9.1.7.1 GO TRANSIT STOUFFVILLE RAILWAY CORRIDOR CROSSINGS

Kennedy Road crosses the GO Transit Stouffville Railway Corridor at-grade at two (2) locations, north of Clayton Drive and north of Austin Drive. Each crossing presents different challenges and the following sections provide the alternative design concepts that were considered. Grade separation designs were prepared adhering to minimum vertical clearance to the underpass and overpass designs as per Metrolinx - General Guidelines for Design of Railway Bridges and Structures, 2018 and Metrolinx Performance Specifications for Structures Passing Over Electrified Corridors, MX-ELEC STR - SPEC-2017-Rev3.0. The minimum vertical clearance for the Underpass was 5.3 m from proposed road profile to underside of rail structure, and the minimum vertical clearance for the Overpass was 7.584m (Top of Rail to lowest point of overhead obstruction)

9.1.7.1.1 North of Clayton Drive

The Go Transit Stouffville Railway Corridor Crossing North of Clayton Drive is currently an at-grade crossing. Based on the Grade Separation Assessment presented in **Section 5.6** of this report, a grade separation is recommended. Table **9-3** presents the alternative design concepts considered to address the problems and opportunities identified for the Kennedy Road and Go Transit Stouffville Railway Corridor at-grade crossing north of Clayton Drive. These alternatives are illustrated in **Exhibit 9-10** through **Exhibit 9-12**.

Table 9-3: Alternative Design Concepts considered for the Go Transit Stouffville Railway Corridor Crossing North of Clayton Drive

Alternative #	Title	Description
1	At-grade with AT Improvements	• Road and rail tracks at the same level • AT facilities continuous through this segment
2	Underpass with AT Improvements	• Road lowered under the rail tracks • AT facilities continuous through this segment
3	Overpass with AT Improvements	• Road raised over the rail tracks • AT facilities continuous through this segment

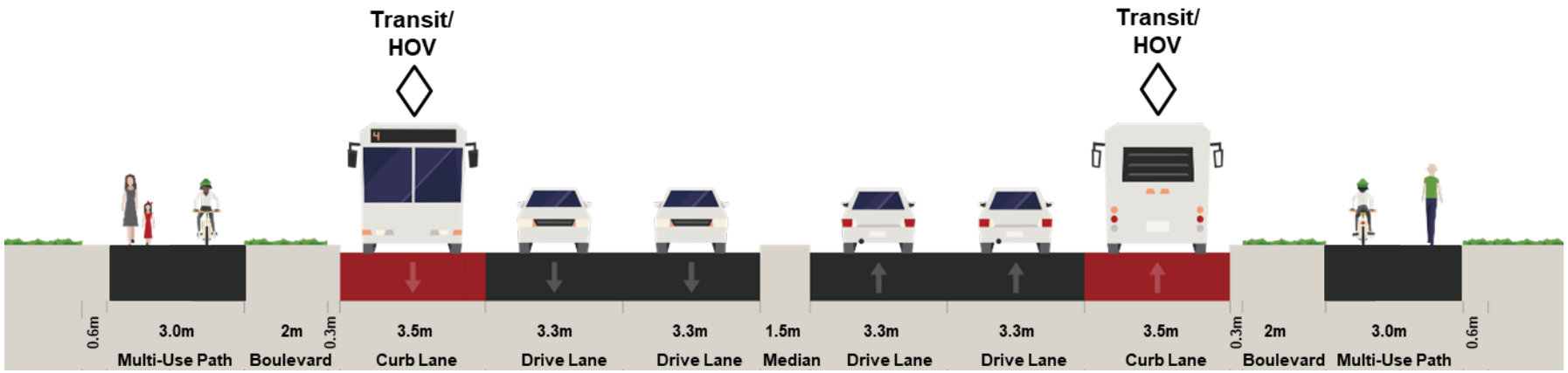


Exhibit 9-10: Alternative 1 –At-grade crossing with AT Improvements

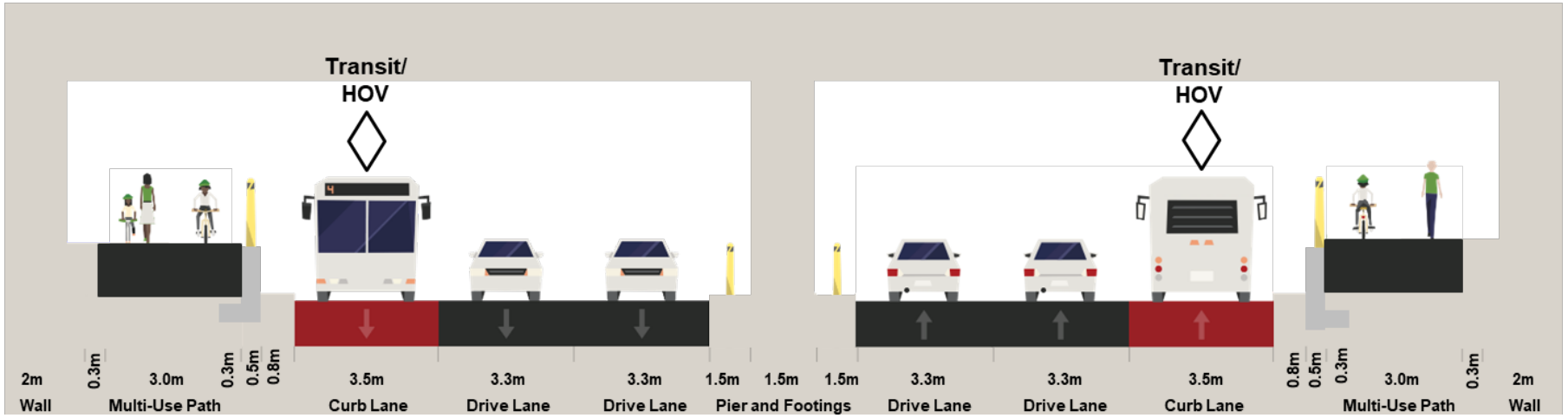


Exhibit 9-11: Alternative 2 – Underpass with AT Improvements

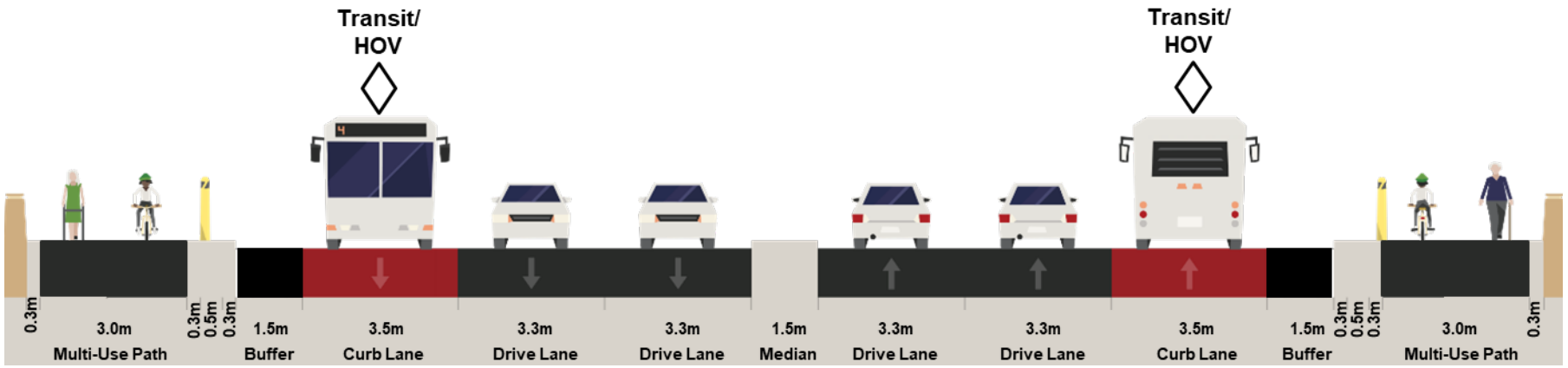


Exhibit 9-12: Alternative 3 – Overpass with AT Improvements

9.1.7.1.2 North of Austin Drive

The Go Transit Stouffville Railway Corridor Crossing north of Austin Drive is also an at-Grade crossing. Based on the Grade Separation Assessment presented in **Section 5.6** of this report, a grade separation is recommended. However, development of the alternative design concepts at this location had to consider the following constraints:

- Proximity to Carlton Road;
- Close proximity of residential buildings to rail crossings;
- Proximity to Austin Drive intersection and required slope to meet the grade separation alternative;
- High groundwater table;
- Location of 1500mm underground watermain;
- Existing floodplain and hydraulic concerns; and,
- Proximity to Rouge River crossing, existing structure width, and grade separation impacts.

Table 9-4 presents the alternative design concepts considered to address the problems and opportunities identified for the Kennedy Road and GO Transit Stouffville Railway Corridor at-grade crossing north of Austin Drive. These alternatives are illustrated in **Exhibit 9-13** through **Exhibit 9-15**.

Table 9-4: Alternative Design Concepts considered for the GO Transit Stouffville Railway Corridor Crossing North of Austin Drive

Alternative #	Title	Description
1	At-grade with AT Improvements	• Road and rail tracks at the same level • AT facilities continuous through this segment
2	Underpass with AT Improvements	• Road lowered under the rail tracks • AT facilities continuous through this segment
3	Overpass with AT Improvements	• Road raised over the rail tracks • AT facilities continuous through this segment

Alternative 1 - At Grade Crossing with AT improvements

The at-grade crossing is a widened transportation corridor with active transportation (AT) improvements such as HOV/transit lanes and multi-use paths as seen in **Exhibit 9-13**.

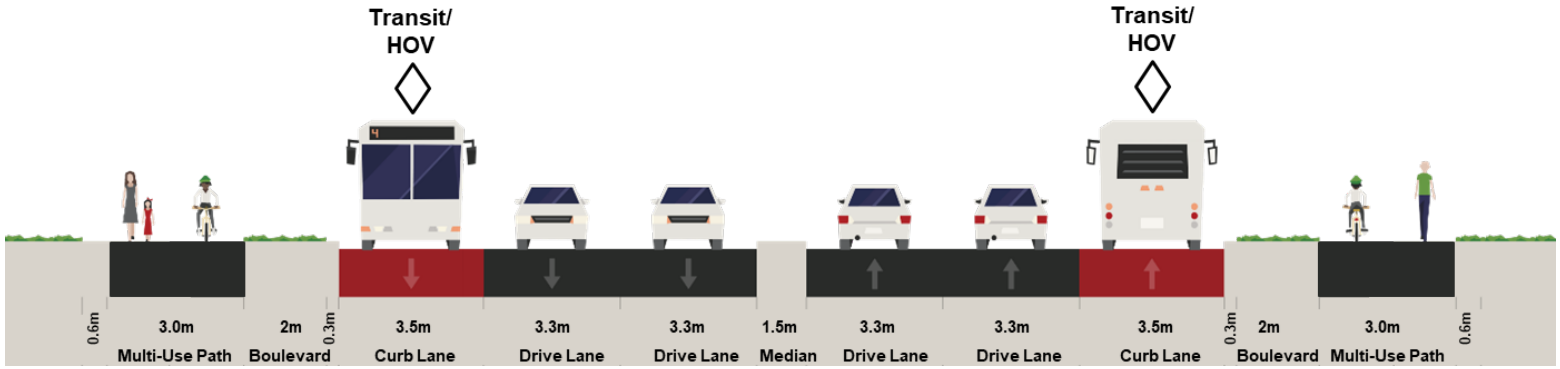


Exhibit 9-13: Alternative 1 –At-grade crossing with AT Improvements

Alternative 2 - Underpass

The Underpass alternative would be a roadway going beneath the GO Rail track and has a cross-section for vehicular lanes and active transportation improvements as seen in **Exhibit 9-14**.

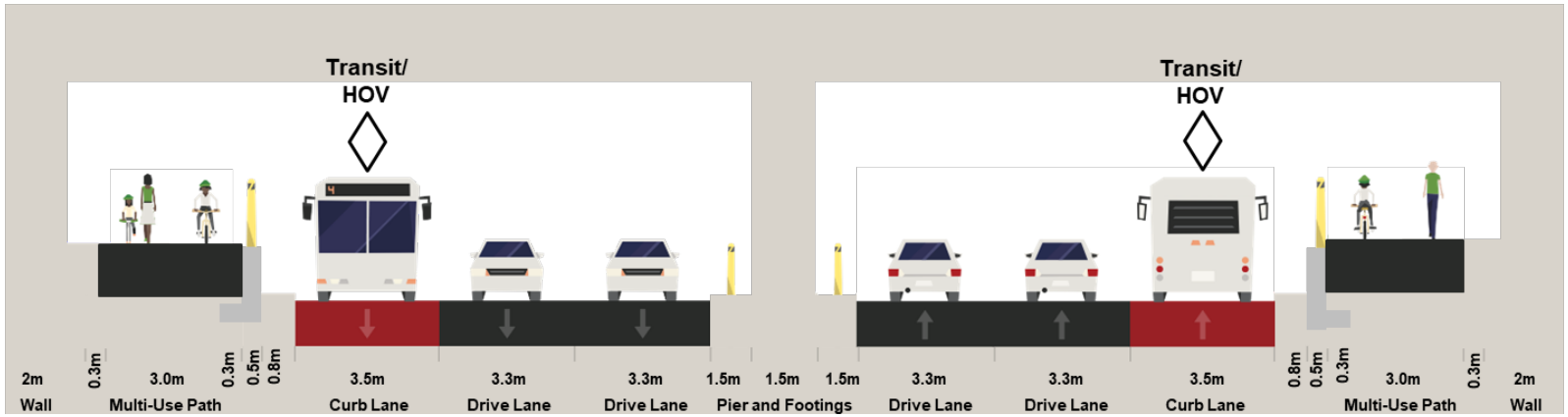


Exhibit 9-14: Alternative 2 – Underpass with AT Improvements

Alternative 3 – Overpass

The overpass alternative is an elevated roadway structure over the GO Rail track and has a cross-section for vehicular lanes and active transportation improvements as seen in **Exhibit 9-15**.

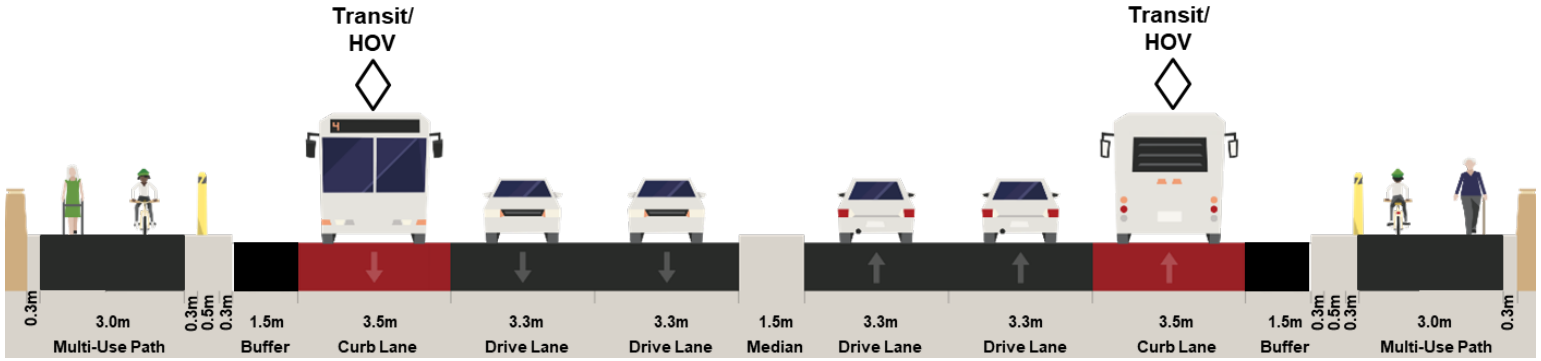


Exhibit 9-15: Alternative 3 – Overpass with AT Improvements

The existing at-grade Go Transit Stouffville Railway Corridor crossing north of Austin Drive was assessed. Due to the number of constraints at this location field verification of the existing 1500mm watermain beneath the rail corridor was identified as required to confirm the feasibility of the underpass design option and to inform the evaluation and decision-making. Based on the assessment the Recommended Design is Alternative 1 for the at-grade crossing and identified the Ultimate Vision as a future grade separation subject to a separate Grade Separation Study when additional information to inform the decision making can be obtained. **Table 9-5** presents an aggregated summary of the recommended alternatives.

Table 9-5: Summary of Recommended Alternatives

Alternatives	Summary of Key Considerations	Action
Alternative 1 - At-Grade Crossing	• Does not address the ultimate vision for grade separation with increased rail service; potential to address needs in the interim	**Recommended Design**
Alternative 2 - Underpass	• Significant capital costs to construct rail bridges, retaining walls, detour roads, raised AT facilities, underpass, and drawdown pumping system. • Requires new structure at the Rouge River crossing to be raised (~0.6 m raise) • Feasibility is dependent on the depth of 1500mm dia. watermain to ensure sufficient cover	**Carry Forward for Future Grade Separation Study for Ultimate Vision**
Alternative 3 - Overpass	• Moderate-Significant capital costs to construct overpass structure on piers south of rail and embankment/retaining walls north of rail, and detour roads • Requires open span on piers south of rail to accommodate Rouge River hydraulics • Independent of the depth of 1500 mm dia. watermain. • Austin Drive connection, east or west side impacts to TRCA lands and proximity to Rouge River and floodplain	**Carry Forward for Future Grade Separation Study for Ultimate Vision**

9.1.7.2 ROUGE RIVER CROSSING

Kennedy Road crosses the Rouge River north of Highway 7 on a bridge. Currently this segment of Kennedy Road does not support cycling facilities and pedestrian safety issues exist as there is minimal separation between pedestrian facilities and vehicular traffic.

Alternatives to accommodate the Preferred Solution require widening or replacing the bridge. As well, due to the proximity of the Rouge River to the Go Transit Stouffville Railway Corridor crossing north of Austin Drive, alternatives at the Rouge River

crossing must also accommodate the recommendation for the grade separation. It is understood that for the Ultimate Vision for the grade separation of the Go Transit Stouffville Railway Corridor north of Austin Drive that the Rouge River bridge would need to be raised and replaced for either an Underpass or Overpass design. This is on account of flooding of the underpass and existing overtopping of the existing Rouge River structure. Recommendations for the Rouge River structure for the Ultimate Vision will be determined through the separate Grade Separation Study.

To support the Recommended Design for the Go Transit Stouffville Railway Corridor north of Austin Drive for an At-Grade crossing for the widened Kennedy Road, the following recommendations at the Rouge River structure are identified in **Table 9-6**, and illustrated in **Exhibit 9-16** and **Exhibit 9-17**.

Table 9-6: Alternative Design Concepts considered at the Rouge River Crossing

Alternative #	Title	Description
1	AT Facilities on Both Sides	• Full bridge replacement or modification of the existing bridge to accommodate widening the road from four to six lanes and AT facilities
2	Separate AT Bridges	• Full bridge replacement or modification of the existing bridge to accommodate widening the road from four to six lanes with separate AT bridges to accommodate pedestrians and cyclists

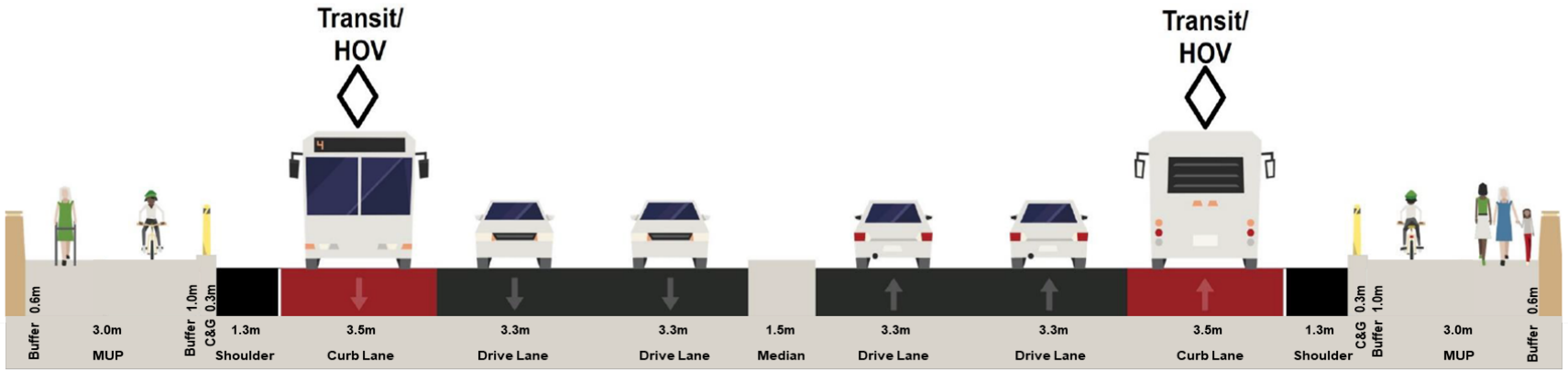


Exhibit 9-16: Alternative 1 – AT facilities on both sides

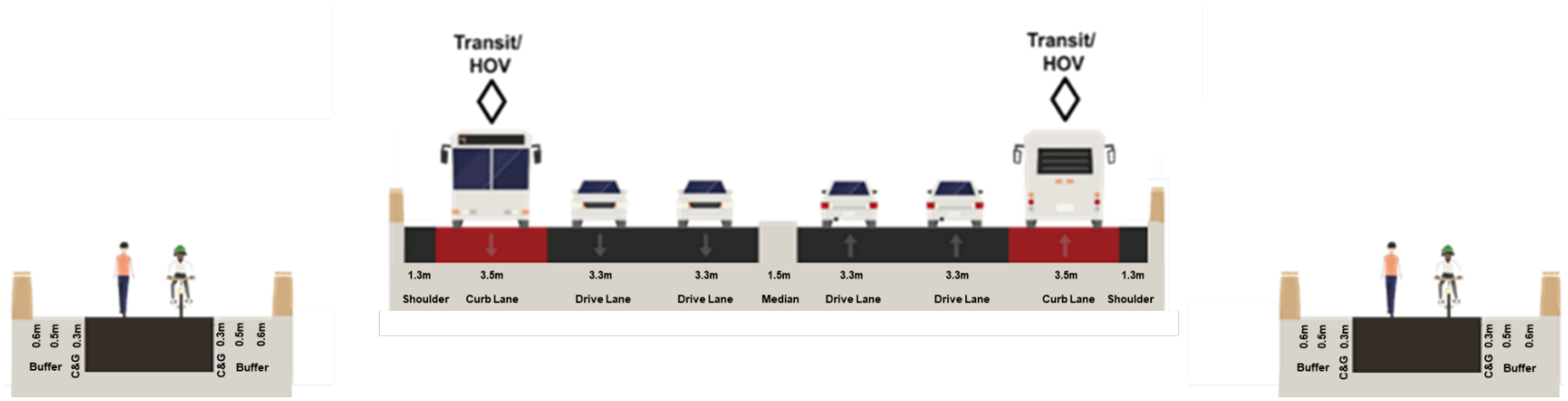


Exhibit 9-17: Alternative 2 – Separate AT Bridges

9.1.7.3 CEMETERIES

There are four cemeteries within the study corridor located adjacent to Kennedy Road. The Hagerman East and Hagerman West Cemeteries which are located on the east and west side of Kennedy Road, between 14th Avenue and Duffield Drive. St. Philips-on-the-Hill and Bethesda Lutheran Cemeteries are located on the west and east side of Kennedy Road respectively, between Beckett Avenue and Wilfred Murison Avenue. The following sections present the alternative design considerations at these locations.

9.1.7.3.1 Hagerman East and Hagerman West Cemeteries

The Hagerman Cemeteries are located on the east and west side of Kennedy Road, between 14th Avenue and Duffield Drive. This segment of Kennedy Road has one of the most constrained ROWs generally less than 33m, with the most constrained location at approximately 25.3m. Currently, this segment does not support cycling facilities and pedestrian safety is an issue as there is minimal separation between pedestrian and vehicular traffic. There are also heritage considerations at this segment due to the proximity of Hagerman Cemeteries and Thomas Morley House to the existing road right-of-way.

Due to the sensitivities of the adjacent cemeteries and Thomas Morley House (Designated under Part V of the Ontario Heritage Act, By-Law 37-93), alternative design concepts looked at opportunities to minimize potential impacts to these lands deviating from the typical section. Alternatives considered reduction in standard lane widths for six-lane roads, removal of active transportation facilities in the segment, provision of shared cycling facilities instead of separated facilities, and/or provision of priority measures (queue jump lanes) in place of dedicated Transit/HOV lanes etc. **Table 9-7** summarizes the alternative solutions considered to address the problems and opportunities identified for the Hagerman Cemeteries road segment. These alternatives are illustrated in **Exhibit 9-18** through **Exhibit 9-25.**

Table 9-7: Alternative Design Concepts Considered for the Hagerman Cemeteries Segment

Alternative #	Title	Description
1	Reduced Lane Width with MUP and Sidewalk, Best Fit Approach	• Six-lane widening for Transit/HOV • Reduced lane width, no centre median, MUP one side and sidewalk other side • Road alignment is shifted west of Hagerman East and east at Hagerman West (“best fit” approach) • No direct impacts to adjacent graves • Potential impacts to the heritage home on the east side

Alternative #	Title	Description
2	Standard Lane Width with MUPs on both sides, Best Fit Approach	• Six-lane widening for Transit/HOV • Standard lane width, no centre median and MUP on both sides • Road alignment is shifted west of Hagerman East and east at Hagerman West (“best fit” approach) • Potential impacts to adjacent graves • Impacts to the heritage home on the east side • Impacts to hydro and watermain
3	Standard Lane Width with MUPs on both sides, Shift alignment West	• Six-lane widening for Transit/HOV • Standard lane width, no centre median and MUP on both sides • Road alignment is shifted west of Hagerman East • Potential impacts to adjacent graves • No direct impacts to the heritage home on the east side • Impacts to hydro
4	Standard Lane Width with MUPs on both sides, Shift alignment East	• Six-lane widening for Transit/HOV • Standard lane width, no centre median and MUP on both sides • Road alignment is shifted east of Hagerman West • Impacts to adjacent graves • Impacts to the heritage home on the east side • Impacts to hydro and watermain
5	Centre Median AT Facility	• Six-lane widening for Transit/HOV • Standard lane width • Centre median with MUP for cycling and pedestrian in the middle of the road • Potential impacts to adjacent graves • Potential impacts to the heritage home on the east side
6	Shared Roadway with Cyclists, and Sidewalks	• Six-lane widening for Transit/HOV • Standard lane width and no centre median • Cycling in shared curb lane with Transit/HOV vehicles (sharrow lane) • Sidewalks on either side

Alternative #	Title	Description
		• Potential impacts to adjacent graves • Potential impacts to the heritage home on the east side
7	No AT Facilities	• Six-lane widening for Transit/HOV • Standard lane width with minimum centre median • No pedestrian and cycling facilities in the corridor • No impacts to adjacent graves • No direct impacts to the heritage home on the east side
8	No widening, MUPs on both sides, and queue jump lanes	• Maintain four lanes with centre left-turn lane • Standard lane width and MUP on both sides • Transit/HOV lanes transition into this segment through queue jump lanes for Transit/HOV vehicles at intersections with14th Avenue and Duffield Drive (or future Miller Ave. extension) • Potential impacts to adjacent graves • Potential impacts to the heritage home on the east side

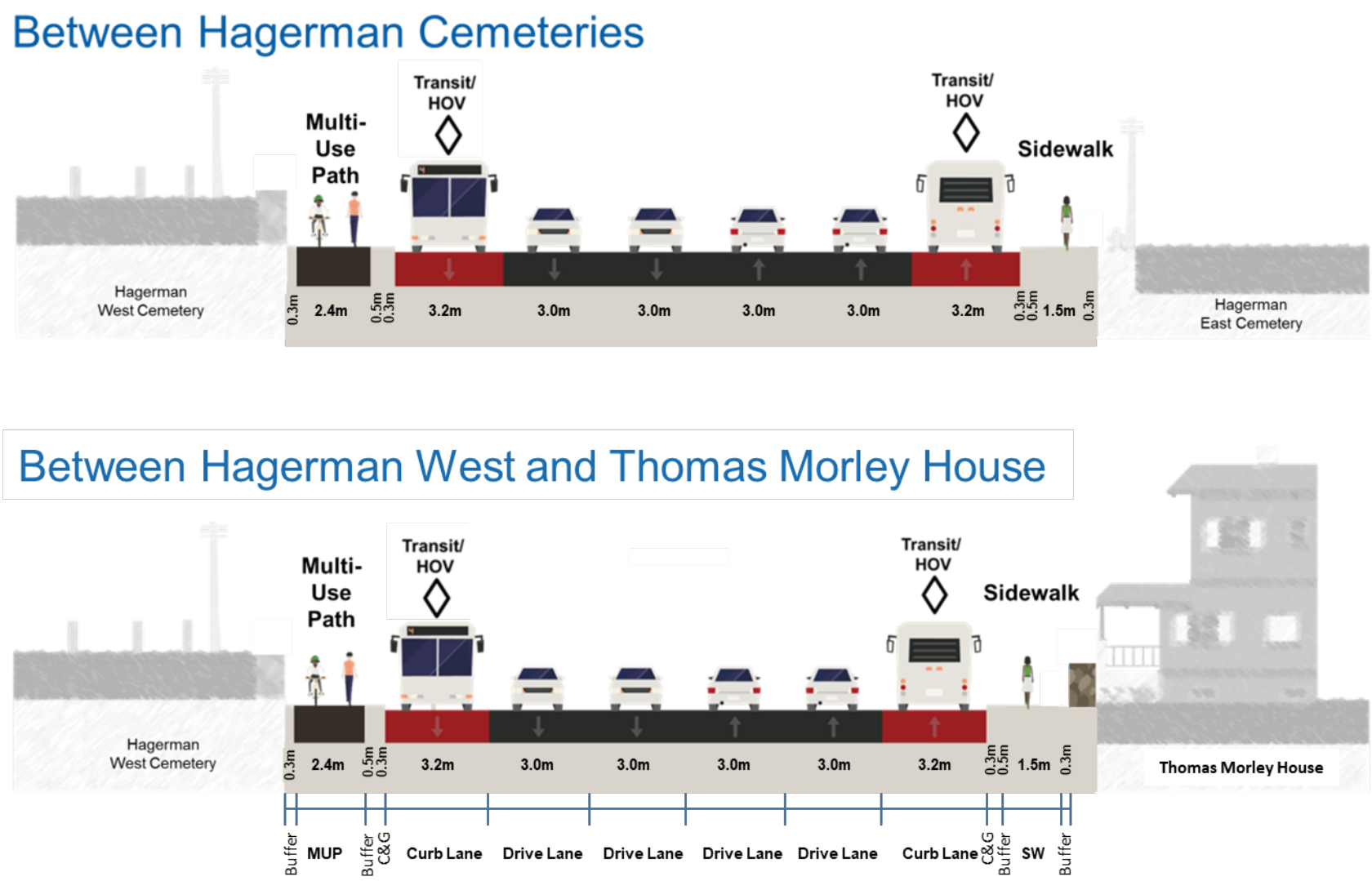


Exhibit 9-18: Alternative 1 – Reduced Lane Width with MUP and Sidewalk, Best Fit Approach

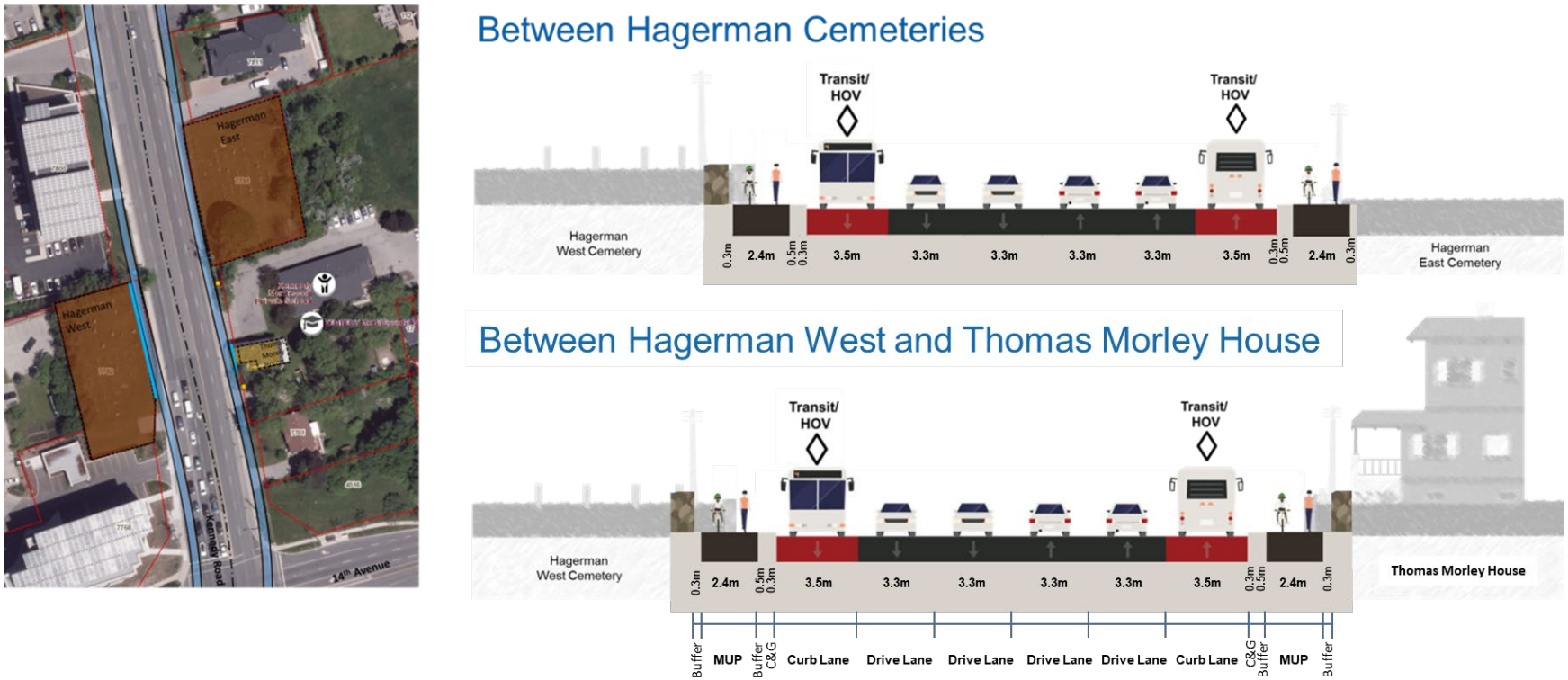


Exhibit 9-19: Alternative 2 – Standard Lane Width with MUPs on Both Sides, Best Fit Approach

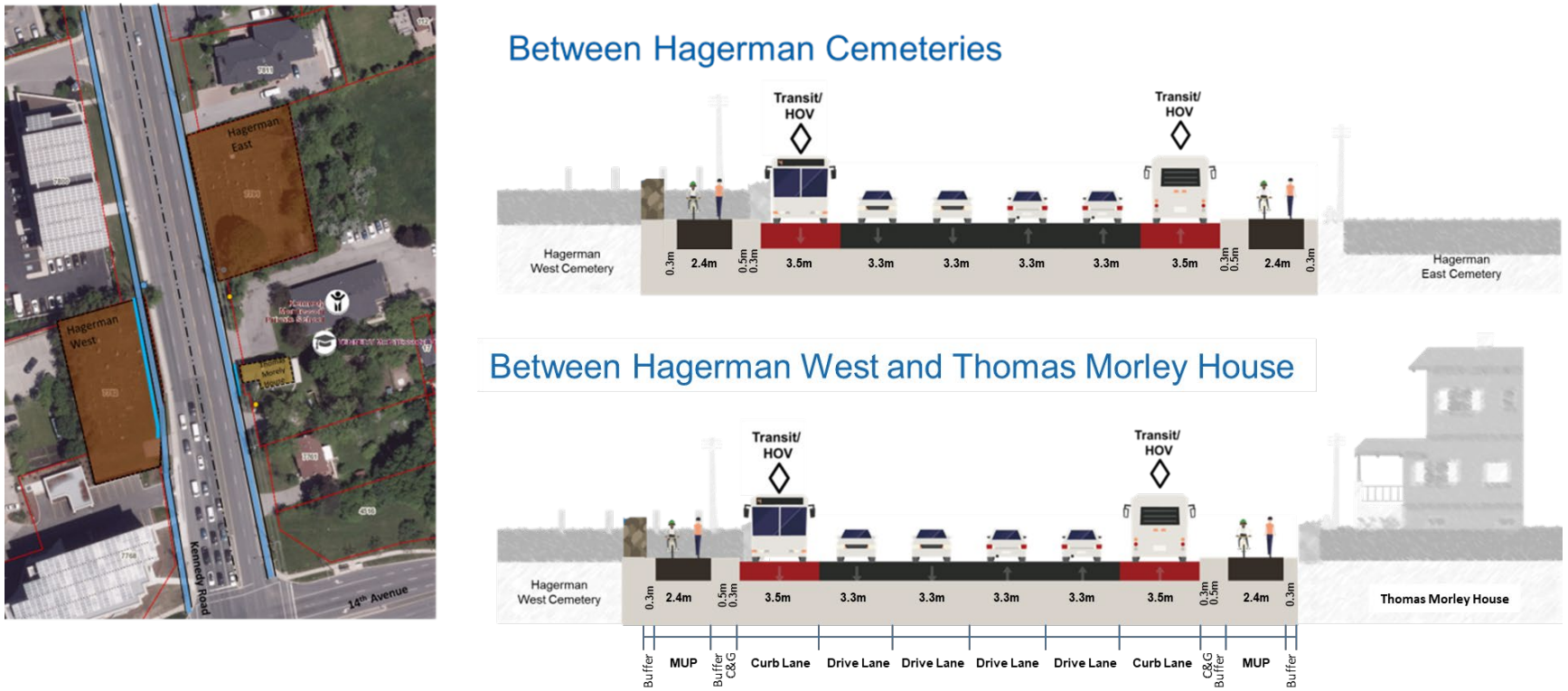


Exhibit 9-20: Alternative 3 – Standard Lane Width with MUPs on Both Sides, Shift Alignment West

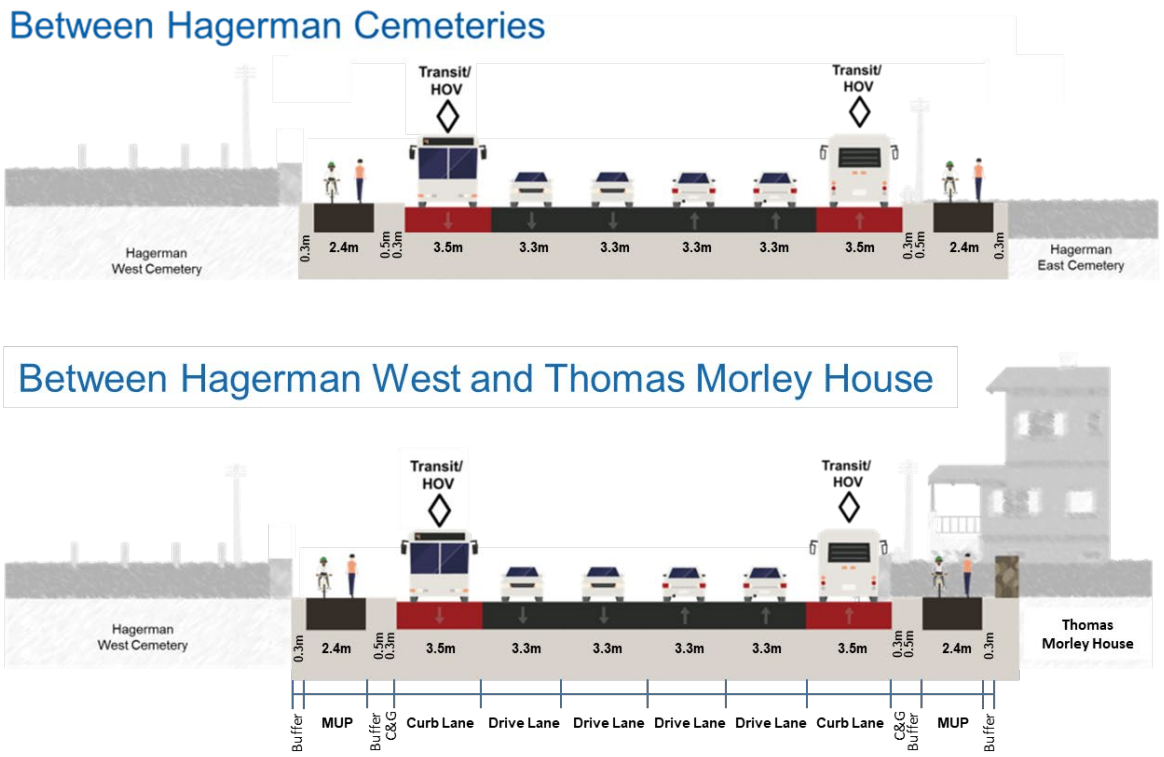


Exhibit 9-21: Alternative 4 – Standard Lane Width with MUPs on Both Sides, Shift Alignment East

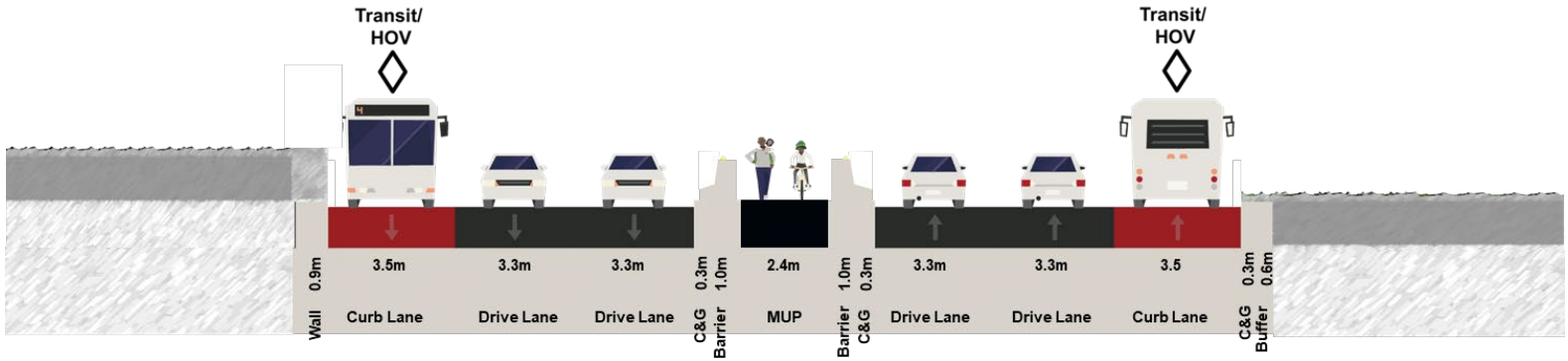


Exhibit 9-22: Alternative 5 – Centre Median AT Facility

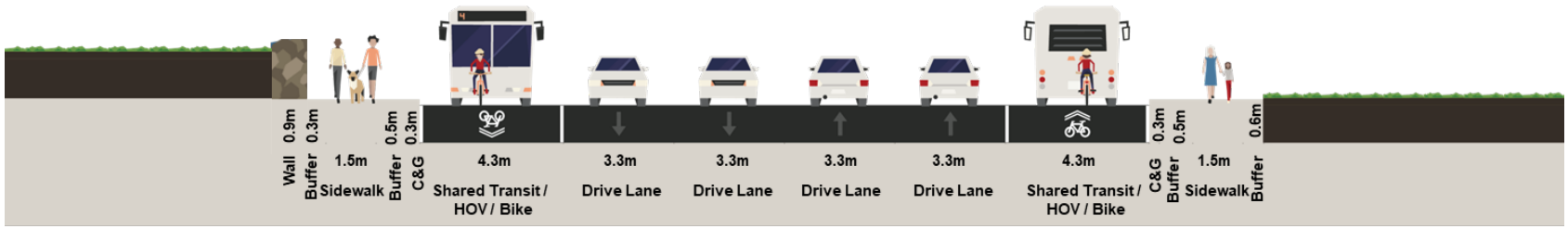


Exhibit 9-23: Alternative 6 – Shared Roadways with Cyclists, and Sidewalks

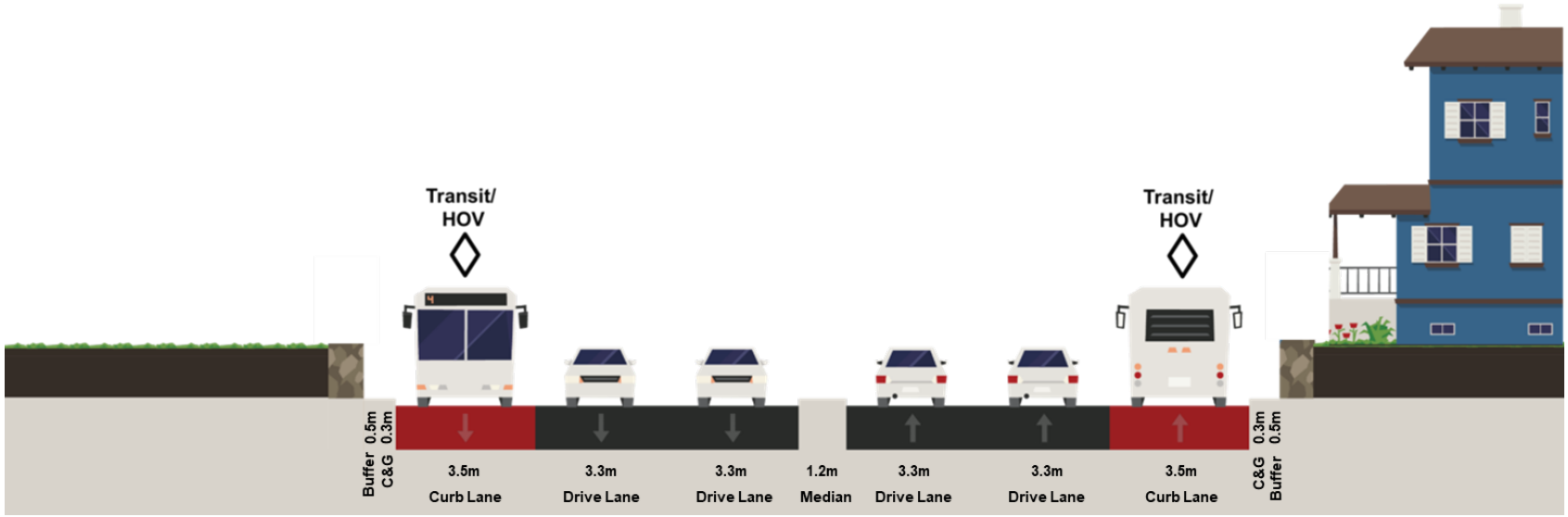


Exhibit 9-24: Alternative 7 – No AT Facilities

Exhibit 9-25: Alternative 8 – No Widening, MUPs on Both Sides, and Queue Jump Lanes

9.1.7.3.2 St. Philip's on-the-Hill and Bethesda cemeteries

St. Philip's on-the-Hill and Bethesda Lutheran Cemeteries are located on the west and east side of Kennedy Road respectively, between Beckett Avenue and Wilfred Murison Avenue. This segment of Kennedy Road has one of the most constrained ROWs generally less than 33m, with the most constrained location at approximately 25.3m, between the St. Philip's on-the-Hill Anglican Church property and Bethesda Lutheran Cemetery. Currently, this segment does not support cycling facilities and pedestrian level of service is low due to existing issues with pedestrian safety. There are also

heritage considerations at this segment due to the proximity of St. Philip's on-the-Hill and Bethesda Cemeteries and Thomas Lownsbrough House to the existing right-of-way.

Due to the sensitivities of the adjacent cemeteries and Thomas Lownsbrough House (listed on the City of Markham's Register of Properties of Cultural Heritage) alternative design concepts looked at opportunities to minimize potential impacts to these lands deviating from the typical section. Alternatives considered reduction in standard lane widths for six-lane roads, removal of active transportation facilities in the segment, provision of shared cycling facilities instead of separated facilities, and/or provision of priority measures (queue jump lanes) in place of dedicated Transit/HOV lanes etc. **Table 9-8** presents the alternative solutions considered to address the problems and opportunities identified for this Kennedy Road segment. These alternatives are illustrated in **Exhibit 9-26** through **Exhibit 9-32**.

Table 9-8: Alternative Design Concepts Considered for the St. Philips and Bethesda Cemeteries Segment

Alternative #	Title	Description
1	Reduced Lane Width with MUP and Sidewalk, Best Fit Approach	• Six lane widening for Transit/HOV • Reduced lane width, no centre median, MUP one side and sidewalk other side • Road alignment is shifted east of St. Philip's on-the-Hill Cemetery and west of Bethesda Lutheran Cemetery ("best fit" approach) • No impacts to adjacent graves • Potential impacts to the heritage home on the west side
2	Standard Lane Width with MUPs on both sides, Best Fit Approach	• Six lane widening for Transit/HOV • Standard lane width, no centre median and MUP on both sides • Road alignment is shifted east of St. Philip's on-the-Hill Cemetery and west of Bethesda Lutheran Cemetery ("best fit" approach) • Potential impacts to adjacent graves • Potential impacts to the heritage home on the west side
3	Standard Lane Width with MUPs on both sides, Shift alignment East	• Six lane widening for Transit/HOV • Standard lane width, no centre median and MUP on both sides • Road alignment is shifted east of St. Philip's on-the-Hill Cemetery • Impacts to adjacent graves • No direct impacts to the heritage home on the west side • Impacts to hydro and watermain

Alternative #	Title	Description
4	Standard Lane Width with MUPs on both sides, discontinuous AT, Shift alignment West	• Six lane widening for Transit/HOV • Standard lane width, no centre median and MUP on both sides with discontinuous MUP at St. Philip's on-the-Hill Cemetery • Road alignment is shifted west of Bethesda Lutheran Cemetery • Potential impacts to adjacent graves • Impacts to the heritage home on the west side • Impacts to hydro and watermain
5	Shared Roadway with Cyclists, and Sidewalks	• Six lane widening for Transit/HOV • Standard lane width and no centre median • Cycling in shared curb lane with Transit/HOV vehicles (sharrow lane) • Sidewalks on either side • Potential impacts to adjacent graves • Potential impacts to the heritage home on the west side
6	No AT Facilities	• Six lane widening for Transit/HOV • Standard lane width with minimum centre median • No pedestrian and cycling facilities in the corridor • No impacts to adjacent graves • No impacts to the heritage home on the west side
7	No widening, MUPs and queue jump lanes	• Maintain four lanes with centre left-turn lane • Standard lane width and MUP on both sides • Transit/HOV lanes transition into this segment through queue jump lanes for Transit/HOV vehicles at intersections with Wilfred Murison Avenue and Beckett Avenue • No impacts to adjacent graves • No direct impacts to the heritage home on the west side

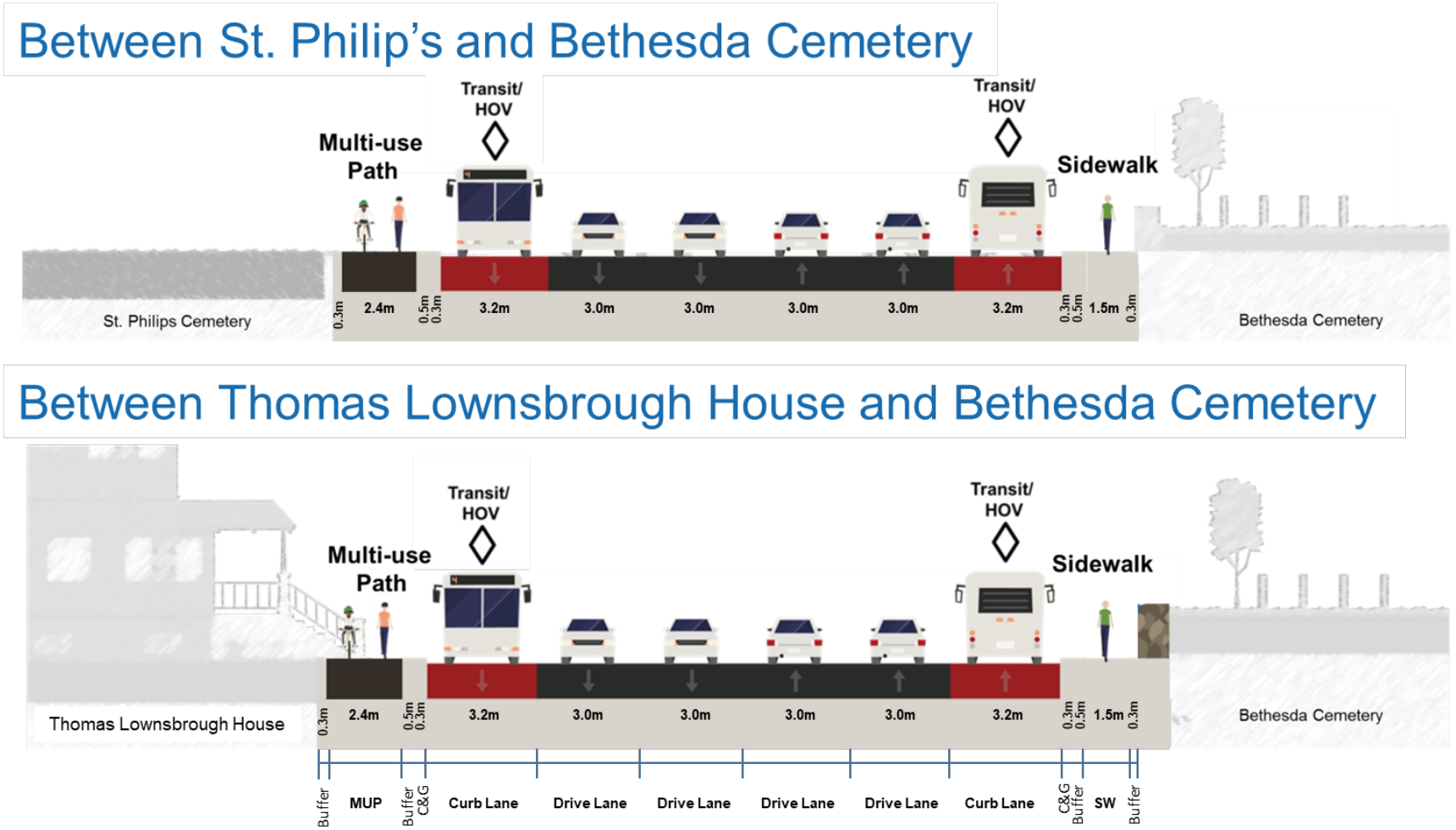


Exhibit 9-26: Alternative 1 – Reduced Lane Width with MUP and Sidewalk, Best Fit Approach

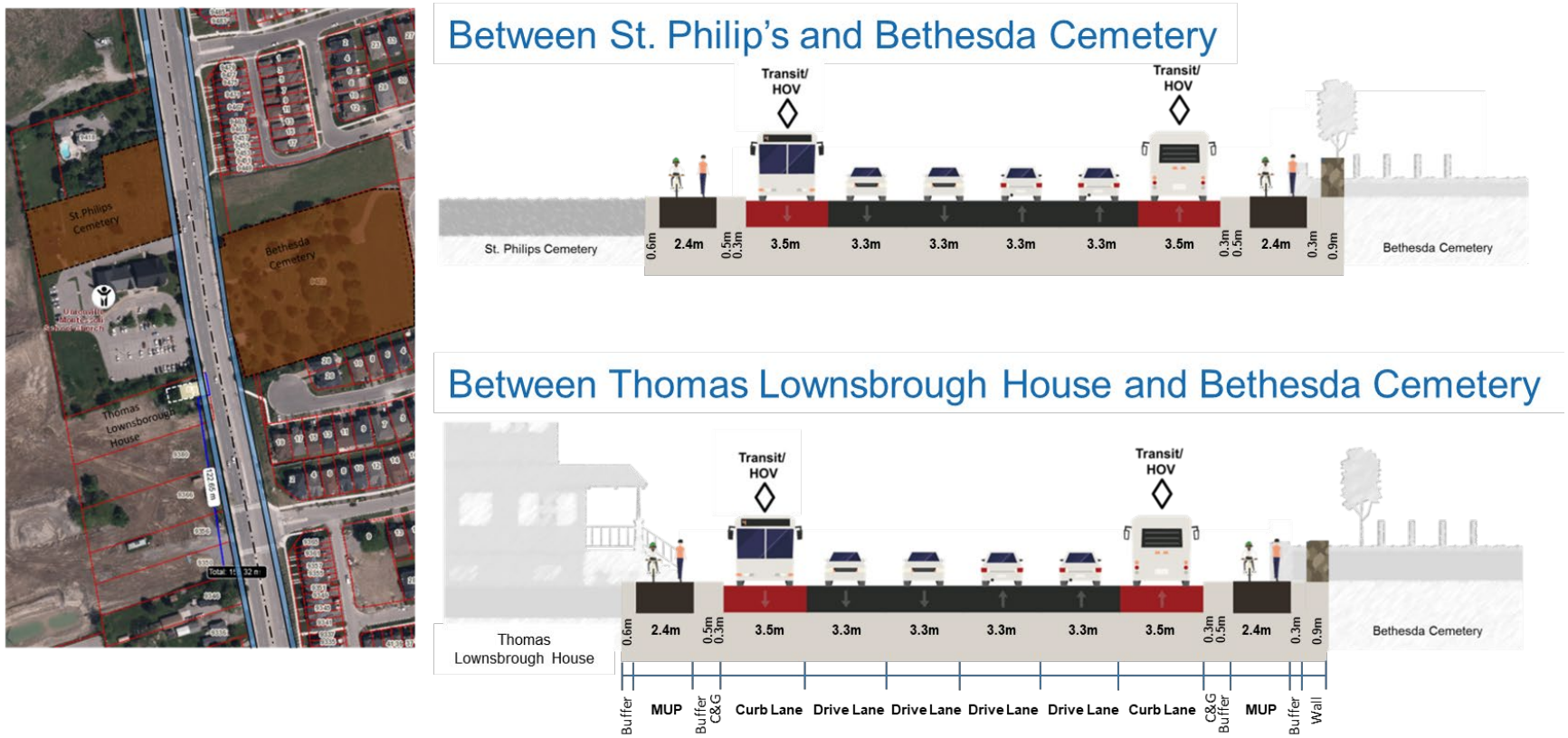


Exhibit 9-27: Alternative 2 – Standard Lane Width with MUPs on both sides, Best Fit Approach

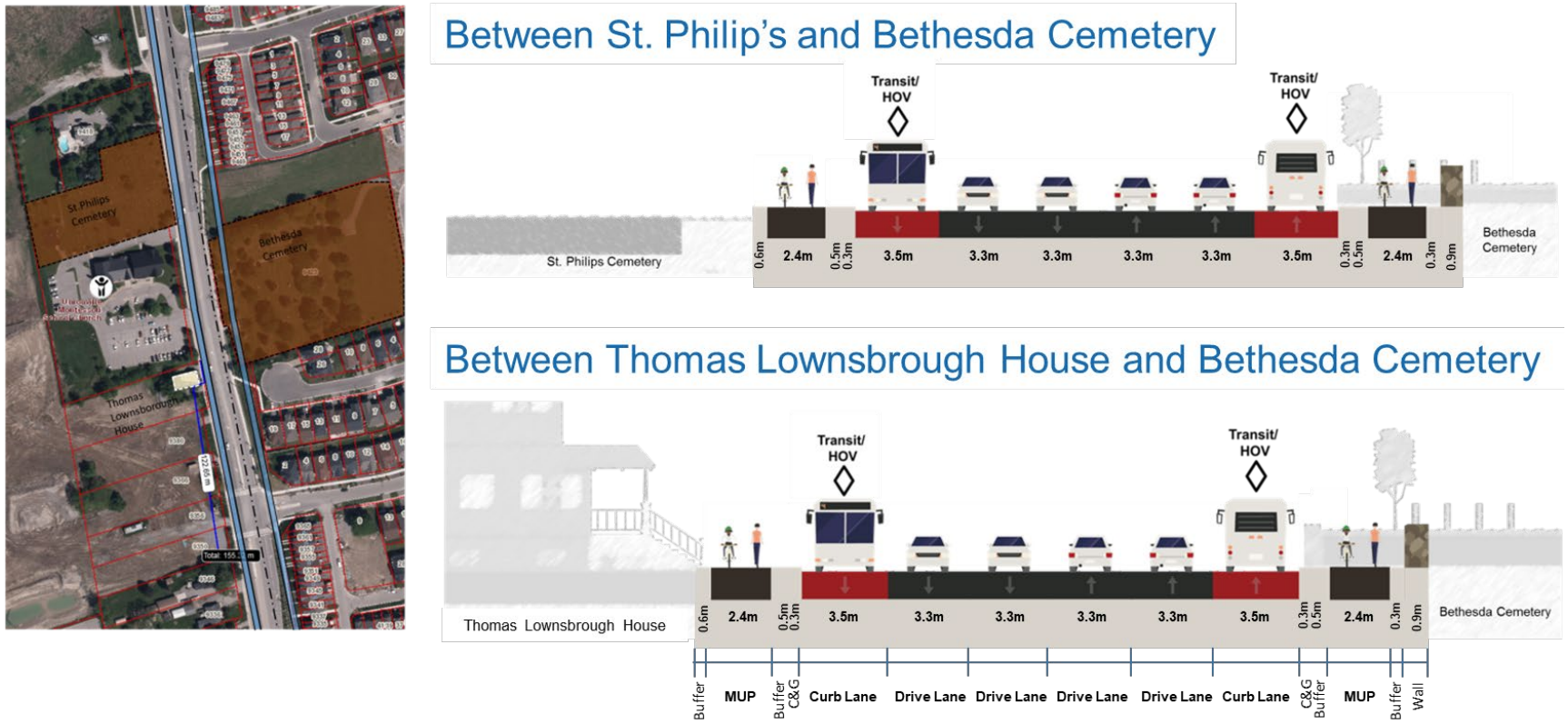


Exhibit 9-28: Alternative 3 – Standard Lane Width with MUPs on both sides, Shift alignment East

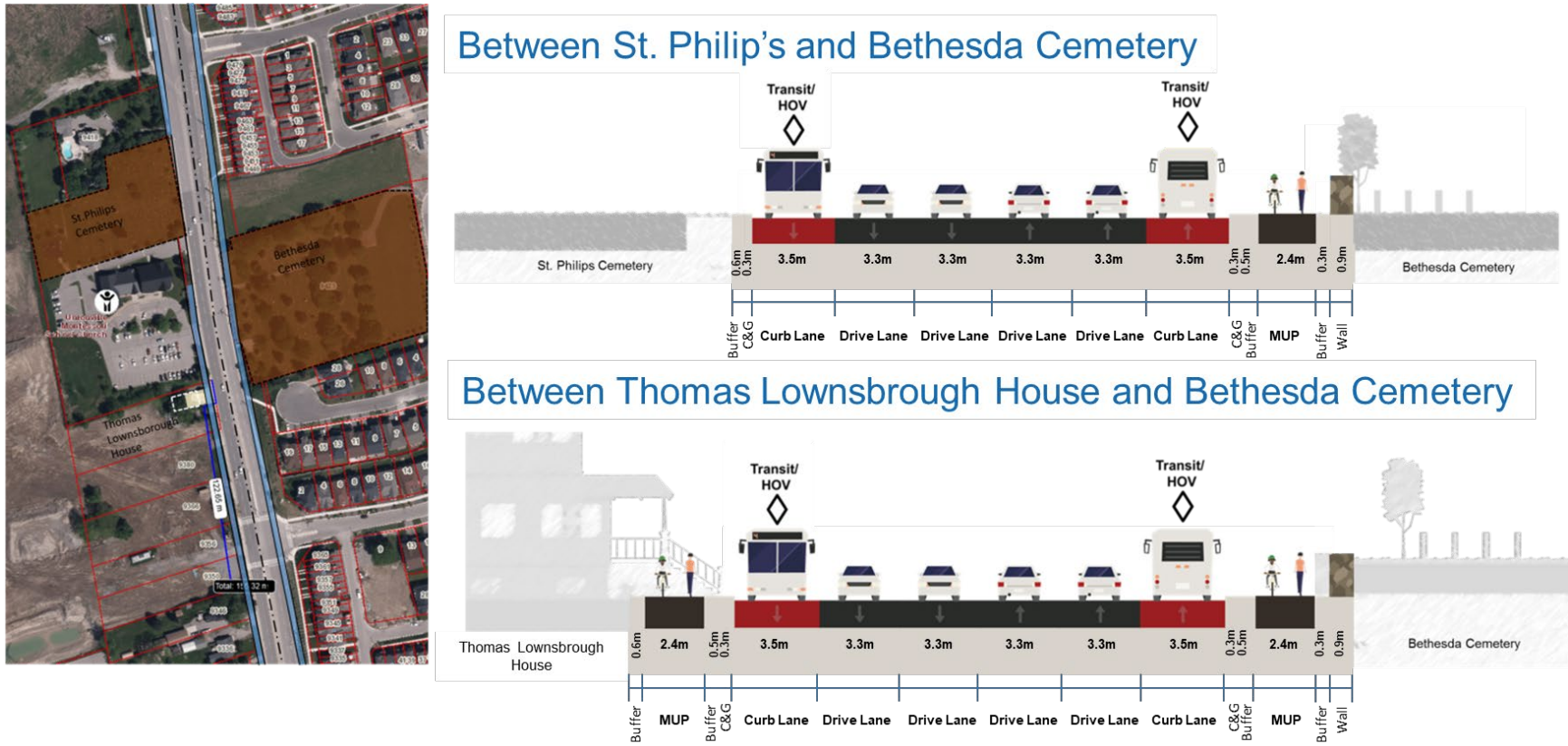


Exhibit 9-29: Alternative 4 – Standard Lane Width with MUPs on both sides, discontinuous AT, Shift alignment West

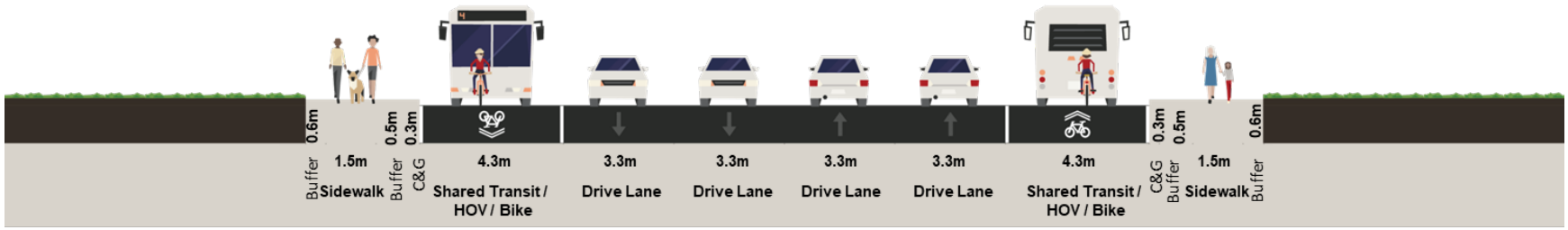


Exhibit 9-30: Alternative 5 – Shared Roadway with Cyclists, and Sidewalks

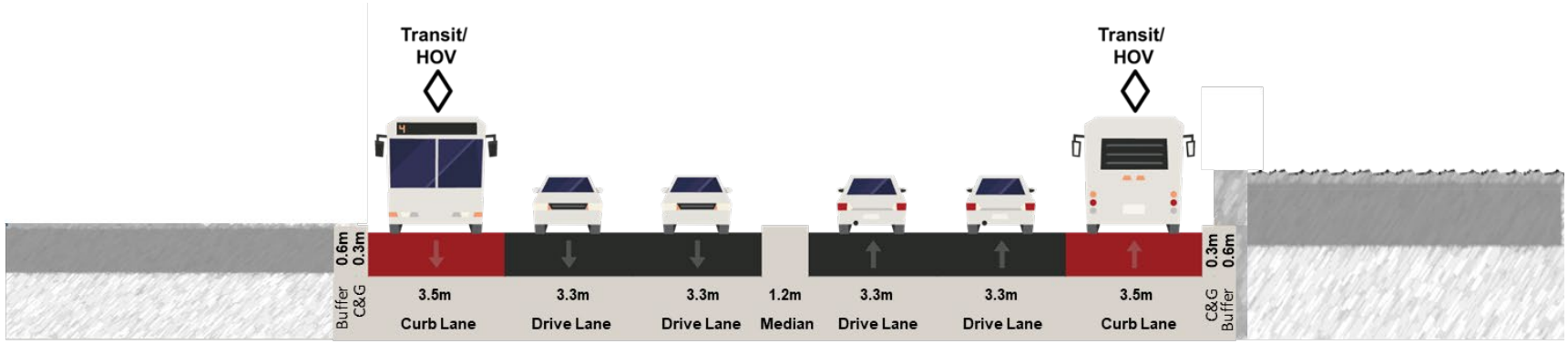


Exhibit 9-31: Alternative 6 – No AT Facilities

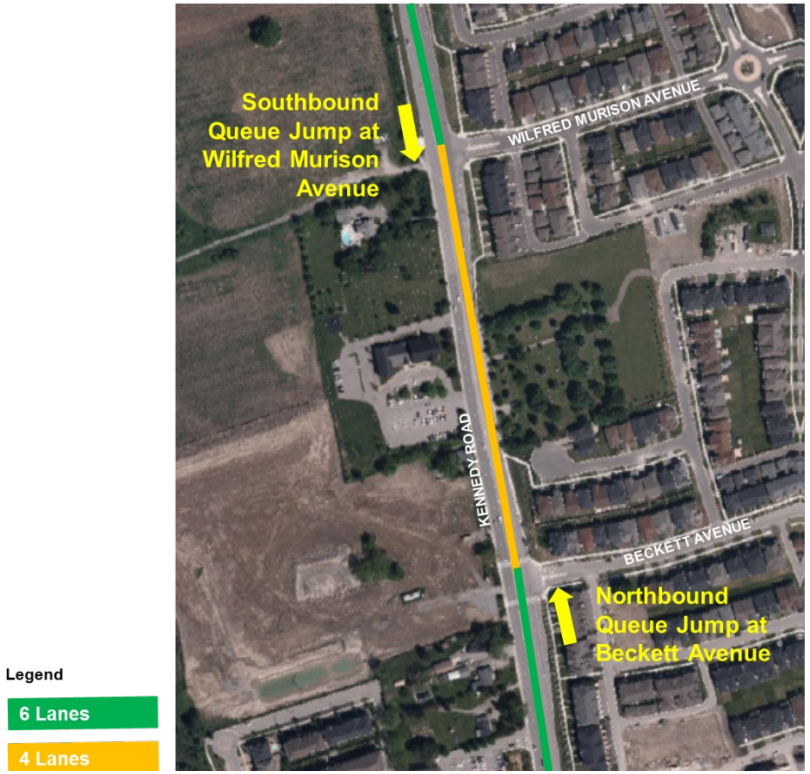


Exhibit 9-32: Alternative 7 - No Widening, MUPs and Queue Jump Lanes

9.1.7.4 CN RAIL OVERPASS CROSSING

Kennedy Road crosses the York-CN Subdivision north of 14th Avenue through an underpass (road lowered underneath the rail tracks). Currently, this segment of Kennedy Road does not support cycling facilities, and pedestrian level of service is low due to existing issues with pedestrian safety. It was determined that the CN Rail bridge overpass will need to be replaced to accommodate the road widening from four to six lanes for Transit/HOV and Active Transportation facilities. To accommodate this construction, a rail detour of the CN track is required which will result in the construction of a temporary rail bridge over Kennedy Road along with the permanent rail bridge over Kennedy Road. To accommodate the replacement of the CN Rail bridge overpass rail diversion concept plans and typical sections were developed for the following options: North Rail Detour, South – 1 Rail detour, and South - 2 Rail Detour. A detailed description of preliminary considerations for each option is summarized in **Table 9-9**. The three options are illustrated in **Exhibit 9-33** through **Exhibit 9-35.**

These concepts were presented to CN on August 20, 2018 and next steps were discussed on April 4, 2019.

The **North Rail Detour** option was carried forward as it meets the current vertical clearance requirements for the structure.

Table 9-9: Alternative Rail Detour Options considered for the CN Rail Overpass Crossing

Rail Detour Option	Preliminary Considerations	Recommendation
North	• No property impacts to commercial and residential properties adjacent to the CN Rail Line • Impacts to hydro lands and access road to DH Cockburn Transformer Station • No impacts to hydro towers and operations • Greatest vertical clearance from bottom of temporary rail bridge and Kennedy Road, meets new standard for vertical clearance.	**Carried Forward**
South – 1	• Impacts to commercial and residential properties south of the CN Rail Line • No impacts to hydro lands, access road to DH Cockburn Transformer Station • Detour is longer in length, greater impacts to CN Rail Line	Not carried forward – Does not meet standard for vertical clearance for new structure.

Rail Detour Option	Preliminary Considerations	Recommendation
	• Reduction in vertical clearance from bottom of temporary rail bridge and Kennedy Road. Rail raise not acceptable to CN; lowering of Kennedy Road profile has potential impacts to Duffield Drive and cemeteries	
South – 2	• Reduced separation between temporary bridge structure and existing bridge structure • Reduced impacts to commercial and residential properties south of the CN Rail Line • No impacts to hydro lands, access road to DH Cockburn Transformer Station • Reduction in vertical clearance from bottom of temporary rail bridge and Kennedy Road. Rail raise not acceptable to CN; lowering of Kennedy Road profile has potential impacts to Duffield Drive and cemeteries	Not carried forward – Does not meet standard for vertical clearance for new structure.

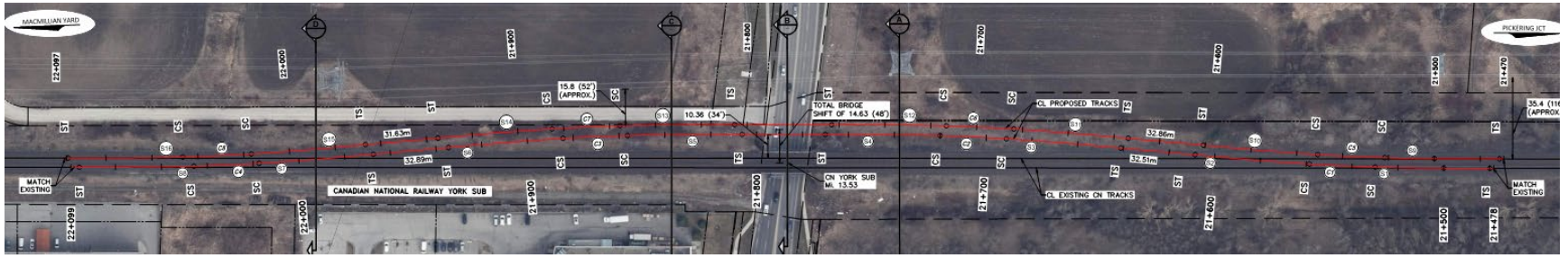


Exhibit 9-33: Alternative 1 – North Rail Detour

Exhibit 9-34: Alternative 2 – South 1 Rail Detour

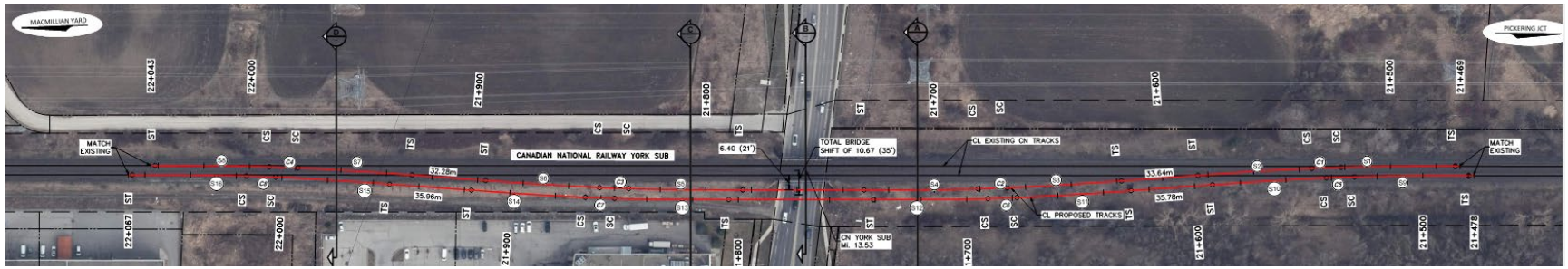


Exhibit 9-35: Alternative 3 - South 2 Rail Detour

9.1.7.5 MILLER AVENUE EXTENSION

In 2013, The City of Markham completed the Miller Avenue Extension EA study and recommended Miller Avenue to connect to Kennedy Road through Duffield Drive intersection, requiring a crossing under the CN Rail. Based on the Miller Avenue Extension EA, the recommended alignment for Miller Avenue Extension was “Preferred Alternative K-1A.” Since the CN Rail Overpass structure at Kennedy Road will be replaced to accommodate Kennedy Road improvements, the recommended road alignment for the Miller Avenue Extension could be revisited as part of the Kennedy Road EA to reassess if the Preferred Alternative K-1A for Miller Avenue was still identified as preferred.

The following options were built off the City’s 2013 Miller Avenue Ext. EA recommendations to reassess the extension of Miller Avenue with consideration of opportunities from a new CN Rail Overpass bridge over Kennedy Road. The options are based on the assessment discussed in **Section 9.1.7.4**, that a north side rail detour was carried forward.

OPTION 1: Maintain Markham EA Preferred Alignment K-1A

- Miller Ave alignment through the hydro corridor, crossing under the CN rail through a new structural culvert west of Kennedy Road, and connecting into Duffield Drive for access to Kennedy Road. Miller Avenue is a four lane road with Multi Use Path (MUP) on one side.

- Kennedy Road crosses under the CN Rail through a new bridge structure. This requires a new rail bridge and temporary rail bridge at Kennedy Road. The temporary rail bridge might need to only accommodate existing Kennedy Road (depending on how Kennedy widening is staged). This is the typical situation for Kennedy Road widening. The cross-section for Kennedy is 6 lanes with curb lanes for transit/HOV, and separated AT facilities in the boulevard.

OPTION 2: Loop with Bridge Extension

- Miller Avenue alignment through the hydro corridor, crossing under the CN rail through a new larger bridge structure at Kennedy Road with an opening size to accommodate passage of Miller Avenue and Kennedy Road. Miller Avenue then connects to Duffield Drive for access to Kennedy Road. This requires a new rail bridge and temporary rail bridge at Kennedy Road. The temporary rail bridge might need to only accommodate existing Kennedy Road (depending on how Kennedy widening is staged). The cross-section for Kennedy is 6 lanes with curb lanes for transit/HOV, and separated AT facilities in the boulevard. Miller Avenue is a four lane road with MUP on one side.

OPTION 3: Buttonhook with New Bridge

- Miller Ave alignment through the hydro corridor with no crossing of CN rail. Miller Avenue is a four lane road with MUP on one side , however Miller Avenue splits north of CN ROW in the hydro corridor with 2 lanes (EB and WB) and one side MUP for a direct right-in-right-out connection at west side of Kennedy Road to allow for southbound travel. The other 2 lanes (EB and WB) run parallel to the CN ROW, travelling over Kennedy Road on the temporary rail bridge (now a permanent road bridge) adjacent to the CN Rail corridor; MUP is not anticipated to follow this portion of Miller Avenue. This temporary rail bridge would have had to carry the north rail detour within the CN ROW, then moved out of the CN ROW to become the permanent bridge for the 2 travel lanes at Miller Avenue. Miller Avenue then loops around the hydro corridor to provide second right-in-right-out direct access at the east side of Kennedy Road to allow for northbound travel. Miller Avenue AT facility not assumed to be carried over bridge structure. Connections at Kennedy Road are unsignalized and do not permit left-in nor left-out movements.

- Kennedy Road crosses under the CN Rail through a new bridge structure. This needs a new rail bridge and temporary rail bridge at Kennedy. The temporary rail bridge would need to accommodate the future Kennedy opening (6 lane plus AT) since it is being kept for the Miller Ave Ext. Cross-section for Kennedy Road is 6 lanes with curb lanes for transit/HOV, and separated AT facilities in the boulevard.

OPTION 4: Markham EA Option K-2

- Miller Ave alignment through the hydro corridor with no crossing of CN rail. Miller Avenue connects to Kennedy Road and permits southbound right-turn, eastbound right-turn and northbound left-turn movements at the connection. Eastbound left-turn movement for northbound travel on Kennedy Road is restricted with this configuration. Connections at Kennedy Road are unsignalized. Miller Avenue is a four lane road with MUP on one side.

- Kennedy Road crosses under the CN Rail through a new bridge structure. Kennedy Road widening in separate new bridge, but needs to accommodate an additional left turn lane. This needs a new rail bridge and temporary rail bridge at Kennedy. The temporary rail bridge might need to only accommodate existing Kennedy Rd opening (depending on how Kennedy widening is staged). Cross-section for Kennedy Road has 6 lanes with curb lanes for transit/HOV with an additional left turn lane, and separated AT facilities in the boulevard.

Exhibit 9-36 through **Exhibit 9-39** illustrate the four options for the Miller Avenue Extension alignment.

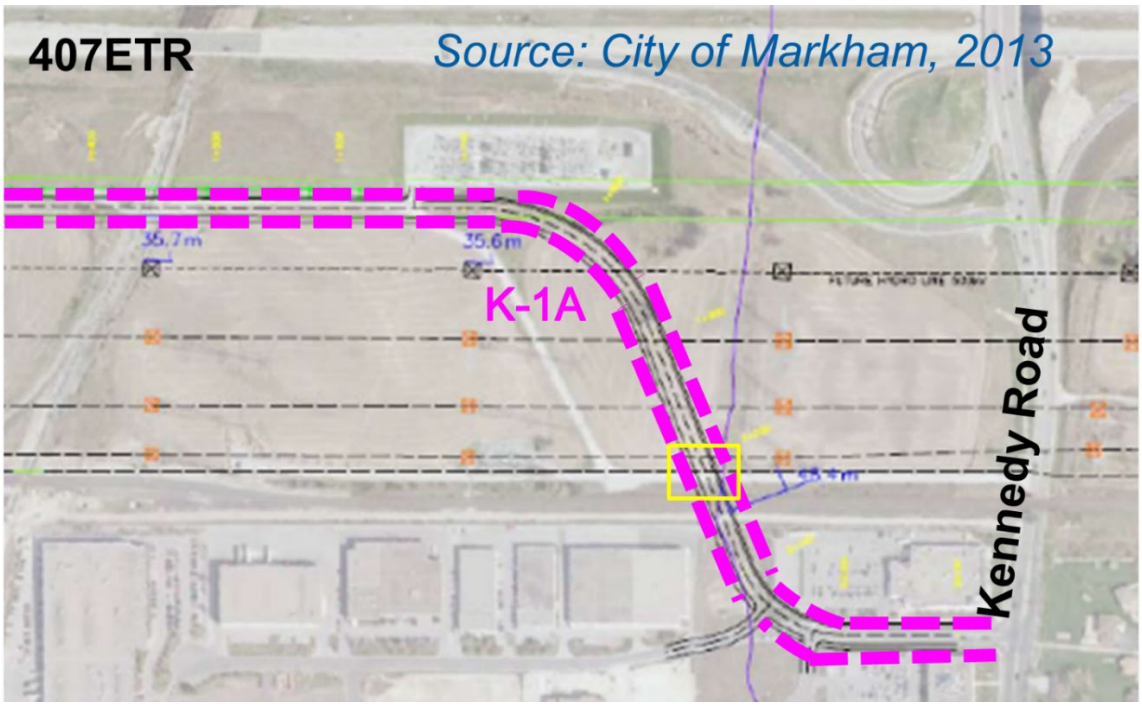


Exhibit 9-36: Alternative 1 – Maintain Markham EA Preferred Alignment K-1A

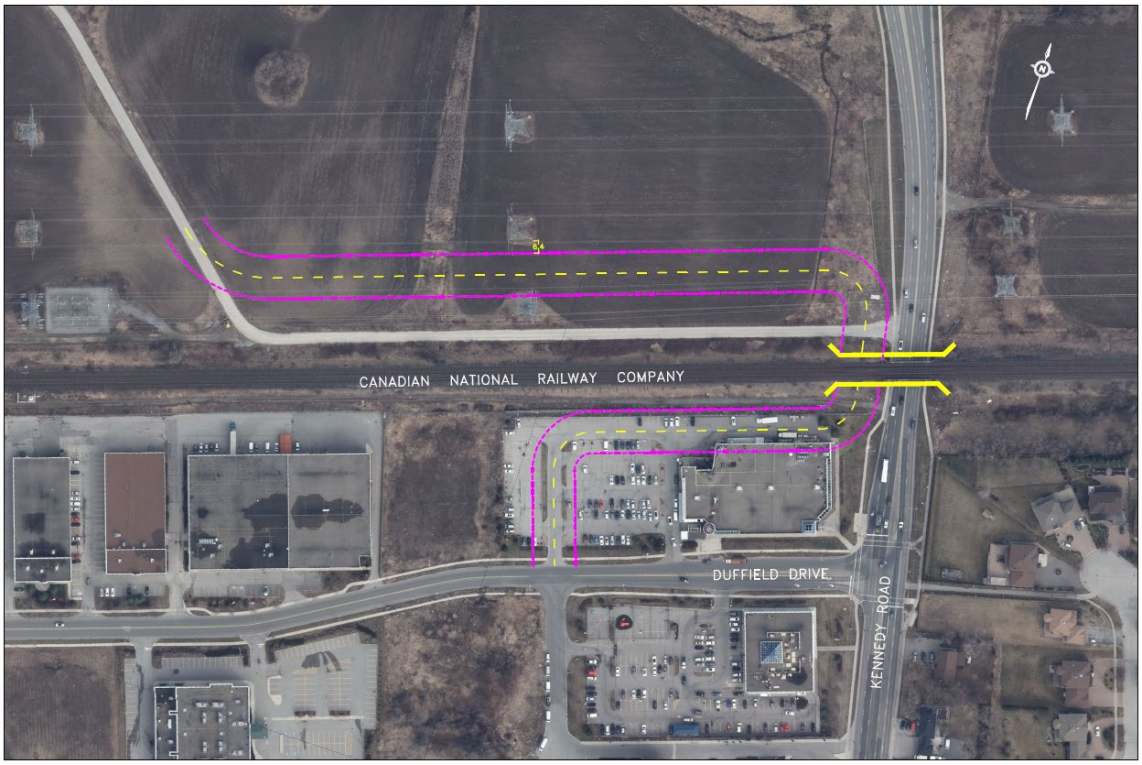


Exhibit 9-37: Alternative 2 - Loop with Bridge Extension

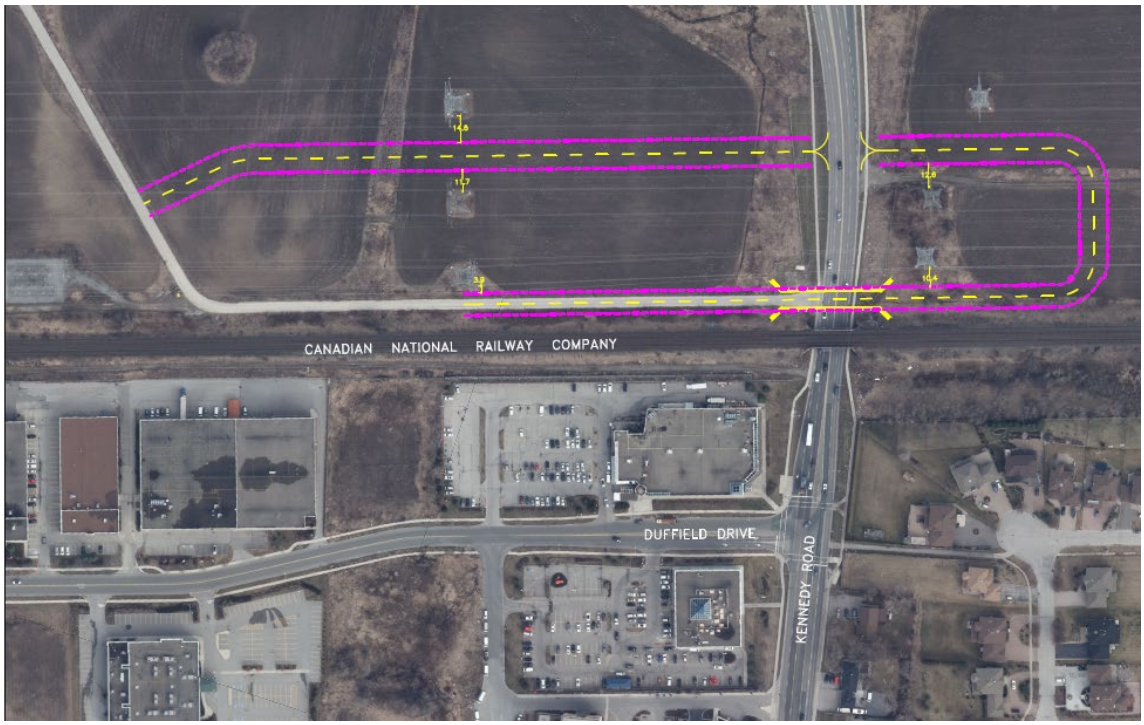


Exhibit 9-38: Alternative 3 – Buttonhook with New Bridge

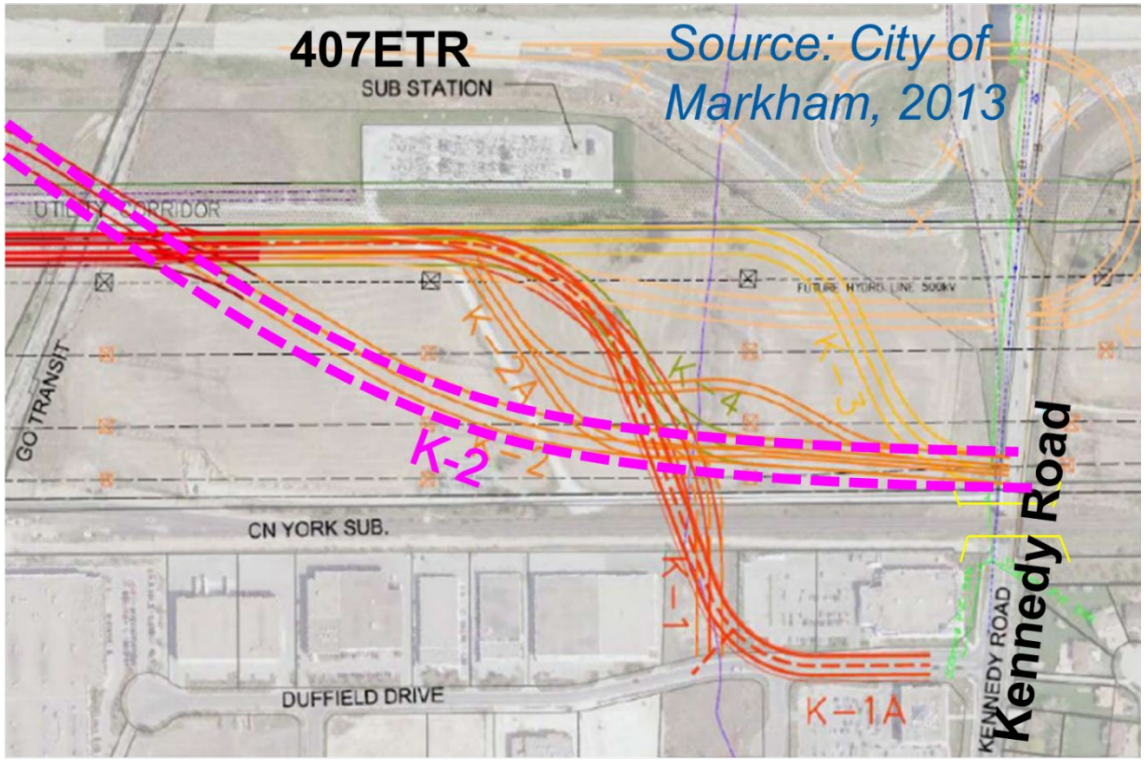


Exhibit 9-39: Alternative 4 – Markham EA Option K-2

9.1.7.6 407ETR INTERCHANGE

Kennedy Road crosses the 407ETR south of YMCA Boulevard, through an overpass. Currently, this segment of Kennedy Road does not support cycling facilities, and there are pedestrian safety issues stemming from conflict points at ramp interchange locations.

A VISSIM micro-simulation analysis was undertaken at the Kennedy Road/407ETR interchange. The purpose of the analysis was to assess impacts to 407ETR users with and without dedicated Speed Change Lanes (SCL) in addition to the proposed improvements to the Kennedy Road EA study corridor - widening from four lanes to six lanes for Transit/High Occupancy Vehicle (HOV).

The analysis determined that there is negligible improvement to travel time, delay and level of service at each of the four on-ramps with the provision of dedicated speed change lanes in comparison to the scenario without dedicated speed change lanes. As such, dedicated speed change lanes at the Kennedy Road/407ETR interchange are not recommended based on traffic operations. For more details on this analysis, refer to *Kennedy / 407ETR Interchange VISSIM Analysis Memo, January 2019* prepared under separate cover.

A meeting with 407ETR, MTO, and the project team was held on January 18th, 2019 to discuss the findings of the VISSIM micro-simulation analysis. No concerns were raised regarding the implementation of the Transit/HOV curb lane in place of the dedicated speed change lanes through the interchange. As a result, dedicated speed change lanes were not carried forward for further consideration in the development and evaluation of Alternative Designs through the interchange.

The following design alternatives presented in **Table 9-10** address considerations for active transportation (AT) facilities through the 407 interchange. Bridge widening to accommodate AT facilities are identified based on the existing structure and its ability to meet vertical clearance requirements with widening.

Table 9-10: Alternative Design Concepts Considered for the 407ETR Interchange

Alternative #	Title	Description
1	No structure widening, 1 MUP (Road Shift)	The current bridge width will be maintained, with the West sidewalk removed, MUP constructed on the East side, and road centreline will be shifted 1.95m to the West.
2	No structure widening, 1 MUP in Median (No Road Shift)	The current bridge width will be maintained, with both existing sidewalks removed, MUP constructed at the centre median, and road centreline will be maintained.

Alternative #	Title	Description
3	Structure Widened by 1 Girder, 1 MUP + 1 Sidewalk (No Road Shift)	The bridge will be widened 1.95m to the East, with the existing West sidewalk remaining, MUP constructed on the East side, and road centreline will be maintained.
4.1	Structure Widened by 1 Girder, 2 MUPs (Road Shift)	The bridge will be widened 3m either to the East/West, with MUP's constructed on both sides, shoulder widths will be reduced, and road centreline will be shifted 1.5m.
4.2	Structure Widened by Propped Cantilevers, 2 MUPs (No Road Shift)	The bridge will be widened 1.5m on both sides, with MUP's constructed on both sides, shoulder widths will be reduced, and road centreline will be maintained.
5.1	Structure Widened by 2 Girders/1 Pier, Sidewalks and Cycle Tracks on Both Sides (Road Shift)	The bridge will be widened 4.5m to the West, with sidewalks and cycle tracks constructed on both sides, and road centreline will be shifted 2.25m to the West.
5.2	Structure Widened by 2 Girders/2 Pier, Sidewalks and Cycle Tracks on Both Sides (No Road Shift)	The bridge will be widened 2.25m on both sides, with sidewalks and cycle tracks constructed on both sides, and road centreline will be maintained.
6	No Structure Widening with Separate AT Bridge(s)	A separate AT bridge will be constructed on both sides of the bridge and will carry a 3.0m MUP over Hwy 407ETR

The alternatives are illustrated in **Exhibit 9-40** through **Exhibit 9-47**.

Further to the January 18th 2019 meeting with 407ETR and MTO, **Alternative 2 - AT with centre median** was **not carried forward** for further consideration due to operational concerns.

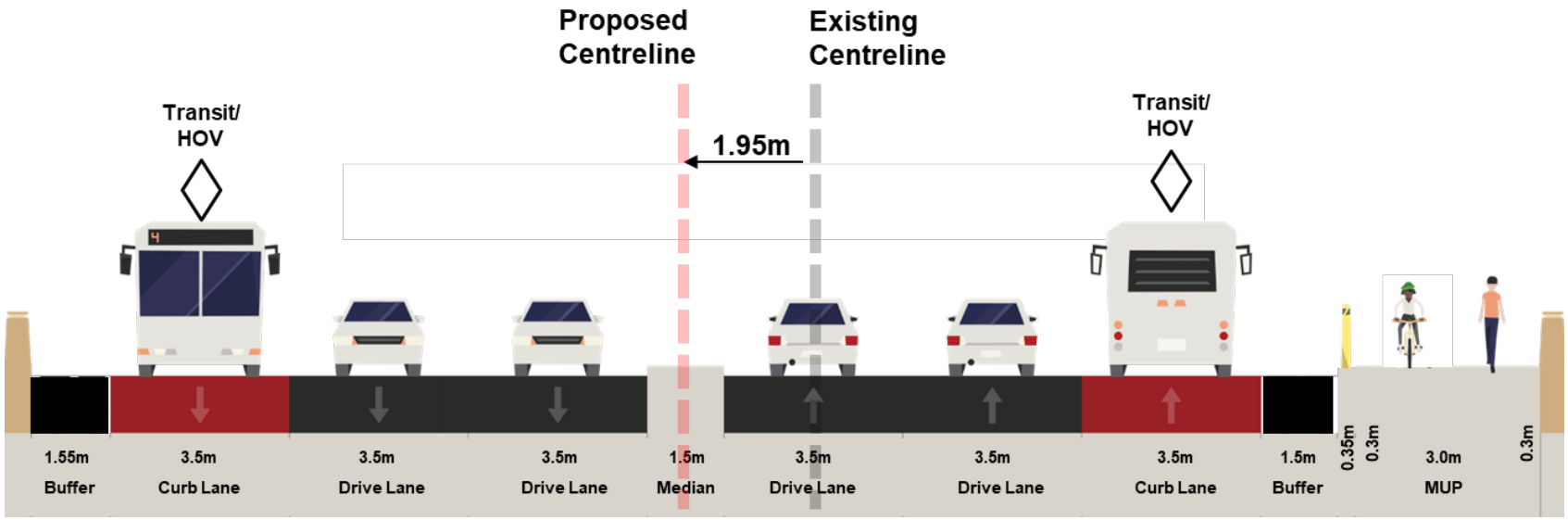


Exhibit 9-40: Alternative 1 – No Structure Widening, 1 MUP (Road Shift)

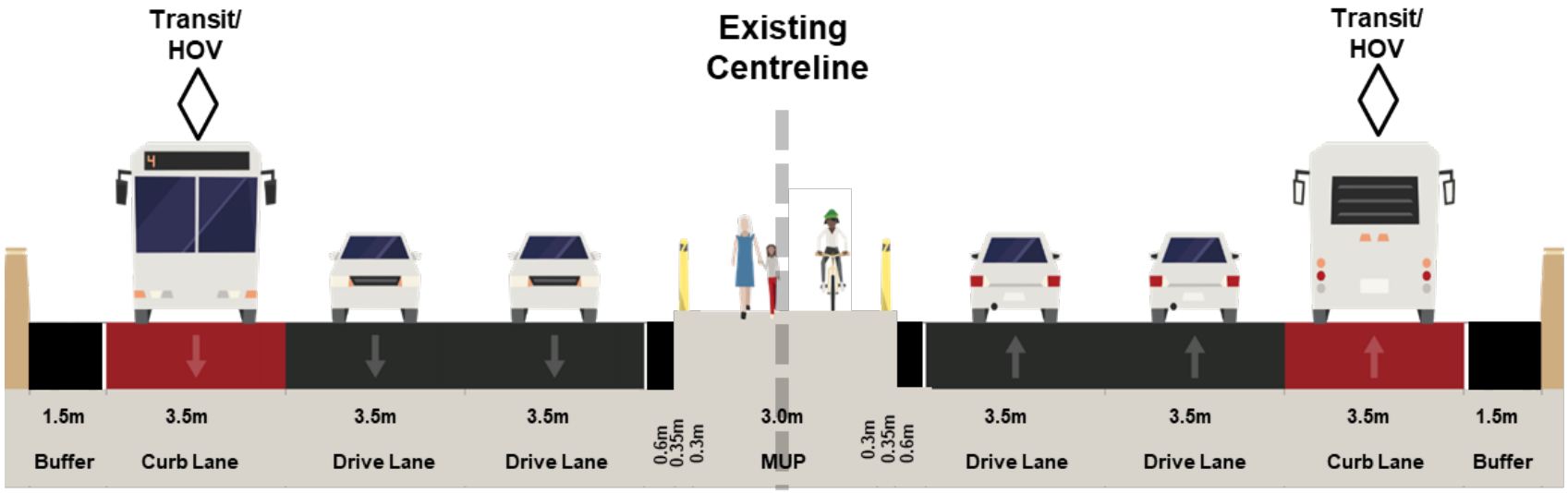


Exhibit 9-41: Alternative 2 - No Structure Widening, 1 MUP in Median (No Road Shift)

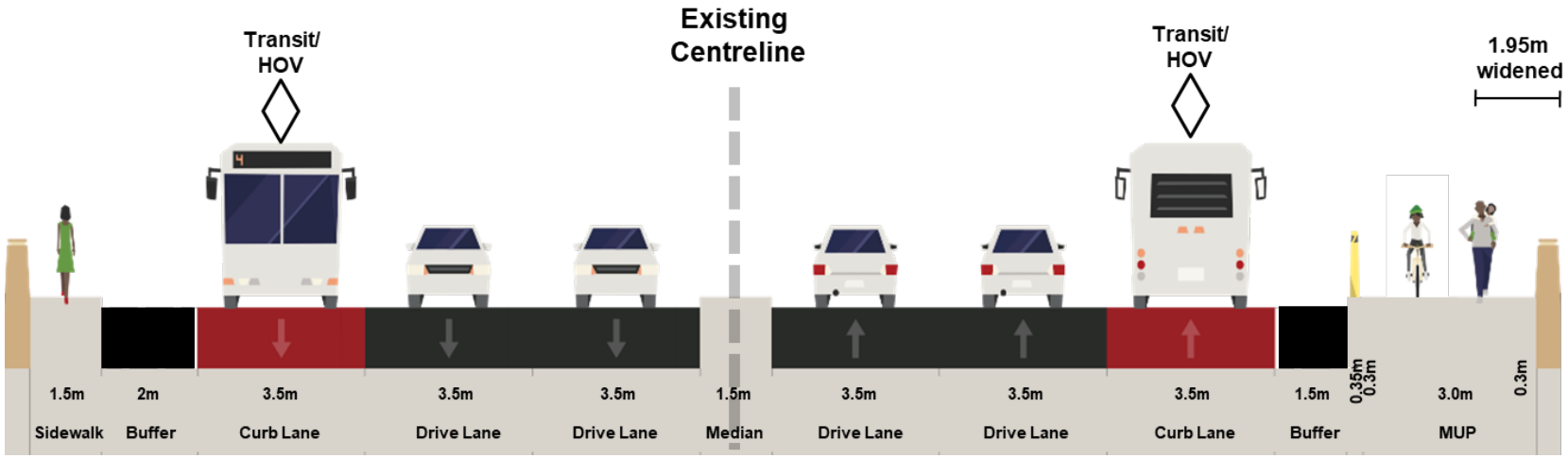


Exhibit 9-42: Alternative 3 – Structure Widened by 1 Girder, 1 MUP, 1 Sidewalk (No Road Shift)

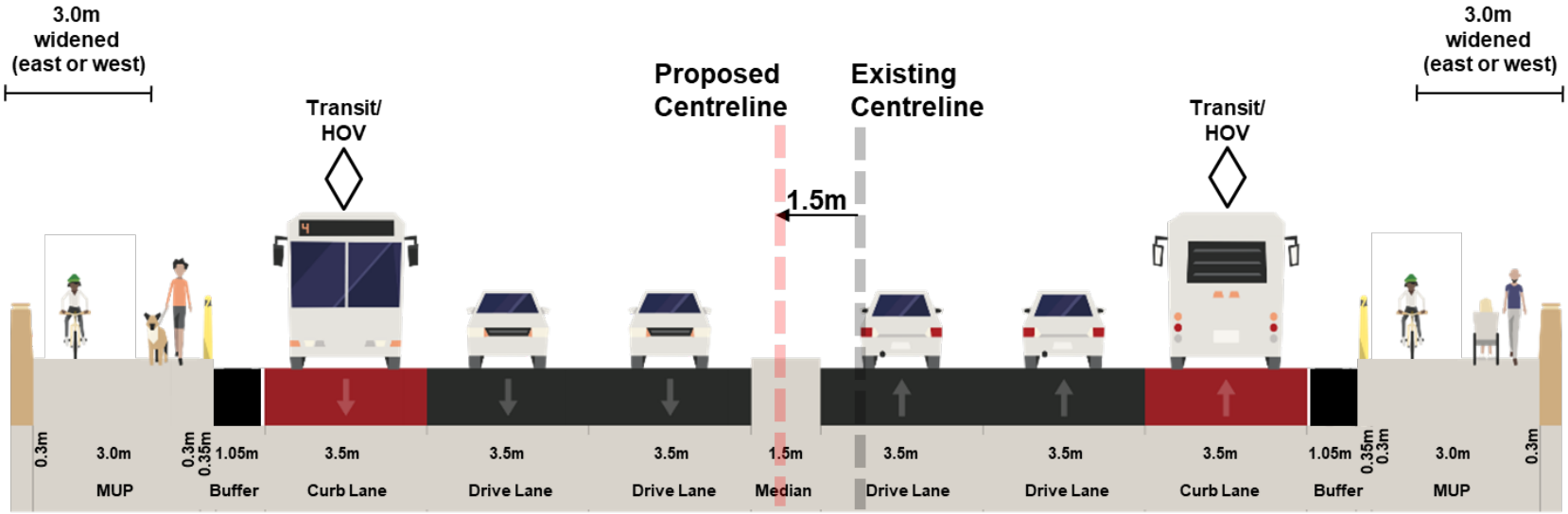


Exhibit 9-43: Alternative 4.1 – Structure Widened by 1 Girder, 2 MUPS (Road Shift)

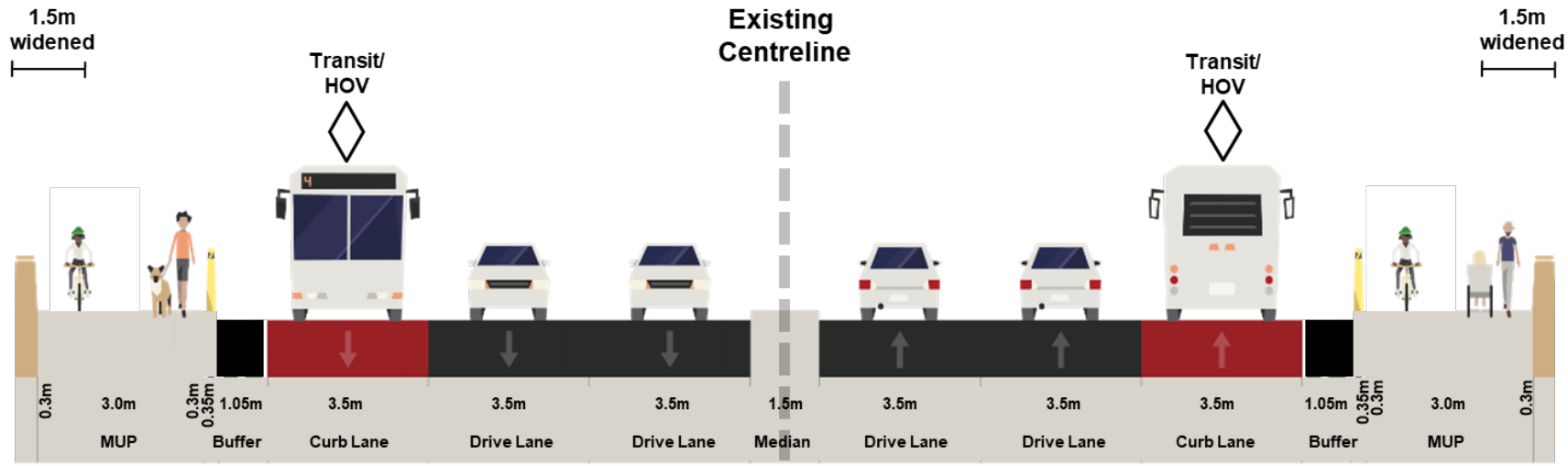


Exhibit 9-44: Alternative 4.2 - Structure Widened by Propped Cantilevers, 2 MUPs (No Road Shift)

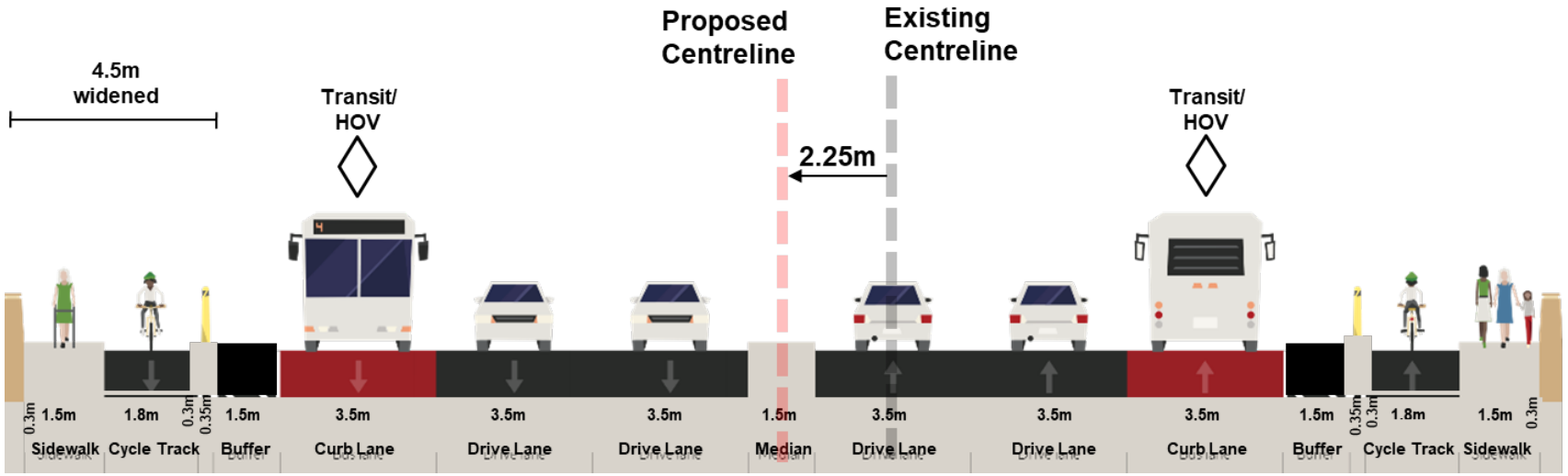


Exhibit 9-45: Alternative 5.1 – Structure Widened by 2 Girders/1 Pier, Sidewalks and Cycle Tracks on both sides (Road Shift)

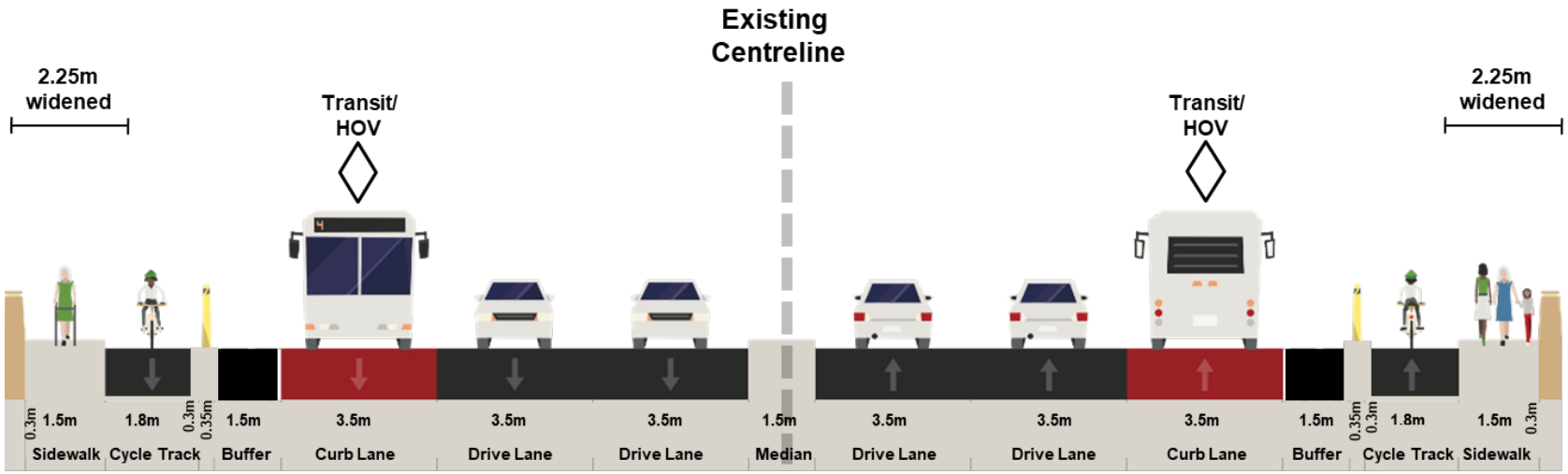
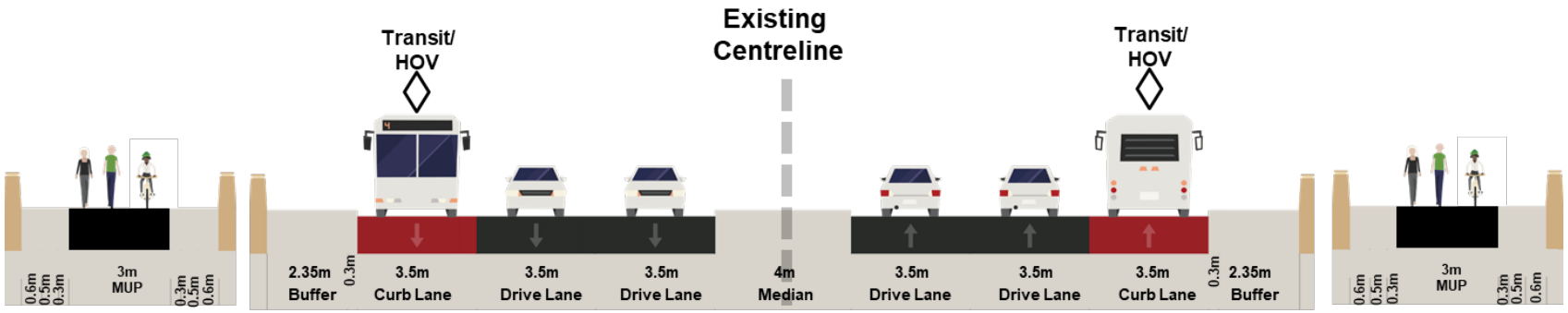


Exhibit 9-46: Alternative 5.2 – Structure Widened by 2 Girders, 2 Piers, Sidewalk and Cycle Track on Both Sides (No Road Shift)



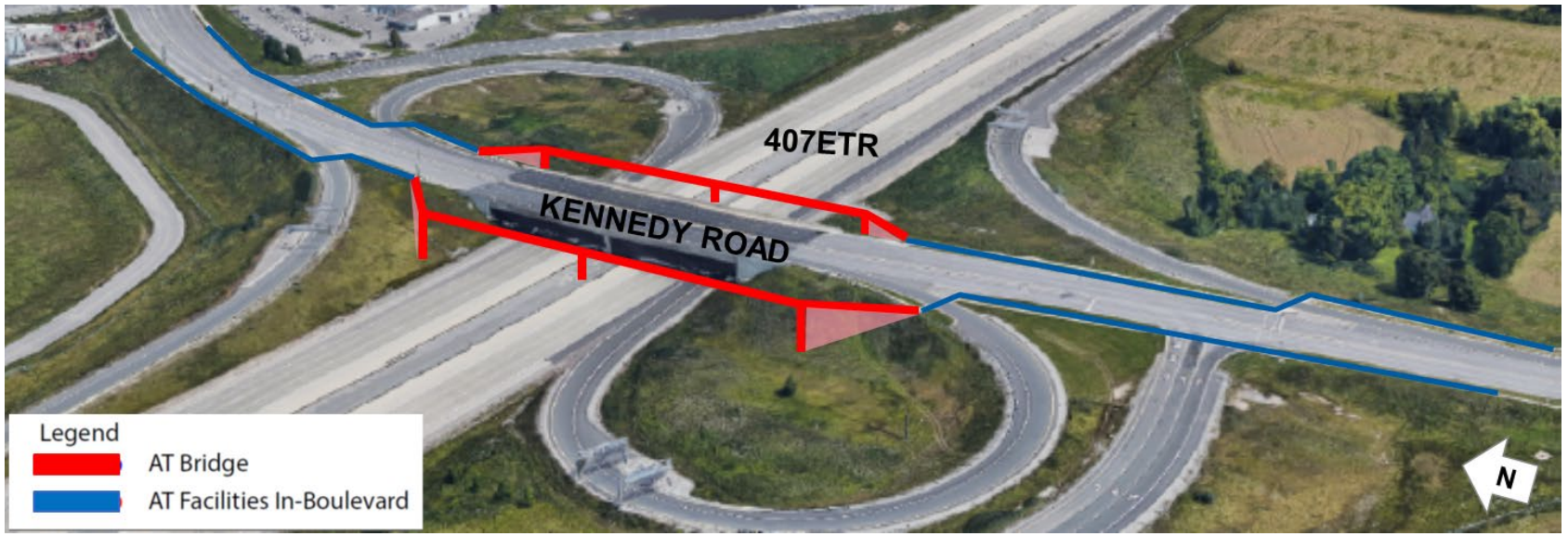


Exhibit 9-47: Alternative 6 - No Structure Widening with Separate AT Bridge(s)

9.1.7.7 PROPOSED VIVA RAPIDWAY

The YR-TMP outlines York Region's Rapid Transit Network and has identified Kennedy Road, between YMCA Boulevard to Highway 7 as a link for the Highway 7 rapidway to service Downtown Markham. This recommendation was carried forward from Highway 7 Corridor and Vaughan North-South Link Public Transit Improvements Environmental Assessment. The Highway 7 Transit EA was approved in 2005 and protects for the Viva rapidway connection to / from Markham Centre to Markham Stouffville Hospital. As noted in **Section 8.3**, the recommendation to implement the rapidway on this section of Kennedy Road was considered alongside the recommendation to widen to 6 lanes for Transit/HOV and provide continuous AT facilities. Currently, this segment does not support cycling facilities and pedestrian level of service is low due to existing issues with pedestrian safety. **Table 9-11** presents the alternative solutions considered to address the problems and opportunities which must also align with YRRTC's Preferred Solution for the Highway 7 rapidway.

Table 9-11: Alternative Design Concepts considered for the Proposed Viva Rapidway

Alternative #	Title	Description
1	Median Viva Rapidway with AT facilities (modified Highway 7 Transit EA)	• Median Viva Rapidway as per Highway 7 Transit EA recommendations, without dedicated lanes for Transit/HOV • AT facilities continuous through this segment
2	Median Viva Rapidway, Transit/HOV curb lanes, with AT facilities	• Median Viva Rapidway • Transit/HOV curb lanes • AT facilities continuous through this segment
3	Shift Viva Rapidway to share Transit/HOV curb lanes, with AT facilities	• Viva Rapidway to operate in shared Transit/HOV curb lanes • AT facilities continuous through this segment

The alternatives from **Table 9-11** are illustrated schematically in **Exhibit 9-48** through **Exhibit 9-50**.

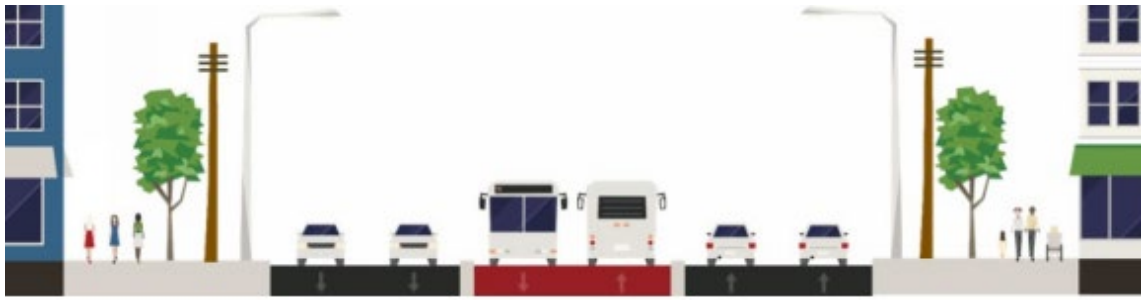


Exhibit 9-48: Alternative 1 – Median Viva Rapidway with AT facilities (modified Highway 7 Transit EA)

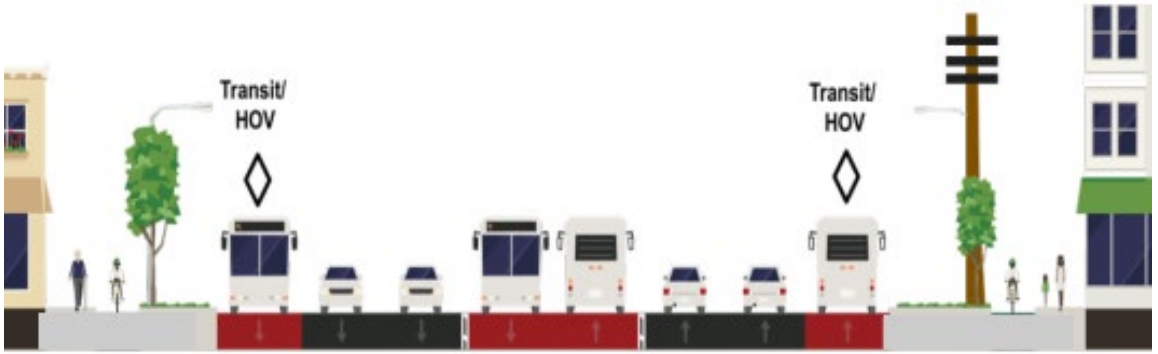


Exhibit 9-49: Alternative 2 – Median Viva Rapidway, Transit/HOV curb lanes, with AT facilities

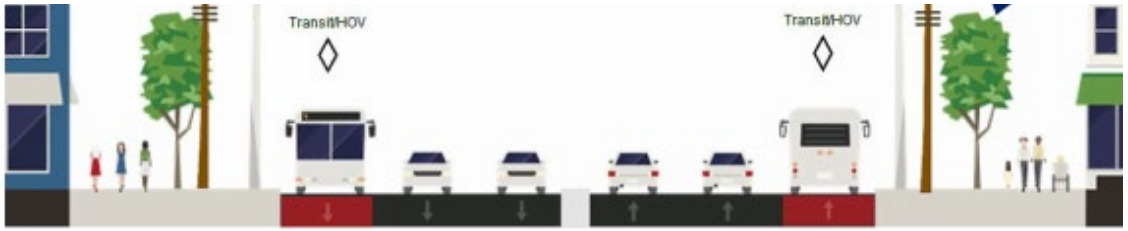


Exhibit 9-50: Alternative 3 – Shift Viva Rapidway to share Transit/HOV curb lanes, with AT Facilities

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9.2 Evaluation Criteria

The evaluation of alternative design concepts included the formulation of evaluation criteria. The evaluation criteria were developed based on transportation considerations as well as impacts to the natural, cultural, and socio-economic environments. The alternative design concepts identified were evaluated based on the following criteria listed in **Table 9-12**. Where possible and appropriate, a Reasoned Argument approach to screen out alternatives to select the recommended design concept was also applied.

Table 9-12: Evaluation Criteria

Consideration	Criteria
Transportation Service	• Improve Public Transit Service • Reduce Traffic Congestion and Delays • Create a Pedestrian-Friendly Environment • Create a Cyclist-Friendly Environment • Improve Safety for all Travel Modes • Improve Mode Choice
Social Environment	• Minimize Impacts on Existing Residential, Institutional and Recreational Dwellings / Properties • Improve Access to Residential Areas, Institutional and Recreational Facilities • Mitigate Traffic on Local Streets • Minimize Traffic Noise • Preserve Archaeological and Cultural Heritage Features • Minimize impacts to cemeteries and burial grounds • Improve Visual Aesthetics • Improve Community Character
Economic Environment and Cost Effectiveness	• Minimize Utility Relocation • Minimize Disruption due to Construction • Minimize Constructability Complexity
Infrastructure Design	• Accommodate Planned Development and Growth • Minimize Impacts on Business Properties • Improve Access to Businesses and Key Employment Areas • Maximize Construction Value • Minimize Property Requirements • Minimize Operating Costs
Natural Environment[1]	• ProtectDesignated Natural Areas • Protect Vegetation • Protect Wildlife • Protect Aquatic Habitat • Protect Surface Water and Ground Water • Improve Air Quality • Minimize Effects on Climate Change

Note 1: Alternatives assessed against opportunities to “Protect and Maintain” the natural environment to minimize adverse impacts to the natural environment.

9.3 Evaluation of Alternative Design Concepts

9.3.1 Alternative Widening Evaluation

Three road widening options were considered for Kennedy Road – Widen about the Centreline, Widen to the West, and Widen to the East. An evaluation of the options was undertaken and the results of the detailed analysis is provided in **Table 9-13** through **Table 9-15**, and are split up into three segments (Steeles Avenue to 14th Avenue, Highway 7 to 16th Avenue, and 16th Avenue to Major Mackenzie Drive). The segment between 14th Avenue to Highway 7 will be discussed in **Section 9.3.3.9**, related to the YRRTC Viva Rapidway. The preferred recommendation would have the least impact as it follows a best fit approach, where widening along the centreline with localize alignment shifts in a context sensitive manner and would balance the impacts and maximize the available right-of way.

Alternative 1: Widen About the Centreline, was selected as the recommended design for all four segments of the Kennedy Road Corridor. This option achieves the transportation, economic, environmental, and social objectives of the study. Balancing the impacts on both sides of Kennedy Road will minimize impacts on either side of the street. The potential for property acquisition will be minimized as impacts are balanced on both sides of Kennedy Road as opposed to exclusively widening to the east or west. Detailed evaluation tables are provided in **Appendix P**.

Table 9-13: Kennedy Road Evaluation of Alternative Road Widening Designs (Steeles Avenue to 14th Avenue)

Criteria	Alternative 1: Widen About the Centreline	Alternative 2: Widen to the West	Alternative 3: Widen to the East
Transportation Service	Most Preferred	Most Preferred	Most Preferred
Natural Environment	Less Preferred	Most Preferred	Least Preferred
Social Environment	Less Preferred	Most Preferred	Least Preferred
Infrastructure Design	Most Preferred	Most Preferred	Most Preferred
Economic Environment and Cost Effectiveness	Most Preferred	Least Preferred	Least Preferred
Recommendation	**Recommended**		

Table 9-14: Kennedy Road Evaluation of Alternative Road Widening Designs (Highway 7 to 16th Avenue)

Criteria	Alternative 1: Widen About the Centreline	Alternative 2: Widen to the West	Alternative 3: Widen to the East
Transportation Service	Most Preferred	Most Preferred	Most Preferred
Natural Environment	Most Preferred	Less Preferred	Least Preferred
Social Environment	Most Preferred	Least Preferred	Least Preferred
Infrastructure Design	Most Preferred	Least Preferred	Least Preferred
Economic Environment and Cost Effectiveness	Most Preferred	Least Preferred	Least Preferred
Recommendation	**Recommended**		

Table 9-15: Kennedy Road Evaluation of Alternative Road Widening Designs (16th Avenue to Major Mackenzie Drive)

Criteria	Alternative 1: Widen About the Centreline	Alternative 2: Widen to the West	Alternative 3: Widen to the East
Transportation Service	Most Preferred	Most Preferred	Most Preferred
Natural Environment	Most Preferred	Less Preferred	Least Preferred
Social Environment	Most Preferred	Least Preferred	Less Preferred
Infrastructure Design	Most Preferred	Least Preferred	Least Preferred
Economic Environment and Cost Effectiveness	Most Preferred	Least Preferred	Least Preferred
Recommendation	**Recommended**		

9.3.2 Alternative Active Transportation Evaluation

The Region is designing the corridor to protect for greater separation between vulnerable users and vehicles on bridge structures. The alternative AT options were selected based on the following Design Methodology in conjunction with the AT improvements that could fit within the right-of-way:

1. Protecting for the greatest AT facility separation before confirming the facility type
2. Review of segment specific constraints and impacts to AT options in a holistic manner
3. Review of pedestrian and cycling connections and destinations throughout the corridor
4. Select facility based on:
    - Continuity
    - Connectivity to other connections
    - Surrounding land uses

The evaluation of alternative AT facilities is presented in **Table 9-16**. **Alternative 2, Multi-Use Paths (MUP) on both sides**, was selected as the recommended design.

This AT facility alternative provides the greatest physical separation between AT users and vehicles, while maintaining continuity through constrained locations and servicing various land uses on either boulevard. Separated cycle tracks and sidewalks on both sides was not selected given that the facility type would not be possible in some of the highly constrained areas along the Kennedy Road corridor. Since the cycle track and sidewalk AT alternative could not be continuous due to physical constraints, Alternative 2 – MUPs on both sides was identified as preferred for a consistent facility type throughout the corridor that accommodates both pedestrians and cyclists on both sides.

A detailed evaluation table is provided in **Appendix P.**

Table 9-16: Kennedy Road Evaluation of Alternative Active Transportation Facilities

Criteria	Alternative 1: Cycle Tracks and Sidewalks, Both Sides	Alternative 2: Multi-Use Paths, Both Sides	Alternative 3: Multi-Use Path One Side, Sidewalk One Side
Transportation Service	Less Preferred	Most Preferred	Least Preferred
Natural Environment	Less Preferred	Less Preferred	Most Preferred
Social Environment	Most Preferred	Most Preferred	Least Preferred
Infrastructure Design	Less Preferred	Less Preferred	Most Preferred
Economic Environment and Cost Effectiveness	Least Preferred	Less Preferred	Most Preferred
Recommendation		***Recommended***	

9.3.3 Constrained Locations

9.3.3.1 GRADE SEPARATION AT GO TRANSIT STOUFFVILLE RAILWAY CORRIDOR CROSSING NORTH OF CLAYTON DRIVE

The existing at-grade GO Transit Stouffville Railway corridor crossing has been assessed and the evaluation of alternative designs for the grade separation at the crossing north of Clayton Drive is presented in **Table 9-17**. The recommended design **(Alternative 1) is to maintain the crossing at-grade with AT improvements** until GO Transit increases the frequency of train service. This option provides improved active transportation facilities and dedicated Transit/HOV lanes; however, it does not address vehicle queuing caused by increased GO Train service or safety of at-grade crossing for pedestrians and cyclists. The Ultimate Vision at the crossing is **Alternative 2: Underpass with AT Improvements**, which will address vehicle queuing issues that will occur once the GO Train service increases. This option also provides dedicated Transit/HOV lanes and improved active transportation facilities, where pedestrians and

cyclists travel along a raised platform to minimize travelling distance and are grade separated from the rail crossing. A detailed evaluation table is provided in **Appendix P.**

It should be noted that at the time of writing of this report Metrolinx GO Expansion program's Stouffville Grade Separations Transit Project Assessment Process (TPAP), is underway as of February 2020. Final recommendations at this crossing location will be determined through the Metrolinx study.

Table 9-17: Evaluation of GO Crossing North of Clayton Drive

Criteria	Alternative 1: At-grade crossing with AT improvements	Alternative 2: Underpass with AT improvements	Alternative 3: Overpass with AT improvements
Transportation Service	Least Preferred	Most Preferred	Less Preferred
Natural Environment	Less Preferred	Least Preferred	Most Preferred
Social Environment	Less Preferred	Most Preferred	Least Preferred
Infrastructure Design	Most Preferred	Least Preferred	Less Preferred
Economic Environment and Cost Effectiveness	Most Preferred	Less Preferred	Least Preferred
Recommendation	***Recommended***	**ULTIMATE VISION**	

9.3.3.2 GRADE SEPARATION AT GO TRANSIT STOUFFVILLE RAILWAY CORRIDOR CROSSING NORTH OF AUSTIN DRIVE

A high level evaluation of alternatives was conducted, and results are presented in **Table 9-18**. **Alternative 1: At-grade crossing with AT Improvements** is recommended because it provides improved pedestrian and cyclist facilities and dedicated Transit/HOV lanes until such time increase GO Train Service results in substantial vehicle queuing and increased potential for cyclist and pedestrian crossing conflicts. Alternatives 2 and 3, **Future Grade Separation** (Overpass or Underpass) is the **Ultimate Vision** because it eliminates vehicle queues from increased GO Train service, and it removes rail conflicts with pedestrians and cyclists. However, there is insufficient information available at the time of this EA Study to make a determination of overpass or underpass, and as a result a **separate study** will be completed in the future to identify the appropriate solution for the grade separation.

Table 9-18: Evaluation of GO Crossing North of Austin Drive

Criteria	Alternative 1: At-grade crossing with AT improvements	Alternative 2: Overpass with AT improvements	Alternative 3: Underpass with AT improvements
Transportation Service	Least Preferred	Carry forward for further study	Carry forward for further study
Natural Environment	Less Preferred		
Social Environment	Less Preferred		
Infrastructure Design	Most Preferred		
Economic Environment and Cost Effectiveness	Most Preferred		
Recommendation	***Recommended***	Future Grade Separation Assessment for **ULTIMATE VISION**	

9.3.3.3 ROUGE RIVER CROSSING

Alternatives to accommodate the Preferred Solution requires widening or replacing the existing Rouge River bridge. Due to the proximity of the Rouge River to the GO Transit Stouffville Railway Corridor crossing north of Austin Drive, alternatives at the Rouge River crossing must also accommodate the recommended grade separation recommendations.

As identified in **Section 9.3.3.2** the Ultimate Vision at the GO Transit Stouffville Railway Corridor crossing north of Austin Drive, is to accommodate the future grade separation of the rail and road subject to the findings of a future grade separation study. In undertaking the assessment of alternatives, it was determined that for either an Overpass or Underpass at this rail crossing will require raising of the Kennedy Road profile and subsequent raising of the Rouge River bridge. As such to accommodate the Ultimate Vision grade separation of the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive, the Rouge River bridge will be replaced. The requirements for this new structure will be confirmed through the separate Grade Separation Study at the crossing north of Austin as it is dependent on the grade separation recommendation.

As identified in **Section 9.3.3.2** the Recommended Design at the GO Transit Stouffville Railway Corridor crossing north of Austin Drive is to provide an at-grade crossing for the widened Kennedy Road. To accommodate this recommendation results in widening the Rouge River bridge to provide two additional traffic lanes and multi-use paths for Active Transportation. The following alternatives are carried forward to accommodate Rouge River structure for the Recommended Design of the At-Grade Crossing north of Austin Drive.

Table 9-19: Alternative Design Concepts considered at the Rouge River Crossing

Alternative #	Title	Description	Recommendation
1	AT Facilities on Both Sides	• Full bridge replacement (Alternative 1A) or modification of the existing bridge (Alternative 1B) to accommodate widening the road from four to six lanes and AT facilities	**Carry Forward**
2	Separate AT Bridges	• Full bridge replacement or modification of the existing bridge to accommodate widening the road from four to six lanes with separate AT bridges to accommodate pedestrians and cyclists	**Carry Forward**

Following the second open house and confirmation of the Recommended and Ultimate Vision recommendations at the GO Transit Stouffville Railway corridor crossing north of Austin Drive, additional assessment to confirm the accommodation of the Rouge River structure for the Recommended Design of the At-Grade Crossing north of Austin Drive was considered. The following was noted:

Alternative 1A - Full bridge replacement to accommodate the proposed Kennedy Road widening while the rail crossing north of Austin remains at-grade is not recommended because the bridge would then be replaced a second time to accommodate the Ultimate Vision for the grade separation.

Alternative 2- Separate AT bridges in addition to the existing bridge are not recommended because the overall width of the bridge with the separate AT bridge crossings cannot have a combined width of more than the proposed widened bridge and must be at the same elevation as the existing bridge, otherwise this will result in adverse impacts to flooding. The combined width of the existing bridge with separate AT bridges would be wider than widening the existing bridge. The AT bridges are also anticipated to be lower than the existing bridge, and as such this option is not recommended.

Based on the hydraulic considerations Alternative 1B widening the bridge to accommodate Kennedy Road widening and AT improvements is the recommended approach where the superstructure is replaced to maintain the same elevation as the existing structure (with 1% cross fall) and reduced width.

9.3.3.4 HAGERMAN CEMETERIES

A high-level screening of the alternative design concepts developed at the Hagerman Cemeteries was completed based on compliance of the alternatives with YR-TMP recommendations and YR Pedestrian and Cyclist Guidelines. The results are provided in **Table 9-20**.

Table 9-20: High Level Screening of Hagerman Cemetery Alternatives

Alternative #	Description	Discussion / Recommendation
1	Reduced Lane Width with MUP and Sidewalk, Best Fit Approach	**Carry Forward**
2	Standard Lane Width with MUPs on both sides, Best Fit Approach	**Carry Forward**
3	Standard Lane Width with MUPs on both sides, Shift alignment West	This alternative results in direct impacts to adjacent graves. **Screened out – Do not carry forward**
4	Standard Lane Width with MUPs on both sides, Shift alignment East	This alternative results in direct impacts to adjacent graves. **Screened out – Do not carry forward**
5	Centre Median AT Facility	Centre median AT facility does not provide pedestrian and cyclist access to adjacent lands between Duffield Drive and 14th Avenue. Access to boulevards is only provided at signalized intersections. This alternative is not compliant with York Region's Pedestrian and Cyclist Guidelines. **Screened out – Do not carry forward**
6	Shared Roadway with Cyclists, and Sidewalks	Cyclists travelling in shared Transit/HOV curb lane are not provided with dedicated, separated facilities as per the YR-TMP recommendations. This alternative is not complaint with YR-TMP recommendations nor the York Region's Pedestrian and Cyclist Guidelines. **Screened out – Do not carry forward**

Alternative #	Description	Discussion / Recommendation
7	No AT Facilities	Cyclists and pedestrians are not accommodated in the Kennedy Road corridor. This alternative does not provide AT access for any of the adjacent land use between Duffield Drive and 14th Avenue and there are no adjacent pedestrian and cyclist connections on the local street network. This alternative is not complaint with the YR-TMP recommendations and impacts the AT network. **Screened out – Do not carry forward**
8	No widening, MUPs and queue jump lanes	Transit/HOV lanes from six-lane road transition into four general purpose lane segment. Queue jump lanes used for transition of transit/HOV vehicles at intersections with 14th Avenue and Duffield Drive (or future Miller Ave. extension) will be challenging to implement and monitor use for compliance. This alternative is also not complaint with the YR-TMP recommendations. **Screened out – Do not carry forward**

Based on consultation with the City of Markham, a request was made to consider a modification to Alternative 1 to accommodate dual MUP, but provide a MUP less than the absolute minimum 2.4m width to avoid impacts with the grave sites. In locations where the width of the path is non-standard (less than 2.4m), warning signage is considered to indicate to users of the respective narrow path ahead and potential need to dismount. This variation was prepared as Alternative 1B. The evaluation and recommendations for the options carried forward is presented in **Table 9-21**.
Alternative 1b, Reduced lane width, dual narrow MUP, best fit approach was selected as the recommended design because this option provides improved active transportation facilities on both sides, dedicated Transit/ HOV lanes and avoids direct impacts to grave sites on cemetery lands. Narrower lanes may result in a reduction in vehicle speed creating a safer environment for all users. Relocation of Thomas Morley House would retain the building's heritage attributes and present an opportunity for rehabilitation and adaptive reuse.

Table 9-21: Evaluation of Hagerman Cemeteries

Criteria	Alternative 1a: Reduced Lane Width, Narrow MUP and Sidewalk, Best Fit Approach	Alternative 1b: Reduced Lane Width, Dual Narrow MUP, Best Fit Approach	Alternative 2: Standard Lane Width, Dual MUP, Best Fit Approach
Transportation Service	Least Preferred	Less Preferred	Most Preferred
Natural Environment	Less Preferred	Most Preferred	Least Preferred
Social Environment	Most Preferred	Less Preferred	Least Preferred
Infrastructure Design	Most Preferred	Most Preferred	Least Preferred
Economic Environment and Cost Effectiveness	Most Preferred	Most Preferred	Least Preferred
Recommendation		**Recommended**	

9.3.3.5 ST. PHILIP'S ON-THE-HILL AND BETHESDA LUTHERAN CEMETERIES

A high-level screening of the alternative design concepts developed at the cemeteries located north of 16th Avenue was completed based on compliance of the alternatives with YR-TMP recommendations and YR Pedestrian and Cyclist Guidelines. The results are provided in **Table 9-22**.

Table 9-22: High Level Screening of St. Philip's on-the-Hill and Bethesda Lutheran Cemetery Options

Alternative #	Description	Discussion / Recommendation
1	Reduced Lane Width with MUP and Sidewalk, Best Fit Approach	**Carry Forward**
2	Standard Lane Width with MUPs on both sides, Best Fit Approach	**Carry Forward**
3	Standard Lane Width with MUPs on both sides, Shift alignment East	This alternative results in direct impacts to adjacent graves. **Screened out – Do not carry forward**
4	Standard Lane Width with MUPs on both sides, discontinuous AT, Shift alignment West	This alternative results in direct impacts to adjacent graves. **Screened out – Do not carry forward**
5	Shared Roadway with Cyclists, and Sidewalks	Cyclists travelling in shared Transit/HOV curb lane are not provided with dedicated, separated facilities as per the YR-TMP recommendations. This alternative is not complaint with YR-TMP recommendations nor the York Region's Pedestrian and Cyclist Guidelines. **Screened out – Do not carry forward**

Alternative #	Description	Discussion / Recommendation
6	No AT Facilities	Cyclists and pedestrians are not accommodated in the Kennedy Road corridor. This alternative does not provide AT access for any of the adjacent land use between Wilfred Murison Avenue and Beckett Avenue and adjacent pedestrian and cyclist connections on the local street network are not in proximity to the Kennedy Road corridor. This alternative is not complaint with the YR-TMP recommendations and impacts the AT network. **Screened out – Do not carry forward**
7	No widening, MUPs and queue jump lanes	Transit/HOV lanes from six-lane road transition into four general purpose lane segment. Queue jump lanes used for transition of transit/HOV vehicles at intersections with Wilfred Murison Avenue and Beckett Avenue will be challenging to implement and monitor use for compliance. This alternative is also not complaint with the YR-TMP recommendations. **Screened out – Do not carry forward**

Based on consultation with the City of Markham, a request was made to consider a modification to Alternative 1 to accommodate dual MUP, but maintain a sub-standard width to avoid impacts with the grave sites. In locations where the sub-standard width may be required for the path warning signage to indicate to users of the respective narrow path ahead and potential need to dismount will be considered. This variation was prepared as Alternative 1B. The evaluation and recommendations for the options carried forward is presented in **Table 9-23**. **Alternative 1b, reduced lane width, dual narrow MUP, best fit approach** was selected as the recommended design because this option provides improved active transportation facilities on both sides, dedicated Transit/ HOV lanes and avoids direct impacts to grave sites on cemetery lands. Narrower lanes may result in a reduction in vehicle speed creating a safer environment for all users. Modifications to Thomas Lownsbrough House would retain the building's heritage attributes and connection to Hunter's Corners.

Table 9-23: Evaluation of St. Philip's on-the-Hill and Bethesda Cemeteries

Criteria	Alternative 1a: Reduced Lane Width, Narrow MUP and Sidewalk, Best Fit Approach	Alternative 1b: Reduced Lane Width, Dual Narrow MUP, Best Fit Approach	Alternative 2: Standard Lane Width, Dual MUP, Best Fit Approach
Transportation Service	Least Preferred	Less Preferred	Most Preferred
Natural Environment	Less Preferred	Most Preferred	Least Preferred
Social Environment	Most Preferred	Less Preferred	Least Preferred
Infrastructure Design	Most Preferred	Most Preferred	Least Preferred
Economic Environment and Cost Effectiveness	Most Preferred	Most Preferred	Least Preferred
Recommendation		**Recommended**	

9.3.3.6 MILLER AVENUE EXTENSION

The evaluation of the Miller Avenue Extension is presented in **Table 9-24. Option 1: Maintain Markham EA Preferred Alignment K-1A** is recommended because traffic operations permit full movement access to Kennedy Road at Duffield Drive signalized intersection allowing for northbound and southbound travel, and AT users are accommodated with protected crossings at this signalized intersection. This option is independent of timing of redevelopment of the parcel west of Kennedy Road. Although this option requires two permanent crossings of CN ROW and significantly higher capital costs, the construction of the Miller Avenue Extension can be independent of Kennedy Road Improvements.

Table 9-24: Evaluation of Miller Avenue Extension

Criteria	Option 1: Maintain Markham EA Preferred Alignment K-1A	Option 2: Loop with Bridge Extension	Option 3: Buttonhook with New Bridge	Option 4: Markham EA Option K-2
Transportation Service	Most Preferred	Most Preferred	Less Preferred	Least Preferred
Natural Environment	Most Preferred	Less Preferred	Least Preferred	Less Preferred
Social Environment	Most Preferred	Most Preferred	Less Preferred	Most Preferred
Infrastructure Design	Less Preferred	Less Preferred	Least Preferred	Most Preferred
Economic Environment and Cost Effectiveness	Less Preferred	Least Preferred	Least Preferred	Most Preferred
Recommendation	**Recommended**			

9.3.3.7 CN RAIL OVERPASS CROSSING

It was determined that the CN Rail bridge overpass will need to be replaced to accommodate the road widening from four to six lanes for transit/HOV and Active Transportation facilities. The **North Rail Detour** option was carried forward as it meets the current vertical clearance requirements for the structure as discussed in **Section 9.1.7.4**. Replacement and widening of the CN Rail Overpass structure is recommended

to accommodate Kennedy Road improvements only as the Miller Avenue Extension will have no impact on the CN Rail Overpass.

9.3.3.8 407ETR INTERCHANGE

The evaluation of the 407ETR Interchange is presented in **Table 9-25. Alternative 6, no widening with separate AT bridge adjacent to the existing structure**, was selected as the recommended design because this option does not require widening of the existing 407ETR bridge, nor shifting the Kennedy Road centreline, north ramp reconstruction. It provides continuous separated active transportation bridge(s) over the 407ETR providing the greatest separation from automobiles over 407ETR; however, the number of conflict points remain unchanged.

Table 9-25: Evaluation of 407ETR Interchange

Criteria	Alternative 1: No Structure Widening, 1 MUP (Road Shift)	Alternative 2: No Structure Widening, MUP in Median	Alternative 3: Structure Widened, 1 MUP + 1 Sidewalk (No Road Shift)	Alternative 4.1: Structure Widened, 2 MUPs (Road Shift)	Alternative 4.2: Structure Widened, 2 MUPs (No Road Shift)
Transportation Service	Less Preferred	Not Carried Forward due to operational concerns.	Least Preferred	Less Preferred	Less Preferred
Natural Environment	Most Preferred		Most Preferred	Most Preferred	Most Preferred
Social Environment	Most Preferred		Most Preferred	Most Preferred	Most Preferred
Infrastructure Design	Less Preferred		Less Preferred	Least Preferred	Less Preferred
Economic Environment and Cost Effectiveness	Most Preferred		Less Preferred	Least Preferred	Less Preferred
Recommendation					

Criteria	ALTERNATIVE 5.1: Structure Widened by 2 Girders/1 Pier, Sidewalks and Cycle Tracks on Both Sides (Road Shift)	ALTERNATIVE 5.2: Structure Widened by 2 Girders/2 Pier, Sidewalks and Cycle Tracks on Both Sides (No Road Shift)	ALTERNATIVE 6: No Widening with Separate AT Bridge adjacent to existing structure
Transportation Service	Less Preferred	Less Preferred	Most Preferred
Natural Environment	Most Preferred	Most Preferred	Most Preferred
Social Environment	Most Preferred	Most Preferred	Most Preferred
Infrastructure Design	Least Preferred	Less Preferred	Most Preferred
Economic Environment and Cost Effectiveness	Less Preferred	Least Preferred	Less Preferred
Recommendation			**Recommended**

9.3.3.9 VIVA RAPIDWAY

The evaluation of the Viva Rapidway is presented in **Table 9-26.**

Alternative 1 - Median Viva rapidway with AT facilities (modified Highway 7 Transit EA) is the **Ultimate Vision** as this option provides continuous pedestrian and cyclist facilities with street planting opportunities throughout while minimizing potential impacts to businesses (property and parking loss), and no anticipated business displacement. This option will result in increased congestion in the general purpose lanes but allows for Viva buses to operate within the median rapidway and protects for future LRT. This option may negatively impact YRT service if operating from curb side transit stops from congested general purpose lanes, but has the potential to mitigate this impact if YRT operates from the median rapidway.

Alternative 3 – Shift Viva Rapidway to share Transit / HOV curb lane with AT facilities is the **Recommended Design** as this option provides continuous pedestrian and cyclist facilities with street planting opportunities throughout. It requires minimal impacts to businesses (property requirements), and no business displacement. This option reduces congestion and provides transit connectivity for YRT buses in Transit/HOV lanes; however, Viva buses are required to share the Transit/HOV lanes.

Table 9-26: Evaluation of Viva Rapidway

Criteria	Alternative 1: Median Viva Rapidway with AT facilities (modified YRRTC EA*)	Alternative 2: Median Viva Rapidway with Transit/HOV curb lanes, with AT facilities	Alternative 3: Shift Viva Rapidway to share Transit/HOV curb lane, with AT facilities
Transportation Service	Least Preferred	Most Preferred	Less Preferred
Natural Environment	Less Preferred	Least Preferred	Most Preferred
Social Environment	Less Preferred	Least Preferred	Most Preferred
Infrastructure Design	Less Preferred	Least Preferred	Most Preferred
Economic Environment and Cost Effectiveness	Less Preferred	Least Preferred	Most Preferred
Recommendation	**ULTIMATE VISION**		***Recommended***

**YRRTC EA was approved in 2005 and protects for the Viva rapidway connection to/from Markham Centre to Markham Stouffville Hospital*

Design Approach

Key design parameters to inform the decision making are provided in **Table 9-27** and are based on a review of YRRTC's vivaNext 6-lane Roadway Cross-section minimum and maximum widths, alongside desirable widths for Transit/HOV lanes, active

transportation facilities and streetscaping opportunities. Combinations of various parameters were considered and were vetted in consultation with YRRTC.

Table 9-27: Cross-Section Key Design Parameters

ELEMENT	WIDTH / CLEARANCE	SOURCE/NOTES
Right-of-Way (designated)	Up to 45 m between YMCA Boulevard and Highway 7	Map 12 of the Region's Official Plan, 2010
Transitway and Roadway Elements		
Rapid Transit Lane	3.5 m, one in each direction	YRRTC vivaNext 6-lane Roadway
Buffers to Rapid Transit Lanes	0.3m painted buffer (minimum) 0.5m painted buffer (maximum) 1.0m physical buffer	OPSD 600.080 Discussions with YRRTC and YR to prevent non-rapidway vehicles crossing the median rapidway
Median / Station to Rapidway Lanes	1.4m to 4.0 m concrete median 0.25 m curb & gutter to median (maximum)	YRRTC vivaNext 6-lane Roadway
Lane Widths	3.3m through lanes 3.5 m Transit/HOV lanes 3.3 m auxiliary left-turn lane, adjacent to 0.3m painted buffer (minimum) 3.5m auxiliary left turn lane, adjacent to 0.5m painted buffer (desired).	Section 5.1 of Towards Great Regional Streets, 2008 YRRTC vivaNext 6-lane Roadway
Boulevard Elements		
Curb and Gutter	0.30m	OPSD 600.040 modified
Boulevard Cycle Track	1.9m adjacent to 0.61m continuity strip	YRRTC vivaNext 6-lane Roadway
Furnishing Zone /	2.35m	YRRTC vivaNext 6-lane Roadway
Planting Zone /	3.5m	Discussions with York Region Internal Team
Above-Ground Utility Zone	2.0 m minimum (1.0 m from back of curb to edge of pole; 0.7 m maximum pole diameter; 0.3 m minimum buffer from edge of pole to edge of AT facility)	Discussions with York Region Internal Team

ELEMENT	WIDTH / CLEARANCE	SOURCE/NOTES
Sidewalk	2.0m desirable Minimum 1.5 m (additional 0.5 m if adjacent to curb)	YRRTC vivaNext 6-lane Roadway Section 5.6 of Towards Great Regional Streets, 2008
Multi-Use Path	3.0 m (ideal) – Minimum 2.4 m at constrained locations (additional 0.5 m if adjacent to curb)	Ontario Traffic Manual – Book 18, 2013
Rounding	0.3 m to 0.6m	YRRTC

Upon review of the various design parameters, the following design approach was proposed to inform the typical section options:

- AT facility type consistent with Kennedy Road EA corridor (3.0m MUP) for continuity
- Opportunities for streetscaping and above-ground utility zones

Alternative 1 Considerations:

- Two 3.5m Median Transitway Lanes
- One 3.3m through lane and a 3.5m curb lane
- Consistent width allocated for left turn lane with buffer and opposing station / platform width at intersections; minimum platform width of 4.0m
- 1.0m physical buffer on one side of the rapidway to prevent non-rapidway vehicles from crossing the median rapidway; 0.5m painted buffer on other side

Alternative 3 Considerations:

- Two 3.3m through lanes and a 3.5m curb Transit/HOV lane

The existing right-of-way for Kennedy Road between YMCA Boulevard and Highway 7 ranges from 36m north of Castan Avenue to 43m south of Castan Avenue, and the Official Plan designated right-of-way is 45m. Various combinations of the identified design parameters were considered to develop typical section options at the midblock and intersections. These options were reviewed against opportunities to acquire additional ROW for the improvements, while minimizing the resulting impacts to surrounding businesses and other properties.

Typical sections were developed for the Ultimate Vision (Alt 1 - Rapidway + 4 GPL + AT facilities) and a design for Six Lanes with Transit / HOV + AT facilities. These options were compared to establish the Recommended (Alt 3 – Six Lane Transit / HOV + AT facilities) Typical Section on the premise of maintaining the boulevards from the Ultimate Vision (Alt 1) to minimize future reconstruction and utility relocations. Additional

width to implement the Ultimate Vision from the Recommended is allocated to a wider centre median. A schematic is provided in **Exhibit 9-51.**

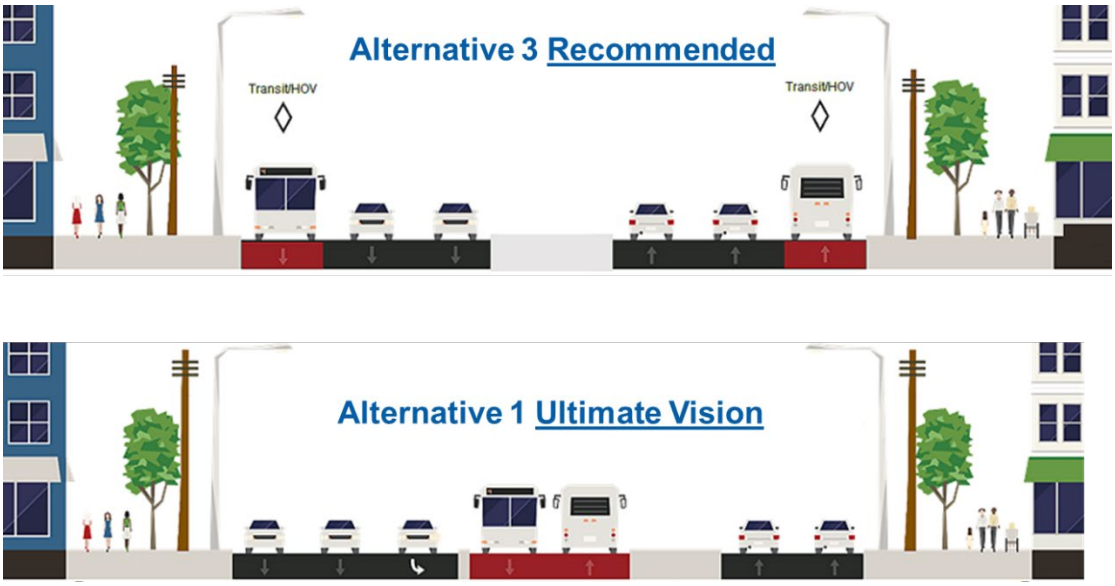


Exhibit 9-51: Viva Rapidway Ultimate and Recommended Typical Section

9.3.4 Intersection and Access Considerations

An analysis of the future 2041 transportation conditions was undertaken to reflect a 6 lane [4 general purpose lanes (GPL) + 2 Transit/HOV lanes] widening scenario between Steeles Avenue and Major Mackenzie Drive.

As part of the future 2041 transportation review, a signal warrant analysis was conducted for unsignalized intersections along Kennedy Road. Based on the signal warrant analysis, only one intersection, Kennedy Road and Wilfred Murison Avenue, was warranted for a signal.

Signalization at residential local crossing streets that currently operate under two-way stop control were considered to be signalized because the proposed road widening would require traffic to cross 3 lanes when performing left turn movements and 6 lanes for through movements. However, future traffic volumes at these intersections will remain relatively low and will not require a signal.

Besides the Kennedy Road / Wilfred Murison Avenue intersection, all commercial/residential entrances/exits that currently operate under stop control along Kennedy Road within the study area are proposed to be converted to Right-in/Right-out (RIRO) driveways due to the widening of Kennedy Road to 6 lanes. The impacts of conversion were reviewed to identify if there could be any potential issues resulting from converting full-movement entrances to RIRO driveways. Criteria considered include the size of the plaza, the accessibility of alternative routes, and the operation of the adjacent signalized intersection. In general, these conversions are not expected to

result in adverse impacts; however, the requirement for Emergency Services will be determined in consultation with local Emergency Services during Detailed Design. A detailed description of the analyses undertaken, and results are documented in the Transportation Technical Report #2 and is provided in **Appendix E**.

9.3.5 Overall Design Recommendations

The following summarizes the Preferred Design Concept for the Kennedy Road corridor:

- **Alternative Widening:** Alternative 1- Widen About the Centreline is recommended because this option achieves the transportation, economic, environmental, and social objectives of the study. Balancing the impacts on both sides of Kennedy Road will minimize impacts on either side of the street. The potential for property acquisition will be minimized as impacts are balanced on both sides of Kennedy Road as opposed to exclusively widening to the east or west.

- **Alternative Active Transportation:** Alternative 2 - Multi-Use Path (MUP) on both sides, was selected as the recommended design. This AT facility alternative provides the greatest physical separation between AT users and vehicles, while maintaining continuity through constrained locations and servicing various land uses on either boulevard. Separated cycle tracks and sidewalks on both sides was not selected given that the facility type would not be continuous and would alternate between MUPs at various locations throughout the corridor.

- **Grade Separation at GO Rail North of Clayton Drive:** Alternative 1 – At-Grade Crossing is the Recommended design until GO Transit increases the frequency of train service. This option provides improved active transportation facilities and dedicated Transit/HOV lanes; however, it does not address vehicle queuing caused by increased GO Train service or safety of at-grade crossing for pedestrians and cyclists. Alternative 2 - Underpass with AT Improvements is the Ultimate Vision at the crossing, which will address vehicle queuing issues that will occur once the GO Train service increases. This option also provides dedicated Transit/HOV lanes and improved active transportation facilities, where pedestrians and cyclists travel along a raised platform to minimize travelling distance and are grade separated from the rail crossing.

  The final design of the underpass will be subject to the findings and recommendations of the Metrolinx GO Expansion program’s Stouffville Grade Separations Transit Project Assessment Process (TPAP), which is underway as of February 2020.

- **Grade Separation at GO Rail North of Austin Drive:** Alternative 1 - At-grade crossing with AT Improvements is the Recommended Design because it provides improved pedestrian and cyclist facilities and dedicated Transit/HOV lanes until such time increase GO Train Service results in substantial vehicle queuing and increased potential for cyclist and pedestrian crossing conflicts. Alternatives 2 and 3, Future Grade Separation (Overpass or Underpass) is the Ultimate Vision because it eliminates vehicle queues from increased GO Train service, and it removes rail conflicts with pedestrians and cyclists. However, there is insufficient information available at the time of this EA Study to make a determination and as a result a **separate study** will be completed in the future to identify the appropriate solution for the grade separation.

- **Rouge River Bridge:** Alternatives to accommodate the Preferred Solution require widening or replacing the bridge. Due to the proximity of the Rouge River to the Go Transit Stouffville Railway Corridor crossing north of Austin Drive, alternatives at the Rouge River crossing must also accommodate the recommended grade separation. To support the Ultimate Vision at the rail crossing for grade separation replacement of the Rouge River bridge will be required and subject to the recommendations of the future separate Grade Separation Study at this location. To support the Recommended Design at the rail crossing for the at-grade crossing, it is recommended to carry forward Alternative 1 – AT Facilities on both Sides and Alternative 2 – Separate AT Bridges.

  Following the second open house and confirmation of the Recommended and Ultimate Vision recommendations at the GO Transit Stouffville Railway corridor crossing north of Austin Drive, additional assessment to confirm the accommodation of the Rouge River structure for the Recommended Design of the At-Grade Crossing north of Austin Drive was considered. The following was noted:

  Alternative 1A - Full bridge replacement to accommodate the proposed Kennedy Road widening while the rail crossing north of Austin remains at-grade is not recommended because the bridge would then be replaced a second time to accommodate the Ultimate Vision for the grade separation.

  Alternative 2- Separate AT bridges in addition to the existing bridge are not recommended because the overall width of the bridge with the separate AT bridge crossings cannot have a combined width of more than the proposed widened bridge and must be at the same elevation as the existing bridge, otherwise this will result in adverse impacts to flooding. The combined width of the existing bridge with separate AT bridges would be wider than widening the

existing bridge. The AT bridges are also anticipated to be lower than the existing bridge, and as such this option is not recommended.

Based on the hydraulic considerations Alternative 1B widening the bridge to accommodate Kennedy Road widening and AT improvements is the recommended approach where the superstructure is replaced to maintain the same elevation as the existing structure (with 1% cross fall) and reduced width.

- **Hagerman Cemeteries:** Alternative 1b, Reduced lane width, dual narrow MUP, best fit approach was selected as the recommended design because this option provides improved active transportation facilities on both sides, dedicated Transit/ HOV lanes and avoids direct impacts to grave sites on cemetery lands. Narrower lanes may result in a reduction in vehicle speed creating a safer environment for all users. Relocation of Thomas Morley House would retain the building's heritage attributes and present an opportunity for rehabilitation and adaptive reuse.

- **St. Philip's and Bethesda Cemeteries:** Alternative 1b, reduced lane width, dual narrow MUP, best fit approach was selected as the recommended design because this option provides improved active transportation facilities on both sides, dedicated Transit/ HOV lanes and avoids direct impacts to grave sites on cemetery lands. Narrower lanes may result in a reduction in vehicle speed creating a safer environment for all users. Relocation and modification to Thomas Lownsbrough House would retain the building's heritage attributes and connection to Hunter's Corners.

- **Miller Avenue Extension:** Option 1, Maintain Markham EA Preferred Alignment K-1A is recommended because traffic operations permit full movement access to Kennedy Road at Duffield Drive signalized intersection allowing for northbound and southbound travel, and AT users are accommodated with protected crossings at this signalized intersection. This option is independent of timing of redevelopment of parcel west of Kennedy Road. Although this option requires two permanent crossings of CN ROW and significantly higher capital costs, the construction of the Miller Avenue Extension can be independent of Kennedy Road Improvements.

- **CN Rail Overpass Crossing:** The North Rail Detour option was carried forward as it meets the current vertical clearance requirements for the structure. Replacement and widening of the CN Rail Overpass structure is recommended to accommodate Kennedy Road improvements only as the Miller Avenue Extension will have no impact on the CN Rail Overpass.

- **407ETR Interchange:** Alternative 6, no widening with separate AT bridge adjacent to the existing structure, was selected as the recommended design because this option provides a separated active transportation bridge over the 407ETR on both sides, providing the greatest separation from automobiles; however, the number of conflict points remain unchanged. This option does not impact the road alignment and ramps.

  After the second Open House, comments were received regarding safety concerns at the four conflict points at the on-ramps. Through consultation with 407ETR and MTO, as an Ultimate Vision, in addition to the AT bridges over the 407ETR, additional AT bridges over the 407ETR on-ramps are recommended to reduce conflict points between vehicles and pedestrians and cyclists crossing the ramps.

- **Viva Rapidway:** Alternative 3, Shift Viva Rapidway to share Transit/HOV curb lane is the Recommended option as it allows for YRT and Viva to service the corridor while minimizing impacts and reduce congestion, and provides for continuity of the Transit/HOV network along Kennedy Road and continuous AT facilities and landscaping opportunities. Alternative 1, Median Viva Rapidway with AT facilities (Modified Highway 7 Transit EA) is the Ultimate Vision as Viva transit service can operate within a dedicated median Rapidway and it allows for future opportunities to implement higher order transit service (Light Rail Transit) within the median in the longer term. It also provides for continuous AT facilities and landscaping opportunities while minimizing potential impacts to businesses and does not result in business displacement. The boulevards from the Ultimate Vision (Alt 1) are incorporated into the Recommended Design (Alt 3) to minimize future reconstruction and utility relocations. Additional width to implement the Ultimate Vision from the Recommended is allocated to a wider centre median.

10. Project Description

10.1 Description of the Recommended Design Concept

The preferred design for Kennedy Road was chosen with consideration of transportation service for all road users (pedestrians, cyclists, transit riders, and motorists) and potential impacts to the natural environment, community, cultural heritage, operations, aesthetics, driveway access, property requirements, and capital construction and maintenance costs. The preferred design concept best meets the goals of the project with regards to transportation service improvements, while also considering the overall impact of the project and mitigation measures. The preferred design was selected, developed, and refined through extensive consultation with agencies, stakeholders and the public, as detailed in **Appendix B**, **Appendix C**, and **Appendix D**. The preferred design is illustrated in the preliminary design drawings in **Appendix A**.

10.1.1 Design Criteria

The Design Criteria for the Study Corridor is summarized in **Table 10-1**. The standards and guidelines referenced in preparation of the Design Criteria include:

- York Region Road Design Guidelines (YRRDG) – December 2016, Version 1.20
- York Region Towards Great Regional Streets (TGRS) – December 2008
- York Region Transit Concrete Bus Pad Specifications and Drawings - 2016
- York Region Pedestrian and Cycling Planning & Design Guidelines - 2018
- Geometric Design Guide for Canadian Roads - (TAC) – September 1999, Updated June 2017
- MTO Geometric Design Standards for Ontario Highways
- Ontario Traffic Manual Book 18 (OTM) – December 2013

At the time of Detailed Design, any changes to design standards and/or industry best practices are to be considered.

Within MTO's Controlled Access Highway Limits at the 407ETR interchange, the MTO Design Standards and the MTO Design Supplement to TAC December 2017 applies. This results in a modification to the Design Criteria for this segment of the corridor, where all lane widths are 3.5m wide.

The proposed structures documented in later sections of **Section 10** are to be designed in accordance with CAN / CSA – S6 – 19 Canadian Highway Bridge Design Code (CHBDC), Ministry of Transportation of Ontario's Structural Manual and other current directive and standards.

In addition, the railway bridges will be designed in accordance with the American Railway Engineering and Maintenance of Way Association (AREMA).

The Ultimate Vision underpass design for the rail grade separation north of Clayton Drive will be designed in accordance with the minimum vertical clearance of 5.3m from the proposed road profile to the underside of the rail structure as per page 1-3 of the Metrolinx – General Guidelines for Design of Railway Bridges and Structures, 2018. The final design of the underpass will be subject to the findings and recommendations of the Metrolinx' s GO Expansion program's Stouffville Grade Separations Transit Project Assessment Process (TPAP) which is underway as of February 2020.

Table 10-1 Kennedy Road Design Criteria

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS	SOURCE (e.g. TAC, MTO, YR)
ROAD DESIGN				
Design Classification	UAU70	UAU60	UAU60	TGRS Pg. 126
R.O.W. Width	25m to 53m	43 m (45m between YMCA Blvd and Highway 7)	28.5m (Cemeteries north of 16th Avenue) to 53m	York Region Official Plan 2010 (Map 12)
Posted Speed	60 km/h	60 km/h	60 km/h	TGRS Pg. 126
Design Speed	70 km/h (based on Reverse Crown at 330m radius)	60 km/h	60 km/h	TGRS Pg. 126
Minimum Stopping Sight Distance	170m	85 m	130	TAC Ch. 2 pg. 38
Equivalent Minimum 'K' Factor	44 Crest 41 Sag	11 Crest 8 Sag	11 Crest 8 Sag	TAC Ch. 3 Pg. 59 Ch. 3 Pg. 63
Grades Maximum	6.5%	6%	6%	TAC Ch. 3 Pg. 55

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS	SOURCE (e.g. TAC, MTO, YR)
Radius Minimum	330m	1290 m (Normal Crown) 185 m (Reverse Crown) 130 m (e_{max}=0.04 m/m)	1290 m (Normal Crown) 250 m (Reverse Crown)	TAC Ch. 3 Pg. 23
Maximum Rate Of Superelevation (4% Max)	4%	4%	4%	TAC Ch. 3 Pg. 23
Pavement Width	Per direction: 1 x 3.5 m general purpose through lanes 1 x 3.75m curb lane 1 x 3.5 m right-turn lane 1 x 5.0 m left-turn lane (with island)	Per direction: 2 x 3.3 m general purpose through lanes 1 x 5.5 m HOV-transit curb lane (including 1.5 m bicycle lane and 0.5 m buffer) 1 x 5.0 m left-turn lane (with island) **407ETR CAH** Per Direction: 1 x 3.75 m curb/speed change lane 2 x 3.5 m general through lane	Per direction: 2 x 3.3 m general purpose through lanes 1 x 3.5 m Transit/HOV curb lane 1 x 5.0 m left-turn lane (with island) Off-street cycling facilities to be provided instead of on-street facilities **Cemeteries**[1] 2 x 3.0 m minimum general purpose through lanes 1 x 3.2 m minimum HOV-transit lane **407ETR CAH** <u>Per Direction</u> 2 x 3.5m general through lanes 1 x 3.5m Transit/ HOV curb lane	YRRDG Pg. 46-47 TGRS Pg. 126 MTO Design Supplement to TAC December 2017
Shoulder Width (Fully Paved)	N/A	N/A	N/A	N/A
Shoulder Rounding	N/A	N/A	N/A	N/A

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS	SOURCE (e.g. TAC, MTO, YR)
Median Width	0m to 5m	5.0 m (two-way left–turn lane) 1.4 m – 5.0 m (raised median)	1.5 - 5.0m (raised median)	YRRDG Pg. 21 DS-109 DS-112
Signals & Illumination	Full illumination. Full signalization or two-way stop control (Kennedy is the major street).	Full illumination. Full signalization or two-way stop control (Kennedy is the major street).	Full illumination. Full signalization or two-way stop control (Kennedy is the major street).	YRRDG Pg. 23
Erosion & Sediment Controls For Design	N/A	To Be Determined during Design Phase	To Be Determined during Design Phase	As per the Greater Golden Horseshoe Area Conservation Authorities – ESC Guidelines – December 2006
CYCLING AND PEDESTRIAN DESIGN				
Cycling Facility Type (E.G. On-Street, Off-Street, MUP)	N/A	On-street bicycle lane: 1.5 m with 0.5 m buffer 1.5 m minimum for one-way raised cycle track. 2.0 m is desirable pending available space.	3.0m minimum preferred Multi-Use Path (2.4m absolute minimum), additional 0.5m if adjacent to curb In select locations <2.4m designated as narrow path and not considered formal MUP	YRRDG Pg.46 Ontario Traffic Manual Book 18 Pg. 106 York Region Draft Pedestrian and Cycling Planning and Design Guidelines
Minimum Boulevard Width	1.5m	3.5 m minimum (absolute min. 2.0m from edge of curb to accommodate utilities) 5.0 m is desirable pending available space	2.0m pending available space	YRRDG Pg.47

DESIGN PARAMETERS	PRESENT CONDITIONS	DESIGN STANDARDS	PROPOSED STANDARDS	SOURCE (e.g. TAC, MTO, YR)
Sidewalk Width	1.5m minimum	1.5 m – 3.0 m	N/a	YRRDG Pg.57
ENTRANCE DESIGN				
MINIMUM WIDTH	5m Res. 5m Com.	5 m Res. 9 m Com.	5m Res. (match existing) 7m Com. (match existing)	YRRDG Pg. 61 DS-203 DS-215
MINIMUM LENGTH (ROW to building)	1m	N/A	1m	As per local municipality standard
MINIMUM RADIUS	0 m Res. 2 m Com.	5 m Res. 9 m Com.	5 m Res. 9 m Com	YRRDG Pg. 61 DS-203 DS-215
MAXIMUM GRADE	7%	10%	7%	YRRDG Pg.62
MAX. ALGEBRAIC GRADE CHANGE (4% Max)	5%	4%	4%	YRRDG Pg.62

10.1.2 Road Geometry

HORIZONTAL ALIGNMENT

The horizontal alignment for the preferred design (with a 60km/h design speed) generally follows the existing centreline of Kennedy Road. However, there are locations where the centreline is shifted slightly to the east or west to provide a best fit for the ultimate design of Kennedy Road within the existing and proposed right-of-way and minimize impacts to adjacent properties and features. Minor adjustments in the horizontal alignment are proposed at some locations in order to address geometric deficiencies and ensure that minimum design standards are met. The proposed horizontal alignment is illustrated on the preliminary design drawings in **Appendix A**.

VERTICAL ALIGNMENT

The proposed vertical alignment accommodates a 60 km/h design speed. This vertical alignment was chosen to match the existing road profile where possible, with minor adjustments proposed at some locations to address geometric

deficiencies and meet the geometric standards required for the class of the road, as per the design criteria identified in **Section 10.1.1**.

Between Clayton Drive and Gorvette Road, the Ultimate Vision grade-separation for the Underpass provides the required vertical clearances at the rail crossing adhering to Metrolinx design standards. This results in 5% slopes proposed for vehicular travel, and 2.6%-3.1% slopes where possible proposed for pedestrian and cyclist travel. The final design of the Underpass at this crossing will be subject to the findings and recommendations of the Metrolinx's GO Expansion program's Stouffville Grade Separations Transit Project Assessment Process (TPAP) which is underway as of February 2020.

The vertical alignment aims to minimize impacts to existing entrances and driveways, minimize impacts on watercourse crossings, and reduce grading impacts to adjacent properties and features. The proposed vertical alignment is illustrated on the preliminary design drawings in **Appendix A**.

10.1.3 Typical Cross-Section

The typical cross-section for Kennedy Road between Steeles Avenue and Major Mackenzie Drive is illustrated in **Exhibit 10-1** and generally consists of:

- Four 3.3m general purpose vehicular lanes (two in each direction)
- Two 3.5m Transit/HOV curb lanes (one in each direction)
- 2.4m to 3.0m multi-use path
- 1.5m – 5.0m raised median where feasible (the median width also accommodates left-turn lanes at intersections)
- Landscaping within the boulevards as feasible, allowing for space to accommodate utilities and bus pads (minimum 2.0m to accommodate utilities and light poles from back of curb; tree planting opportunities identified where 2.9m or wider boulevard space is available with the preference of 3.5m where possible)
- Landscaping within the median as feasible, (minimum 2.0m landscaping opportunities; tree planting opportunities to be identified where 4.0m or wider median is available)
- A modified 0.3m curb and gutter
- A 0.6m grading buffer

Grading will be contained within the proposed right-of-way where feasible. In those areas where grading extends beyond the proposed right-of-way, grading

easements or property acquisition may be required as discussed in **Section 10.1.9**.

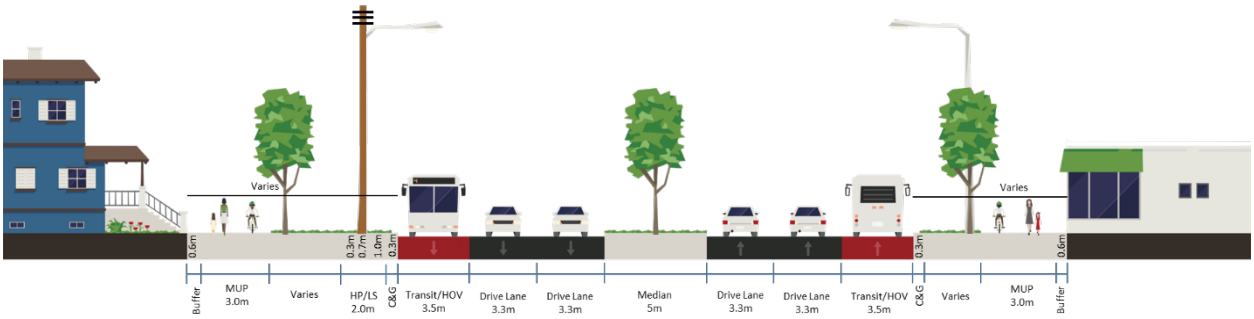


Exhibit 10-1: Typical Cross-Section

Constrained Locations

Due to the heavily constrained Kennedy Road corridor, modifications to the typical cross-section were made at the GO Transit Stouffville Railway Corridor crossing north of Clayton Drive, CN Rail structure, 407ETR interchange, Tributary to the Rouge River and the Rouge River watercourse crossing to protect for greater separation between active transportation (AT) facilities and curb lanes and are discussed in further detail in **Sections 10.1.11** through to **Section 10.1.15.** During Detailed Design, these designs should be reviewed and any changes to design standards and/or industry best practices should be considered.

In addition, modifications to the typical section were also made in three distinct areas; at the two sets of cemeteries located north of 14th Avenue and north of 16th Avenue, and for the section between YMCA Boulevard and Highway 7 to protect for the Ultimate Vision Rapidway.

Cemeteries

The typical cross-section for Kennedy Road at the two sets of cemeteries along Kennedy Road (at Hagerman East and Hagerman West Cemeteries from north of 14th Avenue to Duffield Drive, and at St. Philips on-the-hill and Bethesda Cemeteries from Beckett Drive to Wilfred Murison Avenue) generally consists of:

- Four 3.0m general purpose vehicular lanes (two in each direction)
- Two 3.2m Transit/HOV curb lanes (one in each direction)
- 2.4m multi-use path with additional 0.5m if adjacent to the curb, with limited boulevard within the most constrained locations. It is noted the width of the multi-use path will be reviewed and may be further reduced in Detailed Design in order to avoid any impact to grave sites.

- A 0.3m curb and gutter
- A 0.6m grading buffer

Grading will be contained within the proposed right-of-way where feasible with retaining walls as identified on the preliminary design drawings. In areas where grading extends beyond the proposed right-of-way, grading easements or property acquisition may be required as discussed in **Section 10.1.9**.

Viva Rapidway

The typical cross-section for Kennedy Road between YMCA Boulevard and Highway 7 is based on the Recommended Design for this section and generally consists of:

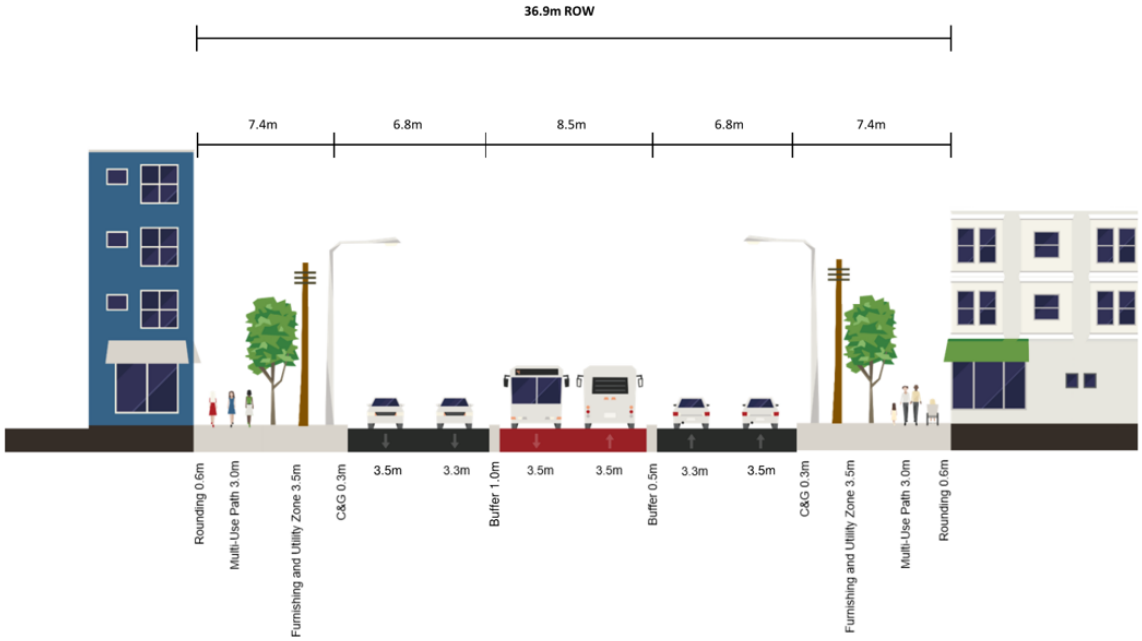
- Four 3.3m general purpose vehicular lanes (two in each direction)
- Two 3.5m Transit/HOV curb lanes (one in each direction)
- 3.0m multi-use path
- 1.9m – varies raised median where feasible (the median width also accommodates left-turn lanes at intersections, with additional width to protect for the future conversion to the Ultimate Vision Rapidway)
- Landscaping within the boulevards as feasible, allowing for space to accommodate utilities and bus pads (minimum 2.0m to accommodate utilities and light poles from back of curb; tree planting opportunities identified where 2.9m or wider boulevard space is available with the preference of 3.5m where possible)
- No median plantings are proposed under the Recommended EA six lanes scenario, in anticipation of removal for the future Ultimate Vision Rapidway construction
- A 0.3m curb and gutter
- A 0.6m grading buffer

The Ultimate Vision Viva Rapidway along this section of Kennedy Road is based on converting the centre median to accommodate two 3.5m transit lanes with raised and painted buffers, platforms, and reconverting the travel lanes to two general purpose lanes (one in each direction) of 3.3m and 3.5m curb lane. To minimize reconstruction costs the boulevards including curb locations, utility corridors, landscaping and active transportation facilities are intended to remain as per the Recommended Design. Conversion from the Recommended Design

to the Ultimate Vision at the midblock and at intersection/station locations are illustrated in **Exhibit 10-2** through to **Exhibit 10-5**. Based on consultation with YRRTC, protection for widths where the property is not constrained is required. Opportunities to increase the combined Ultimate Vision BRT buffer width from 1.5m to 2.0m in constrained areas for the midblock section are to be considered in detailed design. This may be achieved from re-allocation of width from the boulevard elements (e.g. buffer, furnishing/utility zone) and should be considered when finalizing the Recommended Design section in Detailed Design to minimize reconstruction costs. This preferred cross-section for locations where right-of-way is less constrained is illustrated in **Exhibit 10-6**. The preliminary design plan for this location is the Recommended Design with consideration of the Ultimate Vision requirements as shown in **Appendix A.** At the time of implementation of the Ultimate Vision, YRRTC in consultation with YRT and YR will review and confirm the identified elements and associated widths and impacts and revise as required based on the information and design standards available at the time.

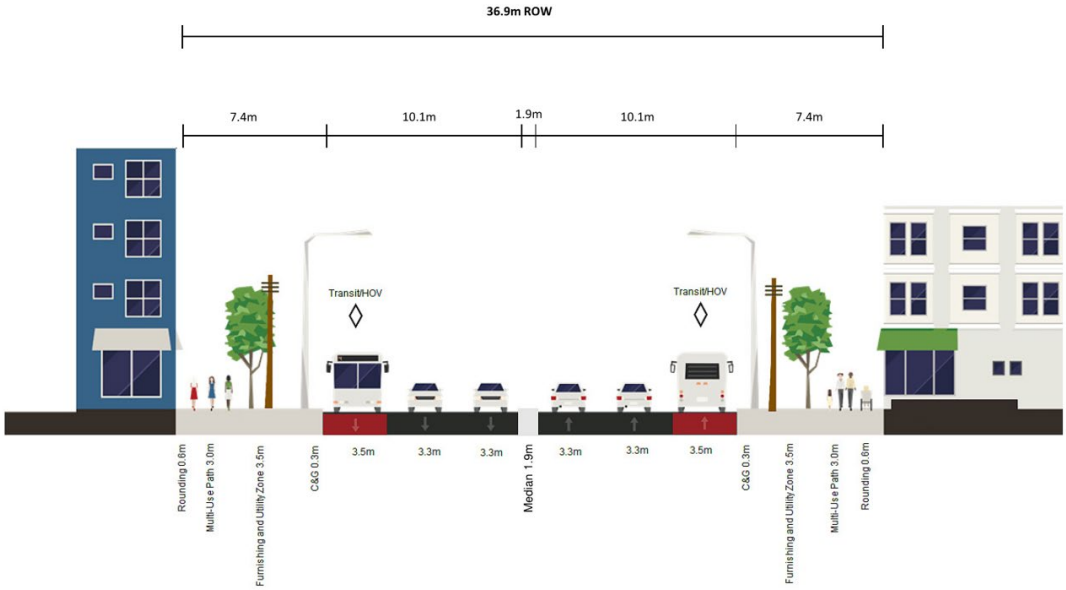
Grading will be contained within the proposed right-of-way where feasible. In those areas where grading extends beyond the proposed right-of-way, grading easements or property acquisition may be required as discussed in **Section 10.1.9.**

It is noted that the Kennedy Road Environmental Study Report (ESR) supplements the Highway 7 Transit EA and supports the installation of the BRT between YMCA Boulevard and Highway 7.



Note: Opportunities to increase the combined BRT buffer width from 1.5m to 2.0m for the midblock section to be considered in detailed design from re-allocation of width from the boulevard elements (e.g. buffer, furnishing/utility zone)

Exhibit 10-2: ULTIMATE VISION Midblock Typical Section at Constrained Right-of-Way – Rapidway with 4 GPL with AT facilities



Note: 0.5m from boulevard(s) may be reallocated to the median to accommodate potential increase in BRT buffer from 1.5m to 2.0m in the Ultimate Vision midblock typical section - to be confirmed in detailed design

Exhibit 10-3: Recommended Midblock Typical Section at Constrained Right-of-Way – Six Lanes for Transit / HOV with AT facilities for Future Conversion

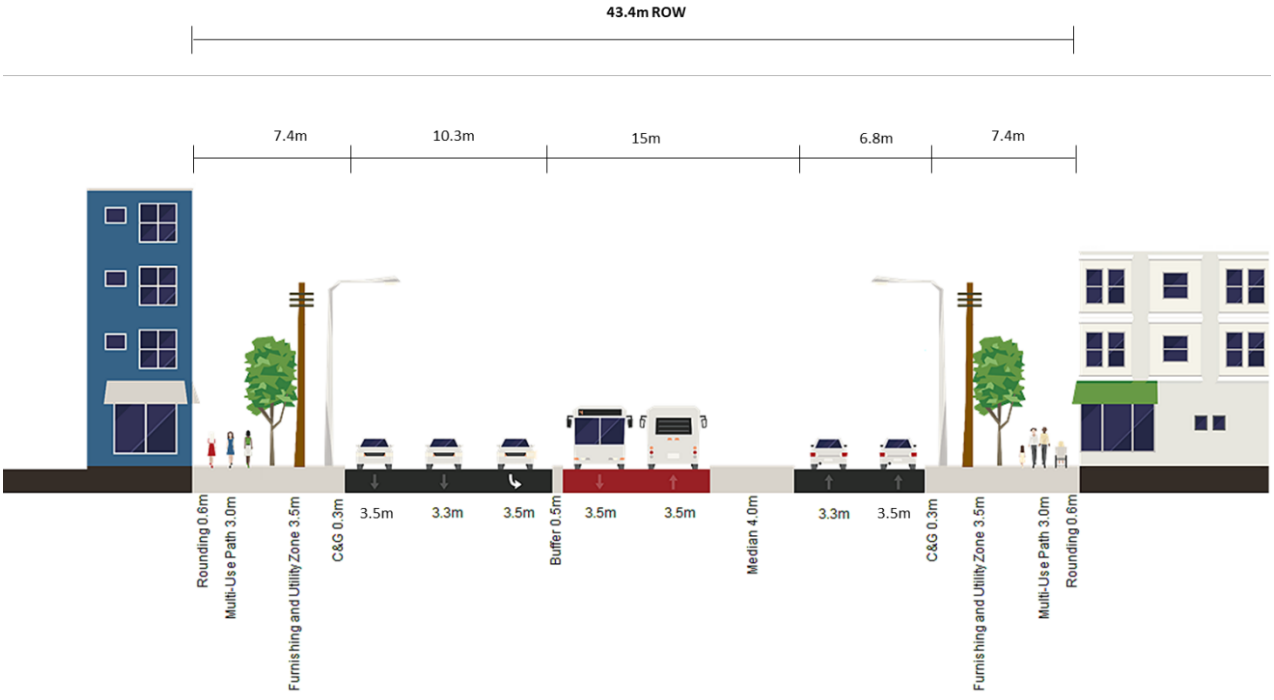


Exhibit 10-4: ULTIMATE VISION Intersection / Station Typical Section – Rapidway with 4 GPL with AT facilities

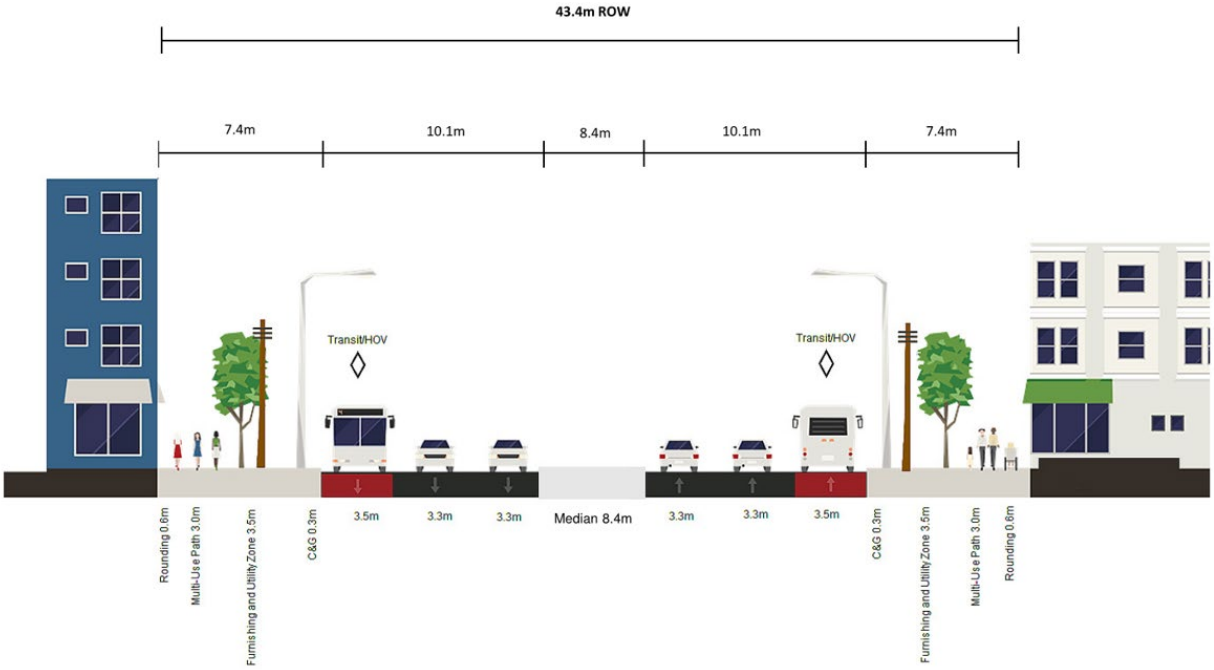


Exhibit 10-5: RECOMMENDED Intersection Typical Section – Six Lanes for Transit / HOV with AT facilities for Future Conversion

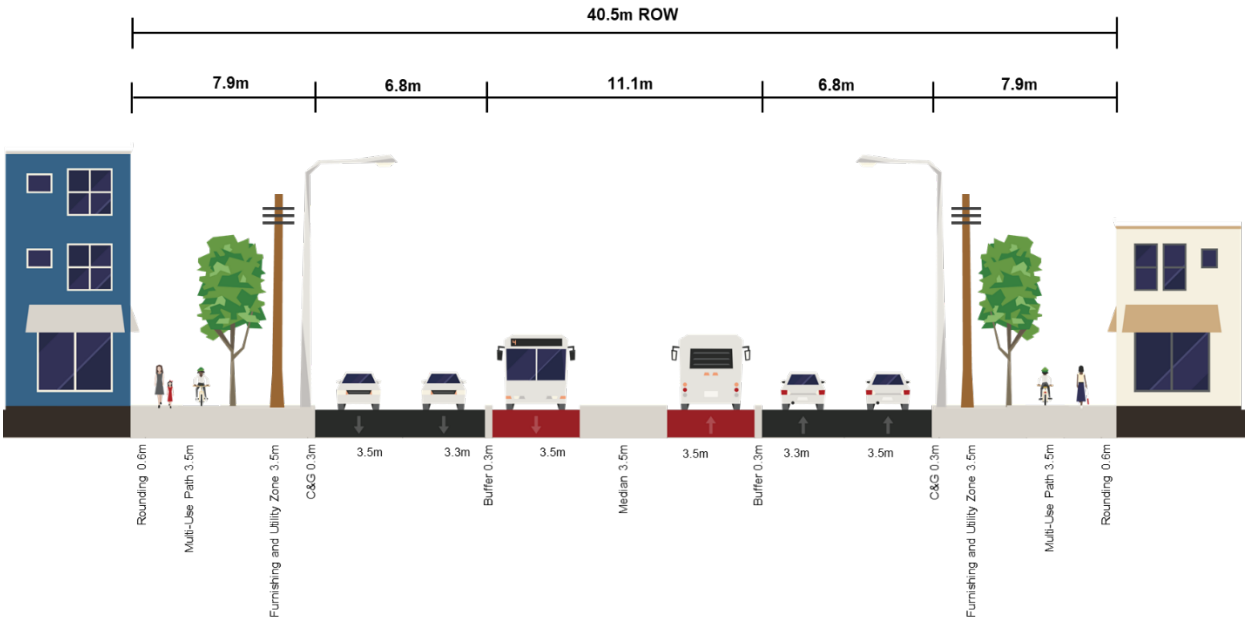


Exhibit 10-6: YRRTC Preferred Ultimate Mid-block Typical Section at less constrained Right-of-Way – Rapidway with 4 GPL with AT facilities

10.1.4 Cycling and Pedestrian Facilities

York Region's Transportation Master Plan aims to make active transportation more comfortable, safe and convenient, and to help residents choose walking and cycling more frequently to meet their daily travel needs. As such, providing more continuous pedestrian and cycling facilities is one of the primary goals for the Kennedy Road study corridor. Continuous pedestrian and cycling facilities, consisting of 3.0m multi-use paths on both sides of Kennedy Road are proposed between Steeles Avenue and Major Mackenzie Drive. In locations where the right-of-way is constrained, the MUPs will be reduced to 2.4m. The final cycling and pedestrian facility will be determined in consultation with the City of Markham and will be signed accordingly. In Detailed Design opportunities to widen the MUP while balancing streetscaping and LID treatment requirements can be considered as requested by the City of Markham.

Generally, the proposed active transportation facilities are located as close to adjacent properties as possible in order to maximize the separation between pedestrians and cyclists and the roadway vehicles and to promote comfort, maximize tree planting opportunities in the boulevard, and allow sufficient space for utilities. At a minimum, a 2.0m utility buffer zone is allocated between the back of the curb and edge of the MUP. This 2.0m minimum utility buffer is allocated as follows: from back of curb to face of pole as a 1.0m clear zone, 0.7m diameter hydro pole / light standard, 0.3m clearance to edge of MUP to allow for clearance for pedals. In locations where there is less than 1.0m between curb and AT facility a splash strip shall be provided. Otherwise, when there is 1.0m or greater spacing between curb and AT facility, topsoil and sod shall be provided.

The material type and treatment for the multi-use path will be confirmed during Detailed Design; however, the City of Markham indicated a preference for concrete facilities. The material type and treatment style will consider the interface between the respective active transportation facility and transit stops. The need for delineation through the bus stop area by signage, tactile warning, or change in elevation will be confirmed during Detailed Design.

Bend-in/bend-out intersection design was integrated in the recommended design. Where feasible, protected intersections will be reviewed during Detailed Design.

At the future CN bridge structure, AT users will be accommodated with a multi-use path configuration located behind the piers to maximize separation between AT users and vehicular traffic.

At the 407ETR interchange, in the Recommended Design pedestrians and cyclists will use at-grade crossing of the 407ETR on-ramps waiting for gaps in traffic. Pedestrians and cyclists will then transition from boulevard AT facilities

(3.0m MUP) to separate AT bridges (3.0m MUP) over the 407ETR. The two separate AT bridges are proposed across the 407ETR on either side of Kennedy Road to provide the greatest separation between AT users and vehicular traffic. The width of the AT bridge facility accommodates a 3.0m facility (MUP) and 0.3m buffer on either side of the parapet wall for pedals and additional clearance. Building on the Recommended Design for the AT bridges over 407ETR (on one or both sides), the Ultimate Vision includes additional AT bridges over the on-ramps on one or both sides to eliminate conflict points at the on-ramps. Implementation of the Recommended Design and the Ultimate Vision will be determined in consultation with 407ETR, MTO, and the City of Markham during Detailed Design. The final width of the bridge(s) will be determined in consultation with York Region's Operations and the City of Markham to address maintenance requirements.

For the Recommended Design at both the GO Transit Stouffville Railway Corridor crossings north of Clayton Drive and north of Austin Drive, AT facilities are proposed in the form of 3.0m MUPs on both sides. The recommended AT facilities will cross at-grade with the rail tracks which will require a review during Detailed Design of the existing signalized crossing gates, signage and pavement markings for compliance with the Grade Crossing Regulations and Grade Crossing Standards.

For the Ultimate Vision at the proposed Underpass at the GO Transit Stouffville Railway Corridor crossing north of Clayton Drive, AT facilities are provided in the form of a 3.5m MUP on both sides. The AT facilities are proposed to be elevated from the road profile to minimize crossing distance for AT users. Based on the work to date for the Milliken Centre Secondary Plan update, an MUP has been identified along the Stouffville railway corridor. Although the final design of the underpass will be subject to the findings and recommendations of the Metrolinx' s GO Expansion program's Stouffville Grade Separations TPAP, opportunities to provide connectivity between AT facilities along Kennedy Road and the railway corridor should be explored at the time of detailed design.

The AT facilities for the Ultimate Vision for the proposed grade-separation at the GO Transit Stouffville Railway Corridor crossing north of Austin Drive, will be subject to the findings and recommendations of the future Grade Separation Study which will also impact the recommendations for the Rouge River structure.

At the Rouge River watercourse crossing structure, when the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive remains at-grade, additional separation and protection between the pedestrians and cyclists and vehicles is proposed as follows:

- 1.0m* horizontal side clearance, on road from edge of Transit/HOV lane

- 0.35m width to accommodate traffic/combination barrier between the horizontal side clearance and AT facility. Barrier height and railing will accommodate pedestrians/cyclists
- 0.3m buffer from traffic/combination barrier to AT facility, to accommodate buffer for pedals
- Parapet wall with railing to accommodate pedestrian/cyclist movements

**A reduction to 1.0m from desired 1.5m horizontal side clearance is proposed at Rouge River structure to minimize the structure width as adverse impacts to upstream flooding result from a wider bridge structure.*

At the Tributary to the Rouge crossing, additional separation and protection between the pedestrians and cyclists and vehicles is proposed as follows:

- 1.5m horizontal side clearance, on road from edge of Transit/HOV lane
- 0.35m width to accommodate traffic/combination barrier between the horizontal side clearance and AT facility. Barrier height and railing will accommodate pedestrians/cyclists
- 0.3m buffer from traffic/combination barrier to cycle track, to accommodate buffer for pedals
- 0.3m buffer from AT facility to parapet wall
- Parapet wall with railing to accommodate pedestrian/cyclist movements

Pedestrians and cyclists will cross signalized intersections via a “combined cross-ride” along Kennedy Road to provide north-south crossings for Kennedy Road AT facilities. A “combined cross-ride”, is also proposed to provide east-west crossings along one approach of every signalized cross street with or without a formalized/dedicated cycling facility, and a crosswalk provided along the other approach of the cross-street for other east-west movement. During Detailed Design, final intersection configuration will be based on the Region’s latest Pedestrian and Cycling Planning and Design Guidelines, to ensure the proposed design and treatments conform to the most current guidelines.

10.1.5 Transit/HOV Provisions

The study area is currently serviced by transit; however, the preferred design accommodates a future higher order Frequent Transit Network with service planned up to every 15 minutes by 2041, as identified in the York Region Transportation Master Plan Update. Dedicated Transit/HOV lanes are proposed in the curb lanes. To accommodate the higher order transit service identified for

the corridor, bus bays and bus stops/pads are incorporated in the preferred design.

Farside bus bays are identified where they could be accommodated based on available property. The bus bay design accommodates 60' buses and generally follows the City of Toronto's "between intersections" standard (T-501.1) for articulated buses with 35m tapers and 25m loading area/storage. The transit amenities (bus stops/pads) conform to York Region's 2016 Concrete Bus Pad Specifications and Drawings. (YRT-1.06). Stop locations and transit infrastructure should be re-confirmed during Detailed Design in consultation with YRT.

At locations where the MUP intersect with bus pads, the passenger standing area with shelter is proposed behind the MUP. In select locations the configuration of the bus pad and bus bay is separated where the bus pad is adjacent to the curb. In these locations the triangular area between the separated bus bay and pads are to be paved. Bus pad/shelter configuration with bus bays identified on the preferred design are site specific based on the available property.

The locations of the proposed bus bays and bus stops/pads are illustrated on the preliminary design drawings in **Appendix A**.

10.1.6 Streetscaping and Landscaping

The preferred design was carried out in accordance with York Region's Towards Great Regional Streets design guidelines which state that Regional streets are an integral element in promoting high quality urban design, serving as entryways to communities and encouraging the development of pedestrian-friendly and transit-oriented neighbourhoods. To conform to the guidelines, streetscaping and landscaping opportunities are identified, as feasible and based on constraints, to enhance and improve the quality of urban design along Kennedy Road.

A minimum width of 2.0m is required for the centre median to support landscaping and minimum width of 4.0m to support median tree planting. All median plantings will require an irrigation system. The proposed design provides opportunities for 5.0m raised median, taking advantage of the landscaping opportunity in select locations. All medians where plantings cannot be accommodated shall have unit pavers. Median treatments will be defined during Detailed Design, in consultation with the City of Markham, York Region Forestry and Streetscaping Sections, and subject to available funding.

The preferred design also considers maximizing the available boulevard space for plantings and streetscaping between the roadway, active transportation facilities, and property line. In general, the space in the boulevard between the

active transportation facilities and the roadside curb is dedicated for landscaping. In locations where there is less than 1.0m between curb and AT facility, a splash strip shall be provided. Otherwise, where there is 1.0m or more spacing, topsoil and sod shall be provided. Boulevard space of absolute minimum of 2.9m or greater width (with the preference of 3.5m where possible) is identified as a street tree planting area opportunity, where large form street trees may be planted at 8.0m on centre spacing and small form trees at 6.0m on centre spacing. All boulevards with tree plantings will require the installation of growing media (i.e. soil trench) with a sub-drain. At locations where additional space exists between the active transportation facilities and the property line, consideration during Detailed Design should be given to maximizing this space for landscaping opportunities, including to window streets and 0.3m City reserve if feasible. Additional recommendations for the boulevard tree plantings are summarized as follows and are to be confirmed during Detailed Design:

- The recommended offset distance for tree placement in a boulevard is 4.0m from the curb to the centre of tree. The absolute minimum that will be accepted is 3.5m. Trees planted within 2.0m from face of curb can be considered if located in a 350mm high planter.
- Each tree within the boulevard requires a minimum of 16 cubic metres of soil volume with access to an additional 14 cubic metres of shared soil volume.

Where the boulevard width between AT facility and curb and gutter is less than 2.9m in width, considerations for other landscaping treatments such as grass or other small vegetation should be considered during Detailed Design.

All applicable sight triangles are also considered as potential areas for street trees and other vegetation, as per York Region’s Sight Triangle Design Manual.

Where existing streetscape features are to be impacted as a result of the proposed improvements, features are to be restored or relocated, where feasible. If existing streetscaping/landscaping features (e.g. entry walls, pillars, decorative fencing, planting beds, planter curbs/edges, plaza paving, site furnishing, etc.) are substantially impacted by the proposed road works and if abutting lands are not available for the purposes of shifting the streetscape features, consideration should be made to split the features amongst other entry features that do not have streetscape enhancements to provide a more uniform and consistent look throughout the entire length of the Kennedy Road corridor. Architectural enhancements to all new bridge structures, retaining walls and associated railings to be considered during Detailed Design.

Areas for tree planting opportunities are shown on the preliminary design drawings in **Appendix A**. Streetscaping opportunities are to be confirmed, and a

streetscaping planting plan including individual tree planting locations and tree protection zones is to be developed during Detailed Design.

10.1.7 Intersection Design, Traffic Signals and Illumination

Intersections have been designed in accordance with Accessibility for Ontarians with Disabilities (AODA) standards and to facilitate the movement of all road users, including pedestrians and cyclists. Details regarding intersection designs are to be developed during Detailed Design.

The existing traffic signals from Steeles Avenue to Major Mackenzie Drive are proposed to be maintained and new signalized intersection is proposed at Kennedy Road and Wilfred Murison Avenue. The proposed intersection to be signalized considered future traffic needs, increases in pedestrian traffic, increased crossing distances for pedestrians, and the safety risk associated with unsignalized left-turn movements. A new signal is subject to meeting the signal warrant in consultation with York Region Traffic and Safety section.

The consideration of potential pedestrian and / or traffic signals at Angus Glen Boulevard, School House Road, Castan Avenue and Eton Street are as follows.

- At Angus Glen Boulevard and School House Road, conversion of these intersections to RIRO, traffic signalization or pedestrian signals will be confirmed during the Detailed Design phase in consideration of vehicular traffic, transit service, pedestrians and cyclists. York Region to advise City of Markham if conversion is required

- At Castan Avenue conversion of this intersection to RIRO or traffic signalization will be confirmed during Site Plan Approval process in consultation with the City of Markham and York Region, and subject to the approvals of the Traffic Impact Study (TIS) prepared for the proposed redevelopment

- At Eton Street conversion of this intersection to RIRO or traffic signalization will be confirmed during Site Plan Approval process in consultation with the City of Markham and York Region, and subject to the approvals of the Traffic Impact Study (TIS) prepared for the proposed redevelopment.

Illumination along the study corridor will consider the roadway profile, the urban cross-section, and active transportation requirements. Details will be based on York Region’s illumination standards and will be confirmed during Detailed

Design, at which time the type and location of poles and luminaires will be confirmed.

Left-turn lane storage lengths as proposed in the design may not meet the minimum recommendations from the traffic analysis due to localized constraints at some locations (such as right-of-way availability as a result of backyards adjacent to the road) and should be revisited during Detailed Design.

As the Transit/HOV curb lane will permit right-turn movements, exclusive right-turn auxiliary lanes are not proposed along Kennedy Road.

At the 407ETR off-ramp terminals, the eastbound and westbound off-ramp lane configurations are recommended to maintain the existing lane configuration of dual left- and right-turn lane.

10.1.8 Access

The preferred design incorporates a raised centre median along Kennedy Road between Steeles Avenue and Major Mackenzie Drive where compatible with the existing right-of-way characteristics. Where the raised median restricts full access to individual properties and unsignalized intersections, only right-in-right-out (RIRO) access is accommodated. U-turns are permitted at signalized intersections. The introduction of the raised centre median will result in changes to access to right-in-right-out only as indicated throughout the Kennedy Road corridor Preferred Design drawings included in **Appendix A**. The conversion of driveways and unsignalized intersections to a RIRO configuration will be confirmed in consultation with EMS and York Region's Traffic and Safety section during Detailed Design.

At select locations, access will be provided through gaps in the median where feasible, to provide access as follows:

- Additional access points for emergency vehicle will be provided through flexible median posts with mountable or semi-mountable curb at the centre median. During Detailed Design the Region will consult with EMS services to confirm these locations and identify which are necessary along the corridor.

- At Unionville Montessori School, in agreement with York Region Transportation Planning, the south access will be restricted to right-in, right-out, and the north access will be maintained as a full moves access.

Some driveways along the corridor will need to be re-graded to accommodate the proposed road improvements. Details will be confirmed during Detailed

Design. Property owners will be notified of temporary impacts to driveway access prior to construction and in advance of work related to their access.

10.1.9 Property Requirements

Based on York Region's Official Plan Map 12, York Region may acquire up to 45m right-of-way for Kennedy Road between YMCA Boulevard and Highway 7, and up to 43m right-of-way between Steeles Avenue and YMCA Boulevard and between Highway 7 and Major Mackenzie Drive. Additional land may be acquired to accommodate intersection requirements. The proposed design; however, attempts to minimize property requirements.

During the development of the preliminary design, the project team consulted with affected property owners to optimize the design and further reduce potential property impacts where feasible.

Proposed property acquisition resulting from the proposed design is shown on the preliminary design drawings in **Appendix A,** and summarized in **Table 10-2.** In general, grading will be contained within the proposed right-of-way where feasible. Temporary and permanent easements will be considered for construction, maintenance, and grading purposes. During Detailed Design, opportunities to reduce property requirements and for the use of temporary or permanent grading easements instead of permanent property takings should be reviewed where feasible.

Property requirements identified in this section and shown on the preliminary design drawings in **Appendix A** are preliminary and will be finalized during Detailed Design.

Table 10-2: Property Requirements

Location and Description of Property Requirement	Approximate Area Required (m^2)	Owner
Steeles Avenue to 14th Avenue		
4266 Steeles Ave E Sta. 10+120 to 10+260 and Sta. 10+400 to 10+495 north of Steeles Avenue (west side)	255m2	Private
3 Clayton Drive Sta. 10+550 to Sta. 10+570 north of Clayton Drive (west side)	20m2	Private
272 Kennedy Road Sta. 10+850 to Sta. 10+890 south of Gorvette Road (west side)	95m2	Private
7298-7302 Kennedy Road Sta. 10+890 to Sta. 10+980 south of Gorvette Road (west side)	205m2	Private

Location and Description of Property Requirement	Approximate Area Required (m^2)	Owner
7220 Kennedy Road Sta. 10+980 to Sta. 11+055 south of Gorvette Road (west side)	315m2	Private
1661 Denison Street Sta. 11+105 to 11+250 and Sta. 11+250 to 11+305 South of Denison Street (west side)	1000m2	Private
75 Amarillo Ave Sta. 11+355 to 11+510 North of Denison Street (west side)	460m2	Private
7478 Kennedy Road Sta. 11+510 to Sta.11+620 north of Denison Street (west side)	575m2	Private
7522 Kennedy Road Sta. 11+620 to Sta.11+805 and Sta. 11+820 to Sta.11+845 north of Denison Street (west side)	1285m2	Private
7600 Kennedy Road Sta. 11+845 to Sta.12+065 and Sta. 12+080 to Sta.12+215 south of 14th Avenue (west side)	2650m2	Private
7710 Kennedy Road Sta. 12+215 to Sta. 12+250 south of 14th Avenue (west side)	165m2	Private
7750 Kennedy Road Sta. 12+250 to Sta.12+330 south of 14th Avenue (west side)	360m2	Private
7077 Kennedy Road Sta. 10+115 to Sta. 10+500 north of Steeles Avenue (east side)	2230m2	Private
4394 Steeles Avenue East Sta. 10+535 to Sta. 10+620 north of Clayton Drive (east side)	220m2	Private
262 Old Kennedy Rd Sta. 10+835 to Sta. 10+880 north of Stouffville GO Crossing (east side)	250m2	Private
272 Old Kennedy Rd Sta. 10+880 to Sta. 10+920 north of Stouffville GO Crossing (east side)	95m2	Private
N/A Sta. 10+920 to Sta. 11+010 north of Stouffville GO Crossing (east side)	435m2	Private
7241 Kennedy Road Sta. 11+010 to Sta. 11+140 north of Stouffville GO Crossing (east side)	645m2	Private
7363 – 7373 Kennedy Road Sta. 11+140 to Sta. 11+305 south of Denison Street (east side)	825m2	Private
7381 Kennedy Road Sta. 11+350 to Sta. 11+475 north of Denison Street (east side)	585m2	Private

Location and Description of Property Requirement	Approximate Area Required (m^2)	Owner
7543 Kennedy Road Sta. 11+740 to Sta. 11+760 south of Highglen Avenue (east side)	75m2	Private
7609 Kennedy Road Sta. 11+910 to Sta. 11+935 north of Highglen Avenue (east side)	125m2	Private
7619 Kennedy Road Sta. 11+935 to Sta. 11+960 north of Highglen Avenue (east side)	130m2	Private
7647 Kennedy Road Sta. 11+960 to Sta. 12+035 south of Lee Avenue (east side)	190m2	Private
7681 Kennedy Road Sta. 12+130 to Sta. 12+195 north of Lee Avenue (east side)	500m2	Private
7703 Kennedy Road and 7713 Kennedy Road Sta. 12+195 to Sta. 12+250 north of Lee Avenue (east side)	300m2	Private
7733 Kennedy Road Sta. 12+255 to Sta. 12+300 south of 14th Avenue (east side)	245m2	Private
7749 Kennedy Road Sta. 12+300 to Sta. 12+340 south of 14th Avenue (east side)	155m2	Private
14th Avenue to Highway 7		
7828 Kennedy Road Sta. 12+565 to Sta. 12+625 south of Duffield Avenue (west side)	190m2	Private
7 Main Street Unionville Sta. 13+620 to Sta. 13+645 north of YMCA Boulevard (west side)	95m2	Private
21 Main Street Unionville Sta. 13+705 to Sta. 13+730 north of YMCA Boulevard (west side)	65m2	Private
8210 Kennedy Road Sta. 13+800 to Sta. 13+830 south of Unionville Gate (west side)	40m2	Private
8330 Kennedy Road Sta. 13+905 to Sta. 14+050 north of Unionville Gate (west side)	575m2	Private
8350 Kennedy Road Sta. 14+050 to Sta. 14+215 north of Unionville Gate (west side)	560m2	Private
8360 – 8362 Kennedy Road Sta. 14+215 to Sta. 14+295 and Sta. 14+310 to Sta. 14+440 north of Unionville Gate (west side)	1540m2	Private
8380 – 8392 Kennedy Road Sta. 14+465 to Sta. 14+555 south of Highway 7 (west side)	470m2	Private
4641 Highway 7 Sta. 14+555 to Sta. 14+625 south of Highway 7 (west side)	310m2	Private
7761 Kennedy Road Sta. 12+395 to Sta. 12+420 north of 14th Avenue (east side)	115m2	Private
7781 Kennedy Road Sta. 12+420 to Sta. 12+475 north of 14th Avenue (east side)	240m2	Private

Location and Description of Property Requirement	Approximate Area Required (m^2)	Owner
7821 Kennedy Road Sta. 12+560 to Sta. 12+595 south of Duffield Avenue (east side)	160m2	Private
7831 Kennedy Road Sta. 12+595 to Sta. 12+625 south of Duffield Avenue (east side)	200m2	Private
8111 Kennedy Road Sta. 13+650 to Sta. 13+745 and Sta. 13+775 to Sta. 13+835 south of South Unionville Avenue (east side)	195m2	Private
24 Second Street Sta. 14+520 to Sta. 14+545 south of Highway 7 (east side)	65m2	Private
4661 to 4681 Highway 7 Sta. 14+545 to Sta. 14+625 south of Highway 7 (east side)	320m2	Private
Highway 7 to 16th Avenue		
4780 Highway 7 Sta. 14+680 to Sta. 14+765 north of Highway 7 (east side)	160m2	Private
548 Carlton Road Sta. 15+510 to Sta. 15+590 north of Carlton Road (east side)	410m2	Private
10 Waterbridge Lane Sta. 15+590 to Sta. 15+640 north of Carlton Road (east side)	265m2	Private
9227 Kennedy Road Sta. 16+660 to Sta. 16+690 south of 16th Avenue (east side)	35m2	Private
9249 Kennedy Road Sta. 16+805 to Sta. 16+845 south of 16th Avenue (east side)	110m2	Private
16th Avenue to Major Mackenzie Drive		
4486 16th Avenue and 9286 Kennedy Road Sta. 16+905 to Sta. 17+010 north of 16th Avenue (west side)	355m2	Private
9468 Kennedy Road Sta. 17+465 to Sta. 17+500 south of Wilfred Murison Avenue (west side)	160m2	Private
50 Bur Oak Avenue Sta. 17+925 to Sta. 18+000 north of Bur Oak Avenue (east side)	40m2	Private
9693 Kennedy Road Sta. 18+000 to Sta. 18+075 north of Bur Oak Avenue (east side)	345m2	Private
9721 Kennedy Road Sta. 18+140 to Sta. 18+200 north of Bur Oak Avenue (east side)	215m2	Private

10.1.10 Pavement Design

The preliminary pavement investigation recommendations are detailed in **Appendix M** and are provided for both rehabilitation and widening designs.

With regards to rehabilitation design, various treatments have been considered and are detailed in **Appendix M.**

The following considerations were taken into account when selecting the preferred rehabilitation strategy for each section:

- Geometric and grade restrictions;
- Sustainability, in particular opportunities to reuse existing pavement materials;
- Available construction technologies and experience with the selected rehabilitation strategy in the Region;
- Structural adequacy of rehabilitated pavement; and,
- Cost effectiveness.

Three strategies were developed for the rehabilitation and widening of Kennedy Road, based on the design analysis and existing pavement conditions. The three options are Option 1: Mill and Overlay, Option 2: Full Depth Asphalt Removal, and Option 3: Full Depth Reconstruction.

Based on existing pavement conditions, traffic volumes, a comparison of the three options, and the initial and life cycle costs, Option 1 – Mill and Overlay is considered to be the most suitable and cost-effective design for the rehabilitation of Kennedy Road within the project limits. However, in order to achieve no-grade raise an alternate pavement design was also considered.

The recommended pavement rehabilitation and widening design for Kennedy Road between Steeles Avenue and Major Mackenzie Drive is outlined in **Table 10-3**.

Table 10-3: Pavement Rehabilitation and Widening Design Recommendations for Kennedy Road

Pavement Rehabilitation and Widening Design Recommendations for Kennedy Road between Steeles Avenue and Major Mackenzie Drive	
Section 1: Steeles Avenue to 300m north of Denison Street	• Excavate 1,080 mm (southbound) and 910 mm (northbound) below the proposed grade; • Place and compact Granular B, Type I to a depth of 770 mm (SB) and 600 mm (NB) below the final pavement surface grade; • Place and compact 150 mm of Granular A; and, • Place 160 mm of hot mix asphalt (HMA)

Pavement Rehabilitation and Widening Design Recommendations for Kennedy Road between Steeles Avenue and Major Mackenzie Drive	
Section 2: 300m north of Denison Street to 14th Avenue	• Excavate 920 mm (southbound and northbound) below the proposed grade; • Place and compact Granular B, Type I to a depth of 490 mm (SB) and 560 mm (NB) below the final pavement surface grade; • Place and compact 150 mm of Granular A; and, • Place 210 mm of HMA
Section 3: 14th Avenue to 407ETR	• Excavate 840 mm (southbound) and 1.200 mm (northbound) below the proposed grade; • Place and compact Granular B, Type I to a depth of 450 mm (SB) and 870 mm (NB) below the final pavement surface grade; • Place and compact 150 mm of Granular A; and, • Place 240 mm (SB) and 180 mm (NB) of HMA
Section 4: 407ETR to Highway 7	• Excavate 1,020 mm (southbound) and 930 mm (northbound) below the proposed grade; • Place and compact Granular B, Type I to a depth of 630 mm (SB) and 540 mm (NB) below the final pavement surface grade; • Place and compact 150 mm of Granular A; and, • Place 240 mm of HMA
Section 5: Highway 7 to 16th Avenue	• Excavate 1,200 mm (southbound) and 1,025 mm (northbound) below the proposed grade; • Place and compact Granular B, Type I to a depth of 850 mm (SB) and 675 mm (NB) below the final pavement surface grade; • Place and compact 150 mm of Granular A; and, • Place 200 mm of HMA
Section 5: 16th Avenue to Major Mackenzie Drive	• Excavate 1,020 mm (southbound) and 1,050 mm (northbound) below the proposed grade; • Place and compact Granular B, Type I to a depth of 700 mm (SB) and 730 mm (NB) below the final pavement surface grade; • Place and compact 150 mm of Granular A; and, • Place 170 mm of HMA

Pavement design recommendations need to be confirmed during Detailed Design by a geotechnical engineer.

10.1.11 GO Transit Stouffville Railway Corridor Grade Separation North of Clayton Drive

The final design of the Ultimate Vision Underpass north of Clayton Drive will be subject to the findings and recommendations of the Metrolinx' s GO Expansion program's Stouffville Grade Separations Transit Project Assessment Process (TPAP) which is underway as of February 2020.

10.1.11.1 STRUCTURAL RECOMMENDATIONS

The Recommended design at the GO Transit Stouffville Railway Corridor crossing is to widen Kennedy Road for dedicated Transit/ HOV lanes and improved active transportation facilities and maintain an at-grade crossing until GO Transit increases the frequency of train services. This option does not address vehicle queuing caused by increased GO Train service or safety of at-grade crossing for pedestrians and cyclists. There is no structural component for the at-grade crossing.

The Ultimate Vision at the crossing is to provide an underpass to address vehicle queuing issues once the GO Train service increases. Pedestrians and cyclists will travel along a raised platform within the underpass to minimize travelling distance and are grade separated from the rail crossing. The underpass is a depressed corridor along the section of Kennedy Road under the railway track to by-pass the existing GO crossing. The roadway has a maximum grade of 5% and the active transportation facilities have a maximum grade of 3.1%, which complies with AODA standards. The depressed corridor consists of a concrete slab and retaining walls at both sides of the concrete slab forming a U shaped structure that is approximately 47.8 m in length. The structure is overbuilt on one side to accommodate a grade separated detour road during construction. The design speed for Kennedy Road is 60km/hr.

A two (2) span concrete slab on steel girder bridge is recommended for the railway track. This structure incorporates a semi-integral connection between the superstructure and substructure to eliminate the need for costly maintenance prone expansion joints. The foundation of the substructures will be determined during Detailed Design, as three (3) different types of foundations were recommended in the geotechnical report. Vertical clearance between the bottom flange of the steel girder and the roadway shall not be less than 5 m.

The constructability of this alternative is complex. This is due to the extensive coordination with Metrolinx, York Region, and the City of Markham. Vehicular lanes (2 lanes in each direction) and train traffic must be maintained at all times. It is expected the construction could take multiple years to complete. A significant

area around the railway crossing will be required for closure during the construction.

A temporary railway line is required for the construction of the railway bridge, since it is proposed to construct the bridge in different stages. The temporary railway line could result in substantial project schedule risk due to rail operational coordination factors; i.e. rail traffic and operations must be substantially maintained daily as routine during construction.

The depressed corridor also requires underground storage chambers to collect the stormwater and ground water to prevent from flooding. Water collected by the storage chambers must be pumped from the low point of the depressed corridor.

The design of the depressed corridor will be undertaken in accordance with the CAN/CSA-S6—19 Canadian Highway Bridge Design Code (CHBDC), Ministry of Transportation of Ontario's "Structural Manual", and all other current directives and standards.

The design of the railway bridge will be undertaken in accordance with the latest edition of the American Railway Engineering and Maintenance of Way Association (AREMA) Manual and Metrolinx General Guidelines for Design of Railway Bridges and Structures.

For the Structural Design Report and General Arrangement Drawing refer to **Appendix N.**

10.1.11.2 DEWATERING STRUCTURE EXCAVATIONS

For an underpass configuration, permanent drainage of the roadway and pavements will be required to reduce the potential for hydraulic uplift. During subgrade preparation a subdrain system could be installed beneath the pavement granular materials at an appropriate depth and spacing and of proper size to collect groundwater and direct it to a dedicated outlet. Depending on the retaining structure type selected to construct the underpass, effective drainage behind the walls may also be required. It is expected that either a deep gravity sewer or a pumping station will be required to manage groundwater flows.

If permanent dewatering/drainage is prohibited, the structure should be designed to resist uplift pressure based on a design water level at Elevation 200.6m using either a thickened bottom slab or vertical anchors extending into the underlying till strata.

10.1.11.3 GEOTECHNICAL RECOMMENDATIONS

Field work for the preliminary investigation was carried out on November 19th and 21st, 2018. The following summarizes the findings of the investigation and foundation recommendations. Cohesive and non-cohesive fill was encountered underlying the topsoil in the boreholes. The non-cohesive fill layers indicated a compact level of compaction, and the cohesive fill layers indicated a stiff to very stiff consistency.

A till deposit varying in composition from silt and sand to clayey silt and sand was encountered underlying the fill in both boreholes. A 1.5m thick gravel seam was encountered within the till deposit in one borehole at depth of 10.2m below ground surface. The till deposit was encountered at depths of 1.5m and 2.2m below ground surface in both boreholes respectively. Both boreholes terminated within the till deposit at a depth of 15.9m below ground surface. The silt and sand portion of the till deposit indicated a compact to very dense level of compactness.

10.1.11.3.1 Depressed Corridor

The geotechnical report recommended three (3) different types of foundations including shallow foundations, drill shafts, and driven steel H-piles.

Shallow Foundations

The retaining walls and the undercrossing bridge structure may be founded on conventional spread/strip foundations, depending on settlement tolerances and constructability considerations. All spread footings should be provided with a minimum of 1.4m of soil cover for frost protection. In addition, the footings should extend below any existing fill or surficial organic materials. The allowable bearing capacity, similar to the Serviceability Limit State (SLS) condition, for footings with a minimum width of 3m is 225kPa.

Drill Shafts

Drilled shafts maybe be considered for support of the underpass structure. Drilled shaft installed to the tip elevation of about 184.2m may be designed using the allowable bearing resistance of 1400kN, 2000kN and 2500kN for 0.9m, 1.2m and 1.5m caisson diameters, respectively.

Steel H-Piles

H-piles (HP 310x110) is recommended as an alternative for the shallow foundations. The H-piles driven to the tip elevation of about 177.2m may be designed using an allowable shaft bearing capacity of 650kN.

10.1.11.3.2 Overpass Structure

The geotechnical report recommended three (3) different types of foundations including shallow foundations, drill shafts, and driven steel H-piles.

Shallow Foundations

The overhead structure abutments can be supported on shallow foundations approximately 3m wide, founded on the stiff to hard clayey silt and sand or compact to dense silt and sand till deposits underlying the existing fill can be designed with an Ultimate Limit States Resistance of 300 kPa and factored Serviceability Limit States Resistance of 225 kPa.

Drill Shafts

Drilled shafts maybe be considered for support of the overpass structure. Drilled shaft installed to the tip elevation of about 192.2m may be designed using the factored axial resistance at ULS of 1600kN, 2200kN and 3600kN for 0.9m, 1.2m and 1.5m caisson diameters, respectively.

Steel H-Piles

H-piles (HP 310x110) is recommended as an alternative for the shallow foundations. The H-piles driven to the tip elevation of about 185.2m may be designed using a factored axial resistance at ULS of 1000kN

Refer to **Appendix M** for details regarding the Foundation Report for the GO crossing structure.

10.1.12 CN Rail Structure

10.1.12.1 STRUCTURAL RECOMMENDATIONS

Kennedy Road is proposed to be widened under the existing CN Rail Underpass by adding two additional traffic lanes and two (2) Multi-Use Paths for Active Transportation.

The existing CN bridge will need to be replaced as there is insufficient width to provide 3 lanes of traffic in each direction.

The recommended replacement structure is a post-tensioned solid concrete slab bridge. This four span bridge over Kennedy Road is a continuous, cast-in-place, post-tensioned solid slab concrete. The structure has spans of 11.0m, 18.2m, 18.2m, and 11.0m, with total length of 58.4m and a width of 10.3m, with a design speed of 60 km/hr.

The bridge deck is 1.15m deep, is covered with railway ballast, and carries two railway tracks. There are paved concrete slopes under both end spans and hand railing systems on each side of the deck.

The bridge spans over four 3.3m (inner) traffics lanes, two 3.5m (outer) traffic lanes, two 6.0 m boulevards with two 3.0 m multi-use paths, one 6.2m median, and has a min. vertical clearance of 4.8m.

The substructure consists of reinforced concrete abutments and piers supported on steel piles.

The construction of the replacement of the bridge, is proposed to be undertaken in multiple stages. During the construction, all four (4) lanes of road traffic, pedestrian passage, and railway traffic will be maintained throughout construction. A track detour to the north will be required to carry out the construction while maintaining the railway traffic and will require construction of a temporary rail bridge to support the detour.

For the Structural Design Report and General Arrangement Drawing refer to **Appendix N.**

10.1.12.2 GEOTECHNICAL RECOMMENDATIONS

The field work for the preliminary investigation was carried out on November 22 and 23, 2018. Two boreholes (designated as Boreholes CNR-101 and CNR-102) were advanced in the general location of the existing bridge abutments to depths of 15.7 m. The following summarizes the findings of the investigation and foundation recommendations.

Approximately 350mm of asphalt was encountered at ground surface in both boreholes. Non-cohesive fill comprised of gravelly sand containing trace fines were encountered underlying the asphalt. The non-cohesive fill extends to a depth of .73m below ground surface and indicated a compact level of compactness. Cohesive fill, consisting of sandy silty clay and silty clay, was encountered in some locations underlying the non-cohesive fill and extends to a depth of 2.13m below ground surface, and suggests a firm to very stiff consistency.

A glacial till deposit comprised of silty sand, some gravel to clayey silt and sand, and trace to some gravel, was encountered underlying the fill. The cohesive till deposit indicates a stiff to very stiff consistency. The non-cohesive till deposit indicates a compact to very dense level of compactness. Groundwater was observed at a depth of 9.2m below ground surface.

In the Foundations report, shallow foundations are not considered suitable for the support of the bridge foundations at this site due to the presence of soft to stiff sandy silty clay deposit below the fill.

Steel H-piles or Pipe piles and drilled shafts (caissons) are considered appropriate based on the soft to stiff sandy silty clay deposit below the fill. However, due to the presence of water-bearing granular soils, the construction of drilled shafts will require care during foundation drilling to ensure there is no loss of ground adjacent to and/or below the existing steel pipe piles.

Refer to **Appendix M** for details regarding the Foundation Report for CN Rail Structure.

10.1.13 407ETR Interchange

10.1.13.1 STRUCTURAL RECOMMENDATIONS

The preferred design (Recommended) at the 407ETR interchange consists of the current bridge remaining untouched, and separate AT bridges constructed on the east and/or west sides of Kennedy Road. The new bridges will only be designed to support pedestrian, cyclist and small maintenance vehicle loads, and will carry a 3.0m wide MUP with side clearances over the 407ETR. The width of the AT facility will permit maintenance vehicles. AT users will still have to yield to vehicular traffic when crossing the ramp lanes. The Region, in consultation with 407ETR, MTO and City of Markham, will confirm if an AT bridge is implemented on only one side (either east or west), during Detailed Design.

This design will result in the use of common construction materials and techniques and consists of a long construction duration. Existing maintenance requirements will be significantly increased and lane closures on the 407ETR would be required to access the underside of the bridge, as the AT bridges would not be able to accommodate mobile access/inspection vehicles.

The separate AT Bridges for the 407ETR Interchange allow for the existing bridge's median to remain untouched, but the existing sidewalks will be removed to eliminate the option for pedestrians to use them. The removal of these sidewalks will result in wider shoulders in their place, and the road centreline will be maintained. Modification to the existing bridge will be reviewed and discussed with 407ETR during Detailed Design and in addition to sidewalk removal will require raising the height of the barrier wall.

This design provides the greatest AT separation from automobiles, creating a pedestrian and cyclist friendly environment and significantly improving perceived safety.

For the Structural Design Report and General Arrangement Drawing refer to **Appendix N.**

In addition to the AT bridges over the 407ETR, as an Ultimate Vision, additional AT bridges over the 407ETR on-ramps are recommended to reduce conflict points between vehicles and pedestrians and cyclists crossing the ramps. Timing of implementation of the Ultimate Vision is subject to further discussions with the Region, 407ETR, MTO and City of Markham during Detailed Design.

10.1.13.2 GEOTECHNICAL RECOMMENDATIONS

Field work for the preliminary investigation was carried out on November 20 and 21, 2019, were advanced near the existing bridge abutments to depths of 15.7m below ground surface. The following summarizes the findings of the investigation and foundation recommendations.

The subsurface conditions consist of the Kennedy Road Pavement structure underlain by embankment fill extending up to a 7.0m depth. The fill is underlain by a till deposit ranging in composition consisting of clayey silt and sand to silty clay, which is further underlain by a deposit of silty clay.

Below the approximately 150mm and 155mm thick layer of asphalt pavement encountered at ground surface in Boreholes ETR-1 and ETR-2, respectively, is a 1.2m and 0.7m thick layer of granular road base fill. The granular fill varies in composition from sand to gravelly sand to sand and gravel and extended to depths of 1.4m and 0.9m, respectively, and suggests a dense level of compaction.

A 4.2m and 6.2m thick layer of silt and sand fill was encountered underlying the granular fill at depths of 1.4m and 0.9m and extended 5.6m and 7.1m below ground surface, indicating a compact to very dense level of compactness.

A 9.0m and 7.5m thick till deposit was encountered underlying the silt and sand fill. The till deposit varies in composition from clayey silt and sand to silty clay, trace sand and trace gravel extending to a depth of 14.6m below ground surface, suggesting a stiff to hard consistency, but generally a stiff to very stiff consistency.

A deposit of silty clay, trace sand and gravel was encountered underlying the till deposits at a depth of 14.6m below ground surface indicating a stiff consistency. Groundwater was observed at a depth of 15.0m in Borehole ETR-1 and a depth of 10.8m in Borehole ETR-2.

Shallow foundations are not considered suitable for support of widening the existing bridge foundations (Options 1-5) due to the presence of relatively weak (stiff) clayey silt and sand till deposit below the fill. However, shallow foundations

may be considered suitable for support of the separate AT bridge (Option 6) due to the lower load requirements. Deep foundations are considered suitable for Options 1-5. Driven steel H-piles are recommended as it is the most technically feasible option. Drilled shafts (caissons) are also considered suitable; however, the caisson installation process may result in disturbance of the existing piles (i.e. vibration, soil loosening, and loss of shaft friction due to hydrostatic pressure, etc.). Deep foundations are considered suitable for Option 6, though may not be necessary as shallow foundations may provide sufficient geotechnical resistances.

Refer to **Appendix M** for details regarding the Foundation Report for 407ETR Interchange.

10.1.14 Tributary to Rouge River

10.1.14.1 RECOMMENDATION

To accommodate the wider road platform for Kennedy Road improvements, an increased length for the culvert crossing Kennedy Road is required. The hydraulic modelling for the existing twin corrugated steel pipes (CSP) as documented in **Section 6.8** indicates the existing CSPs don't result in overtopping of the road, however they do not meet the MTO freeboard requirements. To address this and the wider road platform, replacement of the existing twin CSPs is recommended to have a larger opening to reduce the water surface level to meet the freeboard criteria. Refer to **Section 10.1.17** for discussion on drainage assessment at this crossing.

Based on the Fluvial Geomorphological field reconnaissance assessment the Tributary to the Rouge River crossing was recognized to be a drainage features that is largely engineered. Refer to **Section 6.10.**

Since CSPs have a shorter service life and are more prone to corrosion and deformation, precast concrete box culverts are preferable. As CSPs have a shorter service life and subject to corrosion and more deformation, the replacement type that is recommended are two precast 1.8m span embedded box culverts (with headwall). The precast option makes this option more economical.

At the Tributary to the Rouge River crossing the existing twin culverts have an openness ratio of 0.4 (one culvert only) and the new openness ratio is 0.7 (one culvert only) which meets the minimum target openness ratio for the movement of smaller wildlife species that are adapted to nocturnal and / or tunnel like conditions (typically a variety of small to mid-size mammals and amphibians).

The final structure type will be confirmed in consultation with TRCA.

10.1.14.2 GEOTECHNICAL RECOMMENDATIONS

The field work for the preliminary investigation was carried out on November 27 and December 7, 2018. Two boreholes (designated as Boreholes TC-1 and TC-2) were advanced in near the existing tributary culverts to depths between 14.9m and 15.2m. The following summarizes the findings of the investigation and foundation recommendations.

The subsurface conditions generally consist of asphalt and road base granular fill underlain by a deposit, which is underlain by a till deposit that varies in composition from silty sand to clayey silt and sand. Interlayers of silt and sand and gravelly sand were encountered within the till deposit in Borehole TC-1.

A 205mm and 180mm thick layer of asphalt was encountered as ground surface in Boreholes TC-1 and TC-2 and non-cohesive gravelly sand fill was encountered underlying the asphalt in both Boreholes and extends to depths of 1.5m and 0.9m below ground surface, suggesting a compact to dense level of compaction.

A 5.7m to 6.3m thick deposit of silty clay containing some sand to sandy was encountered underlying the non-cohesive fill at depths of 1.5m and 0.9m below the ground surface, suggesting a very stiff to very soft consistency.

In Borehole TC-1, underlying the silty clay deposit, a 1.5m thick layer of silt and sand was encountered at a depth of about 7.2m below ground surface and extended to a depth of about 8.7m, suggesting a loose level of compactness.

A 4.6m to 7.8m thick till deposit varying in composition from gravelly sand silt to clayey silt and sand was encountered underlying the silt and sand deposit in Borehole TC-1 at a depth of 8.7m below the ground surface and underlying the silty clay deposit in Borehole TC-2 at a depth of 7.2m below ground surface, indicating a compact to very dense level of compaction.

In Borehole TC-1, underlying the till deposit, a 2.1m thick layer of gravelly sand was encountered at a depth of 13.3m below ground surface and extended to the borehole termination depth at 15.2m below ground surface, indicating a dense level of compaction.

Groundwater was encountered at a depth of 5.5m below ground surface in Borehole TC-1. In Borehole TC-2, a monitoring well was installed within the sandy silty and gravelly silty sand till deposits, and groundwater depths ranged from 3.5m to 5.7m on three different dates.

Based on the foundations report, it is not recommended to extend the existing pipe culverts or open footing culverts due to the difficulties with connecting the pipes to the concrete elements. Deep foundations are also not considered practical or necessary as this may create unacceptable differential settlement between the existing and new widened structure elements, and are not economical for a culvert of this size.

Instead, the preferred culvert option is to extend the existing CSP arch culverts with matching pipes to accommodate the widening. Alternatively, if consideration is given to full replacement of the structure, CSP pipe(s), box culvert(s) or an open footing culvert with wingwalls are considered feasible culvert options supported on shallow foundations.

Refer to **Appendix M** for details regarding the Foundation Report of Tributary Culvert.

10.1.15 Rouge River Structure

10.1.15.1 STRUCTURAL RECOMMENDATIONS

Immediately north of the Rouge River Crossing is the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive. It was determined that to accommodate the future grade separation of the rail and road (identified as the Ultimate Vision subject to a future grade separation study) that replacement of the Rouge River bridge is required. This is because either an Overpass or Underpass at the rail crossing will require raising of the Kennedy Road profile and subsequent raising of the bridge. As such, to accommodate the Ultimate Vision grade separation of the crossing of the GO Transit Stouffville Railway Corridor crossing north of Austin Drive, the Rouge River bridge will be replaced. The requirements for this new structure will be confirmed through a separate Grade Separation Study at the crossing north of Austin Drive as it is dependent on the grade separation recommendation.

In the interim, the Recommended Design at the GO Transit Stouffville Railway Corridor crossing north of Austin Drive is to provide an at-grade crossing for the widened Kennedy Road. Accommodating this recommendation also results in widening of the Rouge River bridge to provide two additional traffic lanes and multi-use paths for Active Transportation. The bridge super structure requires full replacement to accommodate the proposed widening with widened abutments.

Modification to the existing bridge is required to accommodate the proposed widening. The superstructure will be fully replaced with a wider structure matching the existing span, depth, and elevation of the existing structure. The abutments will be extended to support this wider superstructure and a flatter 1%

cross-slope will be used. These measures are recommended to minimize increases to the Regional upstream flood levels and overtopping that currently exists with the existing structure. Refer to **Section 10.1.17** for discussion on the drainage assessment at this crossing.

The existing Rouge River single-span bridge has an openness ratio of 3.85 and accommodates wildlife passage for large mammals. The new openness ratio is 2.14 due to the increased length to accommodate the widened Kennedy Road but is still within the range for passage of large mammals, and therefore the wildlife passage at the Rouge River will remain unchanged.

This recommendation meets the fluvial geomorphological recommendation for any upgrades/replacement of the structure to provide a width of approximately 30m. Refer to **Section 6.10.**

The final structure type will be confirmed in consultation with TRCA.

10.1.15.2 GEOTECHNICAL RECOMMENDATIONS

The field work for the preliminary investigation was carried out on November 7 and 19, 2018. Two boreholes (designated as Boreholes RR-1 and RR-2) were advanced in near the existing bridge abutments to a depth of 15.7m below ground surface. The following summarizes the findings of the investigation and foundation recommendations.

The subsurface conditions generally consist of asphalt underlain by a thick layer of fill deposit, which is underlain by sequential deposits of sandy silty clary and silty sand and gravel to sandy grave. A sandy clayey silt glacial till deposit is present beneath the gravelly deposit in RR-1 and deposits of silty clay and silty sand are present beneath the gravelly deposit in RR-2.

Groundwater observations were 3.4m and 4.4m below ground surface in RR-1 and RR-2 respectively. The overburden samples from the boreholes were generally moist above 3m below ground surface and wet below 3m below ground surface.

Based on the foundations report, it is not recommended to support the bridge abutments on spread / strip footing (shallow foundations) for either widening the structure or full replacement as they are not considered suitable due to the presence of relatively weak (soft to stiff0 sandy silty clay deposit below the fill.

Driven steel H piles (deep foundations) are preferred for the support of new abutments for widened structure / replacement of the Rouge River Bridge.

Refer to **Appendix M** for details regarding the Foundation Report of Rouge River Structure.

10.1.16 Hydrogeology

The findings of the Hydrogeological Study for the proposed works indicate:

- Temporary dewatering of groundwater inflow and direct precipitation into the excavations will be necessary to maintain suitable conditions for the period of construction.
- Surface Water runoff will be directed away from any open excavation.
- Groundwater should be pumped in a manner to prevent loss of ground.
- No dewatering is expected for the structures located at 407ETR, Tributary to the Rouge River and CN rail crossings at Kennedy Road.
- The Ultimate Vision (underpass) at the GO Transit Stouffville Railway corridor crossing north of Clayton Drive will require a Category 3 Permit To Take Water as construction dewatering estimates exceed the threshold of 400m^3/day. The final design of this crossing will be carried out through a TPAP, by Metrolinx which is underway as of February 2020.
- The Rouge River crossing work for the Ultimate Vision (Bridge Replacement when Kennedy Road crossing north of Austin Drive is grade separated from rail tracks) will require a Category 3 Permit To Take Water as construction dewatering estimates exceed the threshold of 400m^3/day. It is anticipated to be less to accommodate the Recommended Design (Rouge River superstructure replacement and widening of bridge abutments to accommodate at-grade Kennedy Road crossing of GO Rail tracks north of Austin Drive)

Refer to **Appendix M** for further discussion.

The dewatering estimate for the GO Transit Stouffville Railway corridor crossing north of Clayton Drive is summarized in **Table 10-4** and should be reviewed and confirmed during Detailed Design.

Table 10-4: Dewatering Estimate Summary

	GO Rail Crossing at Clayton Drive
Radius of Influence (ROI) (m)	35
Steady State Groundwater Flow (m^3/day)	90
Steady State with Factor of Safety (2)	180
Initial Storage (m^3/day)	713
Precipitation (m^3/day)	256
Total per Excavation (m^3/day)	1,149
Number of Excavations	1
Total All Excavations (m^3/day)	1,149

A long-term dewatering strategy is required for the GO Transit Stouffville Railway corridor crossing north of Clayton Drive as the groundwater seepage will continue to discharge into the excavation. The estimate for the long-term dewatering with factor of safety (2) is 180 m^3/day at this location.

There does not appear to be any water supply wells within the estimated zone of influence for dewatering activities. The other water supply wells within 500m of the proposed excavations are outside the zone of influence and there are no potential impacts to these surrounding water wells are anticipated.

There are two watercourse crossing of Kennedy Road (Rouge River and Tributary to Rouge) and there are no provincially significant wetland along Kennedy Road.

Ground settlement associated with dewatering activities at should be reviewed during Detailed Design.

Refer to **Appendix M** for details regarding the Hydrogeological Study.

10.1.17 Drainage/Stormwater Management Plan

Roadway Drainage

The preferred design recommends widening the road from four to six lanes, addition of 3.0m (2.4m where there is a constraint) multi-use paths on both sides of the road and an underpass at the GO Rail crossing north of Clayton Drive to accommodate the roadway widening and to facilitate grade separation between the roadway and the rail corridor. The preferred design between YMCA

Boulevard and Highway 7 is to accommodate the six travel lanes and continuous AT facilities with a wider centre median that will later be converted to a future rapidway when the Ultimate Vision is constructed. Overall, the existing drainage patterns and discharge locations will not be altered as per the proposed roadway improvements, with the exception of the drainage pattern at the proposed underpass near Clayton Drive. The GO rail crossing north of Austin Drive is proposed to remain as an at-grade crossing, and grade separation options will be evaluated as part of a separate, future study. Additional details are included in **Appendix K.**

Minor Drainage System

The storm sewer system for the ultimate roadway configuration is to be designed for a 10-year storm event as per the York Region Road Design Guidelines. The overall drainage pattern will be consistent with the existing conditions, with the exception of the grade separation location north of Clayton Drive. To accommodate the proposed roadway widening, storm sewer upsizing and catchbasin relocations are anticipated. Proposed roadway drainage will be collected by a series of catchbasins and will be conveyed by storm sewers to the existing storm outlet locations. There are a number of existing outlets for the runoff from Kennedy Road within the study corridor.

Major Drainage System

The roadway design should ensure that the major system runoff up to the 100-year storm event can be safely conveyed to watercourse locations and should allow one lane in each direction to be clear of any flooding. Major system relief will occur at major watercourse crossings and intersections. At these locations, major system inlets will capture the 100-year flow and direct it to the appropriate outfalls. A spread analysis should be completed at the detailed design stage to ensure that the ponding at low points encroaches only onto one lane in each direction.

Hydraulic Assessment of the Proposed Transverse Crossing

Under the proposed conditions, the drainage boundary and design peak flow values for the transverse crossings are considered to remain unchanged compared to the existing conditions. The increase in pavement area as a result of the corridor improvements is negligible in comparison to the large external drainage areas contributing to each watercourse crossing location. Therefore, the design peak flows based on the current land use conditions are used to assess the hydraulic performance of the proposed crossings.

The hydraulic assessment for the proposed crossings is based on the preliminary proposed horizontal road design and vertical centreline profile design. Note that

the proposed inverts, length, and slope of the culvert are to be confirmed during detailed design to accommodate the road design and the roadside ditch grading.

Rouge River Crossing

Under the proposed conditions, the existing bridge over the Rouge River needs to be widened in order to accommodate the proposed roadway widening. The span of the bridge will remain at 30.5 m and the crossing length of the structure will be increased to 31 m. However, widening the bridge with the existing 2% cross fall will result in a negative clearance under the design flow because of the lowered soffit elevation.

The existing bridge does not meet the clearance criterion, as the clearance is negative, and further reducing the clearance is not recommended. Therefore, replacement of the superstructure with the same superstructure depth and a reduced cross fall of 1% is recommended in order to match the existing soffit elevation. Under proposed conditions, the bridge will meet the freeboard criteria, and the Regional Storm event will overtop the crossing by 1.83m, which is 0.02m less compared to the existing conditions. Under proposed conditions, the maximum increase in the water surface elevation upstream of the crossing is 0.01m under the 50-year storm event, which is considered a negligible difference.

A preliminary hydraulic assessment using the updated TRCA HEC-RAS model showed that increasing the bridge span will not result in any considerable decrease in the water surface elevation upstream of the bridge. Therefore, to meet the MTO clearance criterion and reduce the Regional flood depth over Kennedy Road, one option would be to raise the roadway profile. However, the hydraulic assessment showed that any raise in the road profile will result in an increase of the upstream Regional flood levels, since Kennedy Road acts as a weir conveying the flow during the Regional storm event. Raising the road profile means raising the weir invert elevation, which will result in an increase in the flow head over the weir. This is not acceptable to TRCA. Therefore, raising the road profile at the Rouge River crossing is not recommended and increasing the span at this bridge will not be beneficial. Based on these results, it is not feasible to meet the MTO design criteria at this bridge. An emergency response plan will need to be developed for this location to close access to this section of Kennedy Road during the Regional storm event, due to the significant depth of flooding at the road sag.

Updates to the hydraulic modelling, floodplain assessment and revisions to TRCA floodplain mapping shall be completed during detailed design to reflect the final design and grading footprint of the crossing. Additional coordination with

both the City of Markham and the TRCA shall be carried out to finalize the preliminary design of the bridge and to minimize impacts to the watercourse.

Tributary to Rouge River

The hydraulic assessment of the proposed crossings was completed and indicates that under proposed conditions for the 50-year storm event, the freeboard will be 1.0 m, and the Check Flow will not overtop the roadway. Consequently, this crossing will meet the required freeboard criteria based on the proposed culvert replacement.

Details of the proposed bridge and culvert crossing's hydraulic performance are provided in **Table 10-5.**

Table 10-5: Hydraulic Analysis Results for Transverse Crossing (Proposed Conditions)

Water Crossing	Type	U/S Invert (m)	D/S Invert (m)	Length (m)	Road Elev. (m)	Water Surface Elev. (m)			Free-board (m)	Clear-ance (m)	Remarks
						50 Yr	100 Yr	Reg.			
Tributary to Rouge River	Culvert	173.23*	173.00*	48.6	175.00	174.00	174.05	174.19 (Check Flow)	1.0	0.86 (HW/D)	Meets MTO design criteria Check flow does not overtop the road
Rouge River	Bridge	167.33 (Channel Inv.)		31.0	172.07	170.73	170.89	173.90	1.18	0.02** (Clearance)	Meets MTO freeboard criterion but not clearance Regional storm overtops road

*Invert at the top of the embedment
**Based on lowest soffit elevation of 170.91

Grade Separations

A grade separation is proposed at the GO Transit Stouffville Railway corridor crossing north of Clayton Drive, which will result in Kennedy Road being constructed as an underpass at the crossing. This will result in the disruption of the existing drainage pattern at this location, as the roadway profile will be lowered by approximately 7 metres. Under proposed conditions, the runoff generated from will flow towards the underpass sag and will be collected by a series of catchbasins. Based on the available information of the existing storm sewer profile and outlet location, the surface runoff generated within the underpass area cannot be drained to the downstream Steeles Avenue regional storm sewer system by gravity. Therefore, a separate storm sewer system, comprised of over-sized storm pipes and a pumping station, will be required for storage and conveyance of both minor and major flows. Further design details, including required water quality and quantity control measures, are to be provided in the detailed design of the underpass. Metrolinx has initiated the study

of this crossing and further information of the drainage requirements will be provided in the Metrolinx TPAP study.

The Recommended Design for the GO Transit Stouffville Railway corridor crossing north of Austin Drive is for an at-grade crossing widened to six lanes and AT facilities. As the Ultimate Vision, future grade separation options will be evaluated as part of a separate future study. It is understood from preliminary grade separation concepts that the future grade separation options (both underpass and overpass) will require the Rouge River Bridge to be replaced. This will be reviewed and confirmed through the separate future grade separation study for this crossing and subsequent Detailed Design.

Stormwater Management Strategy

The stormwater management plan for the Kennedy Road Class EA Study shall be developed to comply with the MECP Stormwater Management Practices Planning and Design Manual, York Region Road Design Guidelines, City of Markham Stormwater Management Guidelines, and the Toronto Region Conservation Authority Stormwater Management Guidelines.

Water Quality Control

Watercourses within TRCA's jurisdiction are classified as requiring an "Enhanced" level of protection, which equates to 80% Total Suspended Solids (TSS) removal.

Stormwater management (water quality) measures within the study limits will be designed to provide "Enhanced" water quality treatment, as a minimum, for the increased pavement area as a result of roadway widening/improvements.

Water Quantity Control

STORM SEWER SYSTEMS

Within the project limits, the stormwater runoff from Kennedy Road discharges either into existing municipal storm sewers or outlets at watercourse crossings. For locations where the runoff discharges into an existing system, the minor system design storm (10-year storm) peak flows must be controlled to the existing peak flows, for which the receiving system was designed. The receiving storm sewer systems within the project limits are either municipal systems (City of Markham), which would have been designed based on a 5 year storm event, or Regional systems (York Region), which would have been designed based on a 10 year storm event.

For catchments that discharge to existing storm sewer systems, where the ultimate outfall is either the Rouge River Tributary or Bruce Creek, the calculated overall storage volume requirements is considered the larger of the volume

required to control the minor system design storm (10 year storm) to the design capacity of the receiving storm system and the volume required to control the major system design storm (100 year storm) from proposed to existing level.

WATERCOURSE CROSSINGS

TRCA has established quantity control targets for the watersheds under its jurisdiction (TRCA Stormwater Management Criteria and The Rouge River Hydrology Study Update). For the Rouge River watershed, TRCA has no quantity control requirements for storm outfalls to the main branch of the Rouge River located downstream of Major Mackenzie Drive. For the Rouge River Tributary, TRCA requires post-development peak flows to be controlled to pre-development levels for all storms up to and including the 100-year storm event (i.e. 2, 5, 10, 25, 50, and 100 year storm events). For Bruce Creek, TRCA requires post-development peak flows to be controlled to pre-development levels, established by a Unitary Discharge relationship and storage volume to be provided according to a Unitary Storage relationship (Rouge River Hydrology Update, Wood, 2018). However, given the limited space within the ROW of linear infrastructure, it will be difficult to satisfy these criteria; therefore, a best efforts approach to provide sufficient storage to attenuate the post-development peak flow to the pre-development level for all design storm events is recommended.

Pavement Area Analysis

As a Low Impact Development measure, it is recommended that the boulevard areas outside of the active transportation facilities, as well as roadway medians, be surface-treated with permeable material (e.g. grass, permeable pavement, etc.) to minimize the overall increase in impervious area along the Kennedy Road corridor. Since these are not load bearing surfaces, the use of permeable material will not impact the functionality of the proposed design but will provide water quality and quantity benefits though reduced runoff. Therefore, the proposed stormwater strategy was developed considering the boulevard and median areas as pervious. Additional details and specifications for the permeable material are to be included in the detailed design stage.

It was determined that the proposed roadway improvements will result in an increase in pavement area of 6.72 hectares within the Kennedy Road study corridor as presented in **Table 10-6.**

Table 10-6: Pavement Area Analysis

Study Corridor	Existing Pavement Area (ha)	Proposed Pavement Area (ha)	Increased Pavement Area (ha)	Percentage Increase
Kennedy Road	22.43	29.15	6.72	30

Stormwater Management Plan Summary

The proposed stormwater management plan for the project has been developed by examining the opportunities and constraints within the entire study corridor.

Stormwater best management practices, including catchbasin inserts, oil-grit separator units, infiltration trenches and online storage pipes, are proposed for storm water quality treatment, water balance, erosion control, and quantity control of the roadway runoff from the additional pavement areas. The proposed road improvements will result in an additional pavement area of 6.72 ha. As part of the SWM strategy, a total of 6.96 ha of pavement area will receive quality treatment through the proposed infiltration trenches, which exceeds the MECP requirement of providing treatment to the increased pavement area. A total of 6.24 ha of pavement area will receive quantity control through the proposed online storage pipes. Opportunities to implement supplemental BMP measures to provide additional water quality benefits may be considered during the next phases of design in series with the proposed measures to enhance the overall water quality objectives. A summary of the water quality treatment, water balance, and quantity control strategies proposed to mitigate the increase in impervious surface within the project limits is provided in **Table 10-7.**

Table 10-7: Summary of Stormwater Management Plan

Drainage Area ID	Existing Pavement Area (ha)	Additional Pavement Area (ha)	Pavement Area Receiving Quality/ Balance (ha)	Water Quality/ Balance Storage Volume Provided (m^3)	Target Release Rate (m^3/s)	Corresponding Storm Event Return Period***	Quantity Storage Volume Required (m^3)
A-1	1.45	0.41	N/A	N/A	0.59	10-yr	60
A-2	0.29	0.21	N/A	N/A	0.15	100-yr	273
A-3	0.36	0.21	N/A	N/A	0.72	100-yr	273
A-4	1.75	0.57	N/A	N/A	0.72	5-yr	79
A-5	1.39	0.50	N/A	N/A	0.46	5-yr	134
A-6	0.42	0.11	N/A	N/A	0.16	10-yr	16
A-7	1.96	0.53	N/A	N/A	0.63	5-yr	160
A-8	1.04	0.15	N/A	N/A	0.32	5-yr	63
A-9[1]	0.47	0.07	0.35	35	0.27	100-yr	15
A-10[1]	1.81	0.37	2.04	204	1.00	100-yr	74
A-11	1.24	0.18	N/A	N/A	0.48	10-yr	27
A-12[2]	1.20	0.48	1.68	168	N/A	N/A	N/A
A-13[2]	0.68	0.36	1.04	104	0.24	5-yr	83
A-14	0.72	0.28	N/A	N/A	0.24	5-yr	72
A-15	1.17	0.45	N/A	N/A	0.40	5-yr	118
A-16	1.27	0.35	N/A	N/A	0.40	5-yr	104
A-17	1.51	0.53	N/A	N/A	0.60	10-yr	77
A-18[1]	2.67	0.66	1.70	170	0.90	5-yr	212
A-19	1.03	0.29	N/A	N/A	0.41	10-yr	43
Total	**22.43**	**6.72**	**6.80**	**680**	**-**	**-**	**1610**

*Total pavement area is treated in order to meet MECP requirements of treating the overall increased pavement area in the corridor
**Total pavement area is treated due to sensitivity of the receiving watercourse
***Based on the capacity of the receiving storm sewer system

10.1.18 Noise

A Noise Impact Study was undertaken to identify existing noise barriers and determine potential noise impacts resulting from the proposed road improvement activities. The guiding documents and policies used to establish the criteria for the assessment of noise from road traffic are discussed in **Section 6.6.** The requirements regarding noise control measures for various scenarios, including Capital Program Projects are outlined in the guiding documents and identify that mitigation is required when:

- Future noise levels (i.e. mature state of development) at an Outdoor Living Area (OLA) are expected to increase by more than 5 decibels (dB) and start of construction levels are expected to exceed 55 dBA (Leq 16 hrs – 07:00 to 23:00);

- Or when the start of construction or mature state of development noise levels are expected to exceed 60 dBA.

If a noise barrier is deemed necessary, it must provide a minimum attenuation of 6 dB. Noise mitigation may be deferred until future noise levels exceed 60 dBA.

The noise assessment identified the following:

- The Region's Policy sound level criterion for considering noise barrier mitigation is exceeded at nearly all identified representative Outdoor Living Areas that are generally side, or rear facing and do not already have a noise barrier.
- Nine noise barriers are identified that meet the Region's policy requirements at their respective Outdoor Living Areas and were considered effective in mitigating excess traffic noise levels. They are located along Kennedy Road in the segment between 16th Avenue and Highway 7 and identified on the Figures in the Noise Impact Study report in **Appendix J**.
- During Detailed Design, an assessment of the technical, economic and administrative feasibility of constructing the identified additional barriers is required.

Additional details from the Noise Impact Study are included in **Appendix J**.

10.1.19 Air Quality

An Air Quality Assessment was conducted to determine potential impacts of the proposed road widening on local air quality in the vicinity of the study area. The guiding document used to conduct this assessment is the Ministry of Environment, Conservation, and Parks' (MECP) Central Region Draft Document, "Traffic Related Air Pollution: Mitigation Strategies and Municipal Class Environmental Assessment Air Quality Impact Assessment Protocol" (MECP, 2017a, "MECP Central Region Draft Guidance"). The Air Quality criteria used for assessing the air quality effects of the proposed road improvements are summarized in MECP's "Ontario's Ambient Air Quality Criteria" (MECP, 2018a). The assessment also follows federal criteria as outlined in the "Canadian Ambient Air Quality Standards" (CAAQS) and the "National Ambient Air Quality Objectives" (NAAQO).

The "hot spot methodology" was applied as recommended in the MECP Central Region Draft Guidance. The segment of Kennedy Road selected as the Hot Spot Area was Denison Road to Highway 407 as it has the highest future traffic volumes of all segments and highest number of critical and sensitive receptors in close proximity.

Based on the analysis, the results indicate that the proposed road widening will result in a small increase in predicted concentrations of all indicator compounds, with the exception of NO2 which shows a decrease. However, compared to the project criteria outlined in Ontario's Ambient Air Quality Criteria, predicted concentrations of all relevant compounds are below the relevant criteria.

Additionally, the proposed improvements to Kennedy Road will encourage use of transit and carpooling and improve traffic flows within the local vicinity which will minimize the air quality impact.

The proposed Kennedy Road improvements will be a relatively minor source of emissions and the impact on overall air quality in the region is expected to be negligible.

Additional details from the Air Quality Assessment are included in **Appendix Q.**

10.1.20 Utilities

Existing utilities along the corridor based on available information at the time of the EA are described in **Section 6.7**. A Subsurface Utility Engineering Quality Level B investigation (SUE QL-B) was undertaken during the EA study and is provided in the Region's files. Utilities installed or relocated since the timing of the SUE-B would not be reflected in the SUE-B drawing. Existing utilities along the Kennedy Road study area, including the gas line on either side, buried and aerial hydro, buried Bell and buried and aerial CATV on both sides, will be relocated as necessary to accommodate the Recommended (interim) and Ultimate Vision designs.

Storm sewer within the study area will be relocated or replaced as necessary to accommodate the proposed design subject to the condition of the existing sewer.

The location and alignment of existing municipal services is to be confirmed during Detailed Design, which may result in changes to the identified utility impacts. Formal definition of impacts on utilities will be determined during Detailed Design, in consultation with individual utility companies. All utility information should be updated prior to construction to ensure that the data is accurate and to finalize relocation requirements as necessary. During Detailed Design, meetings will be held with utility companies as required where potential impacts to existing or future services are identified.

10.1.21 Heritage Homes

Heritage Impact Assessments (HIA) for the three heritage homes, Thomas Morley House, George Hunter House and Thomas Lownsbrough House, were completed during the EA study given the proposed improvements impact each of the three homes. Each HIA assessed a range of options based on anticipated

impacts for the project and identified mitigation measures for each. Based on the assessment and in discussions with City of Markham Heritage Staff and Markham Heritage Committee a desire to preserve the heritage value / significance of each site was identified through a recommendation to relocate each of the three homes given avoidance of impact was not deemed feasible and demolition was not supported. To confirm the feasibility to relocate each of these three homes, Heritage Relocation assessments were undertaken. Key findings related to these three Heritage Homes are provided below, and the Heritage Impact Assessments and Heritage Relocation Assessments are included in Appendix H**.**

Thomas Morley House (7781 Kennedy Road):

- Property description: 1 ½ storey, frame, built 1851
- Use: Place of Worship uses
- Heritage Status: Part IV Designation (By-law 37-93) and Heritage Easement Agreement
- Relocation feasibility: Building is in good overall condition. Opportunities for relocation are feasible. Structure can be moved in one piece and no demolition is required.

George Hunter House (9286 Kennedy Road):

- Property description: 1 ½ storey frame, built c. 1860
- Use: Vacant, located on Montessori School Site
- Heritage Status: Part IV Designation (By-law 14-96)
- Relocation feasibility:
- West addition is in unsafe condition and not appropriate for relocation, but documentation and replication is recommended.
- Floor assembly is compromised and could need full removal and reinstatement prior to moving but is still a relocatable building. Exterior of building is intact and straight

Thomas Lownsbrough House (9392 Kennedy Road):

- Property description: 1 ½ storey, frame, built c.1845
- Use: Vacant, residential
- Heritage Status: Listed on Register, to be designated and Heritage Easement Agreement as condition of subdivision approval

- Relocation feasibility: House interior is in decent shape. Relocation is feasible.

10.1.22 Preliminary Cost Estimate

Based on preliminary cost estimates, the cost of the recommended improvements is estimated at just under **$240M**. This preliminary cost estimate includes costs for road work, bridge and retaining wall construction, utility relocation, addition of streetlights and traffic signals, bridge and culvert replacement, underpass north of Clayton Drive (Ultimate Vision), landscaping, traffic control, and engineering services; however, property acquisition costs are not included in the estimate.

There are some items which have been excluded from this estimate, which are but not limited to, the following costs:

- Property Acquisition
- Road and rail detours for the construction of the Metrolinx underpass north of Clayton Drive
- CN rail detour bridge and rail detour
- Additional AT bridges over each of the on-ramps (Ultimate Vision) at the 407ETR interchange (estimate includes the two AT bridges over the 407ETR east and west side of Kennedy Road)
- Grade separation for crossing north of Austin Drive (Ultimate Vision)
- Rapidway Design and construction (Ultimate Vision)

The extent of cost sharing with the developers (including stormwater management facilities within the development and storm sewer systems), with the City of Markham (potentially including multi-use paths, boulevards, and illumination), with YRRTC for the Ultimate Vision of the Rapidway and with Metrolinx for the Ultimate Vision underpass design will be confirmed during Detailed Design.

The breakdown of the preliminary cost estimate is provided in **Table 10-8.** It should be noted that the estimated costs are preliminary only and would be reviewed and confirmed during Detailed Design.

Table 10-8 Preliminary Cost Estimate

Component/ Category	Total
Road Removals	**$6,984,559**
Roadwork	**$61,683,972**
Traffic Signals	**$11,687,500**
Streetlights	**$7,810,000**
Hydro	**$3,220,000**
Landscape	**$1,850,519**
Traffic Control	**$19,630,002**
Engineering	**$22,573,310**
Rouge River Bridge Modifications (Recommended Design)	**$5,018,005**
Tributary to Rouge River Culvert	**$968,760**
CN Structure Replacement	**$34,475,064**
407ETR AT Structures (Recommended - for two AT bridges over the 407ETR only on the east and west side of Kennedy Road; does not include costs for Ultimate Vision for additional separate AT bridges at the on-ramps)	**$4,194,073**
Metrolinx Underpass at Crossing North of Clayton (Ultimate Vision)	**$59,376,323**
Subtotal	
Total	**$239,472,087**

10.1.23 Constructability, Staging, and Detour Considerations

Construction staging for Kennedy Road improvements will maintain 2 lanes of traffic in each direction and pedestrian movements equal to pre-construction levels during construction. However, the nature of the required work is such that traffic disruption and delays cannot be entirely avoided. If deemed necessary, temporary, short-term lane closures may be permitted during off-peak hours only.

Impacts will be temporary in nature and the Region will attempt to mitigate impacts as much as possible. During Detailed Design, a traffic management plan will be developed to determine how traffic and pedestrian access will be accommodated during construction and how access to properties adjacent to Kennedy Road will be maintained.

Construction staging and road and rail detour considerations for the underpass at the GO Transit Stouffville Rail Corridor crossing north of Clayton Drive will be developed by Metrolinx's study.

10.1.24 Construction Monitoring and Maintenance Considerations

The reconstruction of Kennedy Road should be staged to maintain both local and through traffic within the study area. Any necessary interruptions to traffic should be kept brief and to a minimum. In particular there should be close coordination with YRT and Metrolinx to minimize impacts on Kennedy Road traffic, YRT buses, rail operations, and EMS operations.

Property owners and tenants may experience temporary interruptions to their property access during construction. To reduce this impact, all property owners should be notified prior to construction and in advance of work related to their access. Detailed design plans should include details to describe how temporary accesses will be maintained, and contract specifications should specify the allowable lengths of closures and the notification requirements to property owners.

Construction of the improvements has the potential to create noise and dust for the adjacent property owners. Construction noise is temporary noise and will vary periodically during the construction depending on the specific activities being performed. Contract specifications will include provisions to define the allowable work hours, in accordance with local ordinances, to minimize impacts to the adjacent landowners in the evenings. However, some considerations will be given to the ability of completing the work in a lesser duration by allowing longer work hours. The impact of construction noise will vary based on the type of equipment used, number of pieces of equipment, time and duration of operation, and the proximity to noise sensitive receivers in question. Construction noise will be kept to a minimum through the use of well-maintained equipment with appropriate noise controls by the contractors.

Removal of existing paved surface and existing landscaping will expose native soils to wind and rain erosion, and result in a temporary increase in dust in the project area. This dust can become airborne as construction traffic runs on the exposed ground and may be noticeable by the adjacent property owners. This increase in dust levels will be temporary, and the application of best management practices, including the application of non-chloride dust suppressants, by the contractor during his normal operations can help to minimize the exposure of native soils to wind and rain erosion.

All waste generated during construction must be disposed of in accordance with ministry requirements and best management practices. Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met.

Communication protocols for construction will be developed during Detailed Design. Generally, if a resident has a concern during construction, they can typically contact either the Construction Administrator (CA) or Communications and Community Engagement Specialist (CCES), or if it is an emergency outside of normal business hours, they can call York Region Roads Dispatch. A Notice of Construction letter distributed prior to the start of construction lists the contact information for the applicable CA (for construction related inquiries) and CCES (for general inquiries) on the project. This information is also posted on the Road Construction page on york.ca. Concerns are entered into York Region's internal tracking system (Cityworks) after which an investigation is conducted as necessary. The resident will receive a follow up from either the CA, CCES, or the project manager depending on the nature of the concern. Residents can also contact the York Region Roads dispatch (open 24/7), who then enters it into Cityworks and forwards it to the applicable business unit for investigation.

Construction and post-construction monitoring plans should be developed during Detailed Design in consultation with MECP and other regulatory agencies.

11. Potential Environmental Impacts and Mitigation

11.1 Anticipated Impacts and Mitigation Measures

The Kennedy Road EA recommendations consist of a multi-modal approach with direction from York Region's Transportation Master Plan and several other planning plans and policies. The proposed design accommodates future travel demand and provides additional north-south transportation capacity to help accommodate future growth. The improvements focus on road widening for Transit/HOV to support Kennedy Road as a Frequent Transit Network Corridor, as well as provision of active transportation facilities to accommodate existing and future users. The recommended design concept supports improved access and operations for all modes. The EA has taken into account potential improvements at structures and the interchange as well as intersection related countermeasures. The proposed cross-section, horizontal and vertical alignment designs aim to minimize impacts to adjacent lands and features, including sensitive natural areas, vegetation, culturally significant features, buildings, and properties outside the road right-of-way; however, although the benefits outweigh the negative effects, there will be some impacts that will need to be mitigated. A summary of the potential impacts to natural, social/economic and cultural environments, together with recommended mitigation measures, is provided in **Table 11-1**.

Table 11-1: Summary of Anticipated Impacts and Proposed Mitigation Measures

Factor	Details/Anticipated Impact	Proposed Mitigation
Social Environment		
1. Land Use and Socio-Economic Impacts	a. Impacts on residents during construction, including increased travel time or possible detours. b. Impacts to driveway access during construction. c. Some driveways will need to be re-graded.	i. Prior to construction, specific notices and contact information will be delivered to area residents and property owners informing them of construction details, including temporary impacts to driveway access prior to construction and in advance of work related to their access.

Factor	Details/Anticipated Impact	Proposed Mitigation
		ii. Maintain access to individual driveways during construction.
2. Archaeology and Cultural Heritage	a. The study corridor beyond the existing right-of-way exhibits low archaeological potential and does not require further archaeological assessment. b. Hagerman East, Hagerman West, St. Philip's On-the-Hill and Bethesda Lutheran Cemetery boundaries abuts the existing Kennedy Road right-of-way and property impacts are anticipated ranging from potential reconstruction of existing retaining walls to property requirements. Impacts to grave sites will be avoided. These sites require additional Stage 3 AA and HIA for property. c. Relocation of three heritage properties (Thomas Morley House, Thomas Lownsbrough House and George Hunter House) as a result of the proposed improvements for Kennedy Road. Relocation has been confirmed feasible through Structural Assessment, Building Relocation Review and Heritage Impact Assessment Studies which have been completed during the EA study for each site (Thomas Morley House, Thomas Lownsbrough House and George Hunter House).	i. Road improvements are planned beyond the disturbed ROW within Hagerman East, Hagerman West, St. Philip's On-the-Hill and Bethesda Lutheran Cemetery boundaries, and a Stage 3 archaeological assessment is required. The proposed design of Kennedy Road will be revised to avoid impacts to any grave sites (for ex. reducing the MUP to a narrow path and signed accordingly). ii. No further archaeological assessment is identified for the rest of the corridor beyond the four cemeteries. iii. If property cannot be avoided then complete an HIA **during Detailed Design** for the impacts to Hagerman East, Hagerman West, St. Philip's On-the-Hill and Bethesda Lutheran Cemeteries as recommended in the CHAR in **Appendix G**. iv. Relocation of Thomas Morley House (7779-7781 Kennedy Road), Thomas Lownsbrough House (9392 Kennedy Road) and George Hunter House (9286 Kennedy Road) will follow as per the findings and recommendations of the completed Heritage Impact Assessment Studies for each site as provided in **Appendix H.** v. **During construction** the following measures are recommended for 7507 Kennedy Road (Smith House), 7779-7781 Kennedy Road (Thomas Morley House), 7782 Kennedy Road (Hagerman

Factor	Details/Anticipated Impact	Proposed Mitigation
	d. In addition, properties with heritage attributes within proximity to the ROW can be avoided but require monitoring from potential impact from construction vibration as per the CHAR in **Appendix G**. e. There is unknown risk for 215 Austin Drive as the CHVI of the property is not confirmed.	West Cemetery), 7791 Kennedy Road (Hagerman East Cemetery), 9286 Kennedy Road (George Hunter House), 9392 Kennedy Road (Thomas Lownsbrough House), 9423 Kennedy Road (Bethesda Cemetery), 9400 Kennedy Road (St. Philip's on-the-hill Cemetery), 9418 Kennedy Road (St. Philip's Anglican Church Manse), 1000 Kennedy Road / 4465 Major Mackenzie Drive (SS#11 Colty Corners School House) and 10060 Kennedy Road (George Pingle House) as outlined in the CHAR in **Appendix G**: a. Include property on project mapping and communicate to all project personnel for avoidance during design and construction b. Erect temporary fencing at the property line during construction of road improvements to ensure its heritage attributes will be buffered from construction activities c. Conduct ground vibration monitoring during construction when working in proximity of the subject site vi. If property cannot be avoided, then complete a Cultural Heritage Evaluation Report (CHER) during **Detailed Design** for 215 Austin Drive to determine its CHVI. If it is CHVI then complete HIA to determine if subsequent mitigation measures are required during construction. vii. Should future work require an expansion of the study area, then a qualified heritage consultant should be contacted in order to confirm the

Factor	Details/Anticipated Impact	Proposed Mitigation
		impacts of the proposed work on potential heritage resources.
3. Noise	a. The Region's Traffic Noise Mitigation Policy and Noise Mitigation SOP provide requirements for noise assessments and mitigation relating to the construction of new or the expansion of existing Regional Roads. A Noise Impact Study (provided in **Appendix J**) predicted future projected sound levels along the study corridor upon implementation of the proposed Kennedy Road improvements. b. Construction of the improvements has the potential to create noise for the adjacent property owners. Construction noise is temporary noise and will vary periodically during the construction depending on the specific activities being performed. The impact of construction noise will vary based on the type of equipment used, number of pieces of equipment, time and duration of operation, and the proximity to noise sensitive receivers in question	i. Predicted noise levels and performance of alternative barrier heights for investigated representative OLAs were assessed. Results indicate the Region's Policy sound level criterion for considering noise barrier mitigation is exceeded at nearly all identified representative Outdoor Living Areas that are generally side or rear facing and do not already have a noise barrier. However only nine noise barriers were considered effective in mitigating excess traffic noise levels and meet the Region's policy requirements at their respective OLAs. ii. Contract specifications should include provisions to define the allowable work hours, in accordance with local ordinances, to minimize impacts to the adjacent landowners in the evenings. Construction noise can be kept to a minimum through the use of well-maintained equipment with appropriate noise controls by the contractors. It is recommended that during the construction period, the following be considered: • All pertinent noise by-laws to be adhered to. • General noise control measures to be included in contract documents where applicable. • Any noise complaints or concerns to be investigated to ensure compliance with the

Factor	Details/Anticipated Impact	Proposed Mitigation
		noise control measures as recommended in the contract documents. The contractor shall be warned for non-compliance and the contract shall be enforced. • Additional noise control measures are to be investigated in accordance with the MECP sound level criteria for construction equipment if a persistent complaint has been made.
4. Property Requirements	a. Potential property acquisition and construction easements are anticipated at some locations as a result of the proposed design. Details are provided in **Table 10-2.** b. Impacts to trees located outside of the existing right-of-way.	i. Formal definition of property requirements to be confirmed during Detailed Design ii. Temporary or permanent easements, modifications to grading slopes (in accordance with geotechnical recommendations) to reduce the amount of area required, or in some cases considering a retaining wall or other type of soil retention feature to minimize grading footprint iii. Where impacts to trees cannot be avoided, compensation will be provided as per a compensation strategy developed during Detailed Design. This will consist of a plan to either replant trees at these locations or provide compensation to the property owner. iv. During Detailed Design, opportunities to optimize design and cross-sectional elements will be reviewed to identify potential to minimize impacts at constrained locations.
5. Climate Change	a. The Ministry of the Environment, Conservation and Parks (MECP) guide, Consideration of Climate Change in	Consistent with York Region's sustainability policies and practices, the project specific recommendations directly support climate change policies. For example:

Factor	Details/Anticipated Impact	Proposed Mitigation
	Environmental Assessment in Ontario, sets out ministry expectations and supports the province's Climate Change Plan by outlining climate change considerations for EA study. The guide notes "climate consideration" within a project means that consideration has been given to methods to reduce greenhouse gas emissions and developing a design that is more resilient to future changes in climate and helps maintain the ecological integrity of the local environment in the face of a changing climate. b. York Region's approach to considering climate change is guided by provincial policies (Growth Plan and Provincial Policy Statement), and embedded in several of the policies, including the: • Province's Growth Plan • Provincial Policy Statement • York Region Official Plan; and • York Region Transportation Master Plan. c. Climate change impacts related to this study are related to operations and maintenance as the transportation sector is one of the biggest contributors to CO2, a key greenhouse gas. Climate Change will also impact the study area in the future as extreme weather conditions will affect the conditions of the roadways and will require more frequent repairs and updates as time passes.	i. Opportunities for tree planting within the boulevard will be explored ii. Low impact development strategies, including thermal mitigation for surface water entering creeks, will be explored as feasible iii. A key objective of the Kennedy Road EA study is to reduce single occupancy automobile use and encourage a more efficient transportation system that: iv. Encourages increased person carrying capacity by prioritizing transit and high occupancy vehicle travel with the Transit/HOV lane and bus bays v. Supports improved YRT service along the study corridor. vi. Grade separation of the GO Transit Stouffville Railway Corridor crossing north of Clayton crossing to minimize congestion vii. Provides active transportation improvements through dedicated off-road facilities viii. The proposed improvements make use of an existing transportation route and propose to accommodate all road users in such a way that minimizes impacts to surrounding areas including residences, businesses, and the natural environment. To mitigate potential effects during the construction phase of the project, the following best practices will be implemented: ix. Develop and implement detailed erosion and sediment control measures to be carried out

Factor	Details/Anticipated Impact	Proposed Mitigation
		during all construction phases in order to limit the amount of sediment/laden material entering receiving drainage systems x. Dust suppression techniques to be employed for the duration of construction activities xi. A traffic staging plan to be developed during Detailed Design to accommodate local access and through traffic during construction to minimize excessive detouring and congestion in alternate routes. Further opportunities to reduce idling to be considered during Detailed Design. xii. Potential effects to consider pertaining to construction include the greenhouse gas (GHG) emissions associated with the construction period, including the physical machinery and equipment, travel distance and time for construction workers to get to and from the site, and the sourcing of building materials. Movement and access to the site for construction vehicles are to be described in the contract documents to be prepared at the time of Detailed Design. Conditions within the contract documents related to idling and hours of work should also be considered. To mitigate potential effects during the operational phase of the project, aligning with best practices for infrastructure design, practices such as the improvement of hydrological data collection, use of models and monitoring localized effects, more frequent monitoring and maintenance and improvement of road design to be more climate change resistant are

Factor	Details/Anticipated Impact	Proposed Mitigation
		recommended. In addition, measures to adapt to climate change impacts and minimize impacts to individuals using Kennedy Road in the future may include (but are not limited to): xiii. Erosion protection techniques developed during Detailed Design to limit the extent of channel and bank erosion in the vicinity of the watercourse crossings along the study corridor xiv. Updating plans for weather emergencies, closures and rerouting during severe weather conditions/events, and traveler information systems to include future climate change projections xv. As the amount of impervious surface areas will increase, appropriate stormwater capacity should be considered to mitigate additional runoff, climate change and the likelihood of extreme precipitation, as described in **Section 10.1.17**. xvi. Exploring opportunities of using LID treatment to store drainage during storm events beyond the minimum requirements will be reviewed during Detailed Design
6. Air Quality	a. The potential impact of the proposed project infrastructure on local air quality was assessed at a representative hotspot location (Kennedy Road between Denison Road and Highway 407) and are detailed in the Air Quality Assessment found in **Appendix Q.** The following conclusions and recommendations are:	i. The proposed improvements to Kennedy Road will encourage use of transit and carpooling and improve traffic flows within the local vicinity which will minimize the air quality impact. Specific mitigation measures are not warranted as a result of the proposed improvements. However, York Region is committed to implementing best practices that will mitigate air quality impacts.

Factor	Details/Anticipated Impact	Proposed Mitigation
	• The predicted concentrations of all indicator compounds from the proposed road improvements are below the relevant project criteria. The project will contribute to a small increase in total emissions for most indicator compounds but will contribute to decreasing the NO2 concentrations. • Total GHG emissions between the Existing and 2041 Future Build scenarios were predicted to have a slight increase but are insignificant compared to Ontario total transportation sector emissions, contributing less than 0.1%. b. Construction activities have the potential to create temporary, localized effects on air quality in the immediate vicinity of the project. Emissions from construction are primarily comprised of fugitive dust and combustion products from the movement and operation of construction equipment and vehicles. c. The MECP Air Quality in Ontario Report 2016 states that air quality is improving and emissions are decreasing: • Overall, air quality has improved significantly over the past 10 years, especially for nitrogen dioxide (NO2), sulphur dioxide (SO2) and carbon monoxide (CO) that are emitted by	ii. Mitigation measures and best management practices during construction of the roadway for reducing emissions during construction activities to reduce air quality impacts are: a. Regular maintenance of equipment used on site to minimize exhaust b. Use of effective dust suppression techniques such as on-site watering, as necessary c. Reducing speed limits on unpaved areas for mobile equipment d. Optimization of material transfer operations, including reducing distance for material transfers, if possible. iii. The recommendations from the Kennedy Road EA study support various Region initiatives and plans to help improve the overall air quality in the Region by implementing active transportation options that reduce emissions: • York Region is managing emissions and greenhouse gases through sustainable transportation infrastructure planning and implementation. • The planting of trees and vegetation promotes healthy and sustainable communities. There will be opportunities for tree planting and landscape features in the boulevards as part of the EA study. Regional and local municipalities throughout Ontario are working with MECP in taking on tree and vegetation planting initiatives to mitigate air quality

Factor	Details/Anticipated Impact	Proposed Mitigation
	vehicles and industry as well as fine particulate matter ($PM_{2.5}$) which may be emitted directly into the atmosphere as a by-product of fuel combustion d. York Region is committed to ensuring the environmental health of its residents. York Region's Corporate Air Quality Strategy, as approved by Council in 2008, identifies region-wide initiatives (not just road corridor specific) which support the management of emissions and greenhouse gases. The corporate Air Quality Strategy can be found at: http://www.york.ca/wps/wcm/connect/yorkpublic/fcfe024d-f5d6-4678-aecef703f3c96a8a/York+Regional+Corporate+Air+Quality+Strategy.pdf?MOD=AJPERES e. Regional initiatives in support of the Corporate Air Quality Strategy include the Transportation Master Plan – a key plan/ policy document that guided the Kennedy Road EA study. f. The 20/20 Way to Clean Air is a program supported and implemented by the Region. This program provides the link between air pollution, energy use, climate change and public health and acts as a guide to help participants cut down vehicle emissions and home energy use. In support of this, York	impacts resulting from the growing population and increasing traffic volumes. For over 15 years, York Region continues to be pro-active in its region-wide and transportation corridor-specific tree-planting initiatives. The addition of trees creates and maintains healthy natural environments that promote healthy, sustainable communities. The York Region Official Plan sets out a woodland cover goal of 25 percent. York Region is working to achieve the goal through various programs, such as York Region's Greening Strategy, the Region's Streetscape Program, Municipal Streetscape Partnership Program and Towards Great Regional Streets. • The Greening Strategy provides a framework for restoring habitat, increasing forest cover, securing greenlands and their linkages and promoting and protecting the natural environment. One of its targets is planting a minimum of 70,000 trees and shrubs annually. • The TMP plans for a more sustainable region by actively taking steps to move more people by public transit, carpooling, on foot and by bicycle and thus shift the focus away from single occupant motor vehicles to more sustainable travel modes. To support increased transit operations, the Region is planning on implementing road improvements including rapid transit and transit priority corridors like Kennedy Road.

Factor	Details/Anticipated Impact	Proposed Mitigation
	Region offers active transportation options and programs including: • Metrolinx Smart Commute program - This Transportation Demand Management program offers services to employers interested in promoting carpooling, transit and other sustainable means of transportation to their workforce for commuting purposes. The goal is to reduce traffic congestion and vehicle emissions throughout the GTA and surrounding areas; • Public Transit: YRT / Viva and GO Transit; • School Transportation Options: Green Communities Active and Safe Routes to School; and • Tips to Reduce Energy Use on the Road.	
7. Source Water Protection	a. The Kennedy Road study corridor, based on the MECP Source Protection Information Atlas and correspondence with TRCA, is located in the Toronto and Region Source Protection Area and parts of the study area are located on lands designated as Significant Groundwater Recharge Area (SGRA) and Highly Vulnerable Aquifers (HVA) as illustrated in **Exhibit 6-6**	i. The additional impervious surface associated with the roadway improvements would reduce the amount of groundwater infiltration from the surface. To offset these impacts and balance water quantity, the stormwater management strategy described in **Section 10.1.17** addresses infiltration of stormwater runoff from the road right-of-way. In addition, the implementation of Low Impact Development (LID) measures will be considered during Detailed Design.

Factor	Details/Anticipated Impact	Proposed Mitigation
	b. Potential threats associated with the Kennedy Road improvements include: • The establishment, operation, or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage (limited to stormwater runoff) • The application of road salt • The storage of snow (limited to roadway clearing operations only)	ii. Additional road salt associated with winter maintenance for the proposed roadway improvements may increase impacts to source water protection areas. Consistent with best management practices and as suggested in the Clean Water Act policies, York Region, and the City of Markham have developed Salt Management Plans for effective winter maintenance while striving to minimize the amount of salt entering the environment and at the same time meeting Provincial legislation related to road maintenance standards for winter services. iii. Although the proposed roadway improvements will result in additional areas to be maintained in the winter, the study area is not in close proximity to municipal wellheads or surface water intakes. As such, snow storage in the boulevards is not anticipated to result in a serious threat to source water protection areas. In addition, York Region, and the City of Markham have developed Salt Management Plans that reduce the amount of salt that is applied during winter maintenance activities, and therefore reduces the amount of salt present in roadside snow banks. The stormwater management strategy (described in Section **10.1.17**) addresses other contaminants that may be present in roadside snow-banks. These would be treated by stormwater management facilities alongside the corridor prior to discharge into receiving watercourses.

Factor	Details/Anticipated Impact	Proposed Mitigation
8. Streetscaping/ Urban Design	a. Impact to existing trees and landscaped features in the boulevard	i. Where impacts to trees cannot be avoided, compensation will be provided as per a compensation strategy developed during Detailed Design. ii. Impacted features will be restored or relocated, where feasible iii. Increased opportunity for aesthetics throughout the corridor with the provision of landscaped boulevards and median where feasible to be implemented within the right-of-way. iv. Consideration should be given to: • Raised landscaped medians where space allows • Street trees on both sides of the road where space allows • Enhancements to bridge structures such as architectural detailed parapet walls and columns, bridge plaques, anodized aluminum parapet wall railings v. Consideration of enhancements to retaining walls with architectural form liners, armour stone or modular concrete block retaining wall units. vi. Consideration of enhancing pedestrian and cyclist railings to coloured anodized aluminum where applicable
9. Utilities	a. Existing utilities in conflict with proposed improvements.	i. A relocation plan will be developed during Detailed Design as necessary. ii. All utility information will be updated prior to construction to ensure that the data is accurate and

Factor	Details/Anticipated Impact	Proposed Mitigation
		to finalize relocation requirements as necessary, in consultation with utility companies.
10. Construction Detours/ Temporary Lane Restrictions	a. Inconvenience during construction	i. Impacts will be temporary in nature. The Region will attempt to mitigate impacts as much as possible. ii. During Detailed Design, a traffic management plan will be developed to determine how traffic will be accommodated during construction and how access to properties adjacent to Kennedy Road will be maintained. iii. Construction detours for rail and road traffic for the construction of the underpass design at the crossing north of Clayton will be developed by Metrolinx. iv. Construction detours for rail and road traffic for the construction of the CN Rail overpass temporary and permanent structure designs will be developed during Detailed Design in consultation with CN, City of Markham and York Region
Natural Environment		
11. Vegetation and Vegetation Communities	a. Vegetation communities identified within the study area consist mostly of manicured areas with amenity trees planted. Overall, the vegetation communities are considered to be widespread and common in Ontario and secure globally. b. Kentucky Coffee-trees were identified within the study area and are considered Threatened by the Ontario ESA 2007 and.	i. It is expected that plant species displaced and/or disturbed within the cultural vegetation communities due to the road improvements will re-colonize available lands adjacent to the new right-of-way post construction. Disturbance activities often serve to promote the establishment and/or spread of certain plant species (including the disturbance-tolerant species identified within the existing right-of-way).

Factor	Details/Anticipated Impact	Proposed Mitigation
	However, in consultation with the MNRF biologist is has been confirmed that they are not treated as protected under the ESA 2007 due to their non-native origin in the corridor and therefore no consultation with MNRF in regard to Kentucky Coffee trees is required. c. Wetlands are located in vicinity of the study area in an isolated area near Gorvette Road. Impacts to wetlands will primarily be to the outer edge of communities and anticipated that it will not impact the function of remaining portion of the wetlands. There are no Provincially Significant Wetlands or Areas of Natural and Scientific Interest located within the study are, nor located within 120 metres of the study area. d. Cultural Meadow communities are located south of Gorvette Drive, near the 407ETR interchange and CN crossing, Rouge River and west of Bur Oak Avenue. They are noted to typically persist in areas that are regularly disturbed, and as a result generally contain a higher proportion of invasive and non-native plant species that are disturbance tolerant. The natural areas with the Rouge River include numerous early to mid-successional vegetation communities many of which are bisected by established paths.	ii. Preparation of a Tree Preservation Plan with designation of Tree Protection Zone (TPZ) and recommendations for mitigation measures to be identified during Detailed Design as per the Arborist Report provided in **Appendix F.** iii. Regionally rare plant species be retained, to the extent possible. If impacts are unavoidable, it is recommended that these plant species, including individual shrub and trees that measure less than 10 cm DBH, be transplanted into suitable habitat conditions. Where possible, these plants should be transplanted into the newly created edges of those impacted communities, but outside the limit of disturbance. iv. Forest edge management is recommended and will adhere to Forest Edge Management Plan Guidelines (TRCA 2004). v. Wetland impacts to be confirmed during detailed design. The size of impact (1.55m2) south of 407ETR is anticipated to be inconsequential and efforts will be made during Detailed Design to avoid any loss of wetland communities. vi. Where impacts to vegetation (vegetation and wetland) cannot be avoided, compensation will be provided as per a compensation strategy developed during Detailed Design at a rate determined with agencies. Compensation for loss of vegetation communities will be in accordance with the Guideline for Determining Ecosystem Compensation (TRCA 2018).

Factor	Details/Anticipated Impact	Proposed Mitigation
	e. Within the study area there are no provincial plant species of concern, and all species have populations that are considered secure. No other species of TRCA concern or species rare in York Region were located in the study area. White Oak, White Spruce, and Black Walnut were observed planted in manicure strips adjacent to Kennedy Road and are L3 or L5 TRCA ranked. Black Walnut was also observed as naturally occurring within cultural meadow and cultural woodland communities.	
12. Fisheries and Aquatic Habitat	a. Temporary disruption or permanent loss of site-specific habitat b. Temporary changes to water quality c. Changes in water temperature d. Barriers to fish passage e. Rouge River is considered as contributing habitat for Redside Dace as confirmed by MNRF in a meeting in June 2018 where it was confirmed that permitting under the ESA is not required. f. Tributary to Rouge River is not identified as Redside Dace habitat g. Accidental spills in watercourses during construction	i. Work within riparian habitat will be permitted from July 1 to September 15 at the watercourse crossing (to be confirmed by MECP/MNRF and TRCA during Detailed Design) ii. Habitat impacts will require compensation iii. Work areas will be delineated with construction fencing to minimize the area of disturbance iv. Appropriate sediment control structures will be installed prior to and maintained during construction to prevent entry of sediments into the watercourse v. Good housekeeping practices related to materials storage/stockpiling, equipment fueling/maintenance, etc. will be implemented during construction vi. Disturbed riparian areas will be vegetated and/or covered with an erosion control blanket as quickly

Factor	Details/Anticipated Impact	Proposed Mitigation
		as possible to stabilize the banks and minimize the potential for erosion and sedimentation vii. Changes to water quality will be mitigated through the deployment and maintenance of erosion and sediment controls (silt socks, coir logs, etc.) which will prevent sediments from reaching the watercourses from exposed soils upslope viii. Exposed areas will be vegetated as quickly as possible once the work is completed ix. Restoration of disturbed riparian areas associated with slope works should focus on the replacement and enhancement of the riparian vegetation that will be affected by the proposed works. x. Require DFO screening under the Fisheries Act required during Detailed Design to confirm next steps xi. During Construction spills will be reported and documented to MECP's Spill Response Hotline. Efforts will be made to contain a spill if it is safe to do so.
13. Wildlife and Wildlife Habitat	a. Displacement of wildlife and wildlife habitat b. Barrier effects on wildlife passage c. Wildlife/vehicle conflicts d. Disturbance to wildlife from noise, light and visual intrusion; e. Potential impacts to migratory birds f. Displacement of rare, threatened or endangered wildlife or significant wildlife.	i. Structure widening at Rouge River maintains wildlife passage for large mammals. ii. Consideration of wildlife fencing at the Rouge River to direct wildlife under/through the structures rather than across the roadway during Detailed Design. iii. Clearing or disruption of vegetation where birds may be nesting will be completed outside the window of April 1 to August 31 to avoid the

Factor	Details/Anticipated Impact	Proposed Mitigation
	Displacement of species at risk habitat is not anticipated. g. Impacts to designated natural areas	breeding bird season for the majority of the bird species protected under the act iv. No clearing or disruption to vegetation to occur between April 1 and August 31 to avoid the breeding season for the majority of the bird species protected under the act. If clearing or disruptions are required in this period, a nest screening survey needs to be conducted by a qualified avian biologist. v. In the event that these activities must be undertaken from April 1 to August 31, a nest screening survey will be conducted by a qualified avian biologist. If an active nest is located, a mitigation plan shall be developed and provided to Environment Canada – Ontario Region for review prior to implementation. vi. Construction duration and disturbance in the vicinity of the culvert and bridge will be minimized to the extent possible to reduce the potential for increase in road mortality caused by wildlife avoidance of these structures. vii. No permitting under the ESA is anticipated for wildlife, however consultation during detailed design phase with MECP is warranted. viii. Preparation of edge management plans, restoration plans, invasive species management plans and ecological offsets in accordance with TRCA guidelines and policies as required and determined during Detailed Design.

Factor	Details/Anticipated Impact	Proposed Mitigation
14. Groundwater / Hydrogeology	a. An assessment of the hydrogeology within the Study Area was conducted, including dewatering estimates. The findings are summarized in **Section 10.1.16.** Additional details pertaining to the Hydrogeological Investigation are provided in **Appendix M.** b. Based on the review of MECP water well records, there is only one water supply well (located 100m south of the Rouge River crossing) within the preliminary estimated zone of influence for dewatering activities. However, it is anticipated that this well is no longer in use as the area is municipally serviced.	i. When the potential daily withdrawal construction dewatering estimate are greater than 50 m^3/day but less than 400 m^3/day, an Environmental Activity and Sector Registry (EASR) may be required to permit the construction dewatering as stipulated by MECP. An EASR for construction dewatering would apply to the entire project and therefore construction would need to be staged such that the dewatering demands of the entire project do not exceed the 400 m^3/day limit at any time. If simultaneous dewatering is required that would result in the project takings exceeding the 400 m^3/day rate, then a Permit to Take Water (PTTW) would be required from the MECP to permit this level of water taking. ii. No dewatering is expected for the structures located at 407ETR, Tributary to the Rouge River and CN rail crossings at Kennedy Road. iii. The ultimate design at the underpass at GO Transit Stouffville GO Railway corridor crossing north of Clayton Drive will require a Category 3 Permit To Take Water as construction dewatering estimates exceed the threshold of 400m3/day. This is also the case if the recommendation for the Ultimate Vision (grade separation north of Austin Drive is determined to be an Underpass), and for the Ultimate Vision at Rouge River (bridge replacement to accommodate the grade separation north of Austin Drive), then a Category 3 Permit To Take Water is likely required. For the Recommended at the Rouge River crossing (for

Factor	Details/Anticipated Impact	Proposed Mitigation
		superstructure replacement and bridge abutment widening when the rail crossing north of Austin remains at-grade) the dewatering will be less. iv. A long-term dewatering strategy is required for the GO Transit Stouffville GO Railway corridor crossing north of Clayton (permanent pumping station).This is also the case if the recommendation for the Ultimate Vision (grade separation north of Austin Drive is determined to be an Underpass) then a long-term dewatering strategy is likely required. v. Once engineering drawings for structural improvements are finalized, detailed dewatering estimates will be completed prior to commencing construction to determine and support permitting requirements.

Factor	Details/Anticipated Impact	Proposed Mitigation
15. Surface Water	a. Impacts resulting from any excavating or cut and fill operations will be temporary in nature b. Changes to the existing pavement area may result in an increase in quantity runoff	i. Erosion and sedimentation mitigation measures will be implemented prior to the construction phase. Control measures will include, but not be limited to: limiting the geographical extent and duration soils are exposed to the elements; implementing standard erosion and sediment control measures in accordance with Ontario Provincial Standard Specification (OPSS); and managing surface water outside of work areas to prevent water from coming in contact with exposed soils. ii. Monitoring of erosion and sediment control measures during and after construction will be implemented to ensure their effectiveness. These environmental measures should reduce/ minimize adverse environmental impacts iii. A preliminary drainage/stormwater management plan has been prepared to mitigate potential changes to the existing pavement area resulting from potential increase in quantity runoff. This plan will be reviewed and finalized in Detailed Design. iv. An emergency response plan will need to be developed for the location at the Rouge River to close access to this section of Kennedy Road during the Regional storm event, due to the significant depth of flooding at the road sag.
16. Soil Removal and Contaminants	a. Potential for fill material and salt-related impacts as a result of roadway de-icing activities may be present in the study area.	i. An assessment of the quality of the fill material and any sub-surface soils is recommended as part of the proposed construction activities prior to the

Factor	Details/Anticipated Impact	Proposed Mitigation
	The quality and source of this suspected fill material and any salt-related soil and groundwater impacts are unknown. b. Potential for removal of contaminated soils. c. Management of excavated soil must not result in the discharge of a contaminate into the natural environment that causes or may cause an adverse effect. Should this occur, appropriate mitigation measures are required. d. Potential impacts to properties associated with issues of potential environmental concern and spill locations. The study corridor contains 29 properties with potential environmental concern; 20 low risk, 9 moderate risk and 0 properties with high risk. Of the properties identified with potential environmental concern, 20 properties are anticipated to be impacted by the proposed design. These anticipated impacts consist of either proposed property acquisition or grading easement. Buildings within the subject properties are not anticipated to be impacted, and impacted areas are restricted to those adjacent to the existing road right-of-way. The properties with issues of potential environmental concern as well as their associated risk ranking are provided in the Contamination Overview Study are included in **Appendix O.**	reuse of any excavated and/or excess material. Similarly, the quality of water generated during any construction/dewatering activities should be assessed prior to being discharged into the environment ii. If soil removed during construction is determined to be contaminated, the disposal of contaminated soil is to be consistent with Part XV.1 of the Environmental Protection Act and Ontario Regulation 153/04, Records of Site Condition, which detail the requirements related to site assessment and clean up. In addition, should contaminated soil be present at the site, the MECP's York Durham District Office is to be contacted for further consultation. iii. Activities related to management of excess soil through construction should be completed in accordance with MECP's new regulation released December 2019, titled "On-Site and Excess Soil Management" (O. Reg. 406/19). This document provides guidance on proper management of excess soils, ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. iv. Should there be discharge of a contaminate into the natural environment, notice of the discharge

Factor	Details/Anticipated Impact	Proposed Mitigation
		must be provided in accordance with the provisions of the Environmental Protection Act, R.S.O 1990, c. E. 19 (EPA). v. If, at any time, the management of excavated soil or excess soil causes an adverse effect, such as odour, litter, dust, noise, or other impacts to the natural environment or water quality, appropriate preventive and remedial actions will immediately be taken to alleviate the adverse effect or impact. Until these issues are addressed, all soil management activities may need to be suspended, including soil excavating, transporting or receiving. vi. Proposed works adjacent to properties identified as having a moderate risk ranking for contamination concern should be adequately assessed during Detailed Design. If subsurface work is to be conducted in the vicinity of any of the properties identified as having issues of potential environmental concern, further investigations including Phase I and Phase II ESAs may be required and will be undertaken during Detailed Design. If impact is encountered, it should be managed in consultation with a qualified professional. vii. Each spill location would require additional subsurface environmental investigations to assess related impacts

11.1.1 Greenbelt Plan, 2017

The Greenbelt Plan, 2017 (GBP) identifies environmentally and agriculturally protected lands within the Golden Horseshoe, where urbanization should not occur, in order to provide permanent protection to these ecological features and functions, and agricultural lands.

The Rouge River watercourse crossing within the study area falls within the Urban River Valleys designation of the Greenbelt Plan and are subject to Section 6 policies from the Greenbelt Plan.

Section 6.2.3 (3) of the Greenbelt does allow for infrastructure projects within natural heritage features subject to approvals under the Environmental Assessment Act. Section 4.2.1(1) and 4.2.1(2) of the Greenbelt Plan outlines the general policies for infrastructure projects. **Table 11-2** documents how this Class EA meets and complies with these guidelines.

Table 11-2: Kennedy Road EA Study's Compliance with GBP Requirements

Greenbelt Plan Requirements	How the GBP is addressed in this Study
The Requirements of Section 6 of the GBP Watercourse crossings in the study area fall within the Urban River Valleys designation of the Greenbelt Plan and are subject to Section 6 policies from the Greenbelt Plan	
1. Only publicly owned lands are subject to the policies of the Urban River Valley designation. Any privately owned lands within the boundary of the Urban River Valley area are not subject to the policies of this designation. For the purposes of this section, publicly owned lands means lands in the ownership of the Province, a municipality or a local board, including a conservation authority.	Crossing are on lands which are publicly owned.
2. The lands are governed by the applicable official plan policies provided they have regard to the objectives of the Greenbelt Plan.	Widening the road from 4 to 6 lanes for Transit/HOV lanes and Active Transportation Facilities will help accommodate growth within the City and Region by providing different travel options and creating better connections to support goods and people movement.

Greenbelt Plan Requirements	How the GBP is addressed in this Study
3. All existing, expanded or new infrastructure which is subject to and approved under the Environmental Assessment Act, or which receives a similar approval, is permitted provided it supports the needs of adjacent settlement areas or serves the significant growth and economic development expected in southern Ontario and supports the goals and objectives of the Greenbelt Plan.	Widening the road from 4 to 6 lanes for Transit/HOV lanes and Active Transportation Facilities will help accommodate growth within the City and Region by providing different travel options and creating better connections to support goods and people movement.
4. The Protected Countryside policies do not apply except for: a) The policies of section 3.2.6 External Connections; and b) The policies of section 3.3 Parkland, Open Space and Trail policies: The Province should, in partnership with municipalities, conservation authorities, non-government organizations and other interested parties: 1. Encourage the development of a system of publicly accessible parkland, open space and trails where people can pursue the types of recreational activities envisaged by this Plan, and to support the *connectivity* of the Natural Heritage System and the achievement of *complete communities* in *settlement areas* across the Greenbelt. 2. Encourage the development of a trail plan and a coordinated approach to trail planning and development in the Greenbelt to enhance key existing trail networks and to strategically direct more intensive activities away from sensitive landscapes. 3. Promote good stewardship practices for public and private lands within the Greenbelt, including clear demarcation of where public access is permitted.	There are no External Connections from the Greenbelt Plan that fall within the limits of the study corridor. Continuous active transportation facilities for pedestrians and cyclists are recommended along the corridor on both boulevards.
The Requirements of Section 4.2.1(1) of the GBP	
All existing, expanded or new infrastructure subject to and approved under the Canadian Environmental Assessment Act, the	Widening the road from 4 to 6 lanes for Transit/HOV lanes and Active Transportation

Greenbelt Plan Requirements	How the GBP is addressed in this Study
Environmental Assessment Act, the Planning Act, the Aggregate Resources Act or the Telecommunications Act or by the National or Ontario Energy Boards, or which receives a similar environmental approval, is permitted within the Protected Countryside, subject to the policies of this section and provided it meets one of the following two objectives: a) It supports agriculture, recreation and tourism, Towns/Villages and Hamlets, resource use or the rural economic activity that exists and is permitted within the Greenbelt ***(GBP – Section 4.2.1 para. 1(a))*** b) It serves the ***significant*** growth and economic development expected in southern Ontario beyond the Greenbelt by providing for the appropriate infrastructure connections among urban centres and between these centres and Ontario's borders. ***(GBP – Section 4.2.1 para. 1(b))***	Facilities will help accommodate growth within the City and Region by providing different travel options and creating better connections to support goods and people movement.
The Requirements of Section 4.2.1 (2) of the GBP The location and construction of infrastructure and expansions, extensions, operations and maintenance of infrastructure in the Protected Countryside are subject to the following:	
Minimize the Amount of the Greenbelt Traversed and/or Occupied by the Infrastructure (GBP – Section 4.2.1 para. 2(a)) Demonstrate how the amount of greenbelt traversed or occupied by the infrastructure has been minimized	The preferred option minimizes the amount of Greenbelt traversed with the proposed works essentially being along the existing alignment.
Minimize Impacts on the Existing Landscape (GBP – Section 4.2.1 para. 2(b)) Describe how modifications to the existing landscape will be minimized	Widening about the centreline was selected as the recommended design for all four segments of the Kennedy Road Corridor. Balancing the impacts on both sides of Kennedy Road will minimize impacts on either side of the street. The preferred recommendation would have the least impact as it follows a best fit approach, where widening is proposed along the centreline with

Greenbelt Plan Requirements	How the GBP is addressed in this Study
	localized alignment shifts in a context sensitive manner and would balance the impacts and maximize the available right-of way.
Coordination with Other Infrastructure (GBP – Section 4.2.1 para. 2(c)) Identify other infrastructure ROWs or facilities located within the vicinity of the project regardless of ownership.	The proposed works for the Kennedy Road corridor will be coordinated in conjunction with the Metrolinx, 407ETR, and MTO.
Avoid Key Natural Heritage Features (KNHFs) and Key Hydrologic Features (KHFs) unless needed and no reasonable alternative demonstrated (GBP – Section 4.2.1 para. 2(d)) Choose the option that is able to avoid traversing or occupying KNHFs or KHFs if possible.	Widening about the centreline was selected as the recommended design for all four segments of the Kennedy Road Corridor. Balancing the impacts on both sides of Kennedy Road will minimize impacts on either side of the street. There are no Provincially Significant Wetland (PSW) or Environmentally Significant Area (ESA); in the study area.
Minimize Negative Impacts on KNHFs and KHFs and, where reasonable, maintain or improve connectivity (GBP – Section 4.2.1 para. 2(e)) Planning, design and construction practices to be adopted that will minimize adverse effects on KNHFs and KHFs.	**Table 11-1** provides details on anticipated impacts and proposed mitigation measures to be used to minimize impacts on vegetation, wildlife, fisheries and aquatic habitat, surface water, ground water and other factors.
(GBP – Section 4.2.1 para. 2(f), 2(g) and 2(h))	***Not applicable to the study area***

11.2 Key Agency Direction

Key comments, direction, and requirements from agencies are outlined in the following sections. More details are provided in the correspondence in **Appendix C**, and additional details/correspondence is maintained in York Region's project files.

11.2.1 York Region Rapid Transit Corporation (YRRTC)

YRRTC provided the following key comments and worked with the project team:

- The Rapidway requires a centre median rapidway with dedicated transit lanes to allow for the potential for future Light Rail Transit in the longer term. Prior to the construction of the rapidway, the Viva transit vehicles can operate in the Transit/HOV lanes.
- Transition from six-lane widening for Transit/HOV to the Ultimate Vision for the Rapidway should minimize reconstruction costs including utility relocations. Request to plan for the ultimate boulevards and construct a larger centre median so future conversion to the centre median rapidway will not require the boulevards to be reconstructed to minimize disruption and additional costs. To provide additional buffer to BRT lanes for the Ultimate Vision consider re-allocation from the boulevard to the road when confirming the typical section during Detailed Design. This would also be reflected in the Recommended Design boulevards.

11.2.2 Toronto and Region Conservation Authority (TRCA)

TRCA provided comments and worked with the project team throughout the course of the study. In particular:

- A TRCA permit under *Ontario Regulation 166/06- Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* will be required for all works within regulated areas (includes channel realignments, where a coordinated design and review process to address both TRCA and Department of Fisheries and Oceans (DFO) requirements will be necessary)
- For the areas draining to existing infrastructure, please confirm the ultimate discharge location. For areas where existing infrastructure discharges immediately to TRCA regulated area please provide and/or confirm SWM treatment.
- As the bridge structure is located within the 100-year erosion limit, please ensure the abutments are protected from scouring. The EA to include

discussions on erosion protection and the detailed design to include calculations and/or models to demonstrate how erosion protection is sufficient.

11.2.3 City of Markham

The City of Markham provided input throughout the study. Direction included:

- Anti-whistling measures at GO Transit corridor crossings are being constructed at the various rail crossings and need to be maintained during construction.
- Pedestrian conflict points at the 407ETR Overpass ramp crossings need for safe automobile/pedestrian interaction. Subsequently an Ultimate Vision for the separated 407ETR was identified to provide for additional AT structures over the on-ramps to be discussed in Detailed Design.
- Preference for AT facilities on both sides of the 407ETR and during Detailed Design would like to provide input if one side is selected.
- Preference is for a continuous multi-use path (MUP) on both sides of the cemeteries and include path of non-standard width rather than only sidewalk in order to maintain cycling access on both sides of Kennedy Road and provide signage for warning for narrow path.
- Heritage Markham is supportive of relocation of the three Heritage Homes impacted by the project; but not supportive of demolition of the homes.
- Supportive of MUP recommendation but request to increase the Active Transportation facility width to 3.5m to allow for future conversion to cycle track and sidewalk. In subsequent discussions with the Region it was understood due to constraints in the study corridor the MUP provides a consistent AT facility type and there is insufficient space for separated cycling and pedestrians. There is also insufficient space to provide for a wider MUP and balance opportunities for plantings and LID treatments. In Detailed Design opportunities to widen the MUP while balancing streetscaping and LID treatment requirements can be considered.
- The two MUPs on separate structures for the Ultimate design that are crossing over Hwy 407 will need to consider winter maintenance operations.
- Review the need for wildlife passage accommodation at Rouge River proposed structure improvements / replacements.

- Milliken is identified as an intensification area in the City's Official Plan, envisioned as a pedestrian friendly and transit supportive community. Based on the work to date for the Milliken Secondary Plan update, a large portion of Kennedy Rd through the secondary plan area is identified as Mixed Use High Rise. The streetscape design through this area needs to balance active transportation needs, the requirements of the future grade separation, in addition to a design that supports active retail frontages envisioned for this area.
- Preference for soft landscaped areas over hard surfaces.
- Consider tree plantings opportunities on private yards when tree planting opportunities within Kennedy Road ROW are constrained.
- Request to reconsider right-in-right-out restriction at select local collector roads in consideration of requirements for vehicular traffic, transit service, pedestrians and cyclists.

11.2.4 Metrolinx

Metrolinx was consulted regarding the at-grade GO Transit Stouffville Railway Corridor crossings on Kennedy Road north of Clayton Road and north of Austin Drive. Input and direction included:

- Electrification is planned for the Stouffville GO corridor within the 10-year program. Any undertaking as part of the EA should protect for electrification at this crossing, including appropriate horizontal and vertical clearances.
- Coordination regarding Metrolinx's TPAP Grade Separation study for crossing north of Clayton which was initiated in February 2020.

11.2.5 CN Rail

CN was consulted regarding the existing CN Rail structure with Kennedy Road. Input and direction included:

- CN indicated the existing bridge a ballasted deck bridge, which is a preferred bridge type as this type of structure is very good for train operation (rails aren't rigid to the bridge).
- CN prefer to maintain the existing 2 tracks during bridge replacement as this would minimize disruption to their operation (require approximately 8 hours to shift tracks).
- CN will not accept a permanent design that has less clearance than the existing structure. The permanent structure must be designed to the latest clearance standards which is 5.3m.

- CN will not accept a raise in track profile as the Kennedy Road crossing is located on a crest and will negatively impact the railway's operation.
- Construction staging for the detour should minimize track outage. CN advised that 4 hours on one track would be a realistic work window but at no time should both tracks be closed simultaneously.
- South rail detour is not a viable option as CN Rail will not accept a raise of 1 m in track profile.
- During detailed design and construction, it is anticipated that CN would split the work into two separate projects – Track and Structure design and construction will be led by CN, and road design and construction led by the Region.

11.2.6 Ministry of Transportation and 407ETR

MTO and 407ETR were consulted regarding the 407 Interchange with Kennedy Road. Input and direction included:

- 407ETR noted they are generally in agreement with the findings of the VISSIM analysis (implementation of the Transit/HOV curb lane in place of the dedicated speed change lanes through the interchange as dedicated speed change lanes were not recommended).
- 407ETR indicated that the existing sidewalk should be removed, and higher barrier parapet wall should be provided on the existing structure.
- 407ETR prefers one crossing of the 407ETR, not two and recommends that construction be done in one stage and built for future pedestrian/cyclist volumes/requirements without the need to come back and expand the potential structure or add a new one. 407 ETR would not support construction in various stages over the course of 5-10 years as it would cause unnecessary impact to traffic on Kennedy Road & Highway 407ETR. York Region is protecting for both east and west sides for the AT bridges through the EA study. During Detailed Design the Region can review and confirm with MTO, 407ETR and the City of Markham on the preferred locations.
- 407ETR will begin the construction of the ultimate configuration of 407ETR widening. There is opportunity to work with 407ETR to do the pier and median work for the AT structure during that time, but the Region would have to accelerate the AT bridge design in order to construct at the same time as 407ETRs construction.
- 407ETR noted that the recommended option (separate AT bridge) does not reduce the existing number of conflict points between vehicles and cyclists/pedestrians at the ramps. Consideration should be given to

separate AT bridges at each on-ramp. York Region considered a variation of the option with additional AT bridges at each on-ramp but was not identified as Recommended. The Ultimate Vision at this location identifies separate AT bridges at the on-ramps. Implementation of the Ultimate Vision (additional AT bridges at the on-ramps) is subject to further discussions with MTO, 407ETR and the City of Markham.

- Any type of crossing (new structure or modification of existing) will require a legal agreement detailing rights and responsibilities during construction and future maintenance. This agreement will also outline the Region's responsibility to cover any/all costs for temporary and permanent utility relocation that may affect the 407 ETR in future operations as a result of a new bridge installation.
- MTO indicated that the separate AT bridge structures will need to be designed to meet vertical and horizontal clearance requirements. Bridge inspections will also be needed to accommodate future maintenance. The 407ETR would own the structure as it would be located on their lands and the Region / City would maintain it. A crossing agreement is likely required between MTO, 407ETR and York Region and can establish ownership and maintenance.
- 407ETR is protecting lands for the Transitway, but it may not be constructed for another 40+ years.

11.2.7 City of Toronto

The City of Toronto provided input on the study. In particular:

- City staff is in agreement with the recommendations at the Kennedy Road and Steeles Avenue intersection. There are no current plans to extend the through lanes south of Steeles Avenue on Kennedy Road.

11.2.8 Toronto Transit Commission (TTC)

The TTC provided input on the study. In particular:

- Bus bay to accommodate 60' transit vehicles

11.2.9 Ministry of Natural Resources and Forestry (MNRF)

MNRF provided comments and worked closely with the project team throughout the course of the study. In particular:

- Confirmed Rouge River crossing at Kennedy Road as contributing habitat for Redside Dace that does not require permitting under the ESA
- Tributary for Rouge River crossing is not regulated for Redside Dace
- Occurrences of Kentucky Coffee within the study area do not require permitting for ESA

It should be noted that Species at Risk are now under the jurisdiction of the Ministry of the Environment, Conservation and Parks (MECP) and additional consultation with MECP will be required during Detailed Design, including permit applications.

11.2.10 Ministry of Environment, Conservation, and Parks (MECP)

MECP was consulted throughout the study to provide guidance on the EA process. Direction included:

- Include documentation regarding climate change.
- Include documentation regarding Source Water Protection detailing whether or not there are vulnerable areas located within the study area and any potential impacts and mitigation.
- Identification of all Indigenous Communities to be consulted for this study.
- Conduct an air quality impact assessment based on the hotspot approach during the EA study. There were no concerns with the results of the air quality assessment presented to MECP.
- Include clear documentation for interim (Recommended) and ultimate solutions (Ultimate Vision) and identify triggers or conditions in place for implementation.
- Include documentation regarding how the Region will consult or communicate further with property owners regarding the detailed design assessment.
- Include reference to MECP's new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil.
- Include documentation of potential impacts and mitigation measures related to accidental fuel spills during construction.
- In Detailed Design the PTTW application to include discussion of potential impacts to the natural environment, any risks posed to nearby structures

due to subsidence resulting from construction dewatering and the potential for the movement of contaminated groundwater due to construction dewatering. PTTW applications should also detail the planned disposal method for the water taken, that the water quality meets the water quality criteria for the chosen method of disposal, and a groundwater depressurization assessment in the event of artesian conditions. Any potential effects should be identified, and appropriate monitoring and mitigation measures should be recommended in a comprehensive monitoring and mitigation plan.

- Recommend development of an Environmental Management Plan (EMP) during the Detailed Design phase of the project. The EMP should include, but not be limited to monitoring and mitigation plans for encountering highly productive zones and artesian conditions.

It should be noted that Species at Risk are now under the jurisdiction of the Ministry of the Environment, Conservation and Parks (MECP) and additional consultation with MECP will be required during Detailed Design, including permit applications.

11.2.11 Ministry of Tourism, Culture, and Sport (MTCS)

MTCS has a mandate to conserve Ontario's cultural heritage, which includes archaeological resources, built heritage resources, and cultural heritage landscapes. Recommendations included:

- Consulting with Indigenous communities to discuss known or potential cultural heritage resources that are of value to these communities
- Consulting with Municipal Heritage Communities, historical societies and other local heritage organizations regarding identification of cultural heritage resources
- Screening the project with the MTCS Criteria for Evaluating Archaeological Potential to determine if an archaeological assessment is needed. Should areas with archaeological potential be identified, then an archaeological assessment (AA) should be undertaken by an archaeologist licensed under the OHA who is responsible for submitting the report directly to MTCS for review
- Screening the project with the MTCS Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes to determine whether the project may impact cultural heritage resources. If potential or

known heritage resources exist, MTCS recommends that a Heritage Impact Assessment (HIA) prepared by a qualified consultant

11.2.12 Infrastructure Ontario

Infrastructure Ontario (IO) identified if IO lands are required to support the project to consult with MOI and IO. Project team contacted IO to confirm requirements for a MOI Public Work Class EA however a response was not received at time of writing. A MOI Public Works Class EA is not anticipated as IO lands identified to be impacted are assumed by MTO within Controlled Access Highway Limits.

12. Timing of Implementation and Future Commitments

12.1 Project Schedule

As part of the Environmental Assessment process, this Environmental Study Report is to be filed and placed on the public record for at least 30 calendar days for review by the public and review agencies.

As per the recently amended through Bill 197, Covid-19 Economic Recovery Act, 2020, the Region cannot proceed with the Kennedy Road project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the Region may not proceed after this time if:

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed Order regarding the project

If after 30 days following the public review period, provided that no Part II Orders are received regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights and a Notice of Proposed Order regarding the project is not issued, the Region may proceed to Phase 5 of the Class EA process – design and construction. Property acquisition and utility relocation will then be scheduled, followed by construction.

12.1.1 Lapse of Time

According to the Municipal Class EA, “If the period of time from the filing of the Notice of Completion of ESR in the public record or the MECP’s denial of a Part II Order request(s), to the proposed commencement of construction for the project exceeds ten (10) years, the proponent shall review the planning and design process and the current environmental setting to ensure that the project and the mitigation measures are still valid given the current planning period. The review shall be recorded in an addendum to the ESR which shall be placed on the public record.”

Notice of Filing of Addendum shall be placed on the public record with the ESR, and shall be given to the public and review agencies, for a minimum 30-day public review period. The notice shall include the public’s right to request a Part II

Order during the 30-day review period. If no Part II Order request is received the proponent is free to proceed with implementation and construction.

12.2 Commitments of Future Work

The ESR identifies specific items to be reviewed and confirmed during Detailed Design. Some of these commitments will address specific concerns raised by property owners and review agencies during the EA process. Items of particular interest to be addressed include:

1. Property Requirements
    a. Review design opportunities to minimize property acquisition requirements at constrained locations.
    b. Property requirements identified in this report and shown on the preliminary design drawings are preliminary and will be finalized during Detailed Design. Where feasible, review opportunities for easements instead of property acquisition.
    c. Obtain Permission to Enter Agreements from landowners where access to their property is required.
    d. Obtain construction easements as required.
    e. Consult with property owners during the development of construction staging plans to maintain access to properties and minimize impacts as feasible.
    f. Review potential impacts to the road infrastructure at 7831 Kennedy Road due to deep drain tiles used to level the property.
    g. Review consideration of no right-turn on red (ROTR) at Lee Avenue to minimize potential conflicts with U-turn movements.
    h. Review potential impacts to existing irrigation systems on the following properties, including but not limited to: 7749 Kennedy Road, 4780 & 4641 Highway 7, and 7077 Kennedy Road
    i. Consult with YRDSB and YRT regarding potential to provide bicycle racks at bus stops in front of the Milliken Mills High School.
    j. Relocation of existing commercial signage along Kennedy Road to be considered.
2. Archaeology

a. Conduct and incorporate findings and recommendations from Stage 1 Archaeological Assessment. Findings from subsequent archaeological assessments are to be filed with the Ministry of Tourism, Culture and Sport (MTCS) to obtain clearance for archaeology.

b. Complete a Stage 3 archaeological assessment and Investigation Authorization if required for Hagerman East and Hagerman West Cemeteries and St. Philip's On-The-Hill and Bethesda Cemeteries. Consult with Indigenous Communities (Mississaugas of the Credit First Nation) to identify opportunities for participation in field investigations if Stage 3 AA is deemed warranted for impacts to the cemeteries.

3. Cultural Heritage

a. Should future work require an expansion of the study area, then a qualified heritage consultant will be contacted in order to confirm the impacts of the proposed work on potential heritage resources.

b. If property cannot be avoided then complete an HIA during Detailed Design for the impacts to Hagerman East, Hagerman West, St. Philip's On-the-Hill and Bethesda Lutheran Cemeteries as recommended in the CHAR in **Appendix G**.

c. During construction the following measures are recommended for 7507 Kennedy Road (Smith House), 7779-7781 Kennedy Road (Thomas Morley House), 7782 Kennedy Road (Hagerman West Cemetery), 7791 Kennedy Road (Hagerman East Cemetery), 9286 Kennedy Road (George Hunter House), 9392 Kennedy Road (Thomas Lownsbrough House), 9423 Kennedy Road (Bethesda Cemetery), 9400 Kennedy Road (St. Philip's On the Hill Cemetery), 9418 Kennedy Road (St. Philip's Anglican Church Manse), 1000 Kennedy Road / 4465 Major Mackenzie Drive (SS#11 Colty Corners School House) and 10060 Kennedy Road (George Pingle House) as outlined in the CHAR in **Appendix G**:

a. Include property on project mapping and communicate to all project personnel for avoidance during design and construction

b. Erect temporary fencing at the property line during construction of road improvements to ensure its heritage attributes will be buffered from construction activities

c. Conduct continuous ground vibration monitoring

d. If property cannot be avoided, then complete a Cultural Heritage Evaluation Report (CHER) during Detailed Design for 215 Austin Drive to determine its CHVI. If it is CHVI then complete HIA to determine if subsequent mitigation measures are required during construction

e. Relocation of Thomas Morley House (7779-7781 Kennedy Road), Thomas Lownsbrough House (9392 Kennedy Road) and George Hunter House (9286 Kennedy Road) will follow as per the findings and recommendations of the completed Heritage Impact Assessment Studies for each site as provided in **Appendix H.**

- For 9392 Kennedy Road, any relocation would need to be coordinated with the developer who is to retain the dwelling on this lot in the approved plan of subdivision.
- For 9286 Kennedy Road, any relocation would need to be coordinated with the current plans for redevelopment of this property which are not approved at this time (expansion of school premises).
- For 7779-81 Kennedy Road, consultation with the City is required to determine the level of support needed for the removal of the tree to facilitate relocation of the house. A site plan showing its new location is also required.

4. Noise
    a. Details of the design of any proposed noise attenuation (nine locations for barriers were identified) will be addressed during Detailed Design. The design of any noise attenuation should minimize impacts to adjacent properties, and entrance features.
    b. The Region will hold a Public Meeting during the Detailed Design to inform residents if additional noise barriers are required on their property.
5. Natural Environment
    a. A TRCA permit under *Ontario Regulation 166/06- Development, Interference with Wetlands and Alterations to Shorelines and Watercourses* will be required for all works within regulated areas.

b. A DFO self-assessment will be completed during Detailed Design to determine if serious harm to fish or fish habitat is expected as a result of activities from the project.

c. Channel realignment to match the upstream and downstream channel with the new structure will be completed by a fluvial geomorphologist using natural channel design principles with the creation of habitat features/structures and the restoration of the banks and riparian vegetation. This work will be done in consultation with aquatic and terrestrial biologists to ensure that an overall habitat improvement will be realized. Efforts will be made to minimize effects to surrounding vegetated areas and vegetation removals will be compensated for via plantings of the same or similar species.

d. To comply with the requirements of the Migratory Birds Convention Act (MBCA), it is recommended that disturbance, clearing or disruption of vegetation where birds may be nesting should be completed outside the window of April 1 to August 31 to avoid the breeding bird season for the majority of the bird species protected under the act. In the event that these activities must be undertaken from April 1 to August 31, a nest screening survey will be conducted by a qualified avian biologist. If an active nest is located, a mitigation plan will be developed and provided to Environment Canada – Ontario Region for review prior to implementation. Specific timing windows are to be confirmed during Detailed Design.

e. A tree preservation plan is to be developed during Detailed Design. The need for a tree compensation strategy will be confirmed during Detailed Design.

f. Tree protection zones need to be installed prior to any construction which includes tree removal and utility work and remain in good repair for the duration of the project.

g. Edge Management Plan; Compensation/Restoration Plans; Erosion and Sediment Control Plan; and, Environmental Inspection and Monitoring Plan to be developed during Detailed Design. MECP to be circulated on ESC Plan for review.

h. Consideration of wildlife fencing at the Rouge River to direct wildlife under/through the structures rather than across the roadway during Detailed Design.

i. Impacts to terrestrial natural heritage system will need to be off-set. A detailed inventory and vegetation removal plans, as well as restoration

and compensation plans, and edge management plans to mitigate impacts will be provided during Detailed Design.

j. Opportunities to reduce the design footprint and minimize impacts to natural features will be reviewed during Detailed Design.

k. Environmental Management Plans per TRCA's draft guidelines, or their equivalent if submitted within other technical reports, are to be provided for any active groundwater controls/dewatering required for construction, as both taking and disposal of groundwater may have negative impacts on natural features. The EMP should include, but not be limited to monitoring and mitigation plans for encountering highly productive zones and artesian conditions (i.e. Rouge River, dewatering interferences with surface water and any groundwater users).

l. Construction and post-construction monitoring plans are to be developed in consultation with MECP.

m. An Information Gathering Form will be submitted to MNRF/MECP during Detailed Design to determine permit requirements under the Ontario *Endangered Species Act, 2007*. If required, the necessary permit(s) will be secured during Detailed Design.

n. Exploration of other enhancement opportunities such as expanded restoration areas, habitat structures and LIDs such as Silva Cells.

o. Consideration of an underdrain with an impermeable liner in the areas where there is potential risk for groundwater contamination in order to achieve the designed efficiency of the infiltration trench.

6. Roadway Design

    a. The Region will address design requirements through the preparation of contract drawings and specifications.

    b. Retaining walls to be considered at constrained locations.

    c. Proposed re-grading at driveways to be confirmed during Detailed Design once each driveway design is developed.

    d. Signage and pavement markings to be confirmed during Detailed Design.

    e. At the time of Detailed Design, any changes to design standards and/or industry best practices compared to those available at the time of the EA are to be considered.

7. Active Transportation Facilities

a. Material type (concrete), width, transitions and treatment for the recommended multi-use path to be confirmed in consultation with City of Markham. Design considerations will be reviewed for consideration with their alignment with the City's Active Transportation Master Plan update.

b. During Detailed Design consideration for warning signage and pavement markings for locations where the multi-use path may be reduced to a width that is less than 2.4m to avoid impacts to grave sites (at Hagerman Cemeteries and St. Philips on-the-hill and Bethesda Cemeteries)

c. During Detailed Design review opportunities to maintain consistent width of MUP between intersections, and review opportunities to provide wider facilities while balancing planting and LID requirements

d. Review Region's latest Active Transportation guidelines during Detailed Design to ensure the proposed design conforms to the most recent guidelines. This includes consideration of the applicable standards for pedestrian and cyclist treatment across entrances and intersections and where feasible protected intersection design.

e. At the time of Detailed Design, any changes to design standards and/or industry best practices related to the accommodation of active transportation users, compared to those available at the time of the EA, are to be considered.

f. During Detailed Design review opportunities to provide flex posts or hand-railing where the MUP is adjacent to the curb.

8. GO Transit Stouffville Railway Corridor Crossing North of Clayton Drive (Recommended at-grade crossing; Ultimate Vision underpass)

    a. Recommended Plan and property requirements may need to be adjusted to match Metrolinx's final design and construction of the railway grade separation (underpass) as per the recommendations of the TPAP.

    b. During detailed design, the Region, in consultation with Metrolinx and the City of Markham, will identify mitigation measures to address the risk of queuing on the tracks, should the crossing remain at-grade. Signage and pavement markings per Transport Canada's Grade Crossing Handbook, 2019, shall be consulted. In addition, any modifications to, or in the vicinity of, the existing crossing must be compliant with the Grade Crossing Regulations and Grade Crossing

Standards. The length of the gate arm for the new cross-section cannot exceed the maximum allowable length specified in the Grade Crossing Standards

c. During detailed design, the Region, in consultation with Metrolinx and the City of Markham, can consider opportunities to provide for connectivity between AT facilities along Kennedy Road and the railway corridor

d. All works on, above or below Metrolinx property will need to be coordinated with railway operations and comply with the following Metrolinx requirements:

    a. Rules, policies, standards and procedures for working within Metrolinx right-of-way;

    b. Liability insurance requirements for works performed on and/or in proximity to the railway or within railway right-of-way; and,

    c. Safety and related requirements and instructions for work on railway right-of-way by non- Metrolinx personnel.

e. All works during prearranged work blocks under railway flagging protection have to be planned and carried out in a manner to leave the work zone at the end of work block in safe condition for railway traffic and operations.

9. GO Transit Stouffville Railway Corridor Crossing North of Austin Drive (Recommended at-grade crossing; Ultimate Vision – Separate Grade Separation Study)

    a. The design of the crossing will be determined by the recommendations from Metrolinx's TPAP.

    b. Construction is anticipated to be completed by Metrolinx.

10. CN bridge

    a. During Detailed Design and construction, consideration of vibration monitoring / restrictions / limitations to minimize impacts and consideration of settling monitoring points as required.

    b. Coordinate and consultation with CN during Detailed Design to obtain CN work permit and establish flagging requirements and work blocks.

c. Coordination for the staging and timing for the construction of for the new bridge structures (temporary and permanent) along the CN ROW and temporary rail detours.

d. All works during prearranged work blocks under railway flagging protection have to be planned and carried out in a manner to leave the work zone at the end of work block in safe condition for railway traffic and operations

11. 407ETR Interchange and AT Bridges

a. Design separate AT bridge structures to meet vertical and horizontal clearance requirements and review for potential interference with 407ETR tolling infrastructure. Bridge inspections will also be needed to accommodate future maintenance. The 407ETR would own the structure as it would be located on their lands and the Region / City would maintain it. A crossing agreement is likely required and can establish ownership and maintenance.

b. Any type of crossing (new structure or modification of existing) will require a legal agreement detailing rights and responsibilities during construction and future maintenance. This agreement will also outline the Region's responsibility to cover any/all costs for temporary and permanent utility relocation that may affect the 407 ETR in future operations as a result of a new bridge installation.

c. The Region in consultation with the City, MTO and 407ETR to confirm ownership, operations and maintenance requirements for the AT structures during Detailed Design.

d. During Detailed Design in discussions with 407ETR, MTO, City of Markham and York Region will discuss and confirm one or both sides of the AT bridges (east or west) and if bridges over on-ramps (ultimate solution) are identified at that time.

e. During Detailed Design in discussions with 407ETR, MTO, City of Markham and York Region will review and confirm ability to accelerate design of AT bridges to coincide with 407ETR construction.

f. The width of the bridge to be confirmed in consultation with Markham and 407ETR during Detailed Design.

g. 407ETR's request to revise the existing bridge structure will be discussed in greater details during the detailed design phase.

h. During construction of new structures or modifications of the existing bridge, there will be no lanes shifts, lane width reductions, or reduction of lanes permitted by 407ETR during peak hours, once the 407ETR median widening is complete.

i. For the ultimate vision, coordination with MTO Transitway, MTO, 407ETR and Markham to review potential adjustments to the AT bridge profile at the on-ramps if required to accommodate modifications to the MTO Transitway based on ongoing discussion with the City of Markham to support the vision of Markham Centre.

12. Intersection Design, Signals, and Illumination

    a. Illumination along the study corridor will consider the roadway profile, the urban cross-section, and active transportation requirements. Details will be based on York Region's illumination standards and will be confirmed during Detailed Design, at which time the type and location of poles and luminaires will be confirmed.

    b. Consideration of potential pedestrian and / or traffic signals at Angus Glen Boulevard, School House Road, Castan Avenue and Eton Street as noted on the design plans to be confirmed in Detailed Design.

13. Transit Facilities

    a. Stop locations and transit amenities to be confirmed during Detailed Design in consultation with York Region Transit (YRT).

    b. Coordination with York Region Rapid Transit Corp. (YRRTC) during Detailed Design for the Recommended Design for the section between South Unionville / YMCA Boulevard and Highway 7 to protect for the Ultimate Vision for the future rapidway.

    c. The proposed bus bays/stops/pads are based on the discussions with YRT and will be further reviewed in consultation with YRT during Detailed Design.

    d. The need for delineation through the bus stop area by signage, tactile warning or change in elevation will be confirmed during Detailed Design.

14. Streetscaping and Landscaping

    a. Streetscaping opportunities as identified in the preliminary designs to be confirmed. A streetscaping plan, including individual tree planting locations, is to be developed during Detailed Design.

b. All bridges to have architectural detail to parapet walls, railings, retaining walls and columns.

c. In consultation with the City of Markham, when Milliken Secondary Plan is initiated, review streetscape requirements and active transportation facilities along this portion of Kennedy Road.

15. Geotechnical and Pavement Design

    a. Review settlement impacts based on dewatering estimates and zones of influence at GO Transit crossings.

16. Contamination

    a. If subsurface work is to be conducted in the vicinity of any of the properties identified with potential environmental concern, further investigations including Phase I and Phase II ESAs may be required and will be undertaken during Detailed Design. If impact is encountered, it will be managed in consultation with a qualified professional.

17. Hydrogeological Investigations

    a. Revisit construction dewatering, and long-term dewatering estimate calculations and groundwater settlement impacts during Detailed Design.

    b. In the event a Permit to Take Water (PTTW) or EASR registration for construction is required, the Region should consider initiating a pre-consultation with MECP hydrologists to expedite the construction process.

    c. Discussion with MECP of potential impacts to the natural environment, risks posed to nearby structures, and potential for the movement of contaminated groundwater due to construction dewatering is required as part of the PTTW application.

    d. The PTTW application should also detail the planned disposal method of water taken, that the water criteria for disposal is met, and a groundwater depressurization assessment is conducted in the event of artesian conditions.

    e. During Detailed Design, conduct a door-to-door well survey along Second Street North to confirm/identify any active wells prior to construction.

    f. At GO Transit Crossing north of Clayton Drive for the Ultimate Vision Underpass design.

i. Further hydraulic testing at multiple well locations.

ii. Collection of additional water level measurements and groundwater sampling.

iii. Review of potential impacts to the natural environment and surface water features, and detailed monitoring and mitigation plans.

g. At GO Transit Crossing north of Austin Drive for the Ultimate Vision if an underpass design is recommended from the Future Grade Separation Study.

i. Further hydraulic testing at multiple well locations.

ii. Collection of additional water level measurements and groundwater sampling.

iii. Review of potential impacts to the natural environment and surface water features, and detailed monitoring and mitigation plans.

18. Drainage and Stormwater Management

a. An emergency response plan will need to be developed for the section of Kennedy Road at the Rouge River crossing to close access during the Regional storm event, due to the significant depth of flooding at the road sag.

b. Updates to the hydraulic modelling, floodplain assessment and revisions to TRCA floodplain mapping will be completed during Detailed Design to reflect the final design and grading footprint of the crossing.

c. A spread analysis will be completed at the Detailed Design stage to ensure that the ponding at low points encroaches only onto one lane in each direction.

d. During Detailed Design, the location and performance characteristics of the infiltration trenches will need to be confirmed to ensure that all infiltration trench design criteria can be met.

19. Utilities

a. Location of existing utilities and resulting impacts and required relocations are to be confirmed.

b. Coordination of utilities, including hydro pole relocation and overhead wiring, is to be reviewed during Detailed Design.

c. Formal definition of impacts on utilities will be determined during Detailed Design, in consultation with individual utility companies.

d. All utility information will be updated prior to construction to ensure that the data is accurate and to finalize relocation requirements as necessary.

e. During Detailed Design, meetings will be held with utility companies as required where potential impacts to existing or future services are identified.

20. Constructability, Staging and Detours

    a. Develop a traffic management plan and staging concept to determine how vehicular (maintain two lanes in each direction) and pedestrian traffic will be accommodated during construction and how access to properties adjacent to Kennedy Road will be maintained.

    b. Consult and coordinate with CN regarding road detour and rail detour for construction of the CN rail bridge replacement.

21. Additional Consultation and Coordination

    a. Consult with affected property owners including those where property is required or where access to their property will be impacted.

    b. Consult with regulatory agencies and individual municipalities as required.

    c. Coordinate with developers as required to determine their status, timelines, and any impacts to the study corridor.

    d. The extent of cost sharing with the developers (including stormwater management facilities within the development and storm sewer systems), with the City of Markham (potentially including multi-use paths, boulevards, and illumination), with CN for the CN Rail detour and temporary and permanent rail bridge replacement, and with Metrolinx for the ultimate underpass design at the crossing north of Clayton Drive and for the future grade separation study for the crossing north of Austin Drive, will be confirmed during Detailed Design.

    e. Depressed median with mountable or semi-mountable curb and flexible delineators to allow for EMS access, to be confirmed in Detailed Design in consultation with local emergency services and fire services.

    f. Maintenance and operations agreements to be discussed and developed with applicable agencies.

22. Summary of Anticipated Permits and Approvals

    a. DFO self-assessment under the Fisheries and Wildlife Conservation Act to confirm if authorization is required.

    b. TRCA permit under *Ontario Regulation 166/06- Development, Interference with Wetlands and Alterations to Shorelines and Watercourses*.

    c. Environmental Activity and Sector Registry (EASR) and/or Permit to Take Water (PTTW) under the *Ontario Water Resources Act* based on the required water takings.

    d. CN Work Permit

    e. 407ETR Encroachment Permit

    f. MTO Concession and Ground Lease Agreement

    g. Environmental Compliance Approval (ECA) will be required from MECP for stormwater management facilities and storm sewers.

    h. Permission to Enter Agreements.

    i. Obtain clearance for cultural heritage and archaeology from MTCS based on findings from subsequent cultural heritage assessments and archaeological assessments as required.

12.3 Timing of Improvements

Timing of improvements is to be confirmed during Detailed Design. Construction timing is anticipated to follow the timing outlined in the Region's current (2020) 10-year Roads and Transit Capital Construction Program. The Kennedy Road segment from 14th Avenue to Highway 7 has been identified in the current plan. However, this plan is reviewed and approved by Regional Council annually and is subject to change.

Recommended and Ultimate Vision – GO Rail Crossing north of Clayton Drive

- **Recommended:** Modified Typical Section - At-Grade Crossing with AT Improvements is Recommended because this option provides improved active transportation facilities and dedicated transit/ HOV lanes; however, it does not address vehicle queuing caused by increased GO Train service or safety of at-grade crossing for pedestrians and cyclists. The Recommended will be considered until such time that GO rail service increases.

- **Ultimate Vision**: Underpass – Modified Typical Section with AT Improvements is recommended for the Ultimate Vision because this option provides improved active transportation facilities, dedicated Transit/ HOV lanes, and mitigates vehicle queuing caused by increased GO Train service. Implementation of the underpass design will be determined by Metrolinx based on their findings of the Grade Separation TPAP study. The Kennedy Road Recommended Plan and property requirements may need to be adjusted to match Metrolinx's final design and construction of the railway grade separation as per the recommendations of the TPAP.

Recommended and Ultimate Vision – GO Rail Crossing north of Austin Drive

- **Recommended:** Modified Typical Section - At-Grade Crossing with AT Improvements is Recommended because this option provides improved active transportation facilities and dedicated transit/ HOV lanes; however, it does not address vehicle queuing caused by increased GO Train service or safety of at-grade crossing for pedestrians and cyclists. The Recommended will be considered until such time that GO rail service increases.
- **Ultimate Vision**: Future Grade Separation (Overpass or Underpass) will eliminate vehicle queues from increased GO Train service and remove rail conflicts with pedestrians and cyclists. As there is insufficient information available at the time of this EA Study to make a determination a separate study will be completed in the future to identify the appropriate solution for the grade separation in consultation with City of Markham and Metrolinx. Implementation will accommodate Metrolinx's timing of additional train services at this crossing.

Recommended and Ultimate Vision – Viva Rapidway (YMCA Boulevard to Highway 7)

- **Recommended:** Shift Viva Rapidway to share Transit/HOV curb allows for YRT and Viva to service the corridor while minimizing impacts and reduce congestion, and provides for continuity of the Transit/HOV network along Kennedy Road and continuous AT facilities and landscaping opportunities. The Recommended will be considered until such time YRRTC identifies the construction timing for Rapidway or LRT in the longer term.

- **Ultimate Vision**: Median Viva Rapidway with AT facilities (Modified Highway 7 Transit EA) allows for Viva transit service to operate within a dedicated median Rapidway and it allows for future opportunities to implement higher order transit service (Light Rail Transit) within the median in the longer term. It also provides for continuous AT facilities and landscaping opportunities while minimizing potential impacts to businesses and does not result in business displacement. The boulevards from the Ultimate Vision (Alt 1) are incorporated into the Recommended Design (Alt 3) to minimize future reconstruction of the boulevard and utility relocations. Additional width to implement the Ultimate Vision from the Recommended is allocated to a wider centre median. Implementation is dependent on YRRTC identification of the construction timing for Rapidway.