Appendix M

Appendix M

Pedestrian Crossing Policy

BURNSIDE

Innisfil

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To: Town of Innisfil

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1.0 Pedestrian Crossing Policy Background and Objectives

1.1 Pedestrian Crossing Policy Objectives

Walking as a form of commute during the morning and afternoon peak periods make up approximately 6% and 2% of the mode share, respectively. On a daily basis, there are approximately 1,400 pedestrian walking trips, which makes up 3% of the daily mode share. These estimates are expected to be higher given they were derived based on expanded household survey data from the Transportation Tomorrow Survey (TTS) which typically underrepresents shorter trips, particularly made by walking. About 8% of all automobile trips, including both auto driver and auto passenger, are less than 2 km (25-min walk) in distance. These trips represent opportunities for travellers to shift to more sustainable modes such as walking, provided that accessible infrastructure is available.

As prescribed in the 2016 Innisfil Trails Master Plan, providing amenities to support walking contributes to better physical health and utilitarian transportation by supporting commuters without access to a vehicle. Emphasis on a pedestrian-accommodating network supports the 2020 Provincial Policy Statement (PPS) in promoting strong, livable and healthy communities, along with the Town's 2020-2030 Community Strategic Plan, which highlights sustainability as a strategic goal by means of protecting and enhancing environments and amenities that residents rely on.

The objectives of Innisfil's pedestrian crossing policies are to address the installation of new pedestrian crossings within the Town, with the purpose of encouraging pedestrian activity, addressing existing and future pedestrian demands, improve safety, and manage costs. The policies also serve to provide direction in addition to or complimentary to that of the Ontario Traffic Manual (OTM).

The pedestrian crossing policies have been developed in light of the benefits of improving driver and pedestrian awareness and understanding of rules of right of way. Research into the development of the policies has included a review of practices in other jurisdictions, generally accepted and published practices in Ontario, original research into traffic safety, and legislative references such as the Ontario Highway Traffic Act (HTA). However, this is a Town of Innisfil

policy, developed in recognition of the roadway environment within the Town, existing pedestrian crossing features, and existing driver expectancy within Innisfil.

The pedestrian crossing policy has been developed in recognition that each site in the road network is unique, and that the application of the policies may not be equally applicable in all instances. In many situations, opportunities to change the fundamental nature of the pedestrian environment may not be feasible. Ultimately, the policy has a consistent goal to maximize driver and pedestrian awareness and understanding of the potential for conflicts.

1.2 Pedestrian Crossing Context – OTM Book 15

The original Ontario Traffic Manual (OTM) Book 15 was the first comprehensive pedestrian crossing design guide in Ontario. OTM Book 15 and the 2016 update provides information and guidance for the planning, design, and operation of pedestrian roadway crossing treatments.

The Innisfil Pedestrian Crossing Policy is intended to serve as a supplement to Book 15 of the OTM, with a focus on preferred treatments to be used in the Town of Innisfil, given Town objectives and the travel characteristics of the Town. OTM Book 15 recognizes the need for local policies and practices and engineering judgment, as prescribed in the introduction:

> *"…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."*

There are, however, elements of OTM Book 15 that will provide context to the Town's policy, along with relevant references pertaining to overarching legal and guiding principles summarized below.

1.2.1 Legal Framework

The legal requirements with respect to pedestrian crossings and accessibility considerations forms a key component in the development of guidelines for the OTM.

The Ontario Highway Traffic Act (HTA) details the responsibilities and rights of motorists and pedestrians at pedestrian crossings of various traffic control, along with specific signage and pavement marking requirements for pedestrian crossovers as per Ontario Regulation 402/15.

The Accessibility for Ontarians with Disabilities Act (AODA) outlines legal requirements to improve accessibility standards with consideration for both physical and mental disabilities (i.e., relating to mobility, vision, hearing and cognition). AODA requirements as prescribed in Ontario Regulation 413/12 details standards for pedestrian crossings within the public right-of-way to ensure that facilities are designed to account for a range of capabilities. Within the context of the

OTM, design considerations for accessibility and a barrier-free environment are detailed for treatments including curb ramps, depressed curb, and accessible pedestrian signals at pedestrian crossings.

1.2.2 Understanding of Safety

Traffic control and crossing treatment components such as signals, signs and pavement markings serve to improve safety by conveying messages that warn road users of hazards, with the intent to provide enough information and time for decision making, and subsequently ensure orderly flow of traffic. These improvements may also serve to minimize the potential for road user conflicts and collisions. Given the unpredictability of collision events, safety of a particular facility may be assessed by reviewing historical collisions and/or conflicts (i.e., near-miss collisions). In any case, consideration of new or modified infrastructure to improve safety requires engineering judgement, including an assessment of potential effects, decision-making time and a comprehensive understanding of the environment and context.

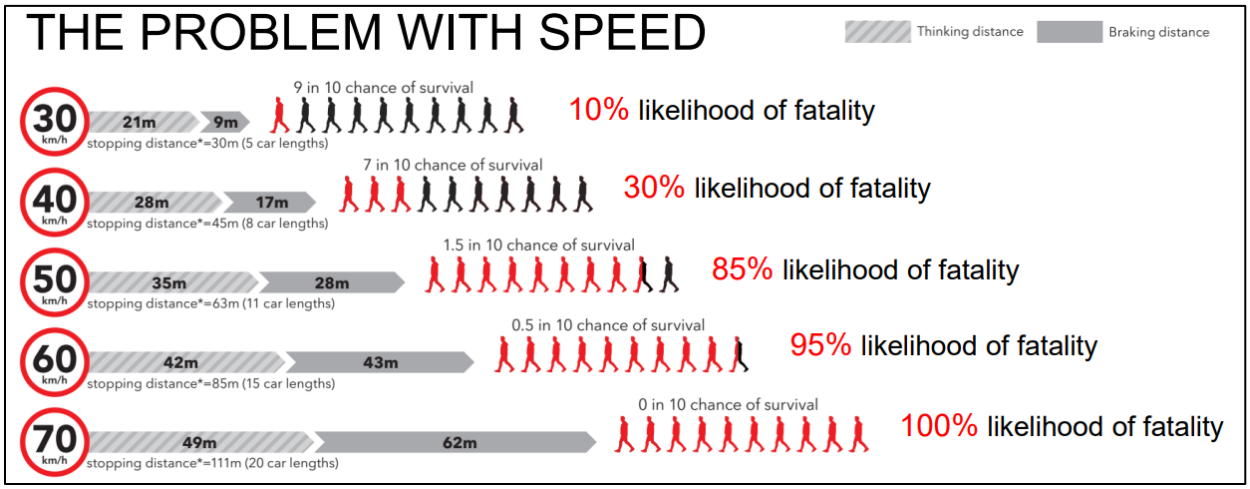
Beyond physical safety measures, consideration for human factors is key in assuring effective implementation and understanding safety. Human factors pertain to the physical, perceptual and mental considerations that guide human interaction with and perception of their surroundings. Road user security is guided by how users feel about the level of safety, their perceived level of risk, both of which impact their reactions and behaviour in the operating environment. Design of pedestrian infrastructure should effectively manage the awareness, expectations and acceptance of risk for road users by ensuring consistency in design and increasing user comfort (e.g., via the level of protection).

1.3 Vision Zero

An important initiative in prioritizing the need to consider human factors is Vision Zero. The goal of Vision Zero is to achieve zero fatalities and serious injuries on roadways. The initiative advocates for a different approach to road safety whereby all collision outcomes are perceived as preventable and a shared responsibility between road users and transportation infrastructure. Vision Zero was initially launched in Sweden in 1997 but has recently been adopted as plans by local municipalities in Ontario, including Toronto, London and Kingston, along with regions including Peel and Durham.

As a part of Vision Zero, there is an emphasis in prioritizing the safety of vulnerable road users such as pedestrians. Pedestrians, especially the elderly, become increasingly susceptible to the likelihood of a fatality in a vehicle-related collision travelling along a roadway with higher operating speeds, as depicted in the figure below. In fact, there is an exponential relationship between vehicle impact speed and the severity of pedestrian injury (i.e., the injury severity increases even faster with respect to increases to speed). This is due to the greater distance and time required for the vehicle to stop or avoid a collision. This is shown in Figure M-1.

Figure M-1: Greater the speed correlates to greater likelihood of fatality
Source: City of Toronto Road Safety Plan (September 2019)



Since pedestrians involved in a collision are much more likely to be injured, their safety should be prioritized in planning for active transportation facilities. The City of Toronto Vision Zero Road Safety Plan (2019) details pedestrian safety improvements that would make crossings more accessible and reduce vehicle-pedestrian conflicts, including:

- Speed reductions.
- Shortened crossing distances.
- No right-turns on red.
- Advance greens for pedestrians (i.e., Leading Pedestrian Intervals).
- Protected left-turns.

1.4 Walkability Guidelines

Walkability refers to the extent to which a neighbourhood supports walking as a mode of travel. The importance of walkability lies in the benefits on physical health and lifestyle along with environmental sustainability (via a shift in the use of more active modes such as walking and cycling). The following primary factors are considered in promoting walkability.

- Land Use Planning – High-density mixed-used communities that encompass facilities for live, work and play. The majority of people are willing to walk an average of 400 m (or 5 to 10 minutes) to reach a destination. The proximity in everyday amenities reduces trip distance and supports walking as a convenient mode of travel.
- Safety – Design elements of walkways and crossings affect the perceived and actual safety of pedestrians. This can include sidewalk widths, crossing distances, signal indications, illumination, and roadway geometrics that contribute to faster vehicular speeds. Effective traffic calming measures are also considered to assure safe walking environments.
- Comfort and Convenience – The desire to walk is influenced by the convenience of the route (i.e., directness of travel). Well-connected sidewalks and trails as well as safe and

frequent crossings are important in establishing a reliable pedestrian system. The visual appeal of the walking environment (defined by buildings, walls, greenspace, landscaping etc.) can also serve to attract more pedestrian activity.

2.0 Pedestrian Ability and Needs

Crossings should be designed to recognize and design for the diversity in pedestrian needs and abilities. The key vulnerable user groups identified for this study are summarized below. The specific components or features of a pedestrian crossing that address the needs of vulnerable pedestrians are identified in Table M-2.

2.1 Cognitive Ability and Age

Young pedestrians or children (particularly under the age of 10) are more likely to misjudge vehicle speeds and available crossing gaps as a result of their limited scanning ability and attention capacity. Children are considered at-risk road users as they tend to have an underdeveloped sense of safety and understanding of traffic control devices. Seniors are also more likely to underestimate the relative depth separating visual targets, misperceive the distance between themselves and vehicles, and process information more slowly. The elderly are vulnerable road users as the likelihood of fatality also increases with age.

To address the limitations and challenges of young pedestrians and the elderly, it is important to recognize the need to manage pedestrian expectations and misguided decisions due to road geometry, land uses or other operating environment characteristics. In addition, there is an emphasis on providing warning devices and/or signs to heed caution and draw drivers' attention in areas with a greater child and/or senior demographic (e.g., near schools, retirement/nursing homes).

2.2 Mobility-Impaired Pedestrians

Mobility-impaired pedestrians refer to those affected by a motor movement disability, including pedestrians who use wheelchairs or walkers/canes. Crossings should be designed to eliminate physical barriers, where feasible, and provide for adequate walking times at signalized crossings. In allocating pedestrian walk times, a design speed of 1.0 m/s is typically used. However, in the case that 20% or more pedestrians using a crossing is expected to be older (65 years or older), a lower walking speed of 0.9 m/s is assumed. At locations where 20% or more pedestrians are mobility-impaired (i.e., using assistive devices such a wheelchairs and canes), it is best practice to use a walking design speed of 0.8 m/s.

These guidelines apply particularly near hospitals and retirement/nursing homes, where there is a need to accommodate a greater number of mobility-impaired pedestrians and the elderly.

2.3 Visually Impaired Pedestrians

Visually-impaired pedestrians depend on auditory and tactual information for travel, to varying degrees. There is a wide range in the extent to which people are visually-impaired, as some may have very limited vision and others may be more sensitive to brightness contrast.

Crossings should be designed to allow visually-impaired pedestrians to easily identify safe pedestrian paths, detect streets and recognize the proper time to cross.

3.0 Crossing Alternatives

The HTA and OTM indicates that when a pedestrian is about to step from the boulevard onto the roadway, there are fundamentally two different forms of pedestrian crossing. The crossing may be either:

- A controlled crossing where vehicles must yield to pedestrians (e.g., traffic control signals, mid-block pedestrian signals, stop signs, designated school crossing, etc.), or
- An uncontrolled crossing where pedestrians must yield to vehicles (e.g., mid-block crossings in the absence of traffic controls, marked crossing in absence of stop or yield signs, designated school crossing in the absence of a crossing guard and/or other controls, roundabouts, etc.).

Either form of crossing may be appropriate given the range of pedestrian demand. There is generally a higher degree of concern for pedestrian safety at uncontrolled crossing points. However, both forms of crossing must be designed to maximize safety.

3.1 Controlled Crossing Treatment

There are several controlled crossing treatments and associated supportive components applied to denote and accommodate pedestrian crossings. Controlled crossings refer to locations with traffic control that requires a vehicle to yield or stop, such as a signalized intersection/midblock, an intersection pedestrian signal, a midblock pedestrian signal, a pedestrian crossover (PXO) with flashing lights, a stop or yield sign, or a crossing guard.

These controlled crossing treatments, listed in descending order of overall complexity in implementation, are described in Table M-1. It is recognized that both intersection/midblock pedestrian signals and PXOs require motorists to stop for pedestrians, but a PXO leaves some responsibility to the pedestrian to make sure motorists stop before crossing whereas pedestrian signals provide traditional visual cues (via traffic signal heads) to warn the motorist to stop for pedestrians. The decision framework used to determine the appropriate type of controlled crossing treatment is provided in the following section.

Table M-1: Controlled Crossing Treatments

	Controlled Crossing Treatment	Description
Traffic Signal	Full Traffic Signal	Traditional traffic control signals that allow for a protected pedestrian phase, including a "WALK" and flashing "DON'T WALK" phase, which can be implemented at an intersection or at a midblock location.
	Intersection Pedestrian Signal (IPS)	Traffic control signal installed on one leg of an intersection to stop main street traffic when the pedestrian signal is activated. Traffic on the side-street is stop-controlled.
	Mid-block Pedestrian Signal (MPS)	Traffic control signal installed at a midblock location to stop traffic when the pedestrian signal is activated.
Pedestrian Crossovers (PXOs)	Level 1 Type A PXO	PXO defined by the use of: Side-mounted "PEDESTRIAN X" (crossover) signs Double-sided, internally illuminated "OVERHEAD X" signs Ladder crosswalk pavement markings Pedestrian-activated rectangular rapid flashing beacons (RRFB) Side mounted and overhead regulatory signs ("Stop for Pedestrians")
	Level 2 Type B PXO	PXO defined by the use of: Ladder crosswalk pavement markings Pedestrian-activated rectangular rapid flashing beacons (RRFB) Side mounted and overhead regulatory signs ("Stop for Pedestrians")
	Level 2 Type C PXO	PXO defined by the use of: Ladder crosswalk pavement markings Pedestrian-activated rectangular rapid flashing beacons (RRFB) Side-mounted regulatory signs ("Stop for Pedestrians")
	Level 2 Type D PXO	PXO defined by the use of: Ladder crosswalk pavement markings Side-mounted regulatory signs ("Stop for Pedestrians")
Stop-Controlled / Yield-Controlled Intersection		Intersections with approaches that are stop-controlled or yield-controlled, cautioning vehicles to stop or yield the right-of-way to pedestrians crossing the intersection.
Supervised School Crossing		Designated school crossings that are supervised by crossing guards or school patrollers during specified peak crossing periods. Note that without the presence of crossing guards or school patrollers, the crossing is considered uncontrolled.

3.2 Crossing Treatment Components

The controlled crossings identified in the previous section are considered pedestrian crossing treatment systems, as each type represents a combination of components/features that form a single strategy to facilitate the crossing of pedestrians.

An uncontrolled crossing has no traffic control measures to give priority to the pedestrian movement but are locations where there is measurable pedestrian crossing activity. However, uncontrolled crossings may still have warning signage and in the case of some jurisdictions, crosswalk pavement markings.

Components or features of crossing treatments can be implemented as additional measures to controlled crossings or supplement uncontrolled crossings. These crossing components can serve to increase driver or pedestrian awareness or simplify the crossing process. The use of some of these features may also increase pedestrians' sense of security. However, these benefits should be weighed against the potential for more aggressive pedestrian behaviour, likelihood of increases in pedestrian crossing activity and the resulting increase in exposure to vehicle-pedestrian conflicts.

Table M-1 provides a summary of the various crossing treatment components or features under consideration. The applicability of each feature at controlled and uncontrolled crossings is identified, along with the vulnerable pedestrian user group(s) (see Section 1.2) it would serve.

Table M-2: Crossing Treatment Components

Treatment Component	Description / Purpose	Crossing Type		Pedestrian Group Prioritized		
		Controlled	Uncontrolled	Children / Seniors	Mobility Impaired	Visually Impaired
Raised medians / pedestrian refuge islands	Reduces the crossing distance and gap acceptance required and allows pedestrians to focus on crossing one direction of traffic at a time	✓	✓	✓		
Bulb-outs / curb extensions	Extension of the sidewalk / curb line or smaller curb radii to reduce the crossing distance and gap acceptance required, slow turning vehicles, and improve sight lines for pedestrians and motorists	✓	✓	✓	✓	
Textured pavement or high-visibility markings	Bolder, more defined painted crosswalks (e.g., zebra markings, raised pavement markers, Duratherm) to provide better visibility and increase drivers' awareness of possible crossings	✓	-[1]	✓	✓	✓
Standard warning signage	Standard pedestrian crossing signs as detailed in OTM Book 5 (Regulatory Signs), Book 6 (Warning Signs) and Book 11 (Pavement, Hazard and Delineation Markings)	✓	✓	✓	✓	✓
Special message signs	Special message signs that explicitly identify the right of way such as "Wait for Gap" (which is included as part of the PXO standards) or "Courtesy Crossing" signs	✓	✓			
Advanced pedestrian signal [2]	Display pedestrian "WALK" phase a few seconds ahead of the vehicle green signal to protect pedestrians and provide left-turning vehicles advanced notice of pedestrian crossings.	✓		✓	✓	✓
Increased pedestrian crossing times at signalized intersections	Use of lower design walking speeds to calculate pedestrian clearance times at signalized intersections, allowing more time for older and mobility-impaired pedestrians to cross the road	✓		✓	✓	

Treatment Component	Description / Purpose	Crossing Type		Pedestrian Group Prioritized		
		Controlled	Uncontrolled	Children / Seniors	Mobility Impaired	Visually Impaired
Accessible Pedestrian Signals (APS)	Devices that use audible tones, verbal messages, and vibration to indicate when pedestrians have the right of way to cross safely (see OTM Book 12 for standards and details)	✓				✓
Flashing beacons	Pedestrian-activated flashing beacons that can be used with “Pedestrian Crosswalk Ahead” warning signs to warn drivers to proceed slowly and with caution.	✓		✓	✓	✓
Curb ramps	Sidewalks that slope into the roadway to allow for safer travel and wheelchair access	✓	✓		✓	
Barriers	Barriers or rails placed along the top curb to guide pedestrians (particularly the visually impaired) to desirable crossing points, prevent crossings where there are sight distance constraints or conflicting flows, and deters motorists from mounting the curb	✓	✓			✓
Delineators	Delineator posts or reflective tape to alert drivers of a crossing and improve night visibility.	✓	✓	✓	✓	✓
Tactile surfaces	Tactile walking surface indicators to alert pedestrians (particularly the visually impaired) when they reach edges of the sidewalk and provide direction on where to safety cross (see Ontario Provincial Standard Drawing (OPSD) 310.039 for details)	✓	✓			✓
Advanced stop/yield line	Encourages drivers to stop further back from the crosswalk, promoting better visibility between pedestrians and motorists.	✓	✓	✓	✓	✓
Raised crosswalk [3]	Crosswalk constructed at a higher elevation than the adjacent roadway to improve drivers’ awareness of pedestrian activity and reduces vehicle speeds	✓	-[1]	✓	✓	✓

Treatment Component	Description / Purpose	Crossing Type		Pedestrian Group Prioritized		
		Controlled	Uncontrolled	Children / Seniors	Mobility Impaired	Visually Impaired
Speed Display	"Watch Your Speed" radar signs that display motorists' vehicle speeds to remind them to check and abide by speed limits	✓	✓	✓	✓	✓

Notes: 1. Crosswalk markings and raised crosswalks are not recommended at an uncontrolled crossing as it may give pedestrians the false impression that they have the right of way.
2. Advanced pedestrian signals have been implemented in jurisdictions such as the City of Toronto, where it is known as a Leading Pedestrian Interval (LPI).
3. Raised crosswalks are considered a traffic calming measure and should therefore be considered in tandem with the Town's traffic calming policies and practices.

4.0 Crossing Needs Assessment

4.1 Best Practices

The OTM Books incorporate current best practices in the Province of Ontario and have recommended thresholds and warrant criteria for the implementation of controlled crossings. Most jurisdictions use OTM Book 12, Book 15 and Book 5 warrants and threshold values for implementing traffic signals, pedestrian crossovers and stop-controlled/yield-controlled crossings. The standard guideline used to assess the need for school crossing guards is the 2017 School Crossing Guard Guide, published by the Ontario Traffic Council (OTC).

4.2 Crossing Treatment Selection

In selecting the appropriate type of controlled crossing treatment for a particular location, warrant thresholds as detailed in the OTM Books and the School Crossing Guard Guide may be used as best practice, as they are generally accepted as the standard within Ontario. The warrant process is summarized below for each type of controlled crossing and should be assessed in the order listed.

4.2.1 Traffic Signal Warrant

As a first step, the crossing location of concern should be assessed for traffic signals. If warranted, full traffic signals, intersection pedestrian signals (IPS) or midblock pedestrian signals (MPS) can be considered. Signals may be implemented at intersections, accesses, or midblocks where pedestrian desire lines and demand is high. Applicability depends on the needs of specific location. There are six justifications that are assessed, as summarized below. Signal warrants are met if any one of the justifications are met. The installation of a pedestrian signal under traffic signal control is met if the site meets Justification 6 (Pedestrian Volume and Delay).

Justification 1 (Minimum Vehicle Volumes)

The peak 8-hour vehicle volume must exceed the following thresholds:

- Restricted Flow (Urban) Conditions:
  - Total Intersection Volume: 720 vph (1-lane approach) or 900 vph (2-lane approach); and
  - Minor Street Approach Volumes: 170 vph (full intersection) or 255 vph (T-intersection)
- Free Flow (Rural) Conditions:
  - Total Intersection Volume: 480 vph (1-lane approach) or 600 vph (2-lane approach); and
  - Minor Street Approach Volumes: 120 vph (full intersection) or 180 vph (T-intersection

Justification 2 (Delay to Cross Traffic)

The peak 8-hour vehicle volume must exceed the following thresholds:

- Restricted Flow (Urban) Conditions:

  - Total Intersection Volume: 720 vph (1-lane approach) or 900 vph (2-lane approach); and
  - Crossing Traffic Volume*: 75 vph
- Free Flow (Rural) Conditions:
  - Total Intersection Volume: 480 vph (1-lane approach) or 600 vph (2-lane approach); and
  - Crossing Traffic Volume*: 50 vph

*Crossing Traffic Volume is the sum of the number of pedestrians crossing the main road, total left turns from both minor street approaches, highest through volume from one of the minor street approaches and 50% of the heavier left turn traffic from the main road when the left-turn volume is greater than 120 vph and the heavier left-turn volume plus its opposing volume is greater than 720 vph.

Justification 3 (Volume/Delay Combination)

If neither Justification 1 nor Justification 2 is 100% satisfied, but both justifications are at least 80% satisfied.

Justification 4 (Minimum Four-Hour Vehicle Volume)

Plot-based warrant (see Figure 20 and Figure 21 of OTM Book 12 for unrestricted and restricted flow conditions, respectively) that assesses the need for signals based on 4-hour vehicular volumes as. This 4-hour warrant is typically accepted for commercial and commuter-dominated areas whereby the 8-hour volumes may not be enough to meet warrants, but there may be high 4-hour peak periods of traffic experienced during the peak morning and afternoon periods.

Justification 5 (Collision Experience)

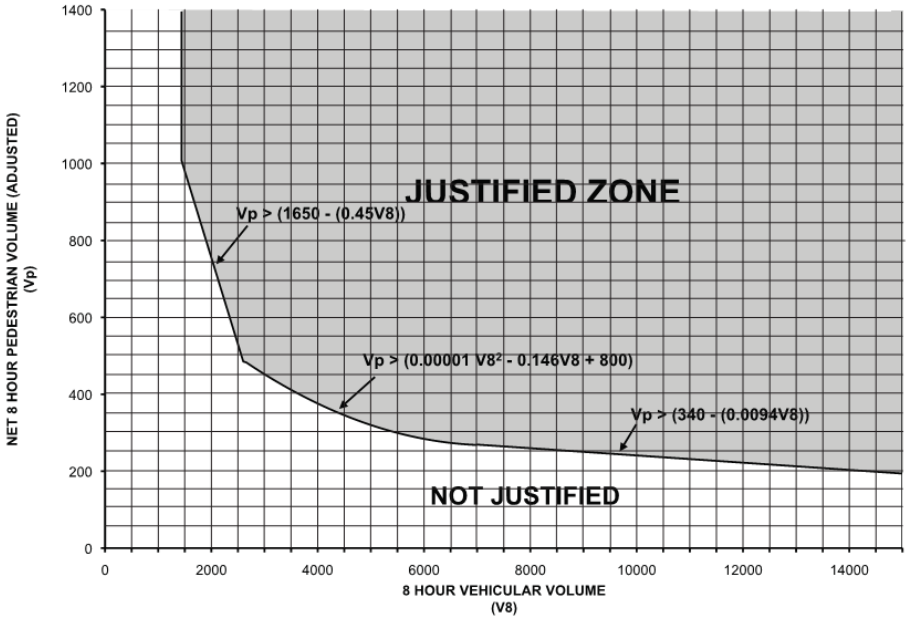
15 “reducible” collisions (i.e., vehicle and/or pedestrian collisions where under signalized control, would be more protected by separate phases) experienced over a 3-year period. Signals are rarely met under this justification alone. It is assumed that the jurisdiction considered and implemented less restrictive mitigation measures that have failed to reduce the collision frequency.

Justification 6 (Pedestrian Volume and Delay)

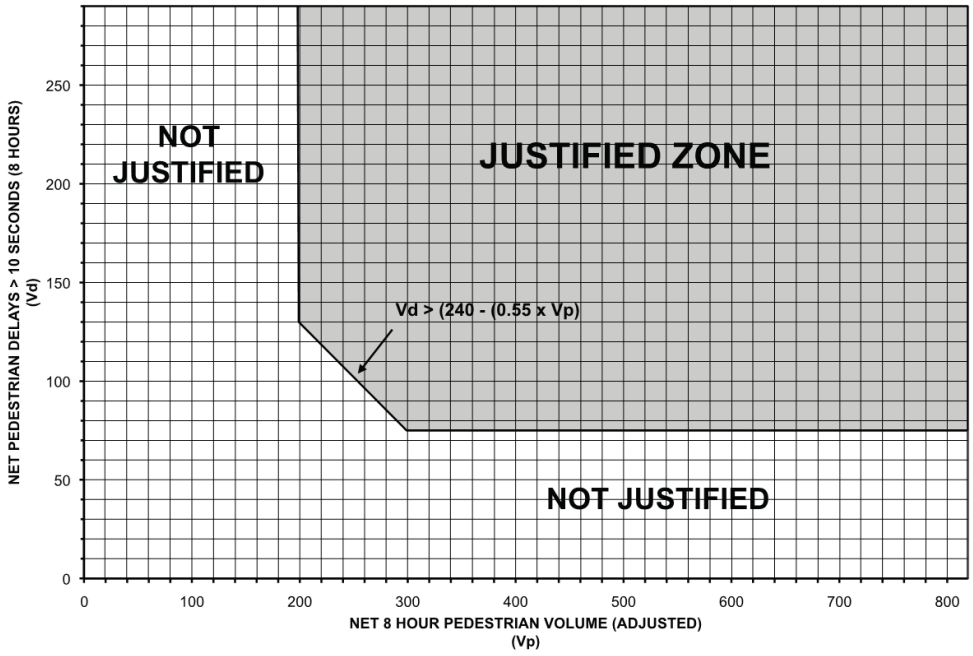
Plot-based warrant based on minimum pedestrian volume and minimum pedestrian delay criteria for the peak 8-hour pedestrian volume period crossing the main road, as shown in the graphs below.

The pedestrian volume is adjusted by a factor of 2 for “assisted” pedestrians (i.e., children under 12 years old, senior citizens and disabled pedestrians) to reflect “equivalent adults”.

Justification 6 – Pedestrian Volume



Justification 6 – Pedestrian Delay



4.2.2 Pedestrian Crossover (PXO)

Warrants for pedestrian crossover (PXO) treatments are assessed based on traffic volumes, pedestrian volumes, pedestrian desire lines, speed limits, and road cross-sections. If a traffic signal is not warranted, the 8-hour and 4-hour pedestrian volumes crossing the main road and vehicular volumes are reviewed against the following thresholds:

- 8-hour pedestrian volume crossing the main road ≥ 100 and 8-hour vehicle volume ≥ 750; or
- 4-hour pedestrian volume crossing the main road ≥ 65 and 8-hour vehicle volume ≥ 395

If the above thresholds are met and the proposed crossing location is at least 200 m away from the nearest traffic control device, the site is a candidate for a pedestrian crossover.

If the above thresholds are not met, there is still a possibility that the site could be a candidate for a PXO, if the site is at least 200 m away from the nearest traffic control device and the proposed crossing location is a requirement for pedestrian system connectivity or would fulfill pedestrian desire lines.

If determined that a PXO is warranted, OTM recommends the minimum PXO treatment types based on the vehicular traffic, speed limit, and road cross-section, as illustrated in the selection matrix below.

Pedestrian Crossover (PXO) Selection Matrix

Two-way Vehicular Volume			Posted Speed Limit (km/h	Total Number of Lanes for the Roadway Cross Section[1]			
Time Period	Lower Bound	Upper Bound		1 or 2 Lanes	3 lanes	4 lanes w/raised refuge	4 lanes w/o raised refuge
8 Hour	750	2,250	≤50	Level 2 Type D	Level 2 Type C[3]	Level 2 Type D[2]	Level 2 Type B
4 Hour	395	1,185					
8 Hour	750	2,250	60	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	395	1,185					
8 Hour	2,250	4,500	≤50	Level 2 Type D	Level 2 Type B	Level 2 Type D[2]	Level 2 Type B
4 Hour	1,185	2,370					
8 Hour	2,250	4,500	60	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	1,185	2,370					
8 Hour	4,500	6,000	≤50	Level 2 Type C	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	2,370	3,155					
8 Hour	4,500	6,000	60	Level 2 Type B	Level 2 Type B	Level 2 Type C[2]	Level 2 Type B
4 Hour	2,370	3,155					
8 Hour	6,000	7,500	≤50	Level 2 Type B	Level 2 Type B	Level 2 Type C[2]	Level 1 Type A
4 Hour	3,155	3,950					
8 Hour	6,000	7,500	60	Level 2 Type B	Level 2 Type B		
4 Hour	3,155	3,950					
8 Hour	7,500	17,500	≤50	Level 2 Type B	Level 2 Type B		
4 Hour	3,950	9,215					
8 Hour	7,500	17,500	60	Level 2 Type B			
4 Hour	3,950	9,215					

Type A Type B Type C Type D

Approaches to roundabouts should be considered a separate roadways.

[1]The total number of lanes is representative of crossing distance. The width of these lanes is assumed to be between 3.0 m and 3.75 m according to MTO Geometric Design Standards for Ontario Highways (Chapter D.2). A cross sectional feature (e.g. bike lane or on-street parking) may extend the average crossing distance beyond this range of lane widths.

[2]Use of two sets of side mounted signs for each direction (one on the right side and one on the median)

[3] Use Level 2 Type B PXO up to 3 lanes total, cross section one-way.

The hatched cells in this table show that a PXO is not recommended for sites with these traffic and geometric conditions. Generally a traffic signal is warranted for such conditions.

4.2.3 Stop-Controlled / Yield-Controlled Intersections

A two-way or all-way stop-controlled intersection allows for protected pedestrian crossings. Yield-controlled intersections are also an alternative treatment that serves to provide some level of protection for pedestrian crossings. However, warrants for traffic signals and PXOs should be reviewed first. Details on warrant thresholds for types of stop-controlled and yield-controlled intersections are provided in OTM Book 5 (Regulatory Signs).

4.2.4 Supervised School Crossing

A school crossing guard are considered when the protection of school children is the primary concern. Crossing guards can be located at midblock locations with the required marked crosswalks and school crossing signs, stop-controlled intersections, pedestrian signals, pedestrian crossovers, roundabouts, and signalized intersections, provided that the road speed limit does not exceed 60 km/h. OTM Book 5 provides guidelines on the use of a crossing guard as a control treatment at a designated crossing. The 2017 School Crossing Guard Guide is the most common guideline used to assess the need for crossing guards within Ontario. However, the OTM notes that the minimum threshold of crossing school children required to warrant a supervised school crossing can be defined by the Local Road Authorities.

Based on a review of current industry practices and research on crossing operations, the following additional factors and respective guiding principles should be considered in selecting the appropriate type of crossing treatment:

- **PXOs** – In implementing PXOs to supplement traffic control signals, they should be installed in sufficient quantity to allow pedestrians and drivers to develop familiarity with their operations. For example, they may be set up as a pilot project at several (3) potential locations that are in close proximity within a unique localized area.
- **Pavement Markings at Uncontrolled Crossings** – Marked crosswalks at uncontrolled crossings are not recommended as they may give pedestrians the false impression that they have the right of way. This may result in increased conflict potential between unaware pedestrians and drivers. As an alternative, signage can better contribute to driver awareness and pedestrian caution without making the rules of right of way ambiguous.
- **Urban vs. Rural Operating Environments** – The warrant thresholds established in OTM Book 12 depend on whether the operating speeds are representative of “restricted flow conditions” or “free flow conditions”. Restricted flow conditions are typically representative of urban flow conditions with operating speeds of less than 70 km/h and where side friction on the roadway (due to parking, numerous entrances, etc.) reduces the operating speed. While free flow conditions are typically representative of rural, higher speed conditions, and restricted flow conditions typically reflect urban, lower speed conditions, this may not always be the case. For example, driving characteristics in small urban areas (e.g., with less than 10,000 in population) may not be subject to the level of restricted flow experienced within larger urban areas, in which case the application of free flow criteria may be better suited for such areas. Regardless, the appropriate flow condition should be assessed based on roadway operations, speeds and the surrounding environment.

- **Visibility Near Crossings** – Typically, a minimum of 30 m should be kept clear in advance of crossings to minimize sight obstructions and improve vehicle and pedestrian visibility. Parking restrictions should be considered within the context and needs of the nearby land uses. For example, parking restrictions may be ignored near schools and major commercial areas. Similarly, trees and street furniture near pedestrian crossings should be located such that they do not impede visibility.
- **Vehicle Speeds** – The posted and operating speeds along roadways should be considered in determining the appropriate type of crossing treatment and/or component. Vehicle speed is a major risk factor for safety, as it increases the likelihood of a pedestrian fatality upon impact. As such, uncontrolled crossings are not recommended along high-speed roadways (i.e., posted speeds greater than 60 km/h). Roadways with higher posted speeds are also characteristic of more rural operating environments, where there are generally less pedestrians. In the case that a controlled crossing is considered in these higher speed areas, a greater emphasis should be placed on visual cues to warn drivers of pedestrians and allocate sufficient sight distance for drivers to stop in time. There may also be consideration to implement measures such as raised platforms, narrowing lanes and other optical treatments to reduce vehicle speeds to prioritize the safety of the pedestrian, provided that it does not significantly impact traffic operations.

4.3 Pedestrian Crossing Location Assessment

It is recognized that the pedestrian crossing warrants approach as detailed in the previous section is predominantly a volume-based approach and is therefore better suited for high volume roads and rarely triggered on local roads. In addition, the need to provide a crossing based on pedestrian desire lines are not clearly outlined.

To conduct a high-level assessment of potential controlled crossing locations within Innisfil, with a focus on addressing system connectivity, pedestrian desire line needs and safety, the crossing criteria shown in Table M-3 were developed. These criteria were established recognizing that the surrounding land uses and corridor conditions play a role in gauging pedestrian crossing needs. The locations identified from this assessment should be further re-evaluated against the crossing treatment selection methodology as described in the previous section.

Table M-3: Pedestrian Crossing Location Assessment Criteria

Criteria	Details	Threshold
Convenience and directness of pedestrian routes and pedestrian system connectivity	Proximity to retirement/nursing homes and hospitals	< 400 m (5 min walking distance)
	Proximity to a school	
	Proximity to a bus stop	
	Proximity to a major trip destination (e.g., employment centre, community centre, etc.)	
	Connection to a major trail	
Historical collisions	Number of pedestrian collisions over the last 5 years	> 1 collision
Proximity to other crossing opportunities within urbanized areas	Distance to the nearest PXO, pedestrian signal or traffic signal	> 200 m
Driver-pedestrian sight distance	Available sight distance at an intersection, driveway access or curve	Varies depending on the operating speed of the roadway [1]

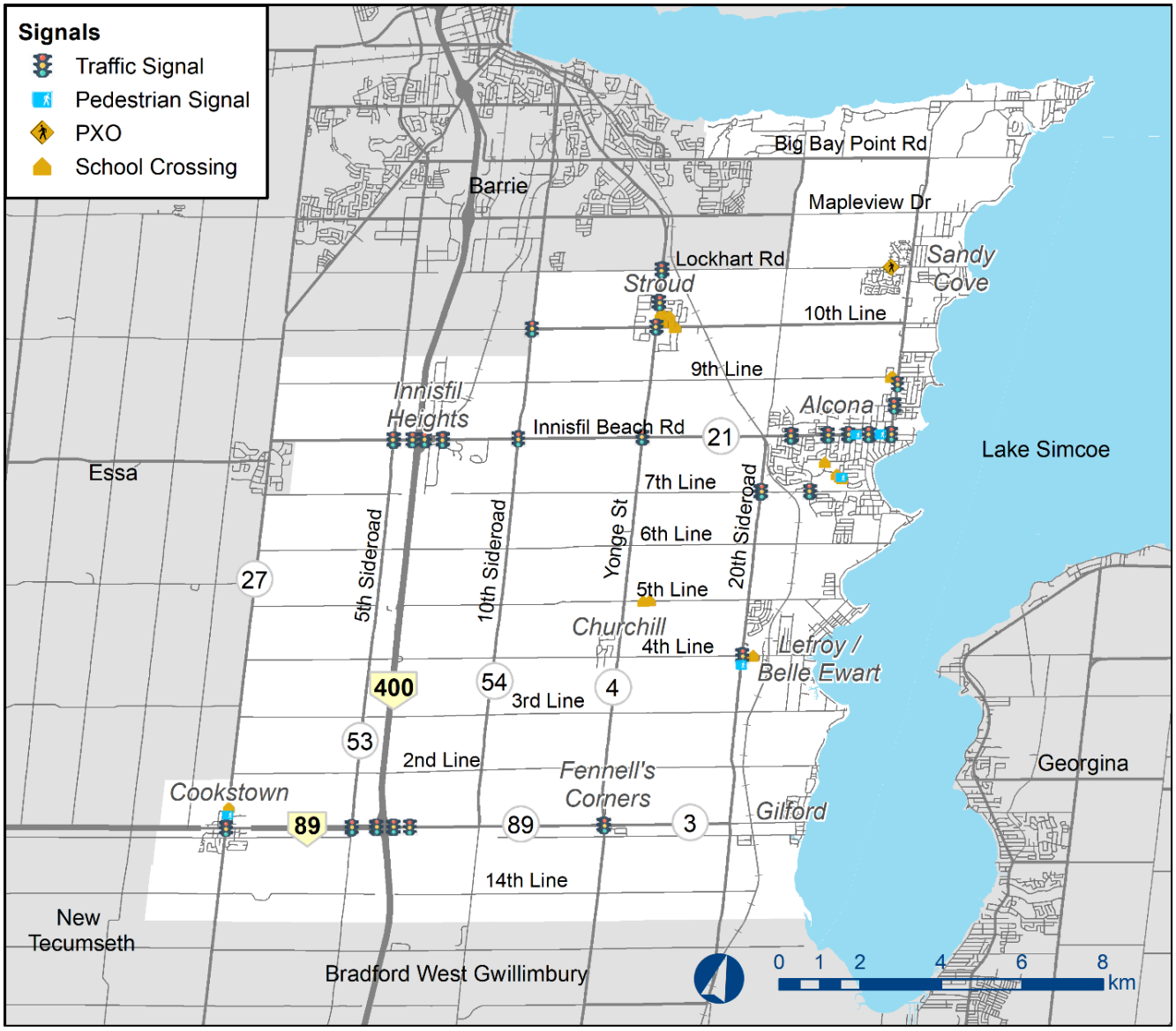
Note: 1. Refer to Transportation Association of Canada (TAC) Geometric Design Guide (June 2017)

5.0 Evaluation of Alternative Treatments

5.1 Innisfil Pedestrian Crossing Alternatives

Existing crossing locations within the Town, including traffic signals, pedestrian signals, PXOs and school crossings, are shown in Figure M-2. Pedestrian crossings within the Town are primarily serviced by full traffic signals. Pedestrian signals have also been installed within a few Town settlement areas, including Alcona, Lefroy / Belle Ewart, and Cookstown. There is one pedestrian crossover (PXO) within Innisfil, located near Sandy Cove.

Figure M-2: Existing Crossing Locations



Note: 1. To minimize crowding, stop-controlled/yield-controlled intersections are not shown.
2. School Crossing points shown indicate locations where school crossing signage is installed; these crossing locations may not necessarily be supervised by crossing guards or school patrollers.

A review was conducted of the Town's existing crossing facilities, with observations summarized below.

5.1.1 Traffic Signals

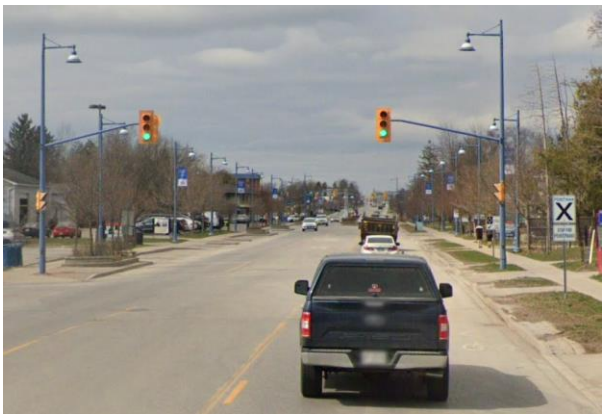
Traffic signals within the Town are generally located within urbanized areas, characteristic of more trafficked locations, and along an arterial. This remains consistent with traffic signal warrants, in that warrants are typically met at high volume intersections or where main street traffic would cause delays to side street traffic under unsignalized conditions.

10th Line (Victoria Street) / Yonge Street (County Road 4)
Source: Google Street View

5.1.2 Pedestrian Signals

Traffic signals within the Town are generally located within or near settlement areas, where surrounding land uses (e.g., institutional, commercial, retail, mixed-use, etc.) generate substantial pedestrian demand to warrant a pedestrian-activated crossing. Locations with existing pedestrian signals are supported by regulatory signage, such as “Stop Here on Red Signal” (as prescribed by OTM Book 15) and “Stop for Pedestrians”. Pedestrian signals near schools (i.e., crossing located at Killarney Beach Public School) also incorporate colourful crosswalk pavement markings for better visibility.

Innisfil Beach Road (County Road 21) / Inglewood Drive
Source: Google Street View



5.1.3 Pedestrian Crossovers (PXOs)

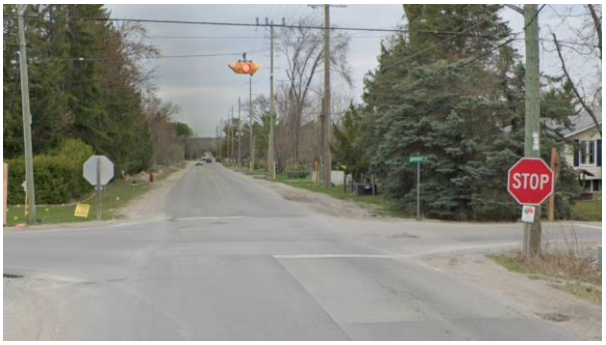
There is one midblock PXO (Level 1, Type A) in Innisfil, along Lockhart Road, as shown in the image on the right. As prescribed by OTM Book 15, an internally illuminated “OVERHEAD X” sign, pedestrian-activated rectangular rapid flashing beacons (RRFB) and “Stop for Pedestrians” signage have also been installed at this location. It is noted that not all PXO locations have painted crosswalks, which improves pedestrian visibility.

Lockhart Road, west of Main Street
Source: Google Street View

5.1.4 Stop-Controlled Intersections

Most non-signalized intersections are two-way or all-way stop-controlled. Some stop-controlled intersections are also complimented by flashing red beacons (as shown in the image to the right), solar stop beacons (i.e., at 10th Sideroad / 20th Sideroad), or advanced warning signs such as “Stop Ahead” (i.e., at 5th Line / 10th Sideroad). It is noted that not all stop-controlled intersections have crosswalk pavement markings.

Lockhart Road / 25th Sideroad
Source: Google Street View

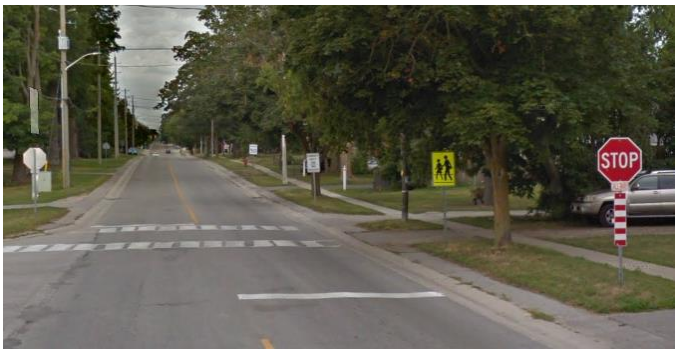


5.1.5 School Crossings

School zone and school crossing signage are installed near schools. School crossings within Innisfil are all either:

- Controlled (i.e., stop-controlled, as depicted in the image to the right, or supervised during specified crossing periods).
- Uncontrolled (i.e., school crossing signage installed only, without the presence of a crossing guard or school patroller).

Victoria Street / North Gate (near Sunnybrae Public School)
Source: Google Street View



5.1.6 Uncontrolled Crossings

An example of an uncontrolled crossing provided within the Town is shown in the image to the right, which is located along Frederick Street. A “Pedestrians Ahead” sign is installed to warn drivers of potential crossing activity near the neighbourhood ahead. The warning sign at this sample location appears to be implemented as a result of the more densely wooded environment surrounding Frederick Street, which may impede drivers from seeing pedestrians crossing ahead.

Frederick Street, south of Claver Avenue
Source: Google Street View

5.2 Pedestrian Crossing Selection Approach

All existing and future controlled crossings in the Town should incorporate the appropriate design features (e.g., signage, pavement markings, etc.) for each respective crossing type, as detailed in the OTM books. This ensures Town-wide consistency in pedestrian facilities, which serves to improve pedestrian comfort as well as better manage driver and pedestrian expectations.

Locations of future crossings for consideration are illustrated in Figure M-3. These locations were identified based on the pedestrian crossing criteria summarized in Table M-3, which better recognizes the need to provide crossings based on pedestrian system connectivity and desire lines. Although this serves as a high-level assessment of crossing needs and therefore, it is recommended that further studies be conducted for these locations to determine the need for and the selection of the appropriate controlled crossing type based on site-specific context and warrant criteria as detailed in Section 1.4.2. Additional locations may also be identified where crossings would be desirable to address site-specific needs (such as inadequate driver-pedestrian sight-distances).

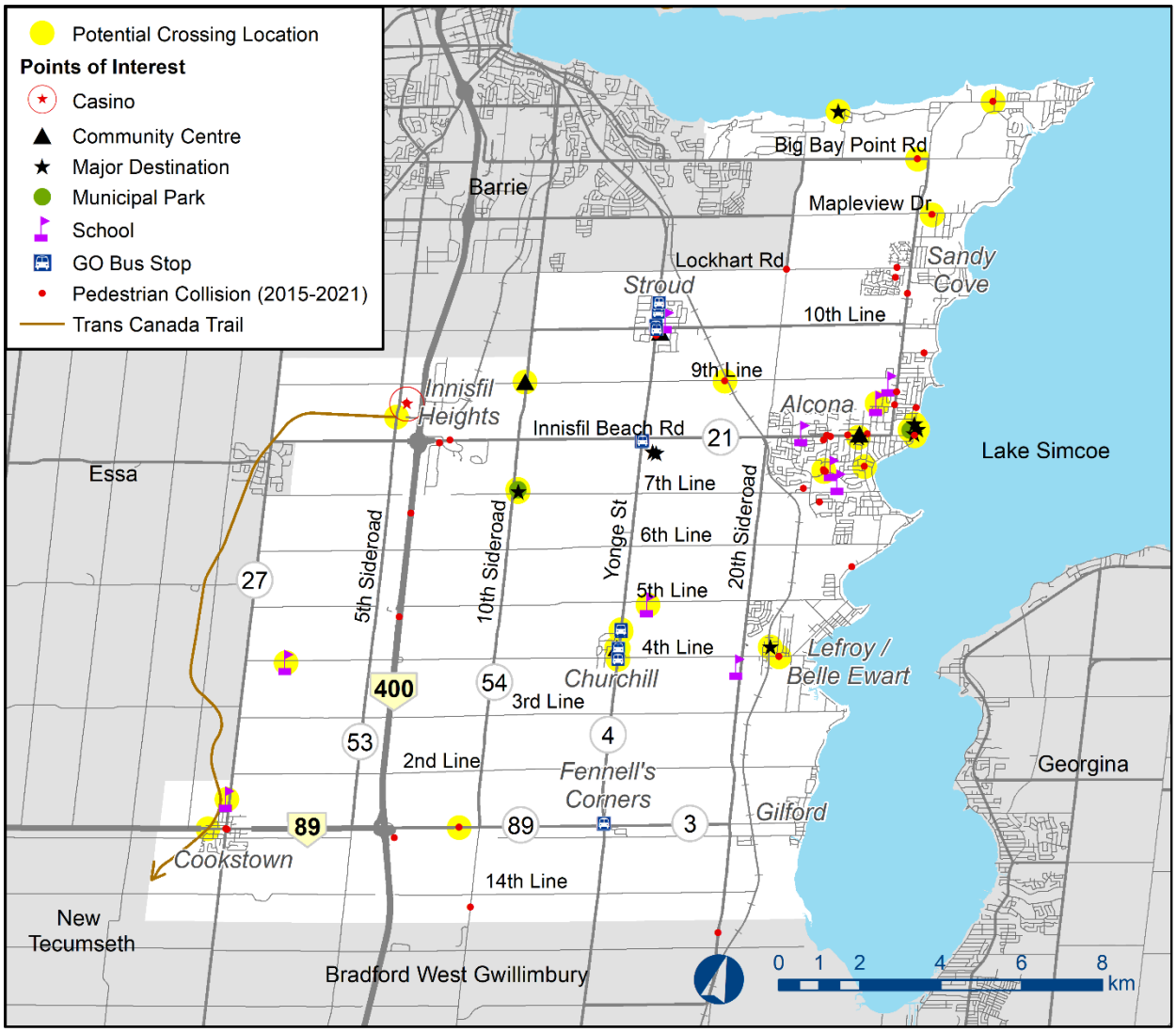
Local residents in Alcona have expressed concerns regarding the 7th Line and St. John's Road intersection, which currently operates as a two-way stop-control and was observed to have substantial pedestrian activity. The skewed north leg at this intersection may warrant the need to provide a more protected crossing (i.e., all-way stop control, PXO or pedestrian signal) to address insufficient approach sight distances.

A list of crossing locations to be assessed through additional studies are provided below. These were established based on the high-level locations assessment shown in Figure M-3, and filtered recognizing that some locations do not have sufficient supporting pedestrian facilities (e.g., sidewalks) or operate within an urban, low-speed context for a desirable crossing environment.

- Leslie Drive / Midland Avenue
- West of Innisfil Beach Road / Spring Street (near the future Town Square)
- Jans Boulevard / Anna Maria Boulevard
- St. John's Street / Helen Street
- Killarney Beach Road / Corner Avenue
- Yonge Street / Meadowland Street
- Yonge Street / 4th Line (already proposed for signalization)
- 5th Sideroad / Trans Canada Trail
- Queen Street / Fisher Lane
- 7th Line / St. John's Road

It is recommended that the above crossing locations be assessed through a Town-wide safety and operations study.

Figure M-3: Potential Crossing Locations



5.3 Preferred Pedestrian Crossing Treatments

Controlled crossing treatments are preferred over uncontrolled treatments, as it prioritizes the right of way of pedestrians. However, uncontrolled treatments can be applied in the case that:

- The pedestrian demand or desire lines do not warrant the need for a controlled crossing.
- Implementation of controlled crossings are constrained by the surrounding environment (e.g., land use, properties, natural features, etc.).
- A controlled crossing would create significant negative implications on traffic flow; and/or
- The cost of the controlled crossing does not justify the need, as determined by the Town (see Table M-4 for estimated costs).

Table M-4: Crossing Treatment Costs

Crossing Treatment	Estimated $2022 Cost
Full Traffic Signal	$300,000
Intersection Pedestrian Signal (IPS)	$150,000 - $200,000
Mid-block Pedestrian Signal (MPS)	$150,000 - $200,000
Pedestrian Crossover (PXO)	$100,000
Stop-Controlled / Yield-Controlled Intersection	$1,500 - $5,000
Supervised School Crossing	$650
Uncontrolled Crossing (i.e., pedestrian crosswalk markings and signs)	$5,000

Note: Costs shown are typical; actual costs vary based on site conditions.

5.3.1 Safety Research

In roadway management, risk and liability exist in perceived negligence, including nonfeasance and malfeasance. To minimize these risks, the Town of Innisfil can proactively monitor the safety of operations at pedestrian crossings to identify hazards, plan for mitigation, and apply improvements to align with policies / best practices. Practices should avoid ambiguity that may lead to confusion and misinterpretation of traffic control devices.

The following resources were identified to help enhance the safety of and/or evaluate the effectiveness of pedestrian crossing treatments or components.

5.3.2 Crash Modification Factors (CMFs)

The Federal Highway Administration Washington (FHWA) provides a database that summarizes the effectiveness of countermeasures to prevent collisions (http://www.cmfclearinghouse.org/). Each countermeasure has a Crash Modification Factor (CMF), which is indicative of the effectiveness of a particular treatment or design element. The CMF is used to provide a rough quantitative estimate of the number of collisions that can be reduced as a result of implementing a particular countermeasure. Note that these CMFs should be used to assess a single countermeasure in isolation, rather than multiple treatments and be applied in situations that match the conditions from which the CMF was developed.

A CMF that is less than 1 indicates that the countermeasure may potentially reduce collisions whereas a CMF above 1 indicates that the countermeasure may potentially increase collisions.

5.3.3 Highway Safety Manual (HSM)

The American Association of State Highway and Transportation Officials (AASHTO) developed the Highway Safety Manual (HSM), which serves as a guiding document to outline methodologies for estimating safety performance on highways. It provides guidance on human factors, traffic safety fundamentals, network screening to identify collision-prone sites, countermeasure selection frameworks, safety effectiveness evaluation and more.

5.3.4 Safe Route to School Strategies

The purpose of Safe Routes to School (SRTS) strategies is to promote the use of active transportation (i.e., walking and cycling) to travel to school. This is achieved through infrastructure improvements to support walking and bicycling, traffic enforcement, public awareness campaigns, safety education, incentives and more. The local government, jurisdictional planning organization, transportation department, school district or a school may be responsible for implementing SRTS programs. Additional resources include the National Center for Safe Routes to School (NCSRTS), which offers resources to support SRTS programs, and the Safe Routes to School National Partnership, which provides information on leveraging infrastructure and best practices to help advance SRTS programs.

6.0 Recommended Pedestrian Crossing Policy

It is recommended that the Town of Innisfil implement the following controlled crossing treatments as warranted based on OTM Book methodologies and thresholds, as well as consideration for pedestrian desire lines, system connectivity and safety (e.g., visibility or measured sight distance constraints, collision trends, or frequent vehicle-pedestrian conflicts):

- Traffic control signals at intersections.
- Midblock pedestrian signals.
- Intersection pedestrian signals
- Stop-controlled / yield-controlled intersections.

It is recommended that the exposure-based approach from the 2017 OTC School Crossing Guard Guideline be adopted as part of the warrant analysis as an initial screening tool for school crossing guard requests. If warrants are not met and there is uncertainty about the impacts of the traffic volumes characteristics on crossing opportunities for a particular site, then a gap survey is recommended and results compared to OTC School Crossing Guard Guideline.

In implementing PXOs to supplement traffic control signals, they should be installed in sufficient quantity to allow pedestrians and drivers to develop familiarity with their operations. For example, they may be set up as a pilot project at several (3) potential locations that are in close proximity within a unique localized area.

Implementation of controlled crossings should consider other design heuristics pertaining to the context of the area surrounding the crossing location such as the operating environment (rural or urban), visibility and vehicle speeds.

All existing and future controlled crossings should incorporate the design features as recommended by and follow the standards of the OTM.

In the case that an uncontrolled crossing is preferred over a controlled crossing, appropriate signage should be installed to emphasis and convey to pedestrians that they do not have the right of way and should wait for a safe gap to cross.

Additional crossing components may be considered at either controlled crossings as additional features or as part of uncontrolled crossings to address site-specific needs and/or vulnerable user groups.

Except for school crosswalks patrolled by a trained crossing guard, marked crosswalks at uncontrolled crossings are discouraged. Consideration may be given to the delineation of high contrast markings to distinguish pedestrian desire lines in highly urban areas where drivers are aware of very high pedestrian activity. In these locations, signage that indicates to pedestrians that they do not have the right of way over vehicles (e.g., Wc-28 sign as per OTM Book 6) should also be implemented.

In addition, warning signage can be implemented as appropriate (e.g., Wc-3, Wc-7 signs as per OTM Book 6 or specialized signs) that will increase drivers' awareness of pedestrian activity. Pedestrian refuge islands or raised medians should also be considered as a passive feature at uncontrolled crossing points where sufficient right-of-way is available and lane alignment is not compromised (e.g., integrated with centre turn lanes). Other measures such as reflective delineator poles may be considered at the boulevard of uncontrolled crossing locations in order to draw the driver's attention to potential crossing activity.

It is recommended that the Town of Innisfil proactively address pedestrian safety needs and establish a program of reviews of pedestrian crossings either through on-going traffic operations studies or annual corridor reviews. Compliance with pedestrian crossing practices should be reviewed, and necessary roadway and traffic control modifications programmed and implemented.

The Town may consider developing a Vision Zero safety plan to assure continued efforts in achieving no pedestrian fatalities through the implementation of effective infrastructure such as crossings. Consideration for land use policies that support walkable neighbourhoods and communities are also recommended to better accommodate and prioritize pedestrians.