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Memorandum

To/Attention	Peter Allaby, Crandall Engineering	Date	March 24, 2019
From	Zibby Petch, IBI Group	Project No	118704
cc	Roland Wong, IBI Group		
Subject	Active Transportation Typical Treatments - Bedford Highway		

Background & Context

The functional plan for the Bedford Highway represents HRM's first Strategic Corridor Plan, and is intended to focus on assessing the feasibility of reconfiguring the corridor to include improved transit and active transportation facilities.

At present, sidewalks and cycling infrastructure along the corridor are disconnected and limit the potential attractiveness of active transportation. The addition of high-quality active transportation facilities has been identified as a critical component of the conceptual design. At this time, it is anticipated that much of the corridor will include a multi-use path on the east (basin) side of the corridor, along with a few sections of sidewalks and on-road bike lanes, as well as upgrades to transit stops along the corridor. Several typical active transportation treatments have been developed based on these anticipated facility types to inform the subsequent stages of design. These typical treatments build upon the design criteria prepared for the corridor with an additional level of detail, including recommendations for pavement markings and signage.

The following sections of the memo illustrate these typical treatments:

- Transit Stops
 - Minimum requirements for transit stops
 - Transit stop integration with Multi-use path (wide boulevard)
 - Transit stop integration with Multi-use path (narrow boulevard)
 - Transit stop integration with Multi-use path (rural cross-section)
- Driveways
 - with Multi-use path (constrained)
 - with Multi-use path (preferred)
- Facility Transitions
 - Multi-use path to on-road bike lanes at signalized intersection
 - Multi-use path on one side of the street to the multi-use path on the far side

Transit Stops

Stop Provisions

In the vicinity of all transit stops, the safety of passengers boarding and alighting from transit facilities should be emphasized through the provision of adequate transit stop provisions. Presently, many transit stops along Bedford Highway do not provide an accessible boarding

zone (refer to Exhibit 1) and there is a desire to upgrade transit stops along the corridor to provide a consistent user experience along the corridor.

Exhibit 1: Transit stop along Bedford Highway; Passengers wait in a designated bike lane



Source: Google Streetview

The following elements ensure that transit stops are attractive, welcoming and convenient for all transit users including persons with disabilities, and reflect the minimum infrastructure that it is desirable to provide along Bedford Highway:

- **Raised Landing Pad** – a concrete passenger waiting area flush with the curb with minimum dimensions of 9 metres by 2.5 metres to accommodate both doors of a standard transit bus. For articulated buses along Bedford Highway, the landing pad can be extended by another 6.5 metres.
- **Accessible Boarding Zone** – These are areas on the landing pad that must be kept clear of any obstructions to allow for accessible ramp deployment and loading. The minimum dimension of the accessible boarding zone is typically 1.5 metres wide by 2.5 metres deep, which allows for enough room for ramp deployment and manoeuvrability
- **Sidewalk Connection (where needed)** – an unobstructed, hard even-surface pathway with a minimum 1.5 metre clearway connecting the landing pad to an accessible sidewalk if it's offset further than 2.5 metres from the landing pad

In addition to basic stop requirements, additional amenities can enhance a user's transit experience by improving comfort and convenience. While it may not be recommended or feasible to provide amenities at every stop along Bedford Highway, there may be key transit stops which are candidates for enhancement. Additional amenities that may be considered where space permits include:

- Shelters;
- Route and schedule information (static or digital/real time displays)
- Seating;
- Litter receptacle; and/or
- Bicycle storage (typically, post and ring racks or longer-term storage such as bicycle lockers).

The placement of amenities should not obstruct the accessible boarding zone, pedestrian movement, or sightlines for road traffic.

Integration with Active Transportation Facilities

Wherever transit stops are adjacent to active transportation facilities, there is potential for conflict between cyclists and transit passengers. The following principles should be applied when designing active transportation facilities in the vicinity of transit stops along Bedford Highway:

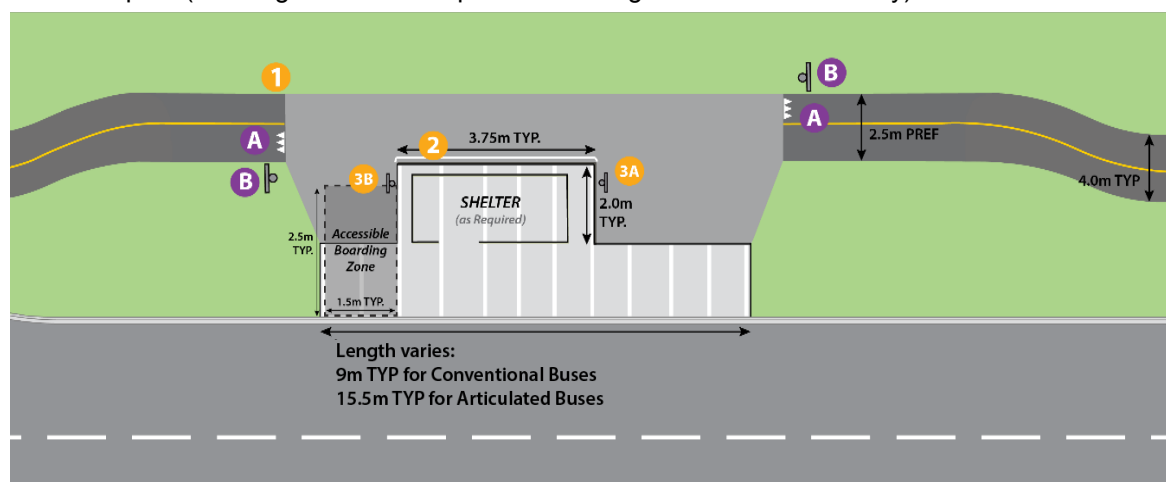
- Whenever possible, **the preferred approach is to separate through cyclists and pedestrians from waiting transit passengers**. Depending on the active transportation facilities, treatments may involve:
 - Bending the multi-use path behind the transit facility and providing a paved connection to the passenger area
 - Ramping an on-road cycling facility up into the boulevard in advance of the transit stop in order to bend it behind the transit facility
- Where it is not possible to bend facilities away from transit facilities due to property or ROW constraints, **mitigation strategies must be employed to reduce or limit conflicts**. Depending on the type of facilities, strategies may include:
 - Application of enhanced pavement markings for on-road cycling facilities to alert bus drivers of potential conflicts with cyclists
 - Providing signage and pavement markings that alert cyclists to pedestrian priority where the cycling facility must cross through shared space
 - Providing other clues that emphasize a changing condition such as through the use of different surface materials for shared facilities

Requiring cyclist to dismount at transit stops is generally not a viable solution and should be avoided.

Typical treatments for multi-use paths in the vicinity of transit stops in preferred and constrained configurations (urban and rural) are shown in Exhibit 2, Exhibit 3 and Exhibit 4.

Exhibit 2: Transit Stop Integration with Multi-use Path (Preferred)**Multi-use Path in the vicinity of Transit Stops (Preferred)**

In this example, the multi-use path is bent away from the adjacent (parallel) roadway to wrap behind the transit stop, thus avoiding potential conflicts between boarding/alighting passengers and cyclists and pedestrians travelling along the corridor. It is desirable wherever possible to provide the 1.5m space for ramp deployment beyond the width allocated to the multi-use path / shared space. The shelter may be placed between the multi-use path and the boarding zone, or behind the multi-use path (allowing the multi-use path to remain closer to the roadway).

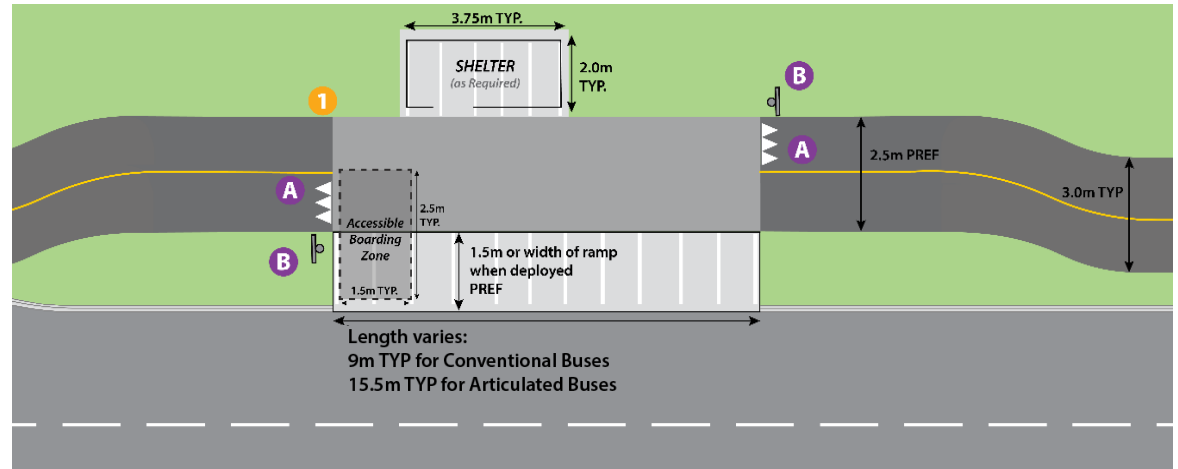


Source: IBI Group

Recommended	Optional
1 Change in surface material to emphasize pedestrian priority in the vicinity of the transit stop 2 A 100mm white solid line should mark the back of the transit stop, where shelters or other street furniture is provided, to warn cyclists of potential hazards 3A 'Object Marker' signage where there are potential hazards associated with the transit stop i.e. transit shelters or bike parking (TAC WA-36L / WA-36L) 3B	A Shark's teeth should be applied to remind cyclists to yield to pedestrians, preferably in a durable pavement marking material. B Cyclists Yield to Pedestrian Signage (TAC RB-39) can be used to reinforce pedestrian priority
Other interventions that may be considered: - A 100mm solid yellow dividing line can be applied to the multi-use path approaching the transit stop to slow cyclists and reduce conflicts - Gentle curve in multi-use path may be used to slow cyclists approaching the transit stop. Radii should generally exceed 5m; with up to 12m preferred.	

Exhibit 3: Transit Stop Integration with Multi-use Path (Constrained)**Multi-use Path in the vicinity of Transit Stops (Constrained)**

In locations with narrow boulevards, the multi-use path can be transitioned close to the adjacent (parallel) roadway to intersect with the transit stop. This option requires less space however it may increase the potential for conflicts between boarding/alighting passengers and cyclists and pedestrians travelling along the corridor. It is desirable wherever possible to provide the 1.5m space for ramp deployment beyond the width allocated to the multi-use path / shared space.



Source: IBI Group

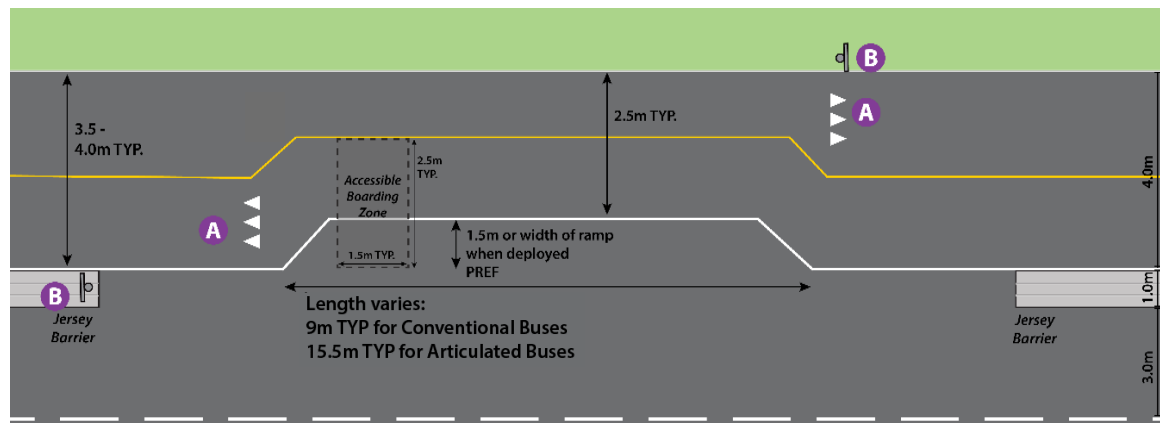
Recommended	Optional
1 Change in surface material to emphasize pedestrian priority in the vicinity of the transit stop	A Shark's teeth can be applied to indicate that cyclists must yield to crossing pedestrians, preferably in a durable pavement marking material. B Cyclists Yield to Pedestrian Signage (TAC RB-39) can be used to reinforce pedestrian priority

Other interventions that may be considered:

- A 100mm solid yellow dividing line can be applied to the multi-use path approaching the transit stop to slow cyclists and reduce conflicts
- Gentle curve in multi-use path may be used to slow cyclists approaching the transit stop. Radii should generally exceed 5m; with up to 12m preferred.

Exhibit 4: Transit Stop Integration with Rural Multi-use Path (Constrained)**Rural Multi-use Path in the vicinity of Transit Stops (Constrained)**

In locations where the multi-use path is separated from the roadway by a jersey barrier, a transit boarding and alighting zone can be created using pavement markings and signage.



Source: IBI Group

Recommended	Optional
	A Shark's teeth should be applied to indicate that cyclists must yield to crossing pedestrians, preferably in a durable pavement marking material. B Cyclists Yield to Pedestrian Signage (TAC RB-39) can be used to reinforce pedestrian priority

Other interventions that may be considered:

- A 100mm solid yellow dividing line can be applied to the multi-use path approaching the transit stop to slow cyclists and reduce conflicts
- Gentle curve in multi-use path may be used to slow cyclists approaching the transit stop. Radii should generally exceed 5m; with up to 12m preferred.

Driveways

Conflicts between vulnerable users and vehicles at driveways can be a serious concern. Whenever possible, driveways should be limited, consolidated and/or formalized through a detailed access management review. Where driveways are unavoidable, it is important that the design of driveways clarifies the right of way and enhances visibility of vulnerable users through geometric improvements and the application of pavement marking and signage to minimize risk. In addition to considering enhanced treatments, it is critical that appropriate sightlines be provided so that vehicles entering and exiting the driveways can see both vulnerable users and motor vehicles on the main roadway.

At present, many of the segments of Bedford Highway include long stretches of continuous access/driveways, which should be consolidated when upgrading existing or introducing new active transportation facilities (refer to Exhibit 5).

Exhibit 5: Examples of areas with poor access management along Bedford Highway



Source: Google Streetview

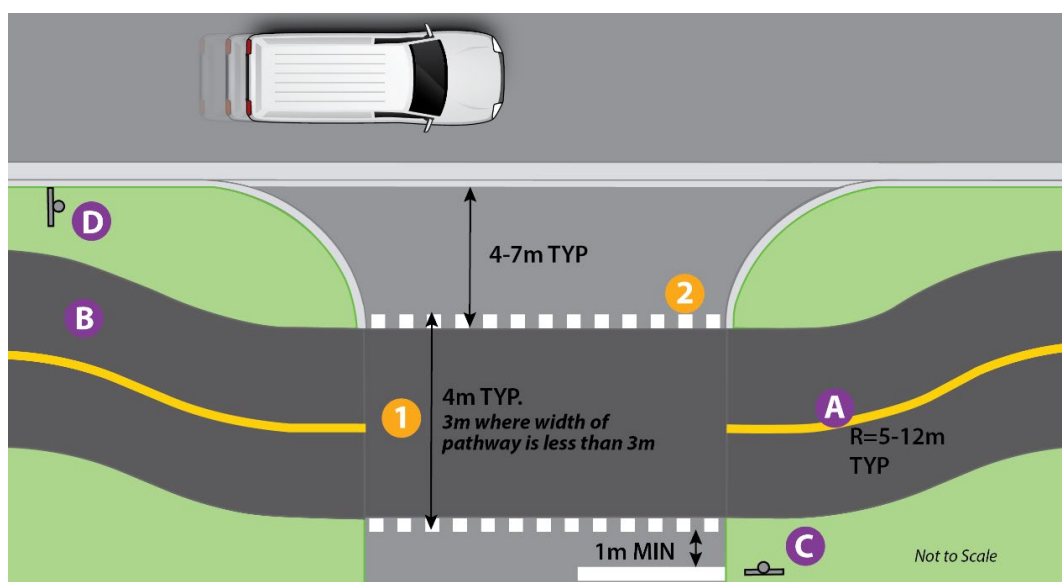
Two types of driveway treatments are presented in the following sections:

- Multi-use path with Bend-out Design (preferred) – refer to Exhibit 6
- Multi-use path with Bend-in Design (constrained) – refer to Exhibit 7

Exhibit 6: Driveway Crossing – Multi-use Path with Bend-Out Design (Preferred)**Multi-use Path with Bend-out Design (Preferred)**

In this example, the multi-use path is bent away from the adjacent (parallel) roadway. In a bend-out application, there is space for turning motorists to queue between the path crossing and the parallel roadway:

- Motorists turn off the parallel roadway and come closer to perpendicular with the trail before yielding to cyclists / pedestrians crossing the driveway (reducing risk of rear-ending from other drivers on the parallel roadway)
- Motorists exiting the driveway yield to cyclists / pedestrians and then have space past the crossing to wait to turn onto the parallel roadway without blocking the crossing (reducing the risk that motorists waiting to exit will block the pathway)



Source: IBI Group

Recommended

- 1 Carry facility through driveway / provide visual contrast with driveway material (i.e. asphalt pathway / concrete driveway apron)
- 2 Elephant's feet markings may be applied to highlight the crossing point



Source: TAC Bikeway Traffic Control Guidelines for Canada, 2012 (Table 7-1)

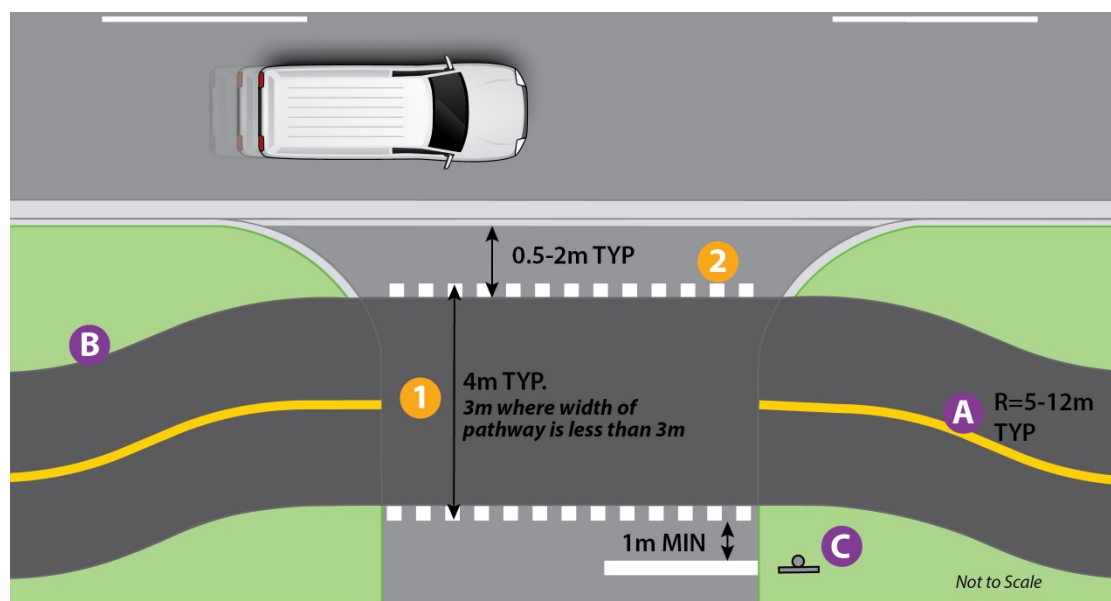
Optional

- A A 100mm solid yellow dividing line can be applied to the multi-use path approaching the driveway to reduce conflicts
- B Gentle curve in multi-use path may be used to slow cyclists approaching the driveway. Radii should generally exceed 5m; with up to 12m preferred.
- C Optional 'Stop' sign (TAC RA-1) and corresponding stop bar, or 'Yield' sign (TAC RA-2) without stop bar. Where neither conditions are warranted, consider applying a 'Pedestrian and Bicycle Crossing Ahead Sign' and tab (OTM Wc-15 –& Wc-32t)

Exhibit 7: Driveway Crossing – Multi-use Path with Bend-In Design (Constrained)**Multi-use Path with Bend-in Design (Constrained)**

In this example, the multi-use path is bent towards from the adjacent (parallel) roadway. In a bend-in application, motorists must have good visibility of approaching cyclists or pedestrians:

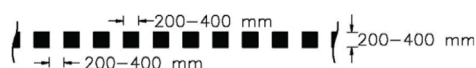
- Motorists yield to cyclists / pedestrians in the crossing before turning off the parallel roadway
- Motorists exiting the driveway yield to cyclists / pedestrians in the crossing and to traffic on the parallel roadway (ideally without blocking the crossing)



Source: IBI Group

Recommended

- 1 Carry facility through driveway / provide visual contrast with driveway material (i.e. asphalt pathway / concrete driveway apron)
- 2 Elephant's feet markings may be applied to highlight the crossing point



Source: TAC Bikeway Traffic Control Guidelines for Canada, 2012 (Table 7-1)

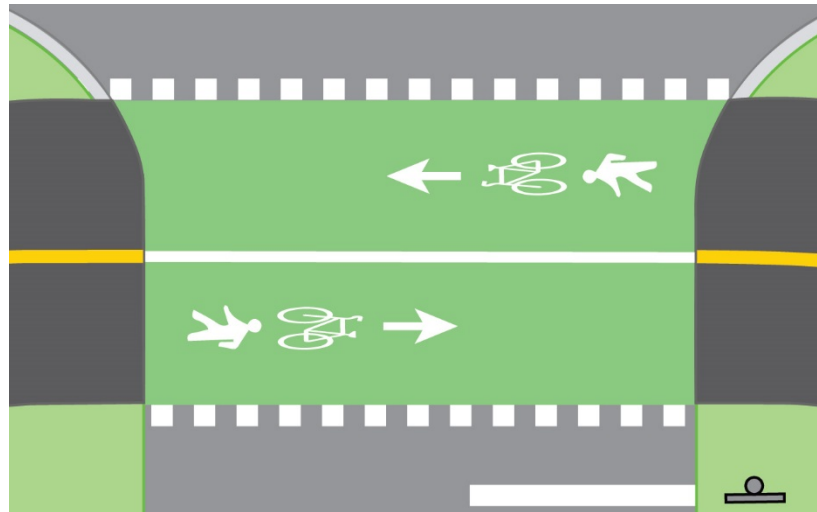
Optional

- A A 100mm solid yellow dividing line can be applied to the multi-use path approaching the driveway to reduce conflicts
- B Gentle curve in multi-use path may be used to slow cyclists approaching the driveway. Radii should generally exceed 5m; with up to 12m preferred.
- C Optional 'Stop' sign (TAC RA-1) and corresponding stop bar, or 'Yield' sign (TAC RA-2) without stop bar. Where neither stop or yield conditions are warranted, consider applying a 'Pedestrian and Bicycle Crossing Ahead Sign' and tab (TAC WC-46 & TAC WC-7S)

Note that in addition to the elephant's feet markings shown in Exhibit 3 and Exhibit 5, facilities crossing higher volume driveways may be candidates for enhanced pavement markings to

improve conspicuity of crossing pedestrians and cyclists. Refer to Exhibit 8 for an example treatment (with or without centre dividing line).

Exhibit 8: Alternative Pavement Marking for High Volume Driveways



Source: IBI Group

Facility Transitions

Facility transitions occur where one facility meets or intersects another. These transitions can present a challenge to users, particularly where uni-directional facilities meet bi-directional facilities, as they create complex and demanding crossings. The design of Bedford Highway should aim to avoid unnecessary facility transitions whenever possible. Where facilities must transition due to ROW limitations or changing context, it is important to minimize the inconvenience of these transitions while ensuring that movements are controlled and predictable. It is recommended that all facility transitions occur at signalized intersections.

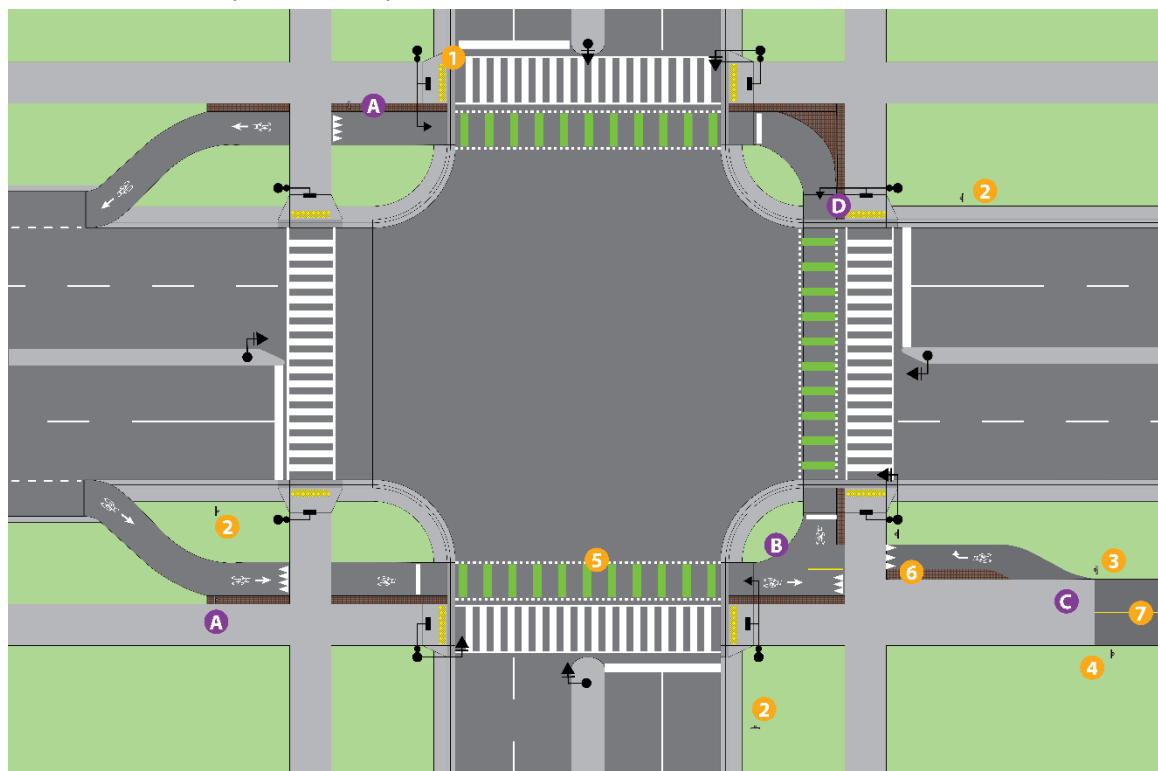
Each facility transition will require detailed consideration of the context, however a generalized example of the following transitions are presented for consideration in subsequent stages of the design:

- Sidewalks and on-road, uni-directional cycling facilities on one side of an intersection transitioning to a multi-use path on the other side of the intersection (potential application: Bedford at Holland Avenue/Convoy Run) – refer to Exhibit 9
- Multi-use path on one side of an intersection transitioning to a multi-use path on the opposite (far) side of the intersection (potential application: Bedford at Manor Lane) – refer to Exhibit 10

Exhibit 9: Sample Transition: Multi-use Path to Uni-directional Facilities

Sidewalks and uni-directional cycling facilities transitioning to a multi-use path

In this modified protected intersection, corner islands are provided with 4-7m setbacks between the parallel road and cycle track crossings. On-road cycling facilities ramp up into the boulevard, providing a higher order facility through the intersection. Cyclists on the multi-use path transition to on-road facilities with a two-stage turn. Consideration should be given to the phasing sequence to reduce the time required to complete the left turn.

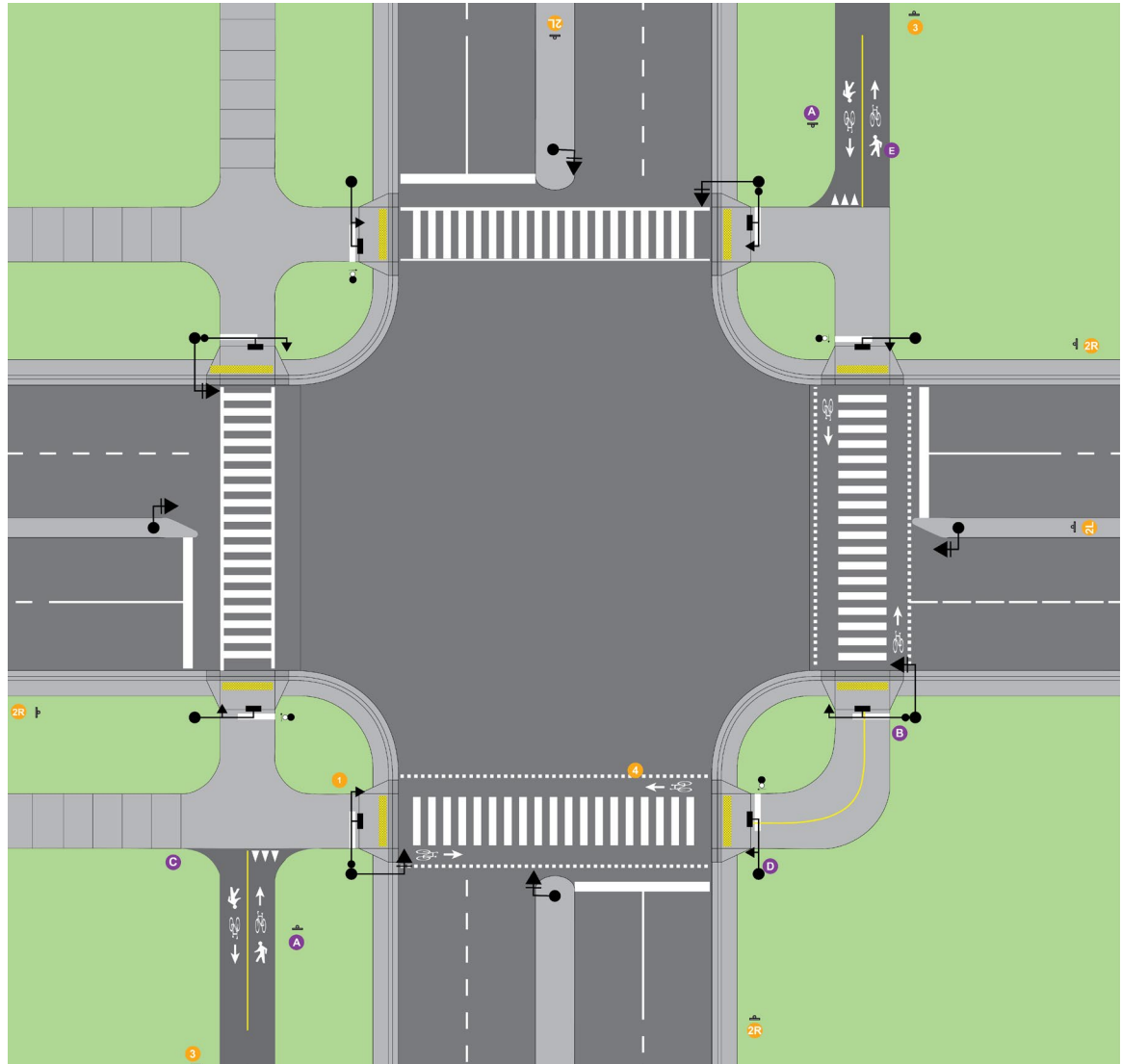


Source: IBI Group

Recommended	Optional
1 Accessible curb ramps and tactile plates 2 'Turning Vehicles Yield To Bicycles' (TAC RB-37) signage to alert drivers that they must yield to cyclists 3 'Bicycle Route' marker signage (TAC IB-23) combined with right turn signage (IS-5R) and custom street signage indicating that cyclists continuing along Bedford Highway must turn right 4 'Shared Pathway' signage (RB-93 – TAC) should be applied downstream of the start of the multi-use pathway	A 'Cyclists Yield to Pedestrians' signage (TAC RB-39) B Optional stop bar for cyclists located at the top of the curb ramp. C Shared use path and cyclist right turn lane can be made of a different material than the sidewalk to mark the beginning of a shared space and to emphasize pedestrian priority. D Separate bicycle signals are preferred to provide consistency through the transition.

Exhibit 10: Sample Transition – Multi-use Path to Multi-use Path**Multi-use path transitioning to a multi-use path (far side)**

crossrides are provided to connect multi-use path on opposite ends of a signalized intersections. Crossside markings are set back 4-7m between the parallel road and crossside markings.



Source: IBI Group

Recommended

- 1 Accessible curb ramps and tactile plates
- 2 'Bicycle Trail Crossing Side Street Sign' signage and optional 'Trail Crossing' tab (TAC WC-44 + WC-44T) alerting drivers to the potential presence of cyclists crossing the intersecting street (WC-44L in median to alert left turners; WC-44R on right side of roadway to alert right turners)

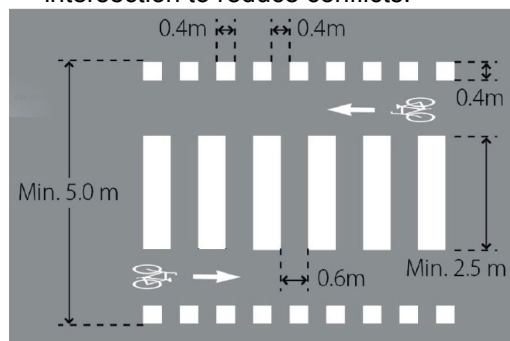
Optional

- A 'Cyclists Yield to Pedestrians' signage (TAC RB-39)
- B Optional stop bar for cyclists located at the top of the curb ramp.

Multi-use path transitioning to a multi-use path (far side)

3 'Shared Pathway' signage (TAC RB-93) should be applied 5-30m downstream of the intersection.

4 Intersection crossing of the multi-use path should be designed as a Combined Pedestrian and Cyclist Crossride (see details of pavement marking below). A yellow dividing line should be applied to the multi-use path approaching the intersection to reduce conflicts.



C Shared use path and cyclist right turn lane can be made of a different material than the sidewalk to mark the beginning of a shared space and to emphasize pedestrian priority.

D Separate bicycle signals are preferred to provide consistency through the transition.

E Optional pedestrian and cyclist markings following / approaching intersection.