7.0 Crossings

A primary challenge to implementing pathway and trail systems is how to accommodate crossings of roads, railways, and other obstacles. Crossing roadways can be very dangerous for pathway and trail users, and hazards will vary between crossing types. For each road crossing identified on **Map 4**, a more detailed analysis must be undertaken to assess traffic conditions, road alignment, distance to the nearest intersection, sight lines, and pathway or trail user volume. This will allow the crossing to be addressed in the safest possible manner.

Example of a basic mid-block crossing treatment across a minor road.

7.1 Minor or Local Roads

For roads with lower volume and speed the crossing can be much simpler. **Figures 7.1 and 7.2** illustrate the key aspects of roadway crossings of minor and local roads.

Mid-block crossings of minor roads may include:

- Access barriers;
- Roadway and trail signing to alert motorists, and pathway users of the crossing
- Perpendicular alignment if possible
- Curb ramps on both sides of the road;

When a mid-block crossing is necessary, it should be designed to provide advance warning to both motorists and trail users of the upcoming crossing. The trail should be designed and signed to reduce speed (in the case of faster moving users) and stop. Grade changes on the trail in advance of the crossing combined with adequate sight distance, signing, textural surface contrast, tactile band where appropriate, and access barriers may also be considered.

Figure 7.1 – Mid Block Crossing Example for Minor or Local Roads

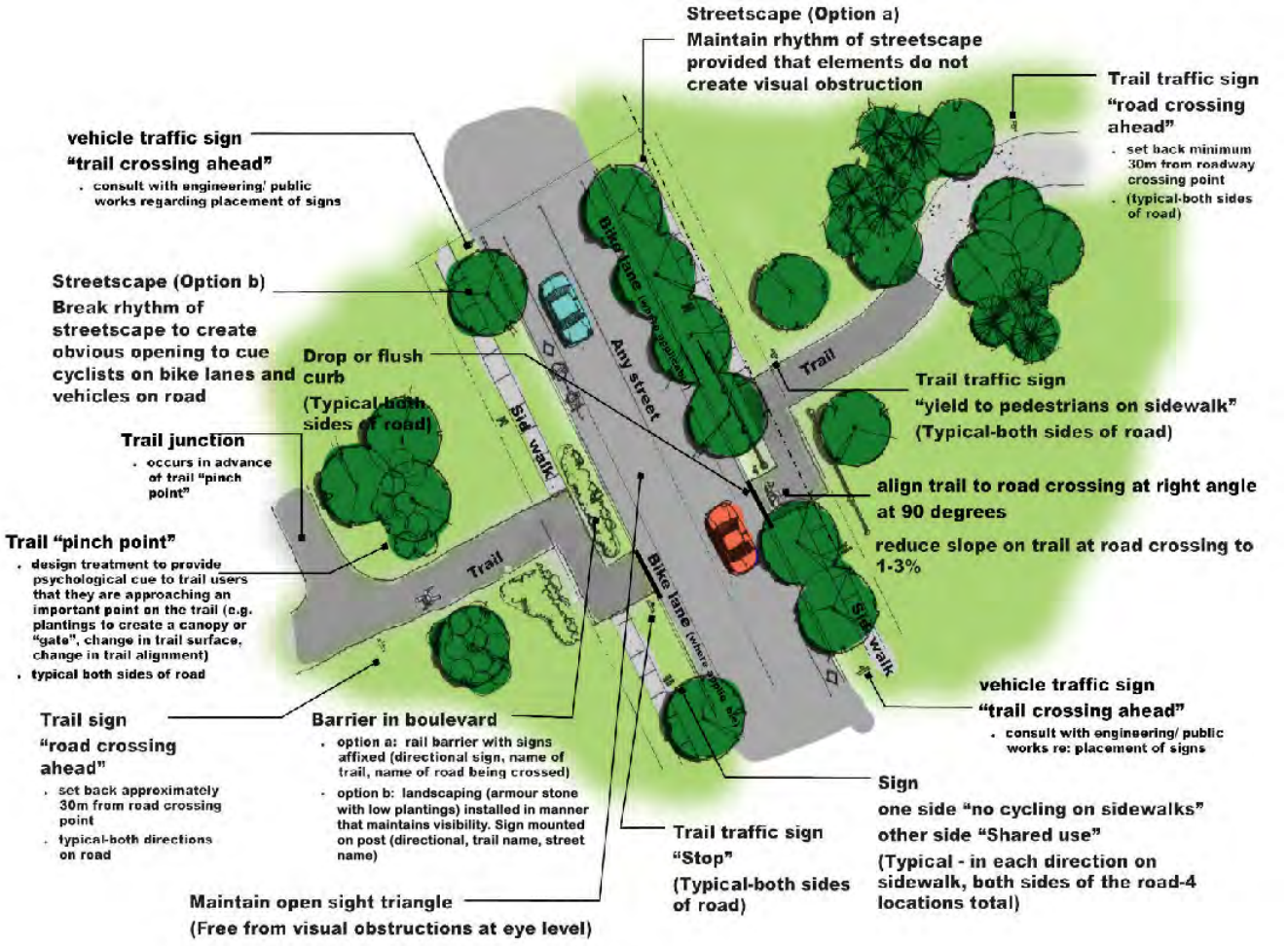
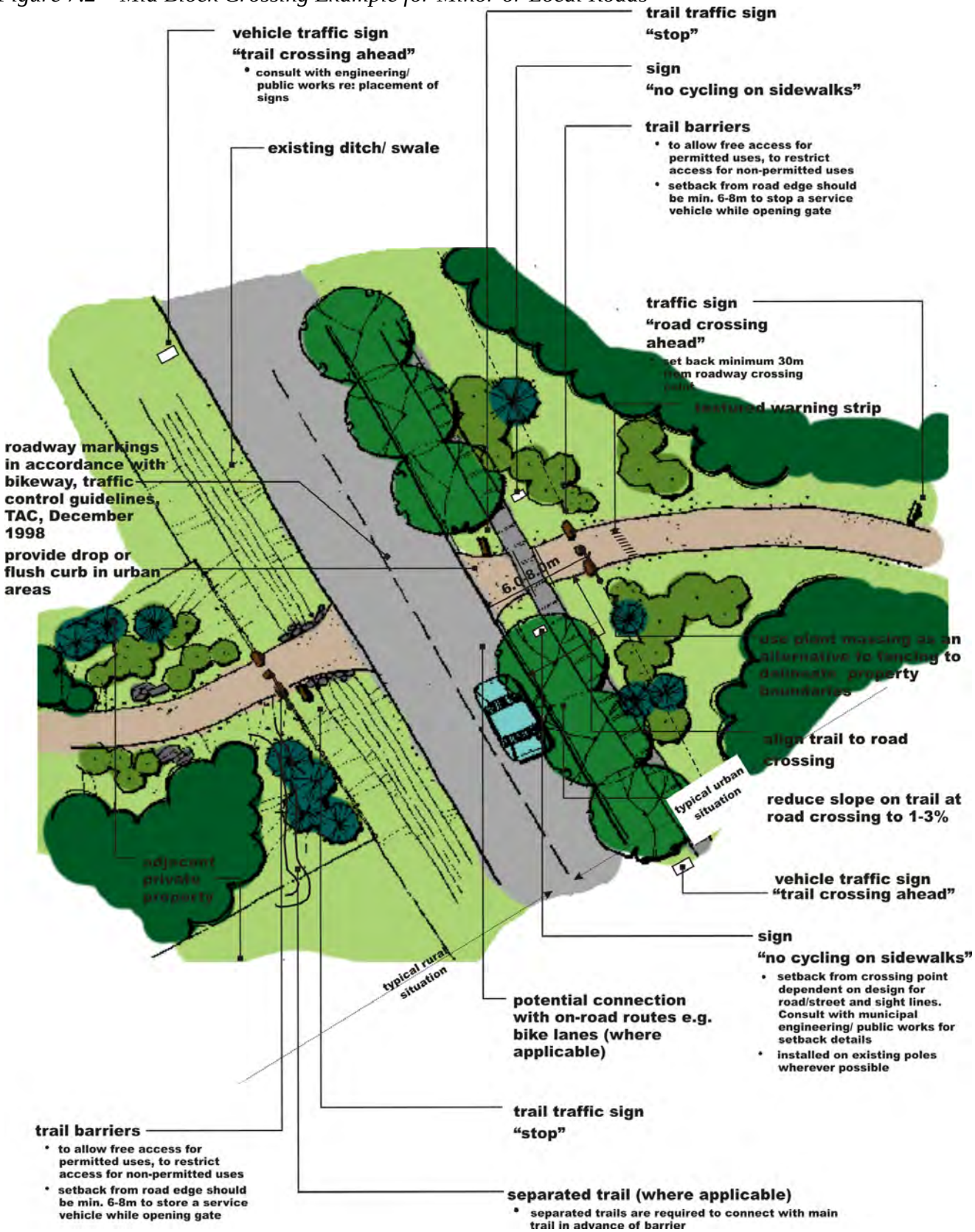


Figure 7.2 – Mid Block Crossing Example for Minor or Local Roads



7.1.1 Raised Crosswalk (Urban Areas)

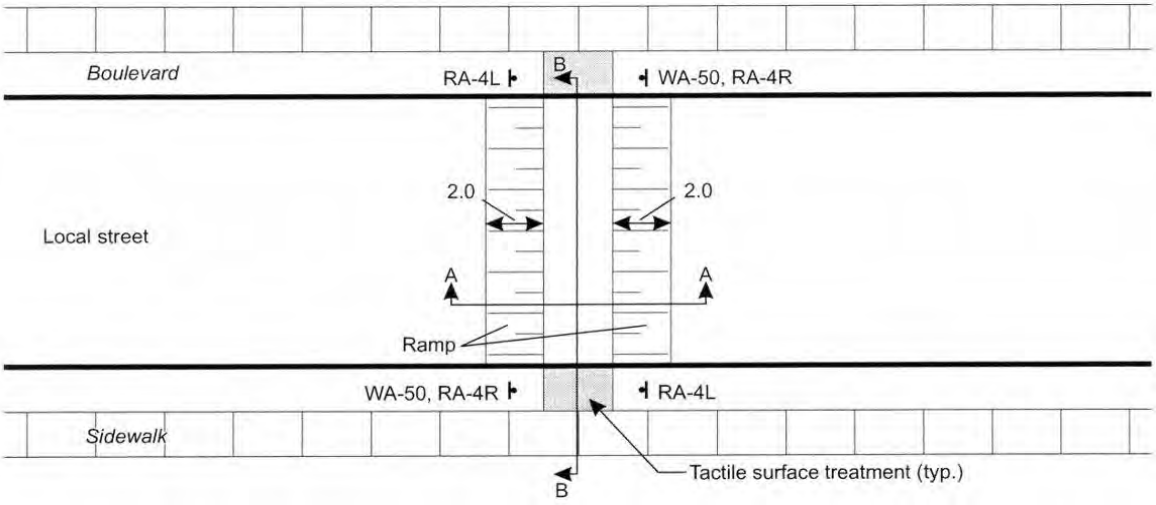
Raised crosswalks have been introduced by a number of municipalities as a design solution for mid-block crossings in urban areas or near schools. The purpose of a raised crosswalk is to reduce vehicle speeds, improve pedestrian and pathway user visibility and reduce the number of cyclist/pedestrian-vehicle conflicts.

This design treatment is most applicable for local collector and residential streets or where the posted speed limit is 50 km/h or less. **Figure 7.3** illustrates a Transportation Association of Canada (TAC) recommended guideline for raised crosswalks.

Raised crosswalks also allow pedestrians to cross streets at the same level as the sidewalk, eliminating the need for curb *ramps.* This concept can also be applied to entire intersections as well. The raised portion of roadway in the intersection encourages motor vehicles to yield, reducing automobile speeds.

Example of a raised crosswalk.
Source: Canadian Guide to Neighbourhood Traffic Calming. TAC (1998)

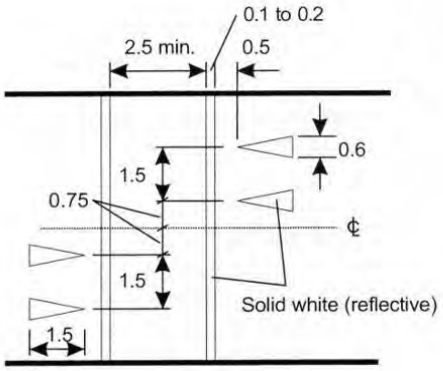
Figure 7.3: Raised Crosswalk Design
(Canadian Guide to Neighbourhood Traffic Calming, TAC/CITE, 1998)



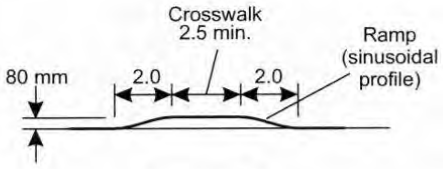
Sign Descriptions:

RA-4	Pedestrian Crosswalk
WA-50	Speed Hump

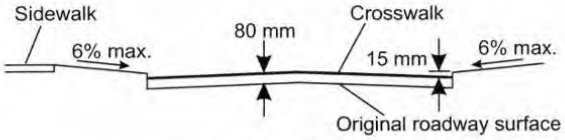
- Catch basins are required on the uphill side of a raised crosswalk.
- To satisfy the recommended curb-face height of 15 mm may require sidewalk reconstruction adjacent to the curb.



Pavement Markings
(two-way street)



Section A-A



Section B-B

Ramp Height Development
Crosswalk profile parallel to roadway surface.

Distance (m)	0.000	0.125	0.250	0.375	0.500	0.625	0.750	0.875	1.000	1.125	1.250	1.375	1.500	1.625	1.750	1.875	2.000
Finished Height (mm)	0	1	3	7	12	18	25	32	40	48	55	62	68	73	77	79	80

All dimensions are in metres unless otherwise noted.

NOT TO SCALE

7.2 Arterial or Collector Roads

Mid-block crossings of arterial or collector roads may warrant consideration of a mid-block pedestrian signal. As part of an evaluation of potential locations for a Mid-block Pedestrian Signal, consideration must be given to:

- Proximity to the nearest signalized intersection;
- Traffic volume;
- Potential concerns regarding coordination of nearby signals along the road corridor. Coordination issues may lead to the perception of long delays in triggering the signals to stop traffic; and
- Cost.

In some cases the preferred solution is to provide a median refuge for users. See **Section 7.3.1** for details on pedestrian refuge islands.

Example of a mid-block pedestrian crossing in Markham.

7.2.1 Mid-Block Crossing Warrant

If a pathway crossing at a collector or arterial road is within the threshold distance to a signalized intersection, or a mid–block pedestrian signal, pathway users should be directed to cross at this location. Once beyond these threshold levels (identified in **Figure 7.4**), users often ignore the protected crossing and attempt to cross at an unprotected point. **Figure 7.4** provides an illustration of this concept and provides some direction regarding the application of signage at the appropriate points to guide trail users to the intersection, and to warn sidewalk users that they may encounter cyclists on this portion of the sidewalk. Note that cyclists are expected (reinforced with signs) to dismount and walk their bicycles through the intersection as per the Highway Traffic Act.

The following guideline threshold distances for mid-block crossings have been used in other Ontario municipalities.

A typical multi-use pathway intersection with a roadway. Note the use of signage and bollards.

Figure 7.4 Guideline Threshold Distances: For Mid-block Crossings that have been applied in other municipalities.

Road Class/Type	**Threshold Distance to Nearest Signalized Intersection**
2 Lane Collector Roadway:	No less than 60m from nearest protected crossing (traffic signal or mid block pedestrian signal)
4 Lane Collector or Arterial Roadway:	No less than 120m from nearest protected crossing (traffic signal or mid-block pedestrian signal)

In addition, adequate site distance along the roadway is required for a cyclist who has dismounted at the "stop" sign at a mid-block crossing, to be able to completely cross the entire roadway without impeding the progress of a vehicle approaching from the cyclists' right side. **Figure 7.5** illustrates how sight distance is determined, while **Figure 7.6** provides values for a range of widths and design speeds.

Figure 7.5: Minimum Sight Distance for Bike Path Crossing (TAC GDGCR, 1999 Figure 3.4.7.2)

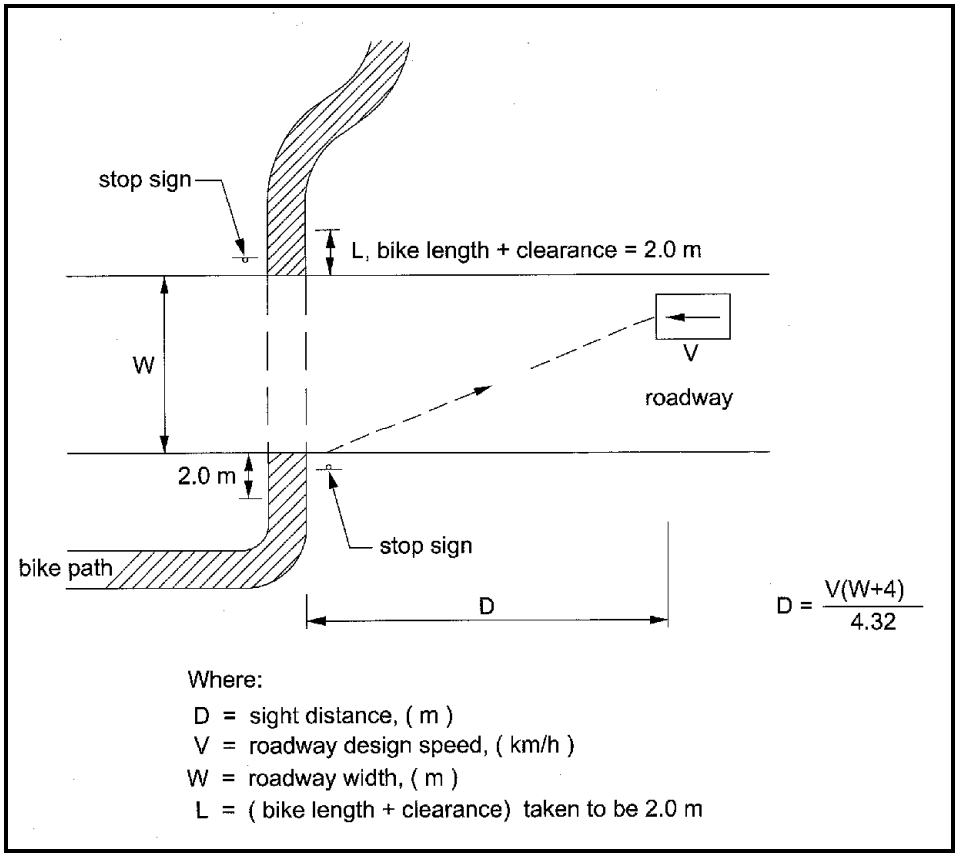


Figure 7.6: Minimum Sight Distance

Width of Roadway - W (m)	Minimum Sight Distance (D) to Approaching Vehicle (m) Roadway Design Speed (km/h)			
	50	60	70	80
7.0	130	150	180	200
10.5	170	200	230	270
14.0	210	250	290	330
17.5	250	300	350	400
21.0	290	350	410	460

Note: Values for other roadway widths and/or design speeds may be derived from the formula in Figure 3.4.7.2.

Source: TAC, GDGCR, 1999 (TAC – Table 3.4.7.1)

7.3 Major Roads

For major roads, preferred crossing designs include:

- Grade separated;
- Occur at an existing signalized or stop-controlled intersection; or
- At a mid-block pedestrian signal/pedestrian half signal
- Include pedestrian refuge islands where warranted;

7.3.1 Pedestrian Refuge Islands

Pedestrian refuge islands may be used to protect trail users while crossing multi-lane roadways such as Highway 7. The offset design forces pathway users to stop and cross each direction of traffic separately. Raised medians can also act as a refuge for pedestrians crossing mid-block. They could provide space for trees and other types of landscaping that can help to define and enhance the character of the area they serve.

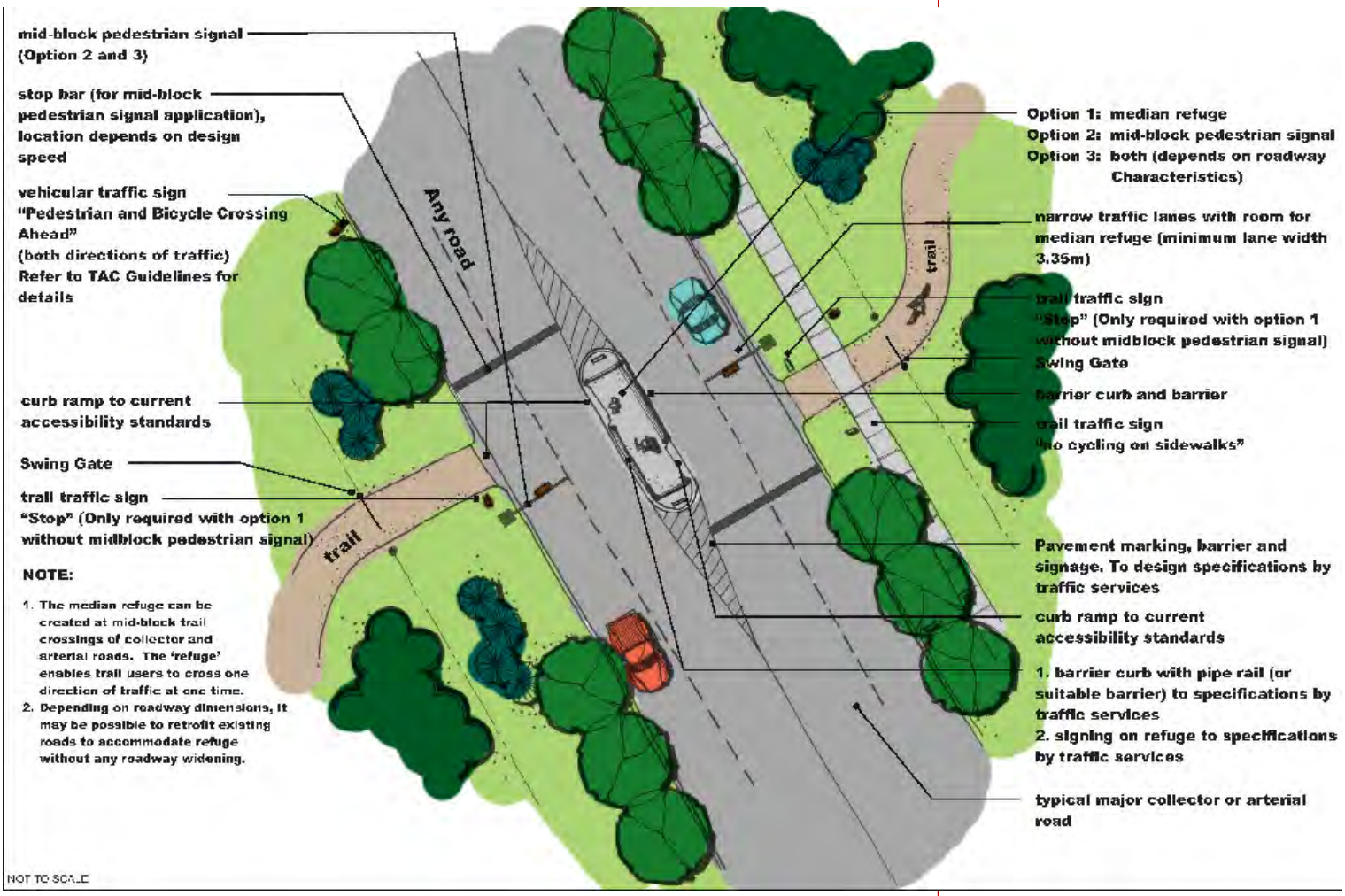
Pedestrian islands and raised medians are most useful on high-volume, high speed roads and should be designed to provide tactile cues for pedestrians with visual impairments to indicate the border between the pedestrian refuge area and the motorized vehicle roadway, see **Figure 7.7**.

The City of Toronto has developed a warrant for the installation of mid-block pedestrian refuge islands, which should be considered for use in Markham. Their warrant is typically 100-115 pedestrians per hour over an 8-hour period.

Example of a pedestrian crossing with refuge island, North Austin, Texas.

Example of a pedestrian crossing with refuge island, Waterloo, Ontario.

Figure 7.7 Example of a Pedestrian Refuge at a Mid-Block Crossing



7.4 Pathway Crossings of Railroads

At the present time, in order to establish a pathway crossing of an active rail line, the Town of Markham may submit their request directly to the railroad company. The submission should identify the location of the crossing, and the basic design for the crossing, which should be consistent with Draft RTD-10, ROAD/RAILWAY GRADE CROSSINGS: TECHNICAL STANDARDS and INSPECTION,TESTING and MAINTENANCE REQUIREMENTS, 2002, which is available from Transport Canada.

A gated approach to safe trail crossings at a railway route.

In the event that an agreement can not be reached on some aspect of the crossing, then an application may be submitted to the Canadian Transportation Agency, who will mediate a resolution between the parties.

Canadian Transportation Agency
Ottawa, ON
K1A 0N9
Telephone: 1-888-222-2592

Example of an at-grade trail crossing of a railway, Newmarket, Ontario, 2006

Railway crossings can be hazardous for all on-road cyclists and off-road pathway and trail users and, therefore, extra caution should be applied to assure their safe operation. It is strongly recommended that appropriate traffic control devices be installed at the intersections of railway tracks and trails. These include:

- Pavement markings;
- Signage;
- Rubber anti-slip pad inserts; and
- Lift gates.

Traffic control devices should be designed and installed in accordance with the Bikeway Traffic Control Guidelines (TAC 1998) and the Manual of Uniform Traffic Control Devices for Canada (TAC 1997).

Example of a trail bridge over an active railway line, Port Hope, Ontario, 2006. (Photo: Eagle Bridge)

Careful consideration should be given to the design of at-grade pathway or trail crossings of railways. Furthermore, it is recommended that pathways and trails be designed to cross railways at as close to right angles as possible. In many situations this may require widening of the pathway/trail in advance of the crossing, thereby allowing cyclists to reduce their speed and position themselves for crossing at right angles. Rubber track guards are also recommended to assure better friction between bike tires and the pavement, and also to narrow the rail gaps.

Existing pathway and/or trail railway crossings should be improved to address above recommendations as part of future enhancement programs.

7.5 Multi-Use Trail Bridges and Underpasses

The pathway and trail system may require multi-use bridges that are designed for pedestrians and cyclists and not for motor vehicle traffic, with the exception of service vehicles. There are typically two basic types of bridges, linear or ramped-type bridges.

Linear Bridge

The approach paths of a flat or linear-type bridge do not ramp greater than 5% and incorporate vertical curves to transition to the bridge deck. This type of bridge crosses over travel barriers such as waterways that are lower in elevation than the trail.

Ramped Bridge

The approach paths of a ramped-type bridge are sloped to gain elevation. This bridge type crosses barriers such as a railway that are at the same elevation or higher than the trail.

Existing Flat / Linear Pathway and Trail Bridges, Town of Markham

In general, a linear-type bridge is preferable because it is the simplest to build and has a flat run-out. This ensures access for all trail users. Space limitations and increased heights may require ramp grades as steep as a maximum of 8 percent. This can cause excessive exit speeds, which is especially dangerous if the end of the bridge is located at an intersection. In these situations, curved ramps should be used. Wherever possible, ramps should be elliptical or circular rather than being interrupted by 90 or 180 degree turns at landings. In addition, bridge approaches should not be located near intersections, both road/trail and trail/trail, or where visibility is limited.

Bridges should be 0.6 m wider (0.3 m wider on each side) than the pathway or trail they are serving, to provide adequate side clearance for the railings. They should also be wide enough and strong enough to support maintenance vehicles where required. An immovable bollard located at the centre of each approach can be used to prevent heavy vehicles from crossing a light duty bridge.

Examples of ramped type bridges

The bridge travel surface should be a non-slip material. Untreated wooden or flat metal surfaces become slippery when wet or icy. Bridge slats made of self-weathering steel with raised dimples for traction have been used successfully. Concrete surfaces can also be used. Open metal grating, on the other hand, is noisy and difficult to travel on by in-line skaters.

Bridges less than 3.3 metres wide are too narrow and not be configured for riding cyclists as part of a high use multi-use path. Warning signage and

centre line bollards can be used to slow cyclists down and alert them to a constricted bridge crossing ahead. In some cases, it may be necessary to sign the bridge as a pedestrian only bridge and request that cyclists walk their bicycles.

Typically pre-fabricated bridges are recommended as a cost-effective solution, except when crossing very wide spans or 400 series highways. In Ontario there are companies that provide these types of bridges. Key design considerations include:

- Surface type. Transverse laid 2" x 10" wood or composite boards are common, provide excellent strength and durability, are reasonably non-slip when wet and are easy to maintain. Metal grate surfaces are effective but tend to be more expensive and are not as desirable for in-line skaters and cyclists. Concrete surfaces are often used for major and more expensive crossing structures.
- Vertical railings should be located on the outside of the bridge structure to avoid damage by service and snow removal vehicles; and
- Cover plates should be used to cover expansion joints.

In some areas, trails could be routed under existing bridges. Locations where this was determined to be a possibility in the field, are identified on Map 4 as “Proposed Trail Under Existing Bridge”. These areas should be studied in more detail to determine requirements of the Conservation Authority and the agency with jurisdiction over the road, to determine whether a trail connection is allowed.

Photo: Potential location for pathway under Highway 7 bridge. (west of McCowan Road)