant.
Design Layout	OTM Book 11 – Pavement, Hazard and Delineation Markings

3.2.5 Aids for Pedestrian Crossings

Road users have a range of capabilities that affect their mobility, speed and ability to perceive and react to potential conflicts. The consistent application of physical pedestrian aids as supplementary (and/or mandatory) devices can enhance the level of safety and security of crossing at traffic signals by:

- Simplifying the crossing tasks for pedestrians
- Controlling motor vehicle and pedestrian paths
- Increasing pedestrian and vehicle visibility and heightening and maximizing the level of the road users' awareness of the crossing
- Informing, clarifying and reinforcing the rules of the road

Pedestrian aids for crossings at traffic signals may include the following:

- Pedestrian Countdown signals [**Section 3.2.5.1**]
- Exclusive Pedestrian Phase [**Section 3.2.5.2**]
- Leading Pedestrian Interval [**Section 3.2.5.3**]
- Audible or Accessible Pedestrian Signals [**Section 3.2.5.4**]
- Alternative Pedestrian Delineation [**Section 3.2.5.5**]
- Advanced Stop Bars [**Section 3.2.5.6**]
- Pedestrian Signs [**Section 3.2.5.7**]

The application of pedestrian aids for crossings at traffic signals is described in **Sect 3.2.5.1** to **Section 3.2.5.7**.

3.2.5.1 Pedestrian Countdown Signals

Pedestrian countdown signals (PCS) supplement the Flashing Don't Walk indicators with a numeric countdown of the number of seconds remaining in the Flashing Don't Walk indications. PCS are optional devices that can be provided at locations where pedestrian signals are installed. The additional information from the PCS devices enhances the pedestrians' understanding of the remaining time to cross. Pedestrian countdown signals are often effective devices at locations that have a high percentage of seniors, children, and other mobility-challenged pedestrians, at locations with a history of high pedestrian-motor vehicle conflicts, and those locations that generate high pedestrian and/or motor vehicle traffic.

The standard elements of PCS consist of:

- Numeric countdown display that is visible to pedestrians entering a crosswalk.
- "Separate Countdown Housing" configuration, "Overlap / Countdown Side by Side" configuration or "Separate Countdown Housing with no Overlap" configuration. See **Figure 13**.
- Standard application of the "WALK" symbol and "DON'T WALK" symbol indicators.
- Optional PCS information sign, which may be installed adjacent to the pedestrian pushbuttons to inform pedestrians of the use of the Pedestrian Countdown Signal.

The recommended practice for pedestrian countdown equipment is to initiate the countdown display at the beginning of the flashing DON'T WALK interval (in which case the numeric display remains blank during the walk indication).

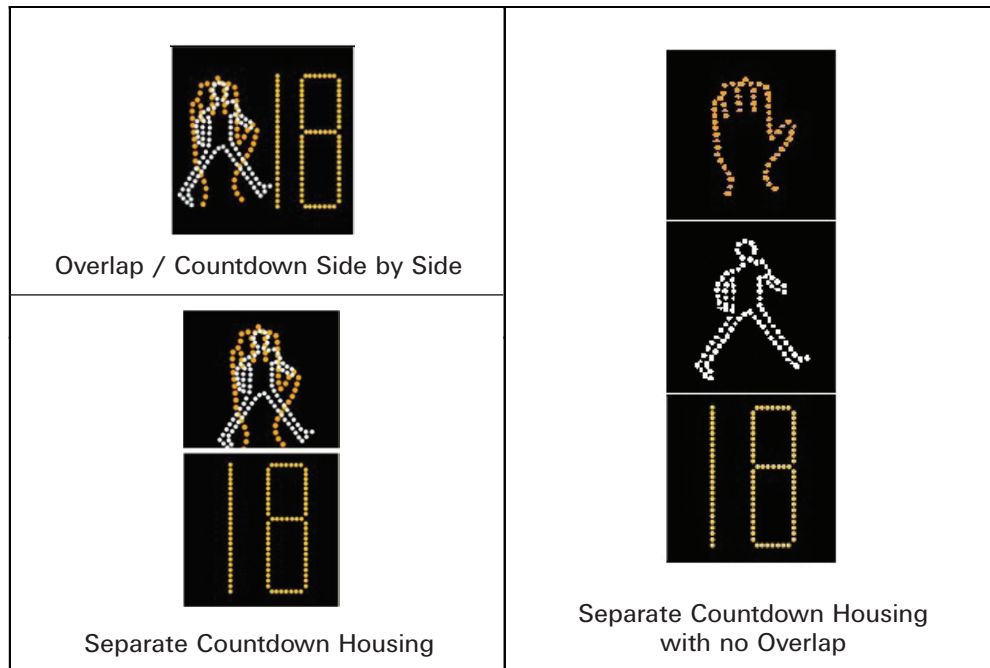


Figure 13 – Pedestrian Countdown Timers Display Configuration

Note: See TAC MUTCD for detail specifications.

Additional reference documents on PCS include [An Informational Report on Pedestrian Countdown Signals \(PCS\), February 2008^{xi}](#). The report provides recommended usage guidelines, as well as recommendations for standard layout and configuration, and timing strategy.

3.2.5.2 Exclusive Pedestrian Phase

An exclusive pedestrian phase is a portion of a traffic signal cycle that is dedicated to one or more pedestrian movements while displaying red on all traffic signal indications for vehicles. **Figure 14** illustrates one example of exclusive pedestrian phasing.

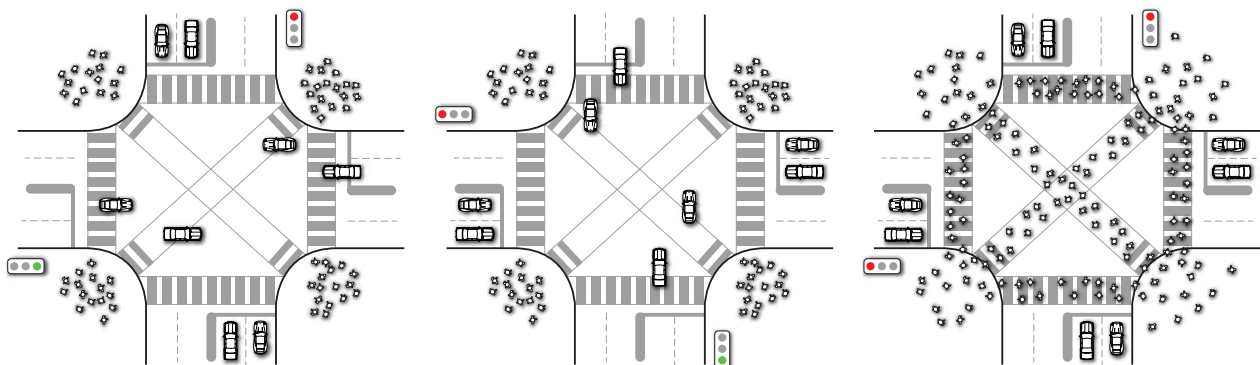


Figure 14 – Exclusive Pedestrian Phase

Exclusive pedestrian phases are normally required only where the volumes of crossing pedestrians are extremely high (such as downtown locations or central business districts) and where safety is impaired by the use of normal pedestrian display intervals parallel to the (vehicle) signal head.

Exclusive pedestrian phases can reduce the risks associated with turning traffic as all vehicular movements are stopped during the pedestrian phase. In some locations turn restrictions are implemented.

Implementing exclusive pedestrian phases requires phasing and timing adjustments to the traffic signals. Adequate signage is also required to ensure restriction of right-turns-on-red and to ensure that pedestrians understand when and where they are permitted to cross. The decision to implement an exclusive pedestrian phase as part of a pedestrian solution must be weighed against its impact to the overall traffic operations. Prior to implementing an exclusive pedestrian phase, careful considerations must be given to:

- The impact of longer cycle lengths (due to the extended walk or pedestrian clearance intervals) on traffic operations. This includes impacts on intersection capacity and network traffic signal coordination.
- Increased pedestrian delays due to prolonged cycle length.
- Potential for increased pedestrian violations during the don't walk interval.
- An understanding from road users of the operation of exclusive pedestrian phases (potential for driver confusion and motor vehicle-pedestrian conflicts) and the need for education campaigns to raise road users' awareness.
- The level of motor vehicle-pedestrian conflicts and the anticipated level of conflicts with the exclusive pedestrian phase.
- Pedestrians with a disability and their ability to navigate the crossings, especially for the visually impaired. Clear signage and appropriate audible cues must be provided for the visually impaired.

For additional information, see [OTM Book 12 – Traffic Signals](#).

3.2.5.3 Leading Pedestrian Interval

A leading pedestrian interval is another form of an exclusive pedestrian phase. One form of application includes a walk indication (generally around 4 to 6 seconds in duration) provided in advance of the corresponding vehicle green indication to give pedestrians a head start on turning traffic. The lead-time allows pedestrians to establish themselves in the crosswalk and reduce conflicts. This may be effective where there are heavy turning movements and where right turn on red is, or can be, restricted. For additional information, see [OTM Book 12 – Traffic Signals](#).

3.2.5.4 Audible or Accessible Pedestrian Signals

Accessible Pedestrian Signals (APS) are auxiliary devices that supplement traffic control signals to aid pedestrians with vision limitations (and those with both visual and hearing impairments) in crossing the road. APS devices communicate information in non-visual format such as audible tones, verbal messages, and/or vibrotactile indications to provide cues to pedestrians at both ends of a crossing. See **Section 5.3.5** for additional information. For comprehensive guidelines on APS applications, practitioners should refer to TAC's [Guidelines for Understanding Use and Implementation of Accessible Pedestrian Signals, May 2008](#).^{xii}

3.2.5.5 Pedestrian Delineation

Crosswalk markings define and delineate the path for pedestrians to cross the roadway. Crosswalks should be marked at all signalized intersections where pedestrian signal indications are provided for pedestrian movements. The width of the crosswalk between the lines is usually determined by the widths of the connected sidewalks and the expected two-way pedestrian flows utilizing the crossing during peak times. The crosswalk must be at least 2.5 m wide. Widths of 3 m to 4 m are typical of urban areas with higher levels of pedestrian activity.

Obstacles such as curbs and raised islands should remain outside the crosswalk lines in consideration of persons with walking impairments and persons using wheelchairs, walkers, and strollers (refer to [Accessibility for Ontarians with Disabilities Act, 2005](#) and see **Section 5.3** for additional information on requirements for accessibility). The traveled part of the crosswalk must be aligned with sidewalk ramps and curb cuts where provided at one or both sides of the roadway.

Pavement marking for pedestrian crosswalks is prescribed in [OTM Book 11 – Pavement, Hazard and Delineation Markings](#). Crosswalks at signalized crossings are marked with solid white parallel retroreflective lines 10 cm to 20 cm wide, extending across the entire width of pavement. Under special circumstances, such as where vehicle stop lines are not provided or where motor vehicle speeds exceed 60 km/hr, the width of the crosswalk lines may be widened to 60 cm. The downstream edge of the crosswalk should be inset at least 60 cm from the projected nearside curb line of the cross street.

Other forms of crosswalk markings may also be considered to supplement the parallel retroreflective lines and to raise the awareness of drivers of pedestrian crossings. These include:

- Ladder crosswalk markings [**Section 3.2.5.5.1**]
- Textured crosswalks [**Section 3.2.5.5.2**]

3.2.5.5.1 Ladder Crosswalk Markings

Ladder crosswalk markings are enhanced pavement markings that incorporate longitudinal stripes to enhance the delineation of pedestrian crosswalks (see **Figure 15**). Ladder style crosswalks are a combination of zebra pavement markings aligned perpendicular to the pedestrian direction of travel together with standard parallel crosswalk lines. The contrast of the markings provides enhanced visibility of the crosswalk and thereby increases drivers' awareness of potential conflicts.

According to the TAC MUTCDC, the typical configuration of zebra crosswalk markings consists of 0.6 metre wide block markings spaced at 0.6 metres. Marking products may include traditional pavement marking paint or durable applications such as thermoplastic or cold plastic.

Warrants for ladder crossings have been established by some jurisdictions as means to prioritize or select crossing locations based on considerations of pedestrian volume, exposure (risk) factor (the level of conflict between motor vehicles and pedestrians), and pedestrian collisions. Some other jurisdictions have established ladder crosswalk markings as a standard feature for all signalized and PXO crossings. It is recommended that practitioners establish application guidelines that reflect their local conditions and agency needs.

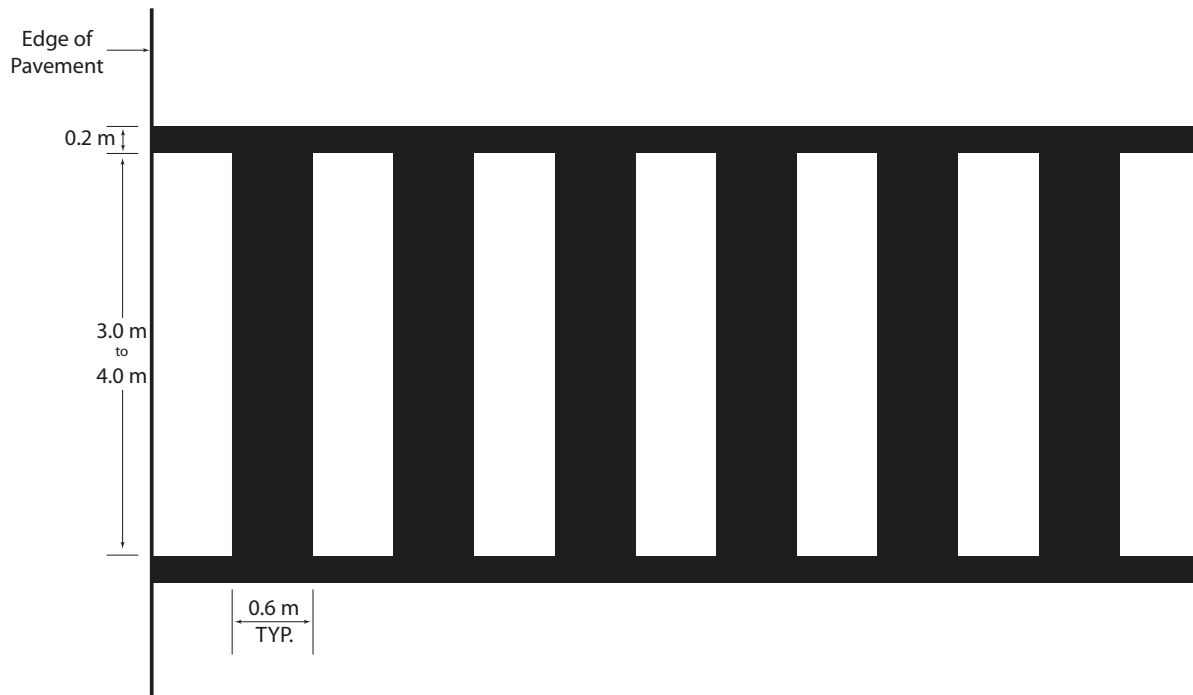


Figure 15 – Pavement Marking for Ladder Crosswalk

3.2.5.5.2 Textured or Coloured Crosswalk

A textured or coloured crosswalk is a crosswalk incorporating a textured and/or patterned surface that is designed to contrast with the adjacent roadway.^{xiii} Similar to ladder crosswalk markings, textured or coloured crosswalks are applied to increase the conspicuity of a pedestrian crossing and increase drivers' awareness of potential conflicts. One of the effects of textured crosswalks is also to reduce speed. A coloured crosswalk may be defined through admixtures in the asphalt or concrete or the use of concrete within an asphalt roadway. Alternatively, a textured crosswalk may consist of interlocking paving stones or coloured reinforced stamped concrete and asphalt.^{xiii} In all cases, parallel standard crosswalk lines are still needed to delineate the outside edges of the crosswalk.

For the implementation of textured crosswalks, consideration should be given to potential for traction and/or stability problems for seniors, the disabled, wheelchairs, bicycles and motorcycles if there are rough or pronounced grooves parallel to the direction of travel. The use of textured materials should be designed to maintain visibility at night and over a long period of time.

Note: When drivers can see the crosswalk better, they are more likely to respect the crosswalk as pedestrian space. However, not all textured or coloured crosswalks have the same level of visibility to motorists.

3.2.5.6 Advanced Stop Bar at Crosswalk

At signalized intersections or signalized mid-block crossings, the stop bar (also called the stop line) is a line that indicates the point beyond which the foremost part of a vehicle must not protrude, should the vehicle be required to stop. The minimum separation between a stop bar and a crosswalk is typically 1 metre. In some instances, the vehicle stop line can be moved further back from the crosswalk to improve visibility (see **Figure 16**) or to accommodate the path of turning vehicles. In other instances, such as MPS or IPS crossings, it is a requirement that sufficient separation be provided between the vehicle stop line and the crosswalk. The driver's vertical vision is limited by the top of the windshield, resulting in a need for overhead indicators to be placed at least 15 metres from the stop bar, and the crosswalk should be maintained such that the minimum separation between crosswalk and vehicle stop bar at IPS is 15 metres and at MPS is 12 metres (15 metres recommended practice).

3.2.5.7 Pedestrian Crossing Signs

The purpose of pedestrian crossing signs is to regulate and safely direct pedestrians crossing the roadway. Pedestrian crossing signs may be used as:

- Regulatory guidance to limit pedestrian crossings to safe locations
- A supplement to traffic control signals to warn road users where unusual conditions exist or where specific information needs to be conveyed

A Road Authority may elect to use pedestrian crossing signs where experience has shown that pedestrians interfere with traffic by crossing against signals, where the length of the pedestrian phase is relatively short, where pedestrians cross at undesignated locations or where the crossing configuration is unusual or unique.

Table 9 provides a summary of applicable regulatory signs for pedestrians at traffic control signals (see also **Figure 8**).

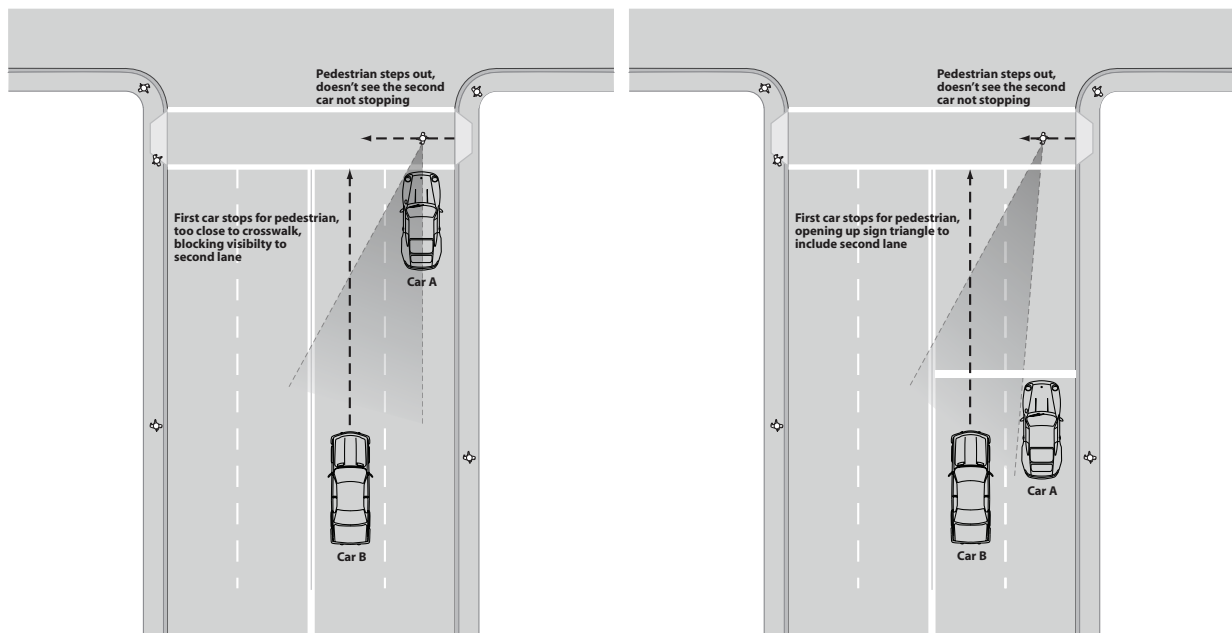


Figure 16 – Pedestrian Visibility with Advanced Stop Bar

Table 9 – Pedestrian Crossing Signs

CROSS ON GREEN LIGHT ONLY sign	Ra-6	Used at signalized intersection where there are no pedestrian signal heads.
CROSS ON WALK SIGNAL ONLY sign	Ra-7	Used at signalized intersections where field studies have shown that there are non-compliance issues with respect to crossing during walk signals.
CROSS OTHER SIDE sign	Ra-9	Must be used where crossings are restricted to the opposite leg of an intersection. This may be the case where there are fully protected dual left turns and it is necessary to facilitate the vehicle flow by removing the need for vehicles to yield to pedestrians.
PEDESTRIAN PUSHBUTTON Symbol sign	Ra-12	Must be used where pedestrian pushbuttons are present.
PEDESTRIAN MUST PUSH BUTTON TO RECEIVE WALK SIGNAL Symbol sign	Ra-13	May be used where field studies have shown that pedestrians are failing to push the pedestrian pushbutton on actuated approaches to obtain a walk signal prior to crossing.

In determining the needs for supplementary information signs for pedestrians, the following should be considered:

- Compliance with standardized signing practices helps promote driver and pedestrian comprehension and encourages better compliance and behaviour.
- The use of too many signs creates visual clutter and could promote non-compliance.

Supplementary signs may include information signs on actuated approaches at pedestrian push button locations. The information signs are intended to increase pedestrian understanding of how to interpret pedestrian signal head symbols. Increased pedestrian understanding and awareness can improve pedestrian safety.

3.2.6 Supplementary Design Features

3.2.6.1 Curb Extension

Curb extensions “extend” the sidewalk or curb line to reduce the length of the crosswalk or define space allocated for curb side parking, as illustrated in **Figure 17**. Curb extensions reduce the distance pedestrians have to walk, hence pedestrians require smaller gaps to cross and pedestrian delays are likely to be shorter. Curb extensions can provide refuge for pedestrians, improve the sight distance and sight lines for both pedestrians and motorists and may also be considered as a traffic calming measure.^{xiv}

Curb extensions are typically installed on local or collector streets with urban cross-sections. Curb extensions are most appropriate with on-street parking or where on-street parking is to be implemented. Where curb extensions are to be installed at intersections, consideration should be given to:

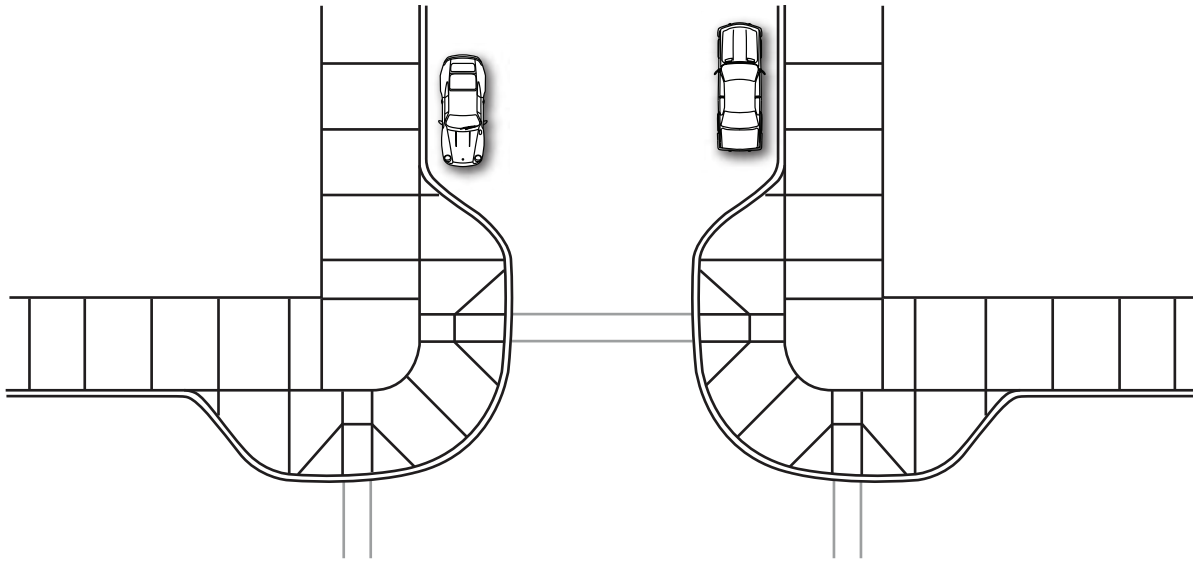


Figure 17 – Example Curb Extension

- Providing turning radii sufficient for commercial vehicles or transit vehicles to prevent them from mounting the curb and putting pedestrians at risk
- The delineation requirements of bicycle lanes
- Restricting parking in close proximity to the curb extension and parking within the boulevard on the curb extension to improve visibility of pedestrians and drivers
- Local requirements for snow removal

3.2.6.2 Curb Depressions

Curb depressions improve accessibility for crossing activity for all pedestrians. They are typically provided in urban areas where pedestrian activity exists. Curb depressions are not intended to imply right-of-way, but rather improve accessibility and safety where pedestrian activity has been demonstrated, or is anticipated.

3.2.6.3 Pedestrian Fencing and Barriers

In some locations, pedestrian demands lead to pedestrian crossing activity in proximity to traffic control signals, but outside the designated pedestrian crosswalk. This crossing activity may lead to additional motor vehicle-pedestrian conflict points, reduced driver awareness of conflicts or other safety implications and operational inefficiencies. In some instances, pedestrian fencing, gates, walls, bollards or other barriers may be implemented to discourage pedestrians from crossing at non-designated locations and to help direct pedestrians to crosswalks.

Physical barriers should be considered where the operational and safety benefits outweigh the anticipated impacts, considering and balancing criteria such as length of facility, operating speed of traffic, traffic volumes, mix of traffic, visibility, safety and interference with pedestrian flow.

If fencing and barriers are installed, they should be placed such that pedestrians who gain access to the roadway outside the designated crosswalk are not confined (i.e., trapped) within the travelled portion of the roadway. However, with strong desire lines, pedestrians may attempt to climb fences or find ways around the fencing or barriers. Furthermore, it is noted that barriers can also be hazards to drivers if within the clear zone and consideration of the relative benefits of safety for all roads users should be considered prior to implementation.

3.2.7 School Crossings

Designated school crossings are locations close to schools where school children have to cross en route between home and school. School crossings are supervised by school patrollers or adult crossing guards during specified hours and during regular school periods. The role of the crossing guards is to direct and supervise the movement of persons (as set out in the [Highway Traffic Act](#)) across a highway by creating necessary gaps in vehicular traffic to provide safe passage at designated school crossing locations. Elementary school aged children generally have not yet developed good judgment related to traffic and in making sound decisions for safe crossings. School crossings and the use of school patrollers or adult crossing guards are intended to provide protection and enhanced safety for children where there is sufficient potential for conflict with motor vehicles. Practitioners should note that school crossing locations without the presence of an adult crossing guard are considered an uncontrolled crossing as they create a false sense of security on the part of pedestrians, particularly children, who may enter the crossing expecting that approaching drivers will see them and stop.

Scenarios in which a school crossing guard may be stationed (provided that the highway speed limit does not exceed 60 km/h) include:

- Mid-block locations with the required marked crossing and school crossing signs (the crossing is uncontrolled when not supervised by the crossing guard) found often in front of, or adjacent to a school site
- Conventional stop-controlled intersections (stop signs) on the side street only
- All-way stop-controlled intersections
- Intersection pedestrian signals and midblock signals
- Pedestrian crossovers
- Traffic control signals

Note: A school crossing in the absence of stop signs, IPS, PXO, MPS or traffic control signals is considered a controlled crossing only when the crossing is being supervised by a school crossing guard. Nonetheless, lines remain visible on the pavement at all times which may provide a false sense of right-of-way to pedestrians when the guard is not present and therefore the choice of location is important. When a stop sign is displayed by a school crossing guard, the driver of any vehicle or streetcar approaching the stop sign shall stop before reaching the crossing. At all other times when a school crossing guard is not present, the school crossing is considered to be an uncontrolled crossing (pedestrians need to wait for safe gaps in vehicular traffic).

The overall planning process for a school crossing guard includes determining the needs for a school crossing; defining the minimum thresholds required for implementing a supervised school crossing; and maintaining consistency in the location and operation of supervised school crossings. These criteria help to ensure the safety of children

who use the crossing and assist in establishing consistent expectations of drivers. The [OTC School Crossing Guard Guide](#)^{xiv} is an information document published in 2005 that provides various guiding principles for the consideration, implementation and maintenance of school crossings. The document outlines:

- **The prescribed legislative requirements** pertaining to the rules of the road and use of mandatory equipment; specific sections of the [Highway Traffic Act](#)ⁱ relevant to school crossing and school crossing guards have been transcribed in their entirety. In Ontario, the [Highway Traffic Act](#) sets out the rules of the road, including the operation of school crossings and school crossing guards. The specific legislation related to school crossings and the operation of school crossing guards is found in [Highway Traffic Act R.S.O. 1990 c. H.8 Section 176](#) and includes the following definitions:
 - a) A school crossing guard means a person sixteen years of age or older who is directing the movement of persons across a highway and who is employed by a municipality or employed by a corporation under contract with a municipality to provide the services of a school crossing guard.
 - b) School crossing guard about to direct persons across a highway with a speed limit not in excess of 60 km/h shall, prior to entering the roadway, display a school crossing stop sign in an upright position so that it is visible to vehicular traffic approaching each direction.
 - c) Where a school crossing stop sign is displayed, the driver of any vehicle or streetcar approaching the stop sign shall stop before reaching the crossing.
- As set out in the [Highway Traffic Act R.R.O. 1990 – Reg. 615 Section 11](#), a school crossing stop sign shall be octagonal in shape, not less than 30 cm in height and not less than 30 cm in width. Each face of a school crossing stop sign shall bear the word “STOP”. The sign may include one red flashing light above or below the word “STOP.”
- Recommendations on use of **supplementary equipment** including safety vest, armbands, gloves, mitts and a raincoat.
- **Guiding principles** to follow in the recruitment, training and administration of school crossing guards.
- Recommended process that may be followed by road authorities and practitioners considering a school crossing guard and recommended warrant criteria to be considered as part of the process.
- **Traffic Control Devices:** Recommendations with respect to “school crossing” sign placement, crosswalk dimensions, parking and stopping controls as well as passing and “lane change” restrictions are provided. (These guidelines build on the information contained in the Ontario Traffic Manual series, in particular, [OTM Book 5 – Regulatory Signs](#), [OTM Book 6 – Warning Signs](#) and [OTM Book 11 – Pavement, Hazard and Delineation Markings](#).)

The specific legislation related to school crossings and the operational procedures for school crossing guards is found in the [Highway Traffic Act R.S.O. 1990 c. H.8 Section 176](#). As per Section 176, a school crossing cannot be implemented on a roadway with a posted speed limit in excess of 60 km/h.

**Note. Changes to Highway Traffic Act
Regulation 615 – Amendment O. Reg. 175/08:**

School Zone Speed Limit Signs

(Regulatory): Amendments made to Regulation 615 of the *Highway Traffic Act* stating the requirements for school zone speed limit signs as displaying a black symbol and black border on a retro-reflective fluorescent yellow-green background, are now in effect. As of January 1, 2015, all school zone speed limit signs must be displayed with the colours described and as shown in **Figure 18**.

School Zone Signs (Warning): The Ministry of Transportation has adopted the use of retro-reflective fluorescent yellow-green sheeting for all School Zone warning signs as shown in **Figure 19**. [OTM Book 6 – Warning Signs](#) will be updated to reflect these changes. Municipalities may consider replacing their existing blue and white School Zone warning signs immediately, or over time as part of regular sign maintenance activities.

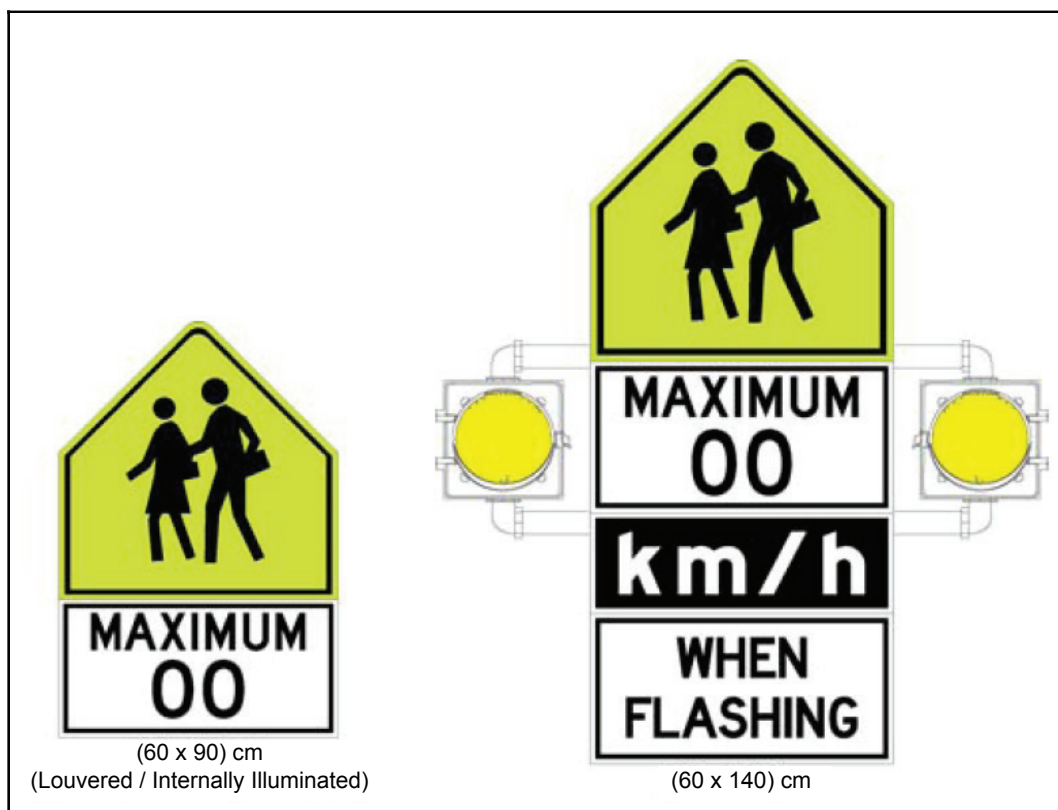


Figure 18 – School Zone Signs (Regulatory)

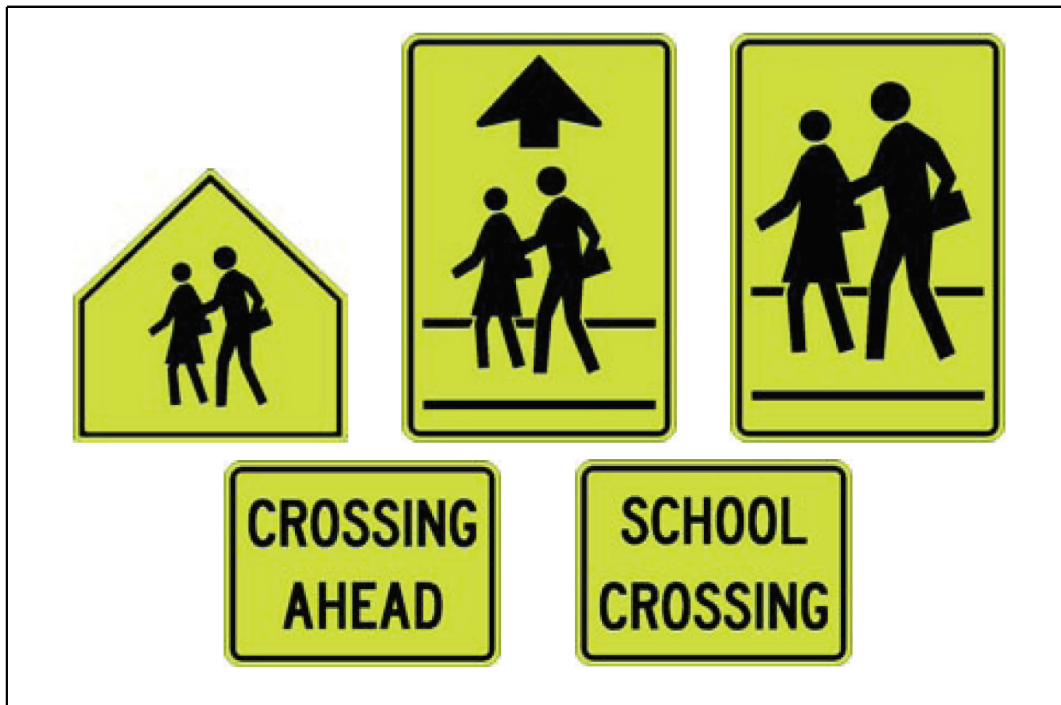


Figure 19 – School Zone Signs (Warning)

3.3 Uncontrolled Pedestrian Crossing

Uncontrolled pedestrian crossings are locations (other than a controlled pedestrian crossing as defined in **Section 3.2**) where pedestrian crossing activity takes place without traffic control measures to designate and assign the right-of-way for pedestrians at the crossing. Consequently, marked or unmarked uncontrolled crossings are to be discouraged where there is a higher likelihood of conflicts given the lack of formal right-of-way designation for pedestrians. Pedestrian crossings should be prioritized first based on consideration of implementing supporting traffic control measures as defined in **Section 3.1.2**, and provided that appropriate warrant and site conditions are satisfactory. Wherever possible, pedestrians are to be encouraged to use crossing locations with traffic control devices.

Under certain circumstances, pedestrian crossing activities may occur at locations where traffic control devices are not warranted (due to low vehicular and/or pedestrian traffic volume or physical constraints) and alternative controlled crossings are not conveniently available. Accommodating pedestrians at these locations must then be evaluated carefully for alternative treatment options. Under special conditions, it may be desirable to focus pedestrians to crossing points where sight distance is greatest and unanticipated conflicts are lowest. Pedestrian treatments in the form of signage and modifications of the physical environment, for example curb cuts / extensions, may be provided at these uncontrolled crossing locations to aid road users.

The decision to provide pedestrian treatments to enhance uncontrolled crossings is a balance between increased driver awareness of crossing

activity and pedestrians' understanding of the rules of the road. The presence of enhanced pedestrian features at uncontrolled crossings may create a false sense of confidence on the part of pedestrians, particularly children, who may enter the crossing expecting that approaching drivers will see them and stop. The basis for justification requires engineering judgment in all cases and careful consideration of the overall roadway environment within the local context. These considerations are further described below.

- **Suitability and Consideration for Control Crossing** — Pedestrians should be encouraged to cross at controlled crosswalk locations in most situations. The use of controlled crossings should therefore be considered first as a potential treatment option (see **Section 3.2.1 – Section 3.2.2** for more information). Where conditions do not promote the use of a controlled crossing, the needs of pedestrians must be evaluated based on other considerations as follows.
- **Motorists' and Pedestrians' Behaviour** — Careful consideration should be given to prevalent behaviour and understanding of drivers and pedestrians at crossings. Road users may exhibit different levels of caution, and behave and react differently at different crossing locations. This can in part be due to their familiarity or unfamiliarity with the crossings, or their age and physical ability. This may also be a function of the surrounding environment to which pedestrians are reacting. The implementation of pedestrian treatments to enhance an uncontrolled crossing should only be considered if there is a high level of caution anticipated to be exhibited by both drivers and pedestrians (for example, a two-lane roadway with on-street parking in a downtown location with steady stream of pedestrian activity along both sides of the street).
- **Vehicle Volumes and Speed (Exposure)** — As increases in vehicle volumes and speeds on the roadway increase the exposure and risk to pedestrians, the disadvantages of uncontrolled crossings would eventually outweigh the benefits. Therefore, enhancements at uncontrolled crossings are not recommended at high exposure locations. As a guideline, uncontrolled crossings are discouraged if the following conditions are exceeded:
 - Speed limit of 60 km/h.
 - The pedestrian and traffic volumes exceed the warrant thresholds for controlled crossing devices (See **Figure 20**).
 - The roadway is more than two through lanes in each direction or not more than three through lanes if it is one-way.
 - The road classification is higher than a collector road, that is, major collector and arterial.
- **Geometry** – Adequate sight distance for both the motorist and pedestrian must exist. This includes examination of any sight-distance restrictions imposed by objects, such as on-street parking, street furniture, landscaping, buildings, etc. Night-time visibility and illumination requirements must also be assessed where uncontrolled crossings are located. There is an inherent limitation in drivers' or pedestrians' ability to detect objects, especially under low visibility conditions.

Enhancements of uncontrolled crossings should not be considered if sight-distance restrictions cannot be removed.
- **Spacing of Crossing Opportunities** — The frequency of crossings should be considered so that they can be provided at the appropriate spacing in relation to the following:

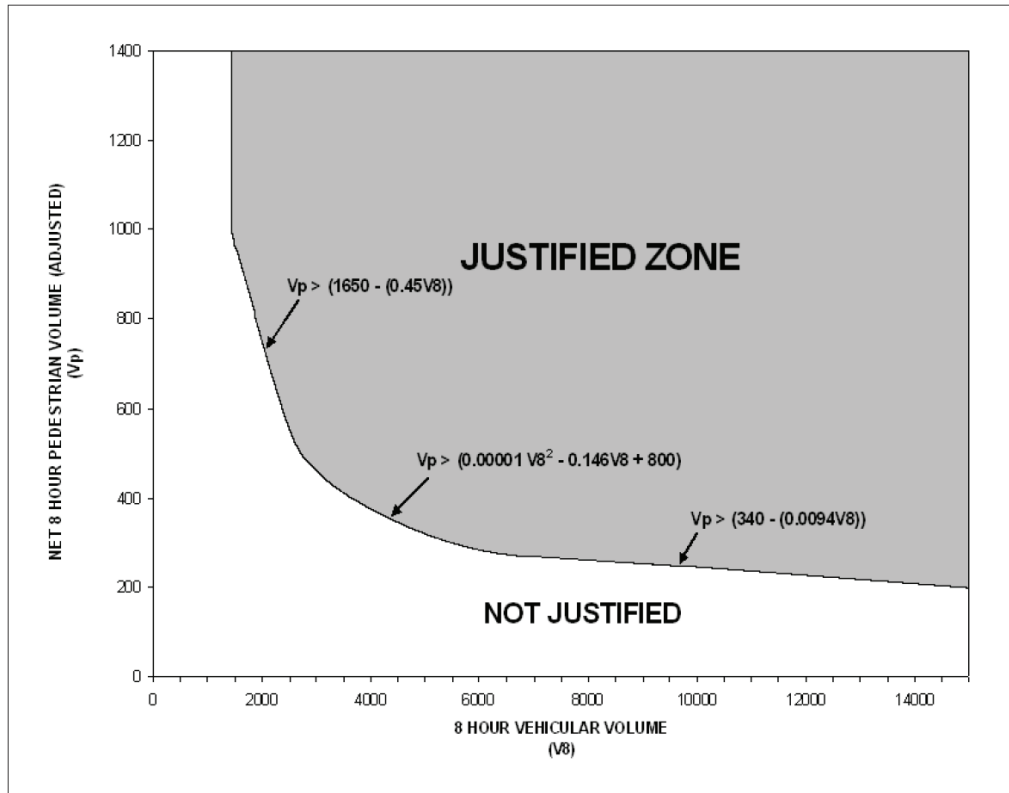


Figure 20 – Traffic Control Device - Justification 6 - Pedestrian Volume

(Source: [OTM Book 12 – Traffic Signals](#))

- a) **The presence of nearby controlled crossings** — Uncontrolled crossings should be avoided if in close proximity to controlled crosswalks. Pedestrians should be encouraged to cross at controlled crosswalks in most situations. It is recommended that a minimum of 100 metres separation from the nearest controlled crossing be maintained.
- b) **The type of road environment** — In pedestrian districts and main street pedestrian design areas where there is a high level of pedestrian activity, it may be desirable to maintain frequent crossing opportunities. In contrast, along areas or strips with low density and dispersed activity generators, which may consist of commercial, civic or residential activities,

where roads have been designed for high vehicular volume and speed, frequent crossing opportunities may not be feasible as the conditions will likely warrant higher level of pedestrian controls.

The distance to which crossing opportunities are provided should be established by the local road authority according to the local conditions. Where possible, pedestrians should be directed to a controlled crossing point by incorporating design features that attract and encourage pedestrians to use it. For example, the proper application of curb extension can provide pedestrians with a vantage point to look for gaps in traffic and pedestrians would feel more comfortable crossing from the curb extension.

3.3.1 Treatments at Standard Intersections or Mid-block Locations

Given that pedestrians do not have any additional protection over motor vehicles at these uncontrolled crossings, the decision to implement pedestrian treatments at uncontrolled crossing points should also consider the need for physical pedestrian aids as supplementary features to help:

- Simplify crossings for pedestrians
- Heighten and maximize the level of road users' awareness of the environment and road hazard
- Inform, clarify and reinforce the rules of the road

Supplementary features may serve to enhance the overall safety through the appropriate use of warning signs (see **Section 3.3.1.1**), and geometric design elements (see **Section 3.2.6.2** to **Section 3.3.1.3**).

Marked crosswalks with painted pavement markings are not recommended at uncontrolled crossings as they create a false sense of security on the part of pedestrians, particularly children, who may enter the crossing expecting that approaching drivers will see them and stop. The only exception is a school crossing (see **Section 3.2.7**).

3.3.1.1 Warning Signs

Warning signs are intended to provide advance notice to road users about unexpected and potentially dangerous conditions on or near the road. The conditions to which warnings signs apply typically require that road users exercise caution, and may require drivers to slow down in order to travel safely in the presence of a hazard. The signs shown in **Table 10** may be intended for drivers in advance of pedestrian activity or more directly for pedestrians at a crossing.

Table 10 – Warning Signs

PEDESTRIAN AHEAD (Wc-7)	<p><u>Advanced Warning Signs for Drivers</u></p> <p>PEDESTRIAN AHEAD (Wc-7) sign should be considered to warn drivers where they may not anticipate situations involving the presence and activity of pedestrians, which may pose a safety hazard both to the pedestrians and to the vehicular traffic. The PEDESTRIAN AHEAD sign should be installed where field observations have indicated that a measurable number of pedestrians frequently cross the road or walk adjacent to it, provided that pedestrian volumes are not high enough to justify the installation of controlled crossings.</p> <p>The purpose of the PEDESTRIAN AHEAD sign would normally be used in rural areas where, from visual observation, the presence of pedestrians in rather uninhabited areas would come as a surprise to the motorists. Application of PEDESTRIAN AHEAD signs is less effective within an urban environment where there is general expectancy of pedestrian activities.</p> <p>The SENIORS tab sign (Wc-7) may be installed in conjunction with the PEDESTRIAN AHEAD sign to warn of senior citizen pedestrian traffic. The tab sign provides drivers with additional detail on the type of pedestrian traffic to expect and accommodate.</p>
WAIT FOR GAP (Wc-28)	<p><u>Warning Signs for Pedestrians</u></p> <p>The purpose of a WAIT FOR GAP (Wc-28) sign is to warn pedestrians wishing to cross at a location where they do not have the right-of-way that they must wait for a gap in traffic sufficiently large to enable them to cross safely. The WAIT FOR GAP sign should be installed where field observations have indicated that pedestrians frequently cross at a location where they are not waiting for the appropriate gaps and where drivers may not anticipate pedestrians. Initiatives to promote the level of understanding of these signs should also be considered.</p>

Appropriate implementation of warning signs may raise the level of road user awareness; however, over-signing or exaggerated signing may result in complacency. For detailed guidelines on the application, design and placement of warning signs, see [OTM Book 6 – Warning Signs](#).

3.3.1.2 Refuge Island and Centre Medians

Refuge islands are raised medians placed in the centre of the roadway at midblock locations or unsignalized intersections. Refuge islands are intended to assist pedestrians in crossing wide streets by providing a safe “refuge” in the centre of the road, allowing pedestrians to cross one direction of traffic at a time. The presence of a refuge island reduces the time a pedestrian must wait for an adequate gap in the traffic stream and reduces the crossing distance (exposure to traffic) that they must face at one time. Where properly installed, pedestrian refuge islands are beneficial in delineating pedestrian activity, and encouraging pedestrians to cross at more desirable crossing locations. Pedestrian refuge islands are particularly suitable near pedestrian generators such as hospitals, schools, malls, etc., and may form part of a larger streetscaping plan.

The typical conditions for consideration of refuge islands are based on factors as shown in **Table 11**.

The design of pedestrian refuge islands may vary in terms of size, shape, etc., and may also form part of a larger streetscaping design solution. Design requirements for pedestrian refuge islands should therefore be established on the basis of the local conditions, experience, and engineering judgment.

The design considerations for pedestrian refuge islands include the following:

1. **Size and Dimensions** — Approaching motorists must recognize pedestrian refuge islands in order for them to navigate around them efficiently and safely. Islands are usually sufficiently large to command attention.^{vii} The smallest desirable island is one that has a minimum area of 20 m². The refuge island area should be wide enough to accommodate a person pushing a stroller or walking a bicycle (with a child trailer attached) or at least 1.8 metres. Larger islands may be required to accommodate other features such as wheelchair ramps, pedestrian storage, cyclists with trailers and traffic signs. In general, the design should consider the requirements of the pedestrians that will be using the facility.
2. **Sight Distances** — Stopping sight distance must be sufficient to accommodate the design speed for vehicles approaching the pedestrian refuge islands. The typical design speed is set at 10 km/h above the posted speed limit for urban conditions. If landscaping is present on the island or median, it should not obstruct the pedestrian pathway, the visibility of the pedestrian and motorists to each other, or the motorist’s sight distance at the intersection.
3. **Illumination** — The design of the pedestrian refuge island should provide lighting at night by situating the island such that pedestrians are lit from both approaches (vertical illuminance). The lighting levels around a pedestrian refuge island should be higher than the ambient light levels to highlight the location and to ensure that a driver is able to see the island and any pedestrians in the area.
4. **Parking** — Parking in the vicinity of a pedestrian island is not desirable. Parked motor vehicles may severely reduce visibility between drivers and pedestrians. A minimum setback of 30 m is recommended to allow adequate visibility between pedestrians and drivers.

Table 11 – Typical Conditions for Consideration of Pedestrian Refuge Island

Number of Lanes	<p>Pedestrian refuge islands are suitable for two-way streets with two or more lanes of moving traffic. Roads with six or more travel lanes however are not desirable for implementing refuge islands. They are seen to present a high degree of conflict for pedestrians in terms of vehicular volumes and gap availability. Wider roads also may present sight line difficulties between pedestrians and drivers.</p> <p>Roadways with five lanes are preferred for refuge islands because they are easier to incorporate within the fifth (centre turn) lane, without adjustments to the road cross section. The minimum pavement width for the installation of refuge islands are usually dictated by the road design standards of the local road authority.</p>
Pedestrian Activity	<p>A formal warrant for refuge islands currently does not exist. Some authorities look for 100 pedestrians in 8 hours, but may consider a lower demand based on collision history, level of difficulty to cross the road, and the need to accommodate the young, elderly or mobility challenged pedestrians.</p>
Speed	<p>Refuge islands are not recommended on arterial roads with posted speed limits in excess of 60 km/h. Operating speeds affect stopping sight distance requirements for pedestrians on refuge islands and lower speeds contribute to the level of comfort for pedestrians. Pedestrian refuge islands should be designed with consideration of appropriate sight distance requirements. They should not be installed in the centre of a high-speed road as they may become hazards to approaching drivers.</p>
Connectivity	<p>Pedestrian refuge islands should link pedestrian destinations. This link should extend into the boulevard area and be directly aligned with the pedestrian island. Proper design of the boulevard will encourage the use of the pedestrian island. Examples of proper designs include:</p> <ul style="list-style-type: none"> • Sidewalks on both sides of the roadway with curb ramps on both sides • A paved path to the road from the sidewalk • In some instances, a path to the sidewalk from nearby pedestrian generators
Nearby Controlled Crossing	<p>A pedestrian refuge island should not be installed in close proximity (< 100 m) to other controlled crossings, since pedestrians should be encouraged to cross at controlled crossing in most situations (Note: A pedestrian refuge island may be installed as part of a controlled crosswalk).</p>
Driveway / Intersections	<p>It is not desirable to locate pedestrian refuge islands in close proximity to driveways or intersections with high turning movement volumes. Pedestrians crossing at the refuge island may focus on gaps in traffic and not be aware of vehicles turning from adjacent intersections. Similarly, drivers turning from adjacent intersections may focus on gaps in the traffic stream and not be aware of pedestrians crossing at the refuge island.</p>

5. **Road Alignment** — Road alignment is an important element of driver guidance. Sudden changes in the alignment of a road may not be anticipated by drivers, therefore it is desirable to maintain a constant lane alignment on the approaches to pedestrian refuge islands where possible. If sufficient road width is available, pedestrian refuge islands should be introduced without widening or shifting the lanes on the road. If road widening is necessary, the transition tangent section approaching the island should be maximized such that the rate of lateral shift of the lanes can be gradual.
6. **Signs** — The road environment should be designed such that there is sufficient information for drivers and pedestrians to make timely and rational decisions. Pedestrian refuge islands should be equipped with signs to allow drivers to identify the hazard of the island and the presence of the pedestrian crossing. The signs should include the standard size KEEP RIGHT sign (Rb-25), (or the oversize KEEP RIGHT sign (Rb-125)), and the OBJECT MARKER sign (Wa-33L). The use of PEDESTRIAN AHEAD sign (Wc-7) and WAIT FOR GAP sign (Wc-28) should also be considered. For further information on the application of these signs, see [OTM Book 5 – Regulatory Signs](#) and [OTM Book 6 – Warning Signs](#).
7. **Pavement Markings** — Drivers expect road hazards to be signed. Pavement markings must be used to guide approaching traffic away from fixed obstructions within the road way. Pavement markings should be continuous and off-set from refuge islands to provide positive guidance and separation from the hazard that the island represents. Pavement markings to delineate pedestrian crossing are not recommended in the design of a refuge island. For further information, see [OTM Book 11 – Pavement, Hazard and Delineation Markings](#).
8. **Accessibility** — Access to the refuge island should be designed to be functional and safe for all pedestrians. The island or median should be large enough to enable a wheelchair to wait on a level landing or a cut-through design should be provided. The cut-through width should be the same as the complete width of the crosswalk.

3.3.1.3 Curb Extensions

Curb extensions “extend” the sidewalk or curb line at specific points to reduce the width of the traveled portion of the roadway or extend out into the spaced allocated for curb side parking. Curb extensions reduce the distance pedestrians have to walk, hence pedestrians require smaller gaps in traffic in order to cross and pedestrian delays are likely to be shorter. Curb extensions can provide a refuge for pedestrians, improve the sight distance and sight lines for both pedestrians and motorists, and may also be considered as a traffic calming measure.^{xiv}

Curb extensions are typically installed on local or collector streets with urban cross-sections. Curb extensions are most appropriate with on-street parking or where on-street parking is to be implemented. Minimum setbacks are recommended to ensure optimum sight distance. Where curb extensions are to be installed at intersections, consideration should be given to:

- Providing turning radii sufficient for long vehicles such as garbage trucks, buses and trucks to prevent them from mounting on the curb and putting pedestrians at risk
- The space requirements of bicycle lanes
- Restricting parking in close proximity to curb extension and parking within the boulevard on the curb extension to improve visibility of pedestrians and drivers
- Local requirements for snow removal
- Delineation to provide visibility to motorists and maintenance crews

3.3.1.4 Raised Crosswalk

A raised crosswalk is a marked pedestrian crossing point at an intersection or mid-block location constructed at a higher elevation than the adjacent roadway.^{xiv} The raised surface improves drivers' awareness of the potential for pedestrians and has a traffic calming effect as one of its effects is to reduce speed. Raised crosswalk applications should be considered within the context of the road authority's traffic calming policies and practices.

3.3.1.5 Courtesy Crossing

A courtesy crossing is currently not a regulated crossing feature, but has been installed in some municipalities to highlight uncontrolled crossing locations in low speed urban environments. At courtesy crossings, pedestrians do not have special right-of-way over vehicles (which remains in accordance to the [Highway Traffic Act](#)) and pedestrians can only cross on available vehicle gaps or when vehicles stop to yield to pedestrians out of "courtesy". The effectiveness of courtesy crossings has been witnessed through an enhanced level of caution and consistency in driver and pedestrian yielding behaviour.

These crossings are marked with non-standard oversized yellow fluorescent warning signs that indicate "COURTESY CROSSING" along with a large black X. At the crossing, a special message sign intended for pedestrians is installed to clearly convey that pedestrians still do not have the right-of-way over vehicles. Courtesy crossings have been introduced initially as a trial (pilot initiative) by some municipalities to gauge the level of compliance.

3.4 Treatment of Pedestrian Crossings at Roundabouts

Roundabouts are circular intersections that are used as an alternative form of traffic control to signalized or stop-controlled intersections. Similar to other forms of traffic controls, roundabouts should be designed to accommodate pedestrians where there is a reasonable possibility of pedestrian activity. A properly designed roundabout places a high priority on encouraging speed reduction, which then reduces crash severity, including crashes with pedestrians, and improves gap opportunity for crossings.^{xv} A roundabout also reduces the number of conflict points in comparison to a regular intersection.

For further information, practitioners are recommended to refer to the TAC *Synthesis of North American Roundabout Practice*, December 2008 and the FHWA [Roundabout: an Informational Guide](#), 2000.

Accommodating pedestrians at a roundabout requires sidewalk connections to the pedestrian crossing, signing, curb depressions, and refuge areas on the splitter islands. The general guiding principles are as follows:

1. Pedestrian crossings are provided around the perimeter of the roundabout on the approaches set back from the yield line. Pedestrian access to the central island is strongly discouraged.
2. Pedestrian crossing at roundabouts should be located one vehicle length, or a multiple thereof, back from the yield line. This length is given in the FHWA guide as 7.5 metres, although many jurisdictions are now using a shorter 6.0 metre distance to better reflect the length of most passenger cars.^{xv, xvi}

The setback distance is intended to separate vehicle-vehicle and motor vehicle-pedestrian conflict points such that it allows for the second entering driver to devote full attention to crossing pedestrians while waiting for the driver ahead to enter the circulatory roadway.

Note. Crossing locations for pedestrians is a balance between safety and convenience. Pedestrians want crossing locations as close to the intersection as possible to minimize deviation from the straight path. At the same time, a setback is necessary to provide drivers exiting the circulatory roadway time for decision-making.^{xvii}

- There are two approaches to aligning pedestrian crossings at roundabouts. Agencies may choose pedestrian crossings in a straight continuous alignment across the entire roundabout approach. The benefit of a straight alignment is a more easily understood configuration for visually impaired pedestrians. The alternative design is to angle the pedestrian crossing perpendicular to the direction of traffic so that a visually impaired pedestrian, who departs perpendicular to the curb, will stay within the crossing and have a shorter crossing distance (see **Figure 21**).^{xvii}

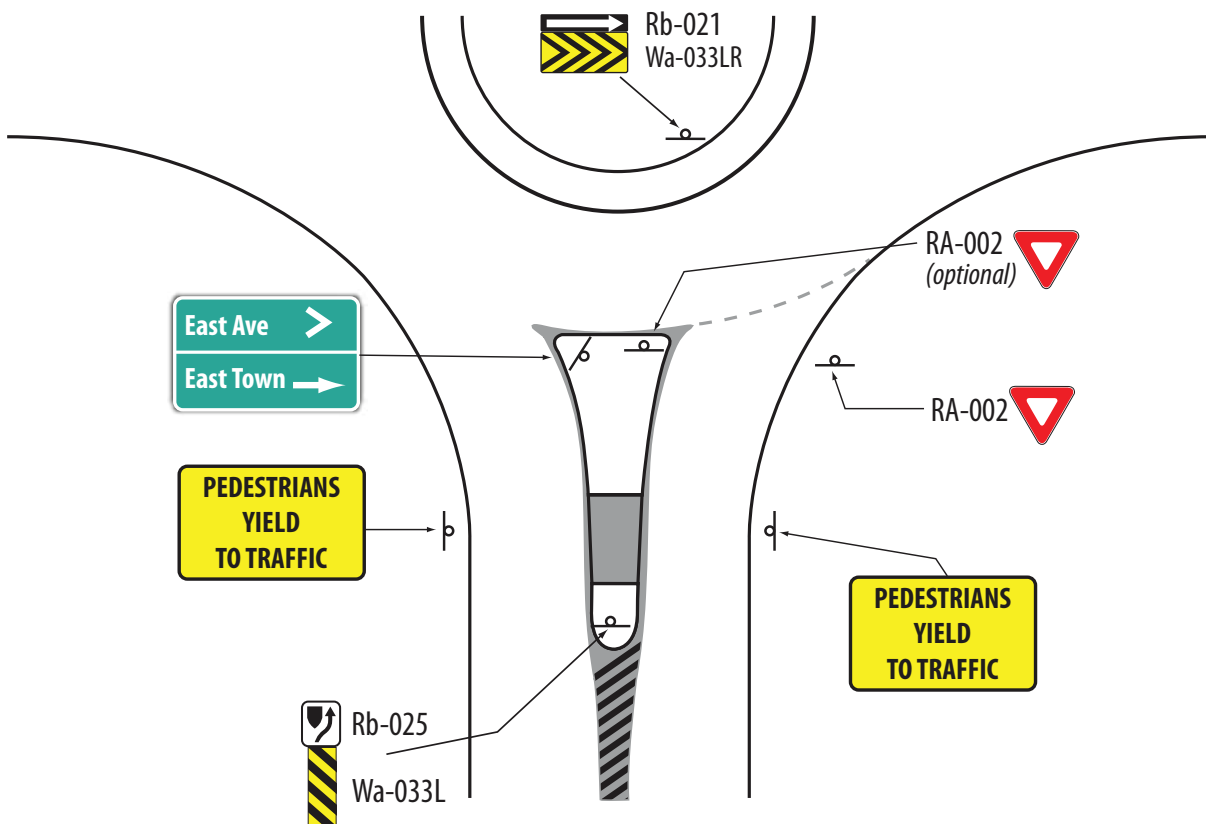


Figure 21 – An example Roundabout without Pedestrian Crosswalk

4. A splitter island is a raised or painted area on an approach to a roundabout that is used to separate entering from exiting traffic. It also deflects and slows entering traffic, and provides storage space for pedestrians crossing the road in two stages (thus functioning as a refuge island). These splitter island refuge areas should be wide enough to accommodate a person pushing a stroller or walking a bicycle (with a child trailer attached) or at least 1.8 metres. The island or median should be large enough to enable a wheelchair to wait on a level landing or a cut-through design should be provided. The cut-through width should be the same as the complete width of the crosswalk.
5. Pedestrian Pavement Markings and Signage — In Ontario, there is no formal pedestrian right-of-way at roundabouts unless accompanied by a traffic control device. As a result, it is considered to be an uncontrolled crossing. Signs and markings for uncontrolled crossings would apply. If a traffic control device is provided, then the crossing can be controlled.
6. The PEDESTRIAN AHEAD (Wc-7) sign may be considered to warn drivers that they should anticipate situations involving the presence and activity of pedestrians, which may pose a safety hazard both to the pedestrians and to the vehicular traffic. The majority of municipalities do not include advanced signing, however conditions may arise where signing in roundabout applications may be beneficial to the non-routine user, particularly in jurisdictions where roundabouts are not yet common.

3.5 Pedestrian Crossings at Right-Turn Channels

Channelized right-turn lanes are implemented to increase intersection efficiency and reduce unnecessary delay and idling emissions where high right-turn vehicular traffic volume exists. Channelization is achieved using an island, which also reduces the crossing distance and pedestrian intervals required for the remainder of the crossing. The island also removes the turning traffic from the intersection and offers a pedestrian refuge area. At signalized intersections, it provides a place to install traffic controls such as a traffic signal pole. Some right-turn channels are also used to reduce excessive pavement areas caused by skewed and flared intersection configurations.

There are two general approaches to pedestrian crossing treatments at right-turn channels, depending on the functionality of the right-turn channel and the pedestrian demands:

1. Where the right-turn channel is free flow, pedestrians crossing to the island must yield right-of-way to motorists because there are no provisions in the [Highway Traffic Act](#)ⁱ indicating otherwise. For free flow channelized right-turn lanes, crosswalk markings should therefore not be applied on the channelization curve. The WAIT FOR GAP (Wc-28) sign should be installed if field observations have indicated that pedestrians frequently cross at a location without waiting for the appropriate gaps and/or where drivers may not expect pedestrians.
2. Not all right-turn channels are free flow. At right-turn channels where a YIELD sign or a STOP sign is posted in advance of a crosswalk, drivers are required to yield the right-of-way to pedestrians.^{xvii} In other instances, the right turn channels may be integrated as part of a signalized intersection or the yield control may be oriented requiring right-turning vehicles to yield to pedestrians in addition to cross-street

traffic. Crosswalk markings are appropriate in these locations. In these circumstances, yield signs are to be installed under the authority of a municipal by-law.

It is recommended that a road authority apply a consistent philosophy for right-turn channels, in providing either controlled crossings or uncontrolled crossings within their jurisdiction. The design of a right-turn channel should take into consideration different geometric elements. The elements to consider generally include:

1. **Curb Radii** — The lower the design speed, the shorter the curve radius and the narrower the lane width requirements for the channelized lane; while the lower the design speed, the shorter the curve radius and the wider the lane width requirements for the channelized lane.
2. **Angle of entry** — The angle of entry of right-turn channels are controlled by the combinations of curve radius and/or spiral lengths. Right turn channels with a low adjacent road entry angle allows vehicles to accelerate and merge into the receiving adjacent lane more quickly than right-turn channels with a higher angle of entry.
3. **Size of Island** — The area of a triangular island should be preferably 10 m² (some agencies prefer 15 m²) however the acceptable minimum standards are^{xviii}:
 - 4.5 m² for urban intersections
 - 7.0 m² for rural intersections

The lengths of the sides of an island excluding rounding at the corners should be as follows:

- 3.5 m preferably and 3.0 m minimum for urban intersections
- 4.5 m preferably and 3.75 m minimum for rural intersections

4. **Placement of Control Signs and Crosswalk** — Alternative approaches are available for the placement of traffic control signs at channelized right-turn lanes. The placement of the YIELD or STOP sign in advance of the crossing point will create a controlled crossing. Under this controlled condition, it would be appropriate to mark the crosswalk between the boulevard and the island.

The urban “Smart Channel” is an emerging concept in the design of right-turn channels, which varies from the traditional concept that are more sweeping, have higher free flow speeds and have a low adjacent road entry angle (see **Figure 22**). Urban Smart Channels are designed to increase the adjacent road entry angle, such that the turning speed can be reduced to be more consistent with yield conditions (as it may require a full stop) and the reduced viewing angle can improve drivers’ visibility of pedestrians.

3.6 Railway Crossing

The regulatory framework for railway safety and security is administered by Transport Canada under the [Railway Safety Act](#), whereby the construction or modifications of a grade crossing requires the authorization by the Canadian Transportation Agency. While the need for such a crossing is typically established by the Public Road Authority, the design and protection requirements must meet the Transport Canada standards. No proposed road crossing may depart from the standards set out in the Regulations except in accordance with an approval of the Minister of Transport granted under the provisions of Section 10 of the [Railway Safety Act](#).^{xix} The respective roles and responsibilities overseeing railway crossings are as follows:

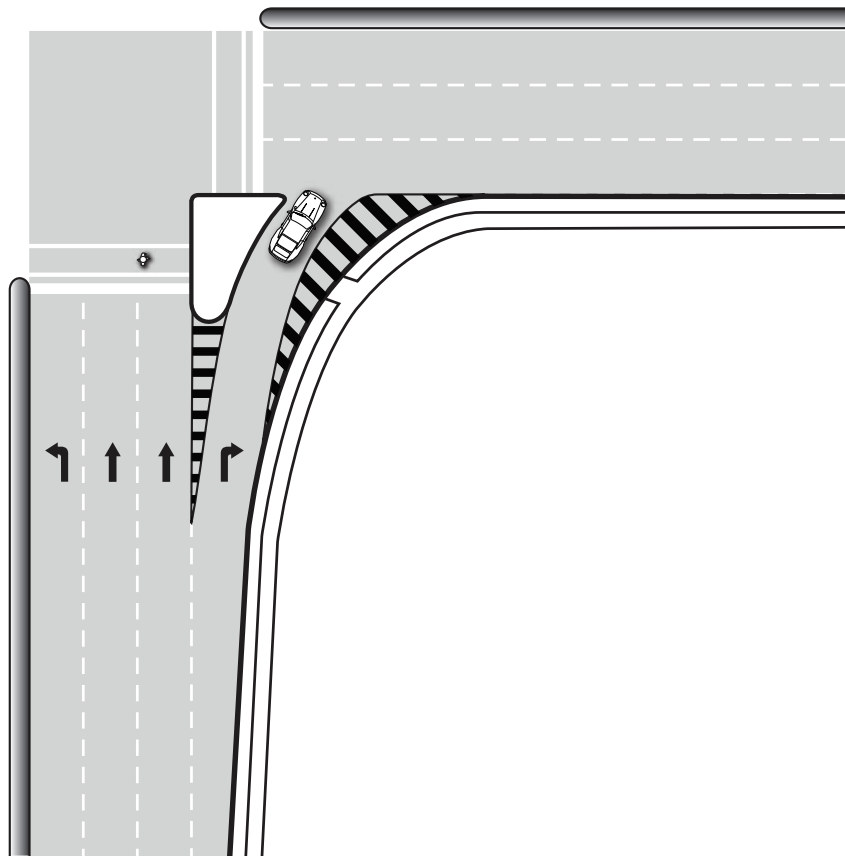


Figure 22 – Right-turn channel – “Smart Channel” Example Configuration

Railway company (in respect of a grade crossing, a railway company that owns or operates over the line of a railway at the grade crossing). The railway company is responsible for:

- The part of the road surface of the grade crossing that lies within the rail right-of-way
- Sightlines along the railway right of way
- Drainage along the railway right of way
- Railway crossing signs
- Grade crossing warning systems

Road authority (in respect of a grade crossing, the road authority that has the legal authority to open and maintain the road that passes across the line of a railway at grade). The road authority is responsible for:

- The road approaches and those parts of the surface of the road up to the ends of the railway ties, including the elevation of the road in relation to the railway track
- Sightlines along the road right of way
- Drainage along the road right of way
- Traffic control devices on road approaches and stop signs at grade crossings, including devices that interconnect with grade crossing warning systems

- Lighting devices to illuminate trains, engines and other railway equipment occupying grade crossings to ensure that they are clearly visible to pedestrians and drivers of vehicles
- The removal of snow from the road for the safe passage of vehicles, bicycles, pedestrians and persons using assistive devices over the grade crossing

While these lists reflect the legal responsibilities of each agency, the general practice in Ontario has been that the Railway company maintains the crossing surface above the rail ties (usually plates or a vulcanized rubber mat) while the Road authority maintains the asphalt leading to the crossing surface above the ties.

In determining the solution most suited to a particular crossing location, a number of factors should be considered, including^{xx}:

- Pedestrian traffic — when the Grade Crossing:
 - Is close to pedestrian attractors (schools, seniors centre, transit stops and commuter stations, parks and places of interest, shopping centres, major employers, public parking lots, sports facilities or fairgrounds and residential areas)
 - Forms part of the safe walkway path to school
 - Forms part of the access to a commuter station
 - Is regularly used by persons using an assistive device
 - Has a high level of pedestrian activity
- Site Condition:
 - Number and type of railway tracks in the grade crossing: main tracks, sidings, service track, etc.
- Volume of train traffic and associated speed
- Use of train whistle at the grade crossing
- Type of grade crossing warning system
- Presence or absence of any sign, signal or marking dedicated to pedestrians
- Location of the sidewalks or pedestrian pathways in relation to the warning signal
- Discontinuity between the sidewalks or pedestrian pathways and the crosswalk across the rail line
- Visibility of the warning system and along the railway line, from the sidewalks or pedestrian pathways leading to the grade crossing
- Other factual information:
 - Accident history
 - Frequent inclement weather

Guidance and detailed information relating to railway crossing at-grade is provided on Transport Canada's website^{xxi}, the *Geometric Design Standards for Ontario Highway* (MTO 1999)^{xviii} and the *Geometric Design Guide for Canadian Roads* (TAC 1999)^{vi}. These references provide guiding principles and design standards for the treatment of pedestrian crossings over railway lines, including the following:

- a) **Crossing Surfaces** must be smooth, continuous and slip resistant. Smooth surfaces will allow the driver to cross the tracks while devoting more attention to the presence of other vehicles, trains and pedestrians rather than concentrating on the best path by which to negotiate the crossing. This is applicable to pedestrian traffic as well.

Crossing surfaces should be clearly delineated such that pedestrians know where to cross, as well as how far they must stop from the railway. Pedestrians are expected to locate themselves 5 m from the nearest rail, or 2 m in advance of a stop sign, railway crossing sign, warning signals, or gate arm, where they exist.^{xxii} Sidewalk, pedestrian path and crosswalk travelled surfaces should be delineated within 8 m of the nearest rail with a continuous solid white line on both edges of the travelled surface. Using materials of different textures and colors will further aid pedestrians in locating crossings.

- b) **The minimum width of the grade crossing surface** must be 8 metres for vehicular use, and another 1.5 metres for pedestrian traffic. If the distance between the vehicle and pedestrian crossovers is greater than or equal to 1 metre the two surfaces may be separated. Crossing surfaces should extend 0.5 metres beyond the edge of the travelled roadway, pathway, sidewalk or trail.
- c) **Passive and active devices** may be used to assist pedestrians at crossings and can be used individually or in tandem, depending on site specific attributes such as pedestrian volumes, frequency of trains, speed of trains, complexity of crossing geometry, sight distance, multiple tracks, etc. Passive devices include fencing, swing gates, barriers, pavement markings, and fixed message signs. Active devices include flashers, audible active control devices, automated pedestrian gates, pedestrian signals, variable message signs and blank-out signs.

Active devices are more effective at reducing risk than passive devices, but are generally more costly to construct and operate.

For detailed information with respect to the design standard and specifications, it is recommended that practitioners refer to TAC's [RTD 10 Road/Railway Grade Crossings - Technical Standards and Inspection, Testing and Maintenance Requirements \(DRAFT\)](#).^{xxiii}

Wherever feasible, grade-separated crossings of railway lines are preferred.

3.7 Temporary Conditions

[OTM Book 7 – Temporary Conditions](#) was developed to provide guidance for traffic control during construction, maintenance and utility work on public roadways in Ontario. Section 1.12 Pedestrian Safety Considerations of the manual recommends the provision of a safe, delineated travel path to separate pedestrians from road traffic and the work area. This control can be provided through the use of warning and guidance devices, including the PEDESTRIAN DIRECTION Sign (TC-40) (see **Figure 23**), in addition to pedestrian barricades, barrels, construction markers, and / or fencing.

[OTM Book 7 – Temporary Conditions](#) is being updated and will include pedestrian accommodation in work zones.



Figure 23 – Pedestrian Direction Sign (TC-40)

4. Physically Separated Facilities

4.1 General

Grade separated crossings in the form of a pedestrian overpass or underpass (tunnel) provides physical separation between vehicles and pedestrians, thereby removing any interaction and conflicts between different types of road users. The complete separation of vehicular and pedestrian traffic allows for a higher degree of safety compared to at-grade alternatives for high-exposure locations. While the installation of grade separated pedestrian crossings (GSPC) may be required due to the complexity of the crossing environment, GSPC may also be necessary to connect and maintain community linkages over major barriers such as freeways and railway lines where at-grade alternatives are not feasible.

The overall costs of GSPC are significantly higher than at-grade crossing alternatives due to the increased complexity through the planning, design and construction stages. The cost effectiveness of GSPC will depend on the usage of the crossing and related reduced exposure of pedestrians to motor vehicle conflicts and collisions. Pedestrians tend to follow the path of least resistance (shortest and most convenient path), and when faced with the need to use stairs or a steep grade to walk up to an overpass (or down to an underpass), the extra effort could dissuade pedestrians into choosing a more direct at grade route across the road.

From a traffic operations perspective, the effectiveness of grade separated crossings can be measured by the degree to which the facilities can:

- Reduce the risk of motor vehicle-pedestrian conflicts where exposure between motor vehicles and pedestrians is high (i.e., high pedestrian volume and/or high motor vehicle volume and/or high vehicle speeds)
- Increase the convenience of pedestrian routes by significantly reducing the pedestrian travel distance between origins and destinations

In addition to traffic operations, there are a multitude of factors that impact the overall feasibility for the installation of GSPC. Considerations of these factors include environmental, traffic, structural, economical and social. The process for the consideration of GSPC will likely require public agencies to carry out a comprehensive feasibility study or environmental assessment study to fully identify and determine the needs.

4.2 Feasibility Study

Requests for GSPC may come from different sources and can be driven by the public, community or private sector projects. Policies may be developed as a means to more formally process GSPC requests and to prioritize needs and resources. The process invariably would include the following:

1. **Needs Assessment** — The needs for GSPC may initially be assessed using a numeric warrant as a screening tool to determine if further assessments may be required to address such crossing needs. A numeric warrant may include:
 - a) An exposure-based criteria that measures the level of interaction and conflict of a crossing (i.e., the vehicular and pedestrian traffic must exceed a minimum threshold such as that of a controlled crossing)
 - b) A directness ratio that measures the crossing opportunities
 - c) Condition-based criteria (e.g., crossing of major barriers such as freeways and railway links)

- d) Consideration of alternative at-grade measures to accommodate the crossing needs
 - e) Safety records if it is an existing facility
2. **Feasibility Assessment** — If it is determined that there is a need for GSPC based on the needs assessment, a further step is to conduct a comprehensive assessment to evaluate the feasibility of a new structure based on impacts to different stakeholders. In assessing whether a grade separated crossing is appropriate at a particular location, consideration should be given to the anticipated benefits (in recognition of use of the crossing) relative to the cost. This benefit and cost assessment would have considerations to the following:
- a) Impact on natural environmental
 - b) Impact on cultural environment (built heritage, archaeological)
 - c) Transportation impact (likely utilization, accessibility, convenience of linkage, safety, potential benefits to other modes of transportation, official plan policies)
 - d) Land-use and social-economical impacts (adjacent landowners impact, community linkages, walkability)
 - e) Engineering feasibility (availability of land, existing constraints, acceptable grades)
 - f) Economics (capital costs and operating / maintenance costs, funding source)
- Public consultation will be a critical element in the decision-making process.

Figure 24 provides an overview of the process.

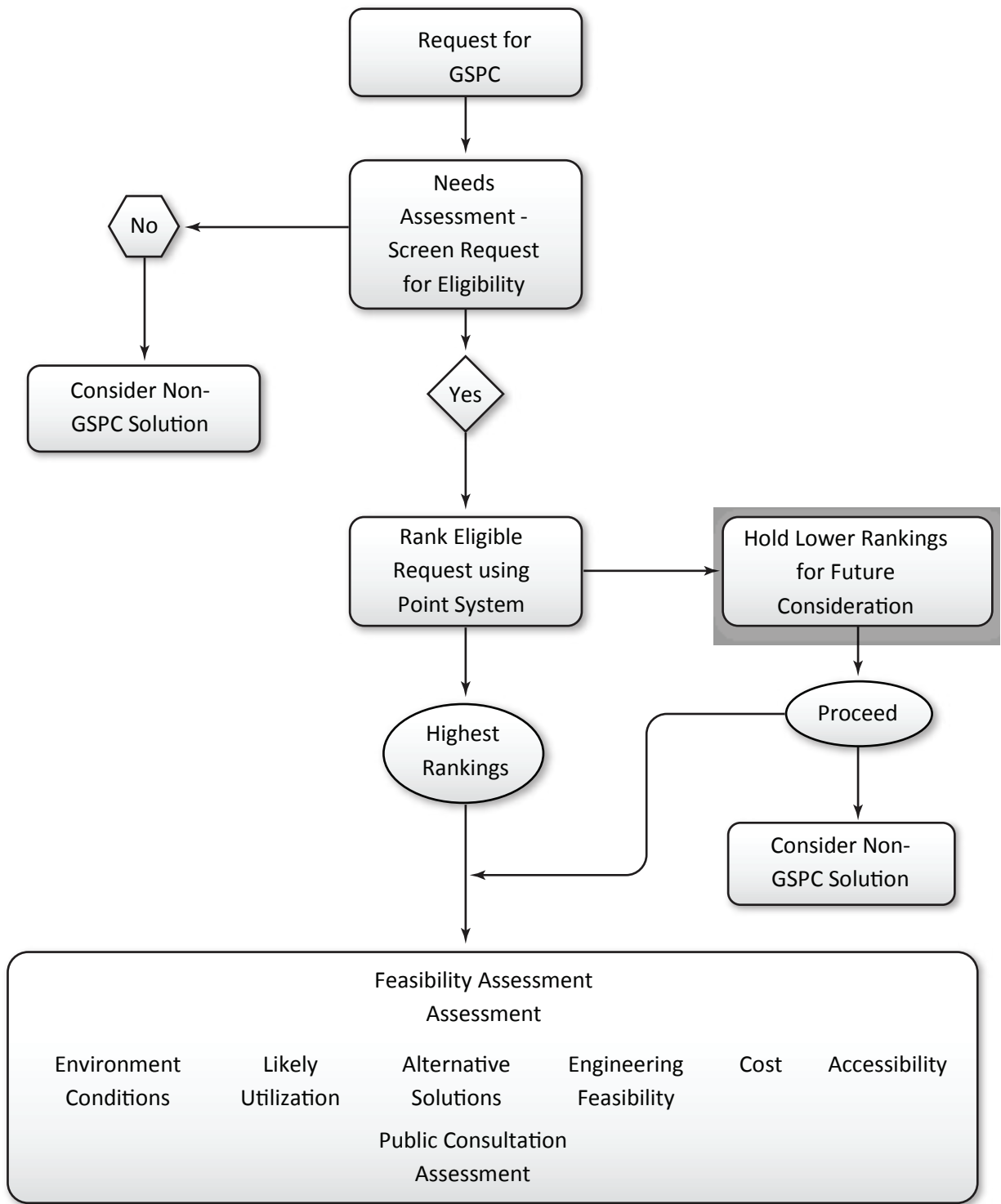


Figure 24 – Grade Separated Pedestrian Crossing Accessibility

5. Accessibility

5.1 General

Road users' range of abilities varies with respect to mobility, vision, hearing, and cognition. Physical and mental impairments often inhibit many individuals from performing certain routine functions and limit their ability as pedestrians at crossings. The ability of individuals, however, shall not preclude them from the right to use any facilities including pedestrian crossings. Provision of pedestrian facilities must therefore address the range of capabilities exhibited by the individuals that might use them. This Section outlines the overall consideration for accessible crossing and further references the Ontario standard.

5.2 Legislative Requirements

The [Accessibility for Ontarians with Disabilities Act, 2005](#), proclaimed on June 13, 2005, sets out the legal requirements for the purpose of improving accessibility standards for Ontarians with physical or mental disabilities. The goal of the AODA is to:

“achieve accessibility for Ontarians with disabilities with respect to goods, services, facilities, accommodation, employment, buildings, structures and premises by January 1, 2025”^{xxiii}.

The requirements of the AODA includes the legal authority, framework, and processes for the Ontario Government to develop, implement and enforce the accessibility standards, under which the public and private sectors must comply based on the mandatory schedule. The AODA is being phased-in and will include future standards in areas of:

- Employment
- Information and Communications
- Transportation

Accessibility standard for pedestrian crossings within public right-of-ways is defined as part of the *Built Environment Standard*. The [Final Proposed Accessible Built Environment Standard, July 2010](#) has been approved and submitted to the government for consideration as law. For latest information on the status of the update, practitioners should refer to the [Ontario Ministry of Community and Social Services](#) website.

It is also further noted that the AODA is intended to eventually replace the [Ontarians with Disabilities Act, 2001 \(ODA\)](#)^{xxiv}. While the AODA is being phased-in, the ODA will remain in force until it is officially repealed. As such, public sector organizations are required to implement both Acts simultaneously during this period.

5.3 Designing for Accessibility

Pedestrian crossings shall provide a continuous, clear and linear path across the vehicular route. An accessible path must be barrier-free and designed to address a range of capabilities as exhibited by the individuals that might use them. Consideration shall be given to the expected number and type of users in determining the design parameters that will enable independent, safe, and efficient use of the crossings by individuals of all ages and abilities.^{xxv}

A barrier-free environment means the elimination of physical or information barriers. Physical barriers such as curbs, steep slopes or obstacles may restrict movements of pedestrians with mobility impairments; while information barriers such as the lack of tactile or audible cues will limit pedestrians with visual or hearing impairments in their ability to recognize the conditions of the environment. According to the *Built Environment Standard*,

- Built Environment*
- Customer Service (Ontario Regulation 427/07)

treatments to enhance accessibility for pedestrian crossings include (but are not limited to) the following:

- Curb Ramps [see **Section 5.3.1**]
- Edge Markings [see **Section 5.3.2**]
- Running Slope / Cross Slope [see **Section 5.3.4**]
- Accessible Pedestrian Signals [see **Section 5.3.5**]

Curb Ramps

Curb ramps provide access for people on wheelchairs or scooters at crossings where there is an elevation change between the sidewalk and the street level crossing. Curb ramps should be considered for all protected crossings, for all corners of all intersections, and at midblock locations with formalized unprotected crossings, where pedestrian demand can be reasonably expected, or where pedestrian crossing is not prohibited, subject to municipal by-laws. However, not all pedestrians with mobility impairments will benefit from the use of

curb ramps. For some pedestrians who use walking aids such as canes, crutches or walkers, it may in fact be physically demanding for these users to travel on the slope of the ramp. To accommodate both wheelchair access and pedestrians who rely on walking aids, the ramp will have to be sufficiently wide (at least 1.5 m).

Pedestrians with visual impairments are another user group that may find challenges with curb ramps. Pedestrians with visual impairments rely on curbs to identify the transition from sidewalk to crosswalk. The lack of vertical edge can create information barriers. Therefore, it is also necessary to install detectable warnings to mark the boundary of the transition as part of the design.

The design of curb ramps may vary according to the selected design elements and parameters that form the overall ramp structure. The design, however, will have to address the needs of pedestrians with mobility impairments and pedestrians with visual impairments. The design elements (as prescribed in the *Built Environment Standard*) are summarized in **Table 12**.

Table 12 – Curb Ramp Designs

Location		The location of curb ramps should be coordinated with crosswalks and sidewalks such that they are aligned.
Width	[see Clause 5.2.6 of Built Environment Standard]	Curb ramp widths should be sufficiently wide to allow two persons in wheelchairs to pass easily. The minimum width of 1.5 m for curb ramp is prescribed in Clause 5.2.6 of Built Environment Standard .
Surfaces	[see Clause 5.2.1 of Built Environment Standard]	<p>The surface of a curb ramp shall:</p> <ul style="list-style-type: none"> • Be stable, firm and slip resistant. • Have a detectable warning surface (that complies with Clause 8.6, Detectable Indicator) to help identify potential hazards through the use of distinct changes in texture. Detectable indicators have a texture that can be felt under foot or detected by person using a long cane. • Have provisions for transition areas either at the level of the vehicular route or the level of the pedestrian sidewalk, or both.

Running Slope	[see Clause 5.2.2 of Built Environment Standard]	<p>The curb ramps shall have:</p> <ul style="list-style-type: none"> • A running slope not exceeding the threshold prescribed in the Built Environment Standard. • A counter slope of gutters and road surfaces immediately adjacent to the bottom of the curb ramp that is not steeper than the threshold prescribed in the Built Environment Standard. The curb ramp shall not create a sudden transition that would impede the transition of the pedestrian from the vehicular route to the curb ramp.
Cross Slope	[see Clause 5.2.3 of Built Environment Standard]	<p>The cross slope on the curb ramps shall:</p> <ul style="list-style-type: none"> • Not be steeper than the ratio prescribed in the Built Environment Standard. • Have a rate of change from the ramp to adjacent road or gutter not exceeding the prescribed threshold in the Built Environment Standard • Be in the direction that reduced the rate of change
Curb Ramp Sides	[see Clause 5.2.4 of Built Environment Standard]	<p>Wherever possible a return curb shall:</p> <ul style="list-style-type: none"> • Be used over the full length of the curb ramp • Have a high colour/tonal contrast and/or texture (complying with the Built Environment Standard requirements) at the outside of the return curbs to clearly designate them as not intended for pedestrian travel
Traffic Islands	[see Clause 5.3.4 of Built Environment Standard]	<p>Where traffic islands are provided within a pedestrian crossing, they shall:</p> <ul style="list-style-type: none"> • Have a level area for pedestrians to wait to cross • Be cut through level with the street or have curb ramps at both sides (that comply with Clause 5.2, Curb Ramps) • Have a tactile detectable warning surface (complying with Clause 8.6, Detectable Indicators) at both ends of the island crossing
Drainage	[see Clause 5.2.7 of Built Environment Standard]	Curb ramp design shall provide for drainage so that water will not accumulate on the accessible route.
Changes in Elevation	[see Clause 5.2 of Built Environment Standard]	Changes in elevation within the surface of the curb ramp, including curb and transition areas, shall not present a tripping hazard or impede the passage of individuals using assistive devices.

Crosswalk Alignment

Crosswalk alignments should be straight and unobstructed. Wherever possible, the crosswalks and crosswalk markings should be within the most direct route from sidewalk to sidewalk.

Edge Markings

To further enhance pedestrian delineation at the crossings, edge markings shall be provided at both sides of pedestrian crossings (according to Clause 5.3.3 of [Built Environment Standard](#)) such that they are marked with permanent high-colour markings and have a surface texture to distinguish them from the main pedestrian crossing path of travel and vehicular route / roadway. For more details on the technical requirements, see [Built Environment Standard](#).

Running Slope and Cross Slope

The running and cross slopes of a pedestrian crossing shall comply with Clause 5.1.3 of [Built Environment Standard](#).

Accessible Pedestrian Signals

Accessible Pedestrian Signals (APS) are auxiliary devices that supplement traffic control signals to aid pedestrians with visual or visual and hearing impairments to cross the road. APS devices communicate information in a non-visual format to provide cues at both ends of a crossing, such as audible tones, verbal messages, and/or vibrotactile indications.

APS devices that have speakers mounted in, on, or near pedestrian pushbuttons emit a sound such as a bell, buzz, tone or birdcall (typically cuckoo and chirp) during the WALK interval. Additional equipment may produce tones to locate the

pushbuttons, tones to acknowledge the button has been pushed, and tones to indicate the direction to start crossing. The sound of APS signals should be capable of being heard above ambient traffic noise.

Infrared transmitters located at the pedestrian head can transmit a speech message to hand-held receivers. Messages may identify the location and direction of travel of the pedestrian, give the name of the street to be crossed, and provide real time information about WALK and DON'T WALK intervals.

APS devices may have vibrating features that operate in parallel with the audible sounds.

For comprehensive guidelines on APS applications, practitioners should refer to TAC's *Guidelines for Understanding Use and Implementation of Accessible Pedestrian Signals, May 2008*. The guideline will shortly replace the audible signal provisions in TAC's *Manual of Uniform Traffic Control Devices, 1991 as amended 2008*, which provides information on the basic standards and pushbutton operation options. The guideline itself is a stand-alone document that provides additional details on all stages of an APS installation. This includes:

- The understanding of steps taken by pedestrians with vision loss to cross a street
- Guidelines on liaising with local communities and recognized agency or body trained in the needs of the visually impaired
- Establishing installation priorities based on pedestrian safety, pedestrian usage, and traffic conditions
- APS operational guidelines on:
 - Pedestrian wayfinding through pushbutton locating tones

- Orientation guidance through the use of information signs, tactile arrows and lettering, Braille, audible (voice) orientation message
- APS actuation
- Types of APS indications
- Traffic control signal operations and phasing
- APS design guidelines on the:
 - Overall layout and intersection configurations
 - Pushbutton location, mounting height, and alignment
 - Beacon mounting height and alignment
 - Pedestrian information signing
- APS deployment guidelines on installation strategies
- APS maintenance and adjustments

6. Glossary / Definitions

Accident

See Collision.

Actuation

The operation of a detector in registering the presence or passage of a vehicle or pedestrian.

Accessibility

Provisions made to facilities to address the range of capabilities of the individual users. This is achieved through the elimination of physical and information barriers that preclude the use of the facility.

Accessible Pedestrian Signal (APS)

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.

Approach Speed

The maximum safe speed that can be maintained over a short section of highway immediately in advance of a potentially hazardous location, taking into account pavement and shoulder width, horizontal and vertical alignment, sight distance, and other controlling factors. The approach speed does not necessarily coincide with the design speed.

Arterial Road

A road, used primarily for through traffic rather than for access to adjacent land, that is characterized by high vehicular capacity and continuity of movement. Intersections are spaced relatively far apart and are frequently signalized. See also Collector Road and Local Road.

At-grade Intersection

An intersection of two roadways where there is no vertical separation between the two roadways at their point of intersection.

Audible Pedestrian Signal

See Accessible Pedestrian Signal.

Bicycle

A vehicle having only two tandem wheels, propelled solely by human power, upon which typically one or two persons may travel. The *Highway Traffic Act* definition of bicycle includes tricycles and unicycles, power assisted bicycles (electric) and excludes motor-assisted bicycles.

Bicycle Lane

A portion of a roadway which has been designated by striping, signing and pavement markings for the preferential or exclusive use of bicyclists.

Bicycle Path

A bikeway physically separated from the motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent right-of-way.

Bus

Any motor vehicle designed, constructed and/or used in the transportation of ten or more seated passengers.

Collector Road

A road for which vehicle movement and access are of equal importance. Direct access to adjacent properties may be permitted in some cases, typically in lower-density residential areas. Intersections are spaced at varying intervals and are typically only signalized where the collector road intersects an arterial road or in some cases another collector road. See Arterial Road and Local Road.

Collision

An incident resulting in property damage, personal injury or death and involving the loss of control and/or the striking of one or more vehicles with another vehicle, a person, an animal or an inanimate object.

Commercial Motor Vehicle

A motor vehicle having a permanently attached truck or delivery body, including fire apparatus, buses, and truck tractors and trailers (combination units) used for hauling purposes on the highways, that may require a Commercial Vehicle Operating Registration (CVOR).

Community

A group of individuals with a common interest. A community is often defined by neighbourhood boundaries, but may also include individuals who live outside the neighbourhood, but who work or operate businesses in the neighbourhood, or whose children attend school in the neighbourhood.

Conflict

A Collision or near-collision which requires evasive action on the part of one or more persons. Conflicts can occur between two motorists, between a motorist and cyclist, between a motorist and pedestrian, and between a cyclist and pedestrian.

Controlled Intersection

An intersection where traffic approaching from any or all directions is regulated by some form of traffic control device.

Controlled Crossing

A location that is controlled by stop or yield signs, pedestrian crossovers (PXO), intersection pedestrian signal (IPS or half signals), mid-block pedestrian signal (MPS), or full traffic control signals. At controlled crossings, vehicles must yield to pedestrians within or closely approaching the driver's half of the roadway.

Crossover

See Pedestrian Crossover.

Crosswalk

See Pedestrian Crosswalk.

Curb

A vertical or sloping construction element along the edge of a pavement or shoulder forming part of a gutter, strengthening or protecting the edge, and clearly defining the edge to vehicle operators. The surface of the curb facing the general direction of the pavement is called the "face".

Curb Depression

Curb depressions improve accessibility for crossing activity for all pedestrians. They are typically provided in urban areas where pedestrian activity exists. Curb depressions are not intended to imply right-of-way, but rather improve accessibility and safety where pedestrian activity has been demonstrated.

Curb Extension

An extension of the sidewalk or curb line to reduce the width of the travelled portion of the roadway and often protrude into the space allocated for curb side parking. Curb extensions provide refuge for pedestrians, and can improve sight distance and sight lines for both pedestrians and motorists, and may also be considered as a traffic calming measure.

Curb Ramps

A ramp to transition between the change in elevation between the sidewalk and the street level crossing.

Curve

A horizontal or vertical deviation in the roadway. A horizontal curve appears as a bend in the roadway, requiring drivers to turn the steering wheel. A

vertical curve appears either as a “crest” or a “sag” to provide for a change in gradient on the profile of the roadway.

Cycle

1. When referring to a traffic signal, cycle describes one complete sequence of signal indications.
2. See Bicycle.

Cyclist

A person riding a bicycle.

Delineation

One, or a combination of several types of devices (excluding Guide Signs) that regulate, warn, or provide tracking information and guidance to drivers.

Design Speed

A speed selected for the purposes of design and correlation of those features of a highway, such as curvature, superelevation, and sight distance, upon which the safe operation of vehicles is dependant.

Device (Traffic Calming)

A physical feature of the roadway, constructed for the purpose of affecting the movement of motor vehicles, bicycles and/or pedestrians.

Device (Traffic Control)

See Traffic Control Device.

Driver

A person who operates a vehicle on a highway.

Driveway

A private road giving access from a public way to a building or property on abutting grounds.

Edge Markings

Permanent high-colour markings with surface texture used to further enhance pedestrian delineation at crossings and distinguish the main pedestrian crossing path of travel from the vehicular route/roadway.

Exclusive Pedestrian Phase

An interval of a traffic signal cycle that is dedicated to one or more pedestrian movements while displaying red on all traffic signal indications for vehicles.

Expectancy

Used in traffic engineering to describe a driver's anticipation of upcoming road design and traffic control conditions. Driver expectancy is usually affected by previous experience and the consistency and continuity of traffic control devices encountered. Violation of driver expectancy should be avoided whenever possible.

Exposure

Degree or level of interaction between pedestrians and vehicles.

Expressway

A divided arterial highway for through traffic with full or partial control of access and generally with grade separations at major intersections.

Flow

Movement of traffic:

1. Interrupted — Non-continuous movement of traffic
2. Uninterrupted — Continuous movement of traffic

Freeway

An expressway with full control of access and interchanges in place of At-grade Intersections. This term includes Toll Highways built to a freeway configuration.

Geometry

When referring to roadway design, geometry refers to the physical characteristics and dimensions of parts of the roadway.

Grade Separation

The vertical separation of two or more intersecting roadways or a roadway and another transportation mode, e.g., railroad, thus permitting traffic on all roads to cross traffic on all other roads without interference.

Guideline

A recommended (but usually not required) practice, method or value for a specific design feature or operating practice.

Highway

A general term denoting a public way for purposes of vehicular and pedestrian travel, including the entire area within the right-of-way. This includes King's Highways, regional and county roads, rural roads, municipal roads and streets.

Highway Traffic Act (HTA)

The Ontario *Highway Traffic Act*.

Human Factors

The consideration of human physical, perceptual and mental limitations in engineering design, so as to optimize the relationship between people and things. The objective is to reduce error and increase user comfort.

Installation

The process or act of placing, erecting, and/or connecting a traffic control device or system into its functional position and state of operational readiness.

Intersection

The area embraced by the prolongation of lateral curb lines or, if none, of the rights-of-way of two or more highways that join one another at an angle, whether or not one highway crosses the other.

Intersection Approach

That part of an intersection leg used by traffic approaching the intersection.

Intersection Channelization

Raised or painted islands at an intersection that prevent specific movement(s) from being made or provide better definition of large uncontrolled areas of pavement.

Intersection Pedestrian Signal (IPS)

Traffic control signal implemented for dedicated pedestrian crossings at intersections. The control of the pedestrian signals is by pedestrian actuated two phase operation with only pedestrian signal indications used for crossing the main street and regular traffic control signals on main roadway approaches. The main road traffic must be fully signalized, while the side road must be controlled with stop signs.

Junction

See Intersection.

Jurisdiction

A legal or other authority with responsibility and control for specific actions within a defined area.

Kilometre

A measure of distance equal to 1000 m (.622 miles).

km

Abbreviation for kilometre.

Ladder Crosswalk Markings

Pavement markings that incorporate longitudinal stripe markings to enhance the delineation of pedestrian crosswalks. A ladder style crosswalk is a combination of zebra pavement markings aligned perpendicular to the standard parallel crosswalk lines. The contrast of the markings provides enhanced conspicuity of the crosswalk and thereby increases the awareness of drivers to potential conflicts.

Lane

A defined width of road intended to accommodate a single line of moving vehicles.

Leading Pedestrian Interval

Leading pedestrian interval is 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.

Legal Authority

The authority provided, by legislation and regulation, to a jurisdiction or enforcement body for the actions it takes.

Local Road

A street or road primarily for access to residence, business or other abutting property.

Luminance

The luminous flux in a light ray, emanating from a surface or falling on a surface, in a given direction, per unit of projected area of the surface as viewed from that direction, per unit of solid angle. (Reflective light.)

m

Abbreviation for metre.

Maintenance

The upkeep of highways, traffic control devices, other transportation facilities, property and/or equipment.

May

Indicates a permissive condition. No requirement for design or application is intended. However, mandatory requirements apply to some specific options if and when they are selected.

Median

That portion of a divided highway separating the travelled ways for traffic in opposite directions.

Median Barrier

A raised island, wall or structure located on the Centreline of a roadway through an intersection or along a road that prevents left turns or straight through movements from being made to and from a side street or private/commercial driveway.

Median Island

A zone or physical island constructed in the centre of a roadway to separate opposing directions of traffic. In the context of traffic calming, it may be used to reduce the overall width of the travel lanes.

Median Strip

An expanse of hard surface material separating opposing lanes on a highway. The hard surface is flush or nearly flush with the adjacent lanes.

Midblock

Segment of the roadway between two intersections.

Midblock Pedestrian Signal (MPS)

Traffic control signal implemented for dedicated pedestrian crossings at midblocks. The control of the pedestrian signals is by pedestrian actuated two phase operation with only pedestrian signal indications used for crossing the main street and

regular traffic control signals on main roadway approaches. The main road traffic must be fully signalized.

Ministry

The Ministry of Transportation, Ontario.

Minor Road

The lesser of two roads at an intersection.

Motor Vehicle

Includes an automobile, motorcycle, motor-assisted bicycle (moped), and any other vehicle propelled or driven other than with muscular power, but does not include a streetcar, or other vehicles designed to operate on rails, power assisted bicycles or a motorized snow vehicle, traction engine, farm tractor and implements of husbandry or road-building machine.

Motorist

See Driver.

MTO

The Ministry of Transportation Ontario.

Multi-use Path

Any off-road dedicated facility for non-motorized traffic such as bicycles, pedestrians and in-line skaters.

Must

Indicates a mandatory condition. Where certain requirements in the design or application of the device are described with the “must” stipulation, it is mandatory that these requirements be met when an installation is made.

MUTCD

The Manual of Uniform Traffic Control Devices for Ontario, 1995.

MUTCDC

The Manual of Uniform Traffic Control Devices for Canada, 1991 as amended in 2008.

MUTCD-US

The U.S. Manual of Uniform Traffic Control Devices, 1988.

Neighbourhood

A cohesive urban area defined by geographic features, the road network or socio-economic characteristics. With respect to traffic calming, neighbourhood boundaries are often defined by the arterial roadway network, which typically presents a significant barrier to travel and interaction.

Object Marker

A traffic sign mounted temporarily or permanently on an obstruction, within or adjacent to the roadway, to make the obstruction as highly visible as possible.

On-street Parking

The use of vehicle parking on the roadway surface or on the adjacent shoulder.

Overhead Sign

A Traffic Sign mounted above the roadway, usually with 4.5 m to 5.3 m of vertical clearance and preferably located over the lane or lanes to which the sign applies.

Oversize Sign

A Traffic Sign with greater proportional dimensions than the minimum dimensions specified in this Manual. Such signs are generally required on higher speed highways, or on other highways in special cases.

Parking

The stationary storage or leaving of a vehicle unoccupied or unattended.

Pavement Marking

A coloured marking applied to the pavement to provide drivers with roadway alignment information.

Pedestrian

Any person who is not in or upon a vehicle, motorized or otherwise propelled, or a person in a non-motorized wheelchair, or person in a motorized wheelchair that cannot travel at over 10 kph or a person pushing a bicycle or motorized or non-motorized wheelchair.

Pedestrian Aids

Used to supplement pedestrian crossings to enhance the level of safety and/or security. Examples include pedestrian countdown signals, exclusive pedestrian phase, leading pedestrian interval, audible / accessible pedestrian signals, pedestrian delineation, advanced stop bar and signage.

Pedestrian Countdown Signals (PCS)

Supplementary devices that provide a numeric countdown display of the number of seconds remaining in the Flashing Don't Walk interval of a pedestrian phase. PCS are optional devices that can be provided at locations where pedestrian signals are installed.

Pedestrian Crossover

Any portion of a Roadway, designated by by-law of a municipality, at an intersection or elsewhere, 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 regulation and the *Highway Traffic Act*, with associated signs Ra-4, Ra-4t, Ra-10 and Ra-11.

Pedestrian Crosswalk

Any portion of the roadway, at an intersection or elsewhere, distinctly indicated for pedestrian crossing by appropriate pavement markings and/or

signs, or by the projections of the lateral lines of the sidewalk on opposite sides of the road. See also Ladder Crosswalk Marking and Textured / Coloured Crosswalk

Pedestrian Delineation

A defined pedestrian crossing as indicated by edge markings, painted pavement markings, surface treatments, etc. With the exception of school crossings, marked crosswalks are not recommended at uncontrolled intersections.

Pedestrian Facility

A facility where pedestrians are controlled and protected from other road users.

Pedestrian Fencing

Physical barriers (including fencing, gates, walls, bollards, etc.) that are implemented to discourage pedestrian crossing at non-designated locations and help direct pedestrians to crosswalks.

Pedestrian Signal (Traffic Signal)

A Traffic Signal head or indication showing either a white walking pedestrian on a black background (when pedestrians are permitted to cross) or an orange hand on a black background (when pedestrians are not permitted to cross, if continuous, or are not permitted to start crossing, if flashing).

Permissive

Refers to areas where a driver is permitted to travel (e.g., a truck route).

Phase (Traffic Signal)

A part of a cycle where one or more traffic movements receive a green indication at the same time. Phase time is the time required from the start to the finish of the phase including Amber and All-red Interval times.

Posted Speed

A section upon which the maximum speed is indicated by the Regulatory Signs or where signs are not present, designated as per Section 128 of the *Highway Traffic Act*.

Posted Speed Zone

A section of highway upon which the maximum speed is indicated by appropriate Regulatory Signs or where signs are not present, designated as per Section 128 of the *Highway Traffic Act*.

Prescribed Sign

The *Highway Traffic Act*, Section 182 (R.S.O. 1990), provides for the regulation of various signs, their type and location on the roadway. The criteria and specifications for application, dimensions, location and orientation are prescribed and illustrated under Regulations 615, 608, 581, 599 (R.R.O. 1990) and are indicated as such in this Manual. Signs erected in accordance with the Regulations, and pursuant to the *Highway Traffic Act*, are enforceable under various provisions of the Act. Enforcement is permitted under the particular section under the authority of which a prescribed sign may be erected to indicate a traffic regulation, or *Highway Traffic Act* Section 182 (R.S.O. 1990), which requires obedience to prescribed signs.

Railroad

All forms of non-highway ground transportation that run on rails or electro-magnetic guideways, including:

1. Commuter or short haul rail passenger service in a metropolitan or suburban area; and
2. High speed ground transportation systems that connect metropolitan areas, without regard to whether they use new technologies not associated with traditional railroads.

Railroad Crossing

A location where one or more railroad tracks cross a public highway, road, street, or private roadway, and includes sidewalks and pathways at or associated with the crossing.

Raised Crosswalk

A marked Pedestrian Crosswalk at an intersection or mid-block, constructed to the same elevation as adjacent curbs and sidewalks.

Ramp

An interconnecting roadway of a traffic interchange, or any connection between highways at different levels or between parallel highways, on which the vehicles may enter or leave a designated roadway.

Refuge Island

An island provided in a street for the safety of pedestrians, either as a Median Island on a wide street, where the width may not permit pedestrians to cross the street on a single Pedestrian Signal indication, or as a loading island for transit, such as Streetcars.

Regulation

A prescribed rule, supported by legislation, such as any regulation made under the *Highway Traffic Act* or municipal bylaw. Regulations provide the legal basis for enforcement.

Regulatory Sign

A traffic sign advising drivers of action they should or must do (or not do), under a given set of circumstances. Disregard of a regulatory sign would usually constitute an offence.

Restrictive

Refers to areas where, or times when, a driver is not permitted to travel.

Retroreflective Material

A type of material applied in either strips or sheets which reflects illumination back to its source.

Right-of-way

1. Allocation of right of movement to a road user, in preference over other road users;
2. The width of the road allowance from the property line on one side to the property line on the opposite side of the roadway.

Right-of-way Rule

Although these may vary in specific localities, in Ontario a vehicle approaching an uncontrolled intersection at the same time as another vehicle must yield to a vehicle approaching to its right.

Right Turn Channel

An intersection design that isolates and directs the right-turn movement on an approach through the use of medians and splitter islands. Right-turn channels at signalized intersections are implemented to increase intersection efficiency and reduce unnecessary delay and idling emissions where high right-turn vehicular traffic volume exists.

Right Turn on Red (RTor)

A right-turning movement permitted on a red signal indication after coming to a stop and ensuring that a right turn can be made safely. Allowed by the *Highway Traffic Act*, but subject to site-specific local by-laws and posted regulatory signs restricting turns on red signals.

Road

See Highway.

Road Authority

The body (Municipal, Provincial or private) that has legal jurisdiction over a roadway.

Roadway

The part of the highway that is improved, designed or ordinarily used for vehicular traffic, but does not include the shoulder, and, where a highway includes two or more separate roadways, the term “roadway” refers to any one roadway separately and not to all of the roadways collectively.

Roundabout

A raised circular island located in the centre of an intersection, which requires vehicles to travel through the intersection in a counter-clockwise direction around the island. Roundabouts are typically used on arterial and collector roads, and are distinguished by YIELD signs and raised Median Islands on all approaches, and in some cases, gradual widening of the entry approach to two or more lanes.

Rural Area

An area outside of the limits of any incorporated or unincorporated city, town, village, or any other designated residential or commercial area.

School Crossing

Designated school crossings are locations close to schools where school children have to cross en route between home and school. School crossings are supervised by school patrollers or adult crossing guards whose role is to direct and supervise the movement of persons (as defined in the *Highway Traffic Act*) across a highway by creating necessary gaps in vehicular traffic.

School Area, School Zones and School Crossing Signs

A group of signs, both Regulatory and Warning, used to control vehicles and protect pedestrians wherever students and pedestrians are likely to be present and conflict with vehicles may occur.

Shall

Means the same as “must”.

Should

Indicates an advisory condition. Where the word “should” is used, the action is advised; recommended but not mandatory. This term is meant to suggest good practice in most situations but also to recognize that in some situations, for good reasons, the recommended action cannot or need not be followed.

Sidewalk

That portion of a road, adjacent to the travelled roadway, which has been improved for the use of pedestrians.

Sight Distance

The distance visible to the driver of a passenger vehicle, measured along the normal travel path of a roadway, to the roadway surface or to a specified height above the roadway, when the view is unobstructed by traffic.

Sign

A Traffic Control Device mounted on a fixed or portable support which conveys a specific message by means of symbols or words, and is officially erected for the purpose of regulating, warning, or guiding traffic.

Signal Indication (Traffic Signal)

The illumination of one or more lenses in a signal head which conveys a message to traffic approaching the signal from one direction.

Signalized Control

The use of a traffic signal control device to control traffic on a road section or intersection.

Speed Limit

The maximum vehicular speed allowed within any given posted or unposted Speed Zone.

Splitter Island

A raised or painted area on an approach used to separate traffic entering from exiting. Splitter islands are implemented at roundabouts, or to form channelized lanes at intersections or to provide storage space for pedestrians crossing the road in two stages (functioning as a refuge island).

Standard

A rule, principle, pattern or measure, which practice or theory has shown to be appropriate for a given set of conditions, and applicable, as the case may be, to planning, design, traffic control devices, operations or maintenance.

Stop Bar

A Pavement Marking placed laterally across the approach half of a travelled roadway at the site of a STOP or YIELD sign, Traffic Signal, or Pedestrian Crosswalk. The line indicates the point beyond which the foremost part of a vehicle must not protrude, should the vehicle be required to stop. Also called Stop Line.

Stop Line

See Stop Bar.

Stopping (where prohibited)

The halting of a vehicle, even temporarily, whether occupied or not, except where necessary to avoid conflict with other vehicles, or in compliance with the directions of a police officer or Traffic Control Signal.

Stopping Sight Distance

The distance required by a driver of a vehicle, travelling at a given speed, to bring the vehicle to a stop after an object on the roadway becomes visible. It includes the distance travelled during the Perception-reaction Time and the vehicle braking distance.

Street

An Urban Highway.

Surface

The top of the pavement material, Substrate, or Sign Sheeting.

Tab Sign

A sign smaller than the primary sign with which it is associated, and mounted below it. There are two types of tab signs:

1. Supplementary Tab Sign — contains additional, related information
2. Educational Tab Sign — conveys the meaning of symbols during their introductory period

Textured / Coloured Crosswalk

A crosswalk that incorporates a textured and / or patterned surface which contrasts with the adjacent roadway. They are applied to better define a pedestrian crossing and increase the awareness of drivers to potential conflicts.

Timing

When referring to traffic signals, timing describes the amount of time allotted to each Phase within each signal cycle.

Traffic

‘Traffic’ includes pedestrians, ridden or herded animals, vehicles, bicycles, and other conveyances, either singly or together, while using a highway for purposes of travel;” British Columbia Motor Vehicle Act. (*Molson v. Squamish Transfer Ltd.* [1969] B.C.J. No. 190)

Traffic Accident

See Collision.

Traffic Calming

The combination of mainly physical measures that reduce vehicle speeds and the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized street users.

Traffic Calming Measure

A physical device, design or other action which affects the movement of motor vehicles, bicycles, and/or pedestrians.

Traffic Control Device

Any sign, signal, marking, or device placed upon, over or adjacent to a roadway by a public authority or official having jurisdiction, for the purpose of regulating, warning, guiding or informing road users.

Traffic Control Person

A person, duly trained and thereby authorized, to direct traffic at a work zone, through the use of a “Stop” and “Slow” paddle. Each traffic control person may only control one direction of travel.

Traffic Control Signal (Traffic Signal)

Any power-operated Traffic Control Device, whether manually, electrically or mechanically operated, by which traffic is alternately directed to stop and permitted to proceed. Traffic Signal:

1. When used in general discussion, a traffic signal is a complete installation including signal heads, wiring, controller, poles and other appurtenances.
2. When used specifically, the terms refers to the signal head which conveys a message to the observer.
3. That part of a traffic control signal system that consists of one set of no less than three coloured lenses, red, amber and green, mounted on a frame and commonly referred to as a signal head.

Traffic Island

A raised or painted island designed to separate streams of vehicular traffic.

Traffic Sign

A device (other than Delineators and Traffic Control Signals) which may be erected beside or above a roadway for the purpose of regulating, warning or guiding traffic.

Truck

A commercial vehicle exceeding a specified weight or length as defined by the *Highway Traffic Act*, municipal by-law, or toll agency.

Turn Lane

A lane designed to facilitate vehicular turn movements from the through roadway.

Uncontrolled Intersection

An intersection which does not have traffic control devices on any of the approaches.

Uniformity

Consistency in the design and application of traffic control devices and operations.

Uncontrolled Pedestrian Crossings

A pedestrian crossing location (marked or unmarked) where there are no traffic control devices to assist pedestrians in crossing.

Urban Area

An indefinite area of land used primarily for residential, commercial, and/or industrial purposes, usually associated with a given area size, population, and density.

Vehicle

Includes a motor vehicle, trailer, traction engine, farm tractor, road-building machine, bicycle, and any vehicle drawn, propelled or driven by any kind of power, including muscular power, but does not include a motorized snow vehicle or streetcar.

Volume

The number of vehicles or pedestrians that pass over a given section of a lane or a roadway or make a particular movement during a specific time period (such as one hour or 24 hours).

Walkability

A measure of the level of integration of pedestrian facilities and accommodation, which consist of sidewalks, trails, crossings, and the ease in which pedestrians can move through the network enjoyably and safely.

Warning Sign

A sign that indicates conditions on or adjacent to a highway or street that are actually or potentially hazardous to traffic operations.

Warrant

A criterion or set of criteria by which justification for a given type of Traffic Control Device or other application is determined.

Yield

To cede the right-of-way.

7. References

- ⁱ *Ontario Highway Traffic Act*, R.S.O. 1990, Chapter H.8. (http://www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_90h08_e.htm).
- ⁱⁱ *Traffic Conflict Techniques for Safety and Operations – Observers Manual*, Publication No. FHWA-IP-88-027, Federal Highway Administration, 1988 (<http://www.fhwa.dot.gov/tfhrc/safety/pubs/88027/88027.pdf>).
- ⁱⁱⁱ David Shinar, *Traffic Safety and Human Behavior*, Elsevier, 2007.
- ^{iv} Frank, et al. , “Many Pathways from Land Use to Health”, *Journal of the American Planning Association* 72 (1), 2006.
- ^v *Guide for the Planning, Design and Operation of Pedestrian Facilities*, American Association of State Highway and Transportation Officials (AASHTO), 2004.
- ^{vi} *Geometric Design Guide for Canadian Roads*, Transportation Association of Canada (TAC), September 1999.
- ^{vii} “Traffic Control Signal Systems”, *Ontario Highway Traffic Act*, Regulation 626 (R.R.O. 1990).
- ^{viii} *Ontario Highway Traffic Act*, R.S.O. 1990, c H.8, s 140, Highway Traffic Act Regulation 615 (R.R.O. 1990), Section 20.1-20.3, 20.7-20.10.
- ^{ix} *Ontario Highway Traffic Act*, R.S.O. 1990, c H.8, s 136 & s 137.
- ^x *Highway Traffic Act*, R.S.O. 1990, c H.8, s 138.
- ^{xi} “An Informational Report on Pedestrian Countdown Signals (PCS)”, Traffic Operation & Management Standing Committee, Pedestrian Countdown Signal Project Steering Committee, TAC, February 2008 (http://wiki.tac-atc.ca/twiki/pub/ChiefEngineers/PedestrianCountdown/Project_253_-_Optional_Use_of_Pedestrian_Countdown_Timers.PDF).
- ^{xii} *Guidelines for Understanding Use and Implementation of Accessible Pedestrian Signals*, TAC, May 2008 (<http://www.tac-atc.ca/>).
- ^{xiii} *Canadian Guide to Neighbourhood Traffic Calming*, TAC/ITE, 1998.
- ^{xiv} *School Crossing Guard Guide*, Ontario Traffic Council, 2005 (http://www.otc.org/communications_report_SCGG.cfm) .
- ^{xv} *Roundabouts: An Informational Guide*, US Department of Transportation Federal Highway Administration, June 2000.
- ^{xvi} *Synthesis of North American Roundabout Practice*, TAC, December 2008.
- ^{xvii} *Highway Traffic Act*, R.S.O. 1990, c. H8, s. 138(1).
- ^{xviii} *Geometric Design Standards for Ontario Highway*, Ministry of Transportation Ontario, 2002.
- ^{xix} *Railway Safety Act* (1985, c. 32 (4th Supp.)) (<http://www.tc.gc.ca/eng/acts-regulations/acts-1985s4-32.htm>).
- ^{xx} *Pedestrian Safety at Grade Crossing Guide*, Transport Canada, September 2007 (<http://www.tc.gc.ca/eng/railsafety/publications-53.htm>).
- ^{xxi} Transport Canada website, <http://www.tc.gc.ca/eng/tc-main.htm>.

^{xxii} *Road/Railway Grade Crossings - Technical Standards and Inspection, Testing and Maintenance Requirements (RTD 10)*, Transport Canada, October 24, 2002 (<http://www.tc.gc.ca/eng/railsafety/guideline-rtd10-500.htm>)

^{xxiii} *Accessibility for Ontarians with Disabilities Act*, S.O. 2005, Chapter 11

^{xxiv} *Ontarians with Disabilities Act*, S.O. 2001, Chapter 32

^{xxv} *Initial Proposed Accessible Built Environment Standard*, Standards Development Committee appointed by the Minister of Community and Social Services, June 2009