8. DEVELOPMENT AND SELECTION OF PREFERRED DESIGN

8.1 EVALUATION METHODOLOGY

In order to select the Technically Preferred Design for the undertaking the following methodology was adopted:

- Each primary route alternative was developed to a level that allowed all benefits and effects to be determined;
- For each of the route alternatives, section design alternatives were developed;
- Segment route/section alternatives were evaluated against a set of Objectives corresponding to the five objectives identified in Chapter 5;
- For each primary objective, “Goals” were developed as factors considered important in choosing between alternatives;
- For each factor, quantifiable and qualitative “Indicators” were identified;
- The Objectives, Goals and Indicators were distributed to the project team and TAC members (as part of the overall rapid transit EA process) and comments received to ensure that they were appropriate. The input of discipline subconsultants was of paramount importance to ensure that the indicators reflected the effects of the alternatives as they relate to the discipline;
- An evaluation methodology was developed to rank alternatives;
- The evaluation was conducted by the project team and presented to the TAC members in summary form prior to presentation to the public;
- The evaluation was presented in summary form to the public for review;
- A Preferred Design was then selected.

The evaluation process ranked each alternative in terms of the indicators using a relative ranking between alternatives. An overall most responsive alternative was then chosen for each objective by summarizing the degree to which each of the goals and objectives were met. A general synopsis of route evaluation findings was tabulated for each objective to explain the rationale behind the selection. This included a description of the advantages and disadvantages of each alternative and its merits regarding the objective and goals.

8.2 EVALUATION OBJECTIVES, GOALS AND INDICATORS

The following table presents the Evaluation Objectives, Goals and Indicators used in the evaluation of alternative methods for the location of the transitway.

Table 8-1
Evaluation Objectives, Goals and Indicators

Objectives and Goals	Typical Indicators measuring route’s ability to achieve goals	Measure
PROTECT AND ENHANCE SOCIAL ENVIRONMENT		
Minimize adverse effects on and maximize benefits for adjacent communities	Number of properties affected Potential for traffic infiltration	Subjective based on design plans
Maintain or improve road traffic and pedestrian circulation	Number of properties with access restricted Availability of turning movements at intersections Change in pedestrian pathways	Subjective
Maintain a high level of public safety & security in the corridor	Number of locations with potential to decrease public safety Ease of access for emergency vehicles	Subjective
Minimize adverse noise and vibration effects	Number of residences impacted by sound or vibration	Analysis based on background report
Minimize adverse effects on cultural resources	Number of built heritage features displaced or disrupted	Analysis based on background report
Minimize disruption of community vistas and adverse effects on street and neighbourhood aesthetics	Visual impact on people living and working in area	Subjective
PROTECT NATURAL ENVIRONMENT		
Minimize adverse effects on Aquatic Ecosystems	Potential effect on watercourses and fish habitat	Analysis based on background report
Minimize adverse effects on Terrestrial Ecosystems	Potential effect on wildlife habitat (loss of habitat area)	Analysis based on background report
Improve regional air quality & minimize adverse local effects	Potential effect on air quality	Analysis based on background report
Minimize adverse effects on corridor hydro geological, geological and hydrological conditions	Potential effect on groundwater	Subjective
PROMOTE SMART GROWTH/ECONOMIC DEVELOPMENT		
Minimize adverse effects on business activities	Number of businesses with entrances/exits affected Number of businesses with parking lost	Subjective based on aerial photos
Protect provisions for goods movement	Ability for trucks to access commercial/industrial areas	Subjective based on Traffic Analysis
Promote transit-oriented development	Opportunities for re-development Potential opportunities for development and higher order uses at stations, terminals and along the corridor	Subjective based on land use inventory
TO PROVIDE AN EFFECTIVE TRANSPORTATION SERVICE		
Ability to maintain adequate level of service for road vehicles	Volume to capacity ratios, Intersection level of service	Analysis based on background report
Maximize convenience of access to rapid transit system	Ease of access to stations	Subjective based on design profiles
MAXIMIZE COST-EFFECTIVENESS OF RAPID TRANSIT		
Minimizes capital costs	Estimate of the cost of capital works including running way, stations, systems and major utility relocation works.	$
Minimizes cost effects of/on adjacent properties	Area of property required	Area
Minimizes adverse effects of alignment characteristics on operating and maintenance costs	Influence of alignment characteristics on operating and maintenance costs	Subjective

8.3 DEVELOPMENT OF SEGMENT ALIGNMENT ALTERNATIVES

In Chapter 5, three basic route alternatives were developed and compared and the Warden Avenue route alternative was selected as the preferred alternative. No changes to infrastructure south of Steeles Avenue are proposed. Therefore this section develops and evaluates alternative methods for providing rapid transit within the Warden Avenue Corridor as well as the Denison Street Corridor, which is used as an east-west connector to existing routes in the City of Toronto.

As characteristics vary along the Warden Avenue corridor, alternative methods were developed for five sections as follows:

Segment A – Highway 7 to Enterprise Drive: This is the area were the Markham N-S Link Corridor will interface with the Highway 7 Corridor, which utilizes Enterprise Drive through Markham Centre. As alignment alternatives north of Enterprise Drive are assessed as part of the Highway 7 Transitway EA, the environmental impacts of these alignments are not developed in this EA. However, potential routing options using the Highway 7 Transitway are discussed.

Segment B – Enterprise Drive to 14th Avenue: Alternatives related to different cross-sections for Warden Avenue.

Segment C –14th Avenue to Denison Street: Alternatives related to different cross-sections for Warden Avenue.

Segment D – East/South Connecting Routes: Two alternative routes are initially developed and assessed followed by alternative cross-sections for the preferred route.

Segment E – Denison Street to Steeles Avenue: This section provides a possible connection to future City of Toronto rapid transit networks.

8.3.1 Segment A – Preferred Alignment and Potential Future Opportunities

The Technically Preferred route for the Highway 7 Transitway (separate EA) is to travel across Warden Avenue on Enterprise Drive to a new dedicated transit facility that would swing north into Town Centre Boulevard. Stations would be located east of Warden Avenue as well as in front of IBM opposite IBM's private access road. The extension of Enterprise Drive across Warden Avenue and the Rouge River valley, nor any potential environmental impacts, is not considered part of the Markham N-S Link.

The most direct route to connect the Markham N-S Link into the Highway 7 Transitway is to do so at the intersection of Warden Avenue and Enterprise Drive with the station just east of Warden Avenue being used for passenger transfer. This alignment has been selected as the preferred design. However, at such time as the Highway 7 Transitway connection across Warden Avenue becomes available, other routing options using these corridors may be pursued for the Markham N-S Link.

Figure 8-1 illustrates a potential concept that would provide for the integration of the Markham N-S Link and the Highway 7 Transitway while providing improved access for IBM. This routing option would utilize the IBM ramp and the new extension of Enterprise Drive as follows:

- Northbound vehicles would travel through Enterprise Drive to the existing IBM ramp and then circle back south to the proposed Highway 7 Transitway station across from IBM. Vehicles would then continue east on the Highway 7 Transitway Corridor.

- Southbound vehicles would travel across Warden Avenue following the Highway 7 Transitway, then east on Cedarland Drive, turning south in mixed traffic on Warden Avenue and into the dedicated transitway south of Enterprise Drive.

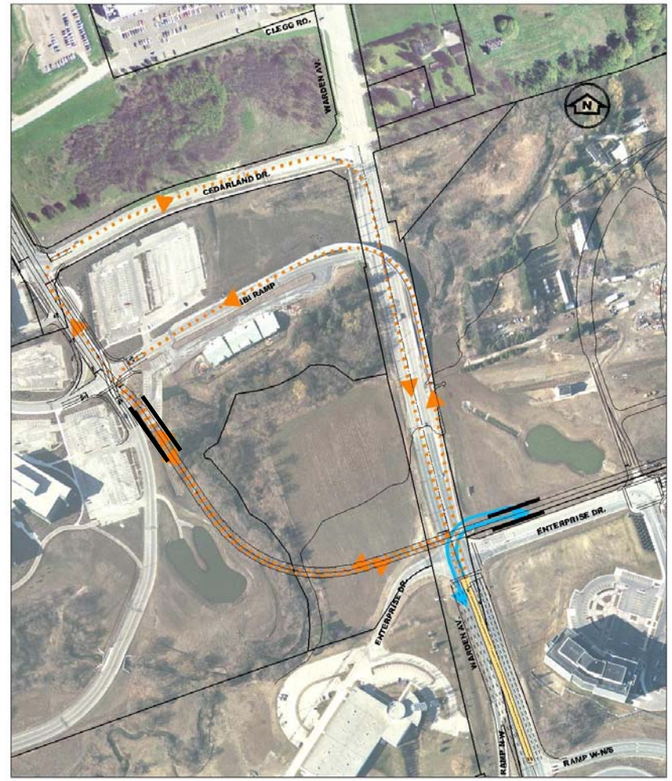
As this alignment option would be using existing/future infrastructure, no approvals would be required under the EA process (other than those for the Highway 7 Transitway). Other approvals, including permission to use the privately owned IBM Ramp would be sought.

It is noted that a preliminary investigation of the structural capacity and geometric design of the IBM ramp was conducted by Marshall Macklin Monaghan in 2004. This preliminary analysis concluded that the ramp had been designed to handle the load of an articulated bus and that horizontal clearances were sufficient. There is presently a height restriction on the ramp to discourage large vehicles.

8.3.2 Segment B – Alternative Methods

There are basically two alternatives for providing rapid transit in the Warden Avenue corridor across Highway 407 as illustrated in Figure 8.2. Alternative (B1) would widen Warden Avenue to provide for the additional median transit lanes while maintaining the planned 6 lanes for regular vehicles. Alternative B2 would maintain the ultimate configuration of 6 lanes; meaning that the soon to be constructed additional vehicle lanes would be utilized for rapid transit. Both of these alternatives were developed fully and carried forward for detailed evaluation.

Figure 8-1
Preferred Alignment and Potential Future Opportunities – Segment A – Highway 7 to Enterprise Drive



Stations for this segment would be located at Enterprise Drive (east of Warden) and at 14th Avenue. An intermediate station could be provided in the future to connect with the planned long term Highway 407 transitway, although this is not considered part of the preferred design. More details on this station are provided in Section 9.1.10

8.3.2.1 Alternative B1: Median Transitway plus 6 traffic lanes

As discussed previously in Chapter 6, Warden Avenue will be widened to 6 lanes from north of Highway 7 to 14th Avenue in 2005. There is sufficient property to widen Warden Avenue further to provide for dedicated transit lanes while maintaining six lanes for regular vehicles.

This alternative would require modifications to the Warden Avenue and Highway 407 ramps, specifically the E-N/S Ramp and the N-W Ramp. It would also involve extending the existing fill sections and potentially providing retaining walls in some sections.

In this alternative, both the Highway 407 bridge and the CN bridge would be widened by one additional lane in each direction, beyond the planned near term widening (for the CN structure). Any changes to these structures would require a legal agreement between York Region and 407 ETR and York Region and CNR.

8.3.2.2 Alternative B2: Median Transitway plus 4 Traffic Lanes

This alternative would essentially use the additional pavement width provided by the planned near term widening for the dedicated median transitway. No major modifications would be required for the Highway 407 ramps and the existing/planned structures would remain six lanes.

8.3.2.3 Alternatives Evaluation Findings and Recommendation

Evaluations were performed comparing Alternatives B1 and B2 and are presented in Table 8.2.

Because both alternatives follow the same basic alignment, the alternatives are fairly similar for most criteria. The evaluation essentially is a trade-off between additional costs and minor property impacts with the widening alternative vs. reduced level of service for road vehicles for the non-widening alternative.

Based on the evaluation, Alternative B1 is preferred because:

- Traffic level of service analysis indicates that significant congestion would occur in peak hours if only two through lanes of traffic are provided in each direction and this may be a limitation to growth in the corridor and in Markham Centre.
- "Taking-away" traffic capacity in the future may have effects in terms of spill-over to other routes, as well as access for goods movement to the industrial areas.
- Property impacts of the widening alternative are not significant as most of the segment is currently fronted on either side by vacant land and the Parkway Belt/Highway 407 corridor.

As noted in Section 11.2.1, it will be important to review the changes in traffic patterns and growth on this segment prior to implementing any road widening, given the many development and road network changes that are expected to take place over the next few years.

8.3.3 Segment C – Alternative Methods

As with Segment C, two basic alternatives were evaluated for this segment as illustrated in Figure 8.3. A major difference is that construction has not been slated for widening Warden Avenue to six lanes south of 14th Avenue, although it is identified in York Region's ten-year capital plan. Therefore, two alternatives were developed fully and carried forward for detailed evaluation: an alternative where Warden Avenue is widened for rapid transit only and an alternative where Warden Avenue is widened for rapid transit plus two additional lanes for regular vehicles.

Stations for this segment would be located at McPherson Street/McNabb Street and at Denison Street. The station at McPherson/McNabb is located closer than the desirable spacing of 1-2 km for efficient BRT operations; however, it represents a primary catchment area being located near American Express.

8.3.3.1 Alternative C1: Median Transitway plus 6 traffic lanes

This alternative would provide for 6 through lanes plus left turn lanes at major intersections. Dedicated rapid transit lanes would be provided in the median resulting in a total effective width of eight lanes.

8.3.3.2 Alternative C2: Median Transitway plus 4 Traffic Lanes

This alternative would utilize the planned roadway expansion width to provide for the dedicated median transit lanes. No additional road capacity would be provided beyond what exists presently. The total effective width would be six lanes including the transitway.

8.3.3.3 Alternatives Evaluation Findings and Recommendation

Alternatives C1 and C2 were compared using detailed criteria as summarized in Table 8.3.

As with the northerly segment, the evaluation is a trade-off between traffic capacity and costs/property impacts. Because the R.O.W. is only 37 m in this section, it would be difficult to provide for six traffic lanes plus a transitway without significant property impacts. Assuming a 5 m boulevard, 6 lanes @ 3.5 m each and a 6.8 m transitway, the required R.O.W. width would be 39.6 m. Therefore, on average, an additional 2.6 m would be required. This is significant since many properties have parking areas that abut the existing R.O.W.

Based on the evaluation, Alternative C2 is preferred because:

- The traffic level of service analysis indicates that projected future traffic demand could be accommodated with 4 through lanes in this segment;
- Providing 6 lanes plus a transitway would have significant property impacts and associated costs, and would limit the amount of space that is dedicated to pedestrians.
- South of Steeles Avenue Warden is four lanes only and this may limit the amount of traffic that would benefit from the widened lanes to the north.

METRIC

ALTERNATIVE B1 - Median Transitway plus 6 traffic lanes

ALTERNATIVE B2 - Median Transitway plus 4 traffic lanes

YRTP

30m 0 50m

1:3000

STATIONS
TRANSITWAY
PROPOSED TRAFFIC LANES
PROPOSED SIDEWALK
PROPOSED LANDSCAPE
PROPOSED RIGHT OF WAY
EXISTING ROADWAYS
EXISTING RIGHT OF WAY
FUTURE RIGHT OF WAY BY OTHERS

MARKHAM NORTH-SOUTH LINK
PUBLIC TRANSIT IMPROVEMENTS
ENVIRONMENTAL ASSESSMENT

FIGURE 8.2

Table 8-2
Evaluation of Alternatives- Segment B

Objectives and Goals	Alternative B1 – Median Transitway Plus 6 lanes		Alternative B2 – Median Transitway Plus 4 lanes	
PROTECT AND ENHANCE SOCIAL ENVIRONMENT				
Minimize adverse effects on and maximize benefits for adjacent communities	◑	Requires property from commercial developments at Warden/14th Minimizes potential for traffic infiltration	◔	Lack of road capacity may cause motorists to seek other routes, potentially through residential areas (e.g. Birchmount)
Maintain or improve road traffic and pedestrian circulation	◕	Provides capacity for regular vehicles to access area Allows for exclusive SB right turn at Warden Avenue/14th Avenue	◔	Congestion will reduce road vehicle access
Maintain a high level of public safety & security in the corridor	◕	Requires modifications to Highway 407 ramps Higher traffic volumes and potentially higher traffic speeds	◕	Higher density of traffic makes cycling more difficult
Minimize adverse noise and vibration effects	◕	Increase in noise is expected to be marginal, no vibration impacts	◕	Increase in noise is expected to be marginal, no vibration impacts
Minimize adverse effects on cultural resources	◑	Reconfiguration of ramps avoids Bethel Cemetery, but construction will be required in close proximity	◕	No known built heritage features or archeological features within R.O.W. affected
Minimize disruption of community vistas and adverse effects on street and neighbourhood aesthetics	◑	Wider roadway is less aesthetically pleasing for pedestrians; however, adjacent development in this section is limited by Highway 407 corridor.	◕	More compact and visually acceptable cross-section
PROTECT NATURAL ENVIRONMENT				
Minimize adverse effects on Aquatic Ecosystems	●	Route does cross any watercourses Widening Warden Avenue may help avoid widening of parallel streets with more significant watercourses	●	Route does cross any watercourses
Minimize adverse effects on Terrestrial Ecosystems	●	No significant habitat area effected	●	No significant habitat area effected
Improve regional air quality & minimize adverse local effects	◕	Air quality is improved over existing situation due to introduction of transit	◑	Air quality is improved over existing situation Congestion may increase localized emissions
Minimize adverse effects on corridor hydro geological, geological and hydrological conditions	◕	Increase in stormwater quantity over existing	●	No impact beyond approved road widening
PROMOTE SMART GROWTH/ECONOMIC DEVELOPMENT				
Minimize adverse effects on business activities	●	All entrances/exits are at signalized intersections	●	All entrances/exits are at signalized intersections
Protect provisions for goods movement	◕	Additional road capacity improves access for trucks	◑	Capacity restrictions will cause delays for trucks
Promote transit-oriented development	◕	Vacant land parcels including Rodick Road employment lands may be developed to take advantage of transitway. Wider roadway width reduces space for pedestrians	●	Vacant land parcels including Rodick Road employment lands may be developed to take advantage of transitway.
PROVIDE AN EFFECTIVE TRANSPORTATION SERVICE				
Ability to maintain adequate level of service for road vehicles	●	Satisfies corridor demand to at least 2021	◔	Projected link volumes will exceed capacity Significant back-ups will occur at Warden and 14th Avenue
Maximize convenience of access to rapid transit system	◑	Pedestrians required to walk across more lanes Reduces width available for potential future integrated station with Highway 407 transitway	◕	Stations accessible for pedestrians Presence of congestion may reduce access for park and ride, drop-off
MAXIMIZE COST-EFFECTIVENESS OF RAPID TRANSIT				
Minimizes capital costs	◑	$28.5 million excluding vehicle costs	◕	$7.1 million excluding vehicle costs
Minimizes cost effects of/on adjacent properties	◑	No property required other than from Hwy 407 corridor Retaining walls are required to minimize impacts of fill on existing properties	◕	No property required
Minimizes adverse effects of alignment characteristics on operating and maintenance costs	◕	Operating and maintenance costs for regular traffic lanes will increase with widening	●	Operating costs are less relative to alternative B1
		Technically Preferred Alternative		

LEGEND: Least Responsive ○ ◔ ◑ ◕ ● Most Responsive

METRIC

ALTERNATIVE C1 - Median Transitway plus 6 traffic lanes

ALTERNATIVE C2 - Median Transitway plus 4 traffic lanes

YRTP

30m 0 50m

1:3000

STATIONS
TRANSITWAY
PROPOSED TRAFFIC LANES
PROPOSED SIDEWALK
PROPOSED LANDSCAPE
PROPOSED RIGHT OF WAY
EXISTING ROADWAYS
EXISTING RIGHT OF WAY
FUTURE RIGHT OF WAY BY OTHERS

MARKHAM NORTH-SOUTH LINK
PUBLIC TRANSIT IMPROVEMENTS
ENVIRONMENTAL ASSESSMENT

FIGURE 8.3

Table 8-3
Evaluation of Alternatives- Segment C

Objectives and Goals		Alternative C1 – Median Transitway Plus 6 lanes		Alternative C2 – Median Transitway Plus 4 lanes
PROTECT AND ENHANCE SOCIAL ENVIRONMENT				
Minimize adverse effects on and maximize benefits for adjacent communities	◔	Requires property from most land uses Minimizes potential for traffic infiltration	◕	Minimal impacts
Maintain or improve road traffic and pedestrian circulation	◕	Provides capacity for regular vehicles to access area Allows for additional turning lanes	◑	Isolated congestion may reduce access for vehicles
Maintain a high level of public safety & security in the corridor	◕	Higher traffic volumes and potentially higher traffic speeds	◑	Higher density of traffic makes cycling more difficult
Minimize adverse noise and vibration effects	◑	Increase in noise is expected to be marginal, no vibration impacts	◕	Increase in noise is expected to be marginal, no vibration impacts
Minimize adverse effects on cultural resources	◑	No known built heritage features or archeological features within R.O.W. affected	◕	No known built heritage features or archeological features within R.O.W. affected
Minimize disruption of community vistas and adverse effects on street and neighbourhood aesthetics	◔	Wider roadway is less aesthetically pleasing for pedestrians; however, adjacent development in this section is limited by Highway 407 corridor.	◕	More compact and visually acceptable cross-section
PROTECT NATURAL ENVIRONMENT				
Minimize adverse effects on Aquatic Ecosystems	●	Route does cross any watercourses Widening Warden Avenue may help avoid widening of parallel streets with more significant watercourses	●	Route does cross any watercourses
Minimize adverse effects on Terrestrial Ecosystems	●	No significant habitat area effected	●	No significant habitat area effected
Improve regional air quality & minimize adverse local effects	◕	Air quality is improved over existing situation	◑	Air quality is improved over existing situation
Minimize adverse effects on corridor hydro geological, geological and hydrological conditions	◕	Slight increase in stormwater quantify	●	Slight increase in stormwater quantify
PROMOTE SMART GROWTH/ECONOMIC DEVELOPMENT				
Minimize adverse effects on business activities	●	One (1) property affected	●	One (1) property affected
Protect provisions for goods movement	◕	Additional capacity improves access for trucks	◑	No significant impacts
Promote transit-oriented development	◑	Vacant land parcels may be developed to take advantage of transitway. Wider roadway width reduces space for pedestrians	●	Vacant land parcels may be developed to take advantage of transitway.
PROVIDE AN EFFECTIVE TRANSPORTATION SERVICE				
Ability to maintain adequate level of service for road vehicles	◕	Satisfies corridor demand to at least 2021	◔	Satisfies corridor demand to at least 2021 Isolated congestion may occur in peak hours
Maximize convenience of access to rapid transit system	◑	Pedestrians required to walk across more lanes	◕	Reduced road width compared to Alternative C1
MAXIMIZE COST-EFFECTIVENESS OF RAPID TRANSIT				
Minimizes capital costs	◔	$24.1 million excluding vehicle costs	◕	$14.1 million excluding vehicle costs
Minimizes cost effects of/on adjacent properties	◑	Property required from all properties	◕	No property required
Minimizes adverse effects of alignment characteristics on operating and maintenance costs	◕	Operating and maintenance costs for regular traffic lanes will increase with widening	◕	Operating costs are less relative to alternative C1
				Technically Preferred Alternative

LEGEND: Least Responsive ○ ◔ ◑ ◕ ● Most Responsive

8.3.4 Segment D – Alternative Methods

Segment D is where the transitway turns easterly and southerly to connect with existing City of Toronto transit corridors. It is an important connection through the Markham employment lands and is also the transition to routes in the City of Toronto.

Based on the preliminary screening of route options in Chapter 5, Denison Street is the preferred corridor for the rapid transit system. Initially, the Steeles Avenue corridor was also examined, but this was eliminated from consideration early on due to the close proximity of residential uses on the south side and the inability to widen the road for transit.

Along Denison there are two possible north-south connecting routes: Esna Park Drive and Victoria Park Avenue, as shown on Figure 8.4. Each of these alignment alternatives were developed as generic facilities (i.e. with or without dedicated transit lanes) and evaluated.

A second evaluation was conducted to compare the advantages and disadvantages of a dedicated transitway vs. an option that would utilize existing lanes.

8.3.4.1 Alternative D1: Denison Street to Esna Park Drive

From Warden Avenue, this alternative would extend west on Denison Street to Esna Park Dr and then south on Esna Park Drive, continuing south across Steeles Avenue to Pharmacy Avenue.

This alignment follows the planned VIVA Phase 1 routing. It was selected for VIVA Phase 1 because it bisects two large employment centres on Steeles Avenue– IBM Canada and the Liberty Centre. An advantage of maintaining the VIVA Phase 1 alignment for the future rapid transit service is that the infrastructure for stations will be in place and VIVA Phase 1 will have built a ridership base along this alignment. In addition, it would be beneficial to have more certainty on the location and timing of new infrastructure in the City of Toronto before altering alignments north of Steeles Avenue.

8.3.4.2 Alternative D2: Denison Street to Victoria Park Avenue

From Warden Avenue, this alignment alternative would extend west on Denison Street to Victoria Park Ave, then south on Victoria Park Avenue across Steeles Avenue.

The Victoria Park alignment is advantageous in that it provides a direct connection to Victoria Park Avenue south of Steeles Avenue, which is identified as a transit priority route in the City of Toronto Official Plan. There are also two undeveloped parcels of land west of Victoria Park north of Steeles Avenue that could incorporate transit-supportive development.

8.3.4.3 Alternatives Evaluation Findings and Recommendation

Based on the advantages and disadvantages of the two local routing options , Alternative D1 is preferred because:

- It bisects two major developments, IBM and Liberty Centre, maximizing ridership potential;
- It reduces capital costs by maintaining VIVA Phase 1 stations;
- It provides consistency for riders that will be established from the VIVA Phase 1 routing.

8.3.5 Segment D – Alternative Cross-Sections

For the preferred alignment, two alternatives were considered for locating the transit service, one with a dedicated median and one involving mixed traffic operations. These alternatives are illustrated in Figure 8.5.

An option that involved taking two of the regular traffic lanes and converting them to dedicated transit lanes was not considered as there is already a congestion problem in the peak hours.

8.3.5.1 Alternative D1 (a): Denison/Esna Park with Transit in mixed traffic except at approach to Warden

This alternative consists of mixed traffic operations with Queue Jump lanes on Denison Street at Warden Avenue.

8.3.5.2 Denison/Esna Park with median transitway plus 4 lanes of general traffic

This alternative consists of an exclusive two-way median transitway in the centre of the roadway with eastbound and westbound vehicular traffic either side of the transitway. This option would maintain four lanes for regular traffic as exists today.

8.3.5.3 Alternatives Evaluation Findings and Recommendation

Widening Denison Street to provide for a full median transitway would provide the best service for rapid transit. However, it would have significant impacts on adjacent properties as additional R.O.W. would be required. In many cases, the only parking for adjacent buildings is abutting the R.O.W and any further widening would impact this parking. As most properties on Denison Street have direct access to the street, introducing a dedicated transitway in the median would have significant impacts on business access, with drivers having to incur significant out-of-way travel. Based on an analysis of traffic volumes, and visual observations, traffic on Denison Street is highly peaked and during off-peak hours there are no capacity concerns.

Considering the impacts on adjacent properties and the lack of serious congestion problems outside of relatively short peaks, the preferred alternative is to operate the rapid transit system in mixed traffic on Denison Street and Esna Park Drive, but mitigate any traffic capacity issues by providing queue jump lanes. Specifically, transit vehicles would access a median transit lane between Hood Road and Warden Avenue, which would allow them to by-pass eastbound traffic queues approaching Warden.

It should be noted that the preferred undertaking would not preclude widening of Denison Street or Esna Park Drive in the future should it be justified to expedite transit.

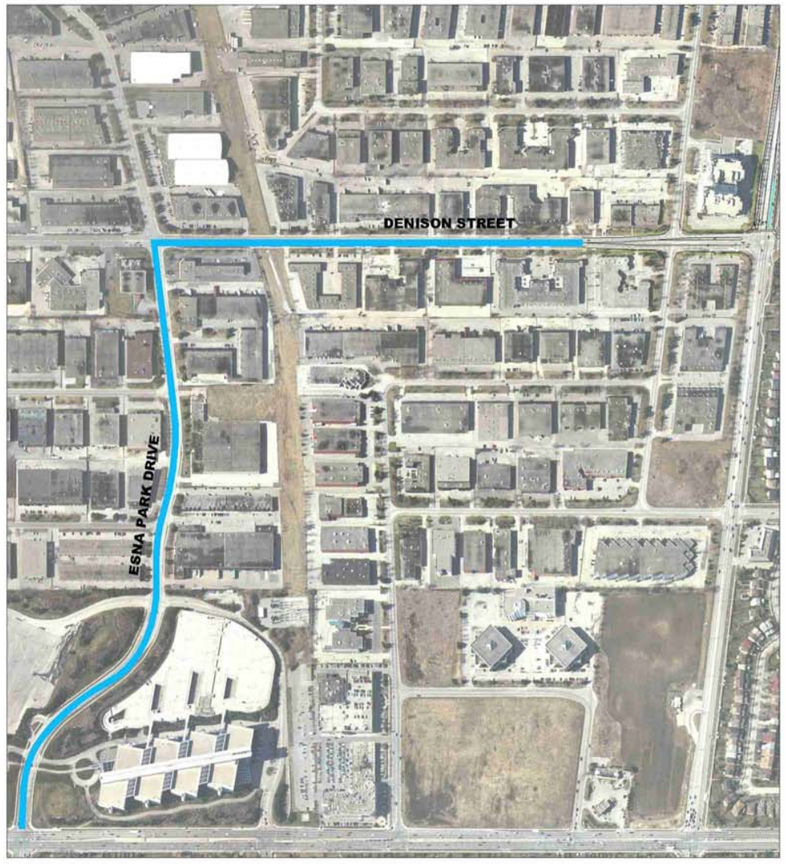
8.3.6 Segment E – Alternative Alignment

In the evaluation and selection of potential routing options presented in Chapter 5, Warden Avenue was chosen as the preferred routing. In the short term, Denison Street was the preferred routing for the east-west connection to Pharmacy Avenue and Gordon Baker Road (to connect with the VIVA Phase 1 alignment) and existing/future City of Toronto transit corridors.

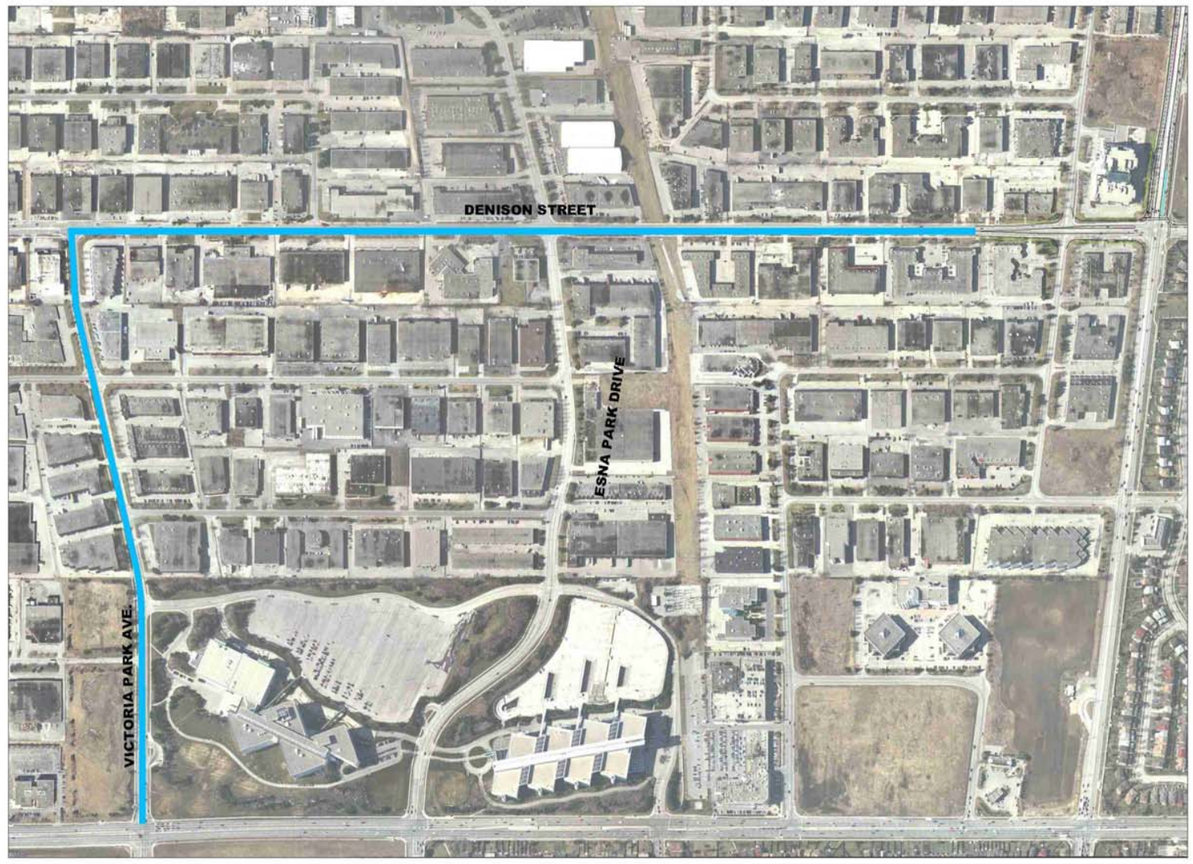
In the longer term, it would be logical to connect surface rapid transit routes using Warden Avenue north of Steeles Avenue to potential future rapid transit services in the City of Toronto, specifically the planned extension of the Sheppard Subway and a potential rapid transit network in the Finch Hydro corridor. For this reason, the preferred undertaking includes the portion of Warden Avenue between Denison Street and Steeles Avenue in the Region of York. This segment could augment or replace the routing using Denison Street and Esna Park Drive. Within the City of Toronto, the system could operate in mixed traffic or potential future dedicated lanes.

The impacts of providing dedicated transit lanes on Warden Avenue between Denison Street and Steeles Avenue are detailed in the next Chapter, which describes the Preferred Undertaking.

METRIC



ALTERNATIVE D1 –
Denison/Esna Park



ALTERNATIVE D2 –
Denison/Victoria Park

YRTP

75m 0 150m

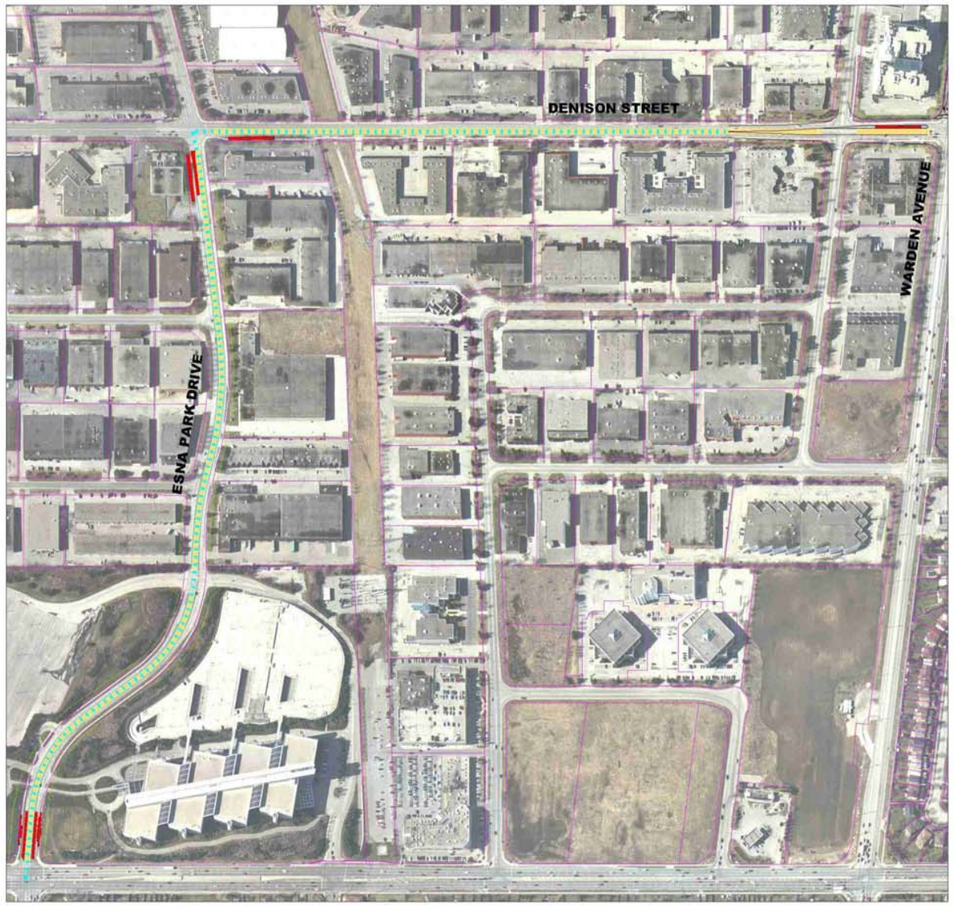
1:750

STATIONS
TRANSITWAY
PROPOSED TRAFFIC LANES
PROPOSED SIDEWALK
PROPOSED LANDSCAPE
PROPOSED RIGHT OF WAY
EXISTING ROADWAYS
EXISTING RIGHT OF WAY
FUTURE RIGHT OF WAY BY OTHERS

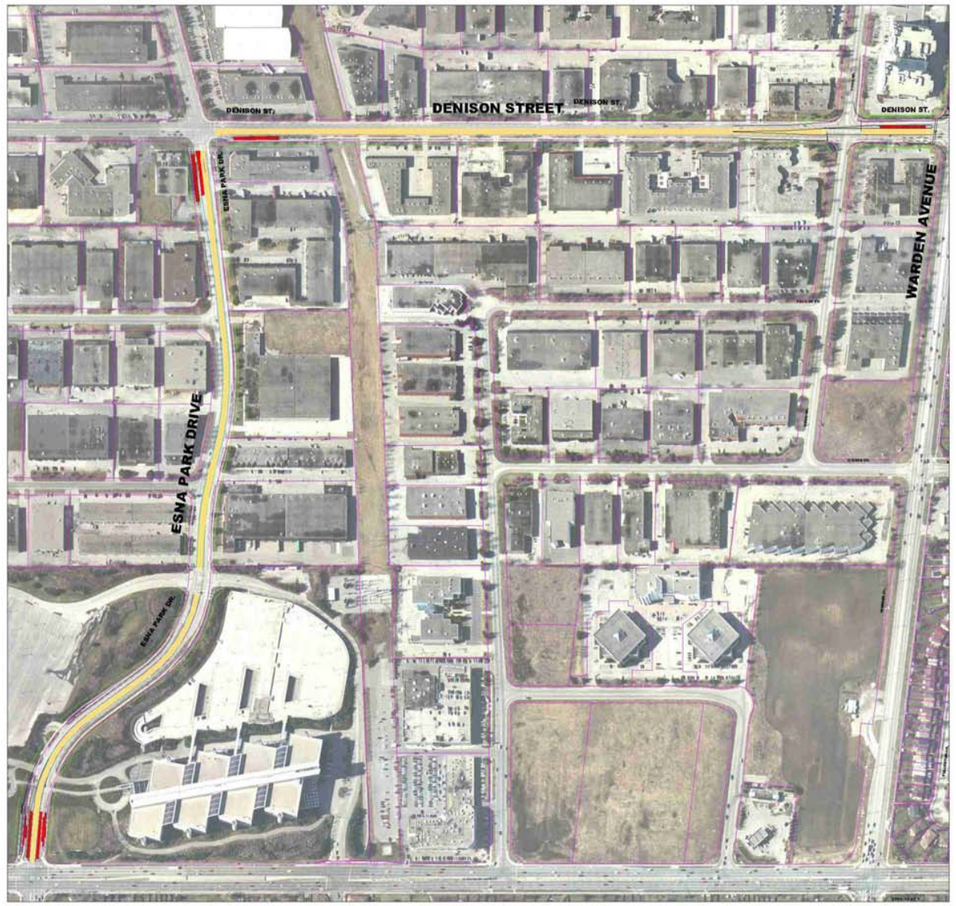
MARKHAM NORTH-SOUTH LINK
PUBLIC TRANSIT IMPROVEMENTS
ENVIRONMENTAL ASSESSMENT

FIGURE 8.4

METRIC



D1 (a) – Denison/Esna Park with Transit in mixed traffic except at approach to Warden



D1 (b) – Denison/Esna Park with median transitway plus 4 lanes of general traffic

YRTP

60m 0 100m

1:6000

STATIONS
TRANSITWAY
PROPOSED TRAFFIC LANES
PROPOSED SIDEWALK
PROPOSED LANDSCAPE
PROPOSED RIGHT OF WAY
EXISTING ROADWAYS
EXISTING RIGHT OF WAY
FUTURE RIGHT OF WAY BY OTHERS

MARKAM NORTH-SOUTH LINK
PUBLIC TRANSIT IMPROVEMENTS
ENVIRONMENTAL ASSESSMENT

FIGURE 8.5

Table 8-4
Evaluation of Alternatives- Segment D

Objectives and Goals		Alternative D1 (a) – Denison/Esna with Transit in Mixed Traffic		Alternative D1 (a) – Denison/Esna with median transitway plus 4 lanes of general traffic
PROTECT AND ENHANCE SOCIAL ENVIRONMENT				
Minimize adverse effects on and maximize benefits for adjacent communities	●	Requires small amount of property at transition point to Warden Avenue, all other properties are unaffected	◔	Required R.O.W. widening would impact surface parking areas for several properties, with limited opportunities to replace parking
Maintain or improve road traffic and pedestrian circulation	◕	Maintains left turn access to all properties	◔	Median transitway would restrict limit left turn access into businesses, pedestrians would be discouraged from crossing at mid-block locations
Maintain a high level of public safety & security in the corridor	◕	Buses would not be segregated from regular traffic, thereby increasing conflicts	◕	Buses are segregated from regular traffic, reducing conflicts Requires vehicles to make U-turns at intersections, potentially reducing safety
Minimize adverse noise and vibration effects	●	Increase in noise is expected to be marginal, no vibration impacts	●	Increase in noise is expected to be marginal, no vibration impacts
Minimize adverse effects on cultural resources	●	No changes required to pavement width	◕	No known built heritage features or archeological features within R.O.W. affected
Minimize disruption of community vistas and adverse effects on street and neighbourhood aesthetics	●	No change in road profile or cross-section	◕	R.O.W widening would reduce available boulevard width
PROTECT NATURAL ENVIRONMENT				
Minimize adverse effects on Aquatic Ecosystems	●	Route does cross any watercourses	●	Route does cross any watercourses
Minimize adverse effects on Terrestrial Ecosystems	●	No significant habitat area effected	◑	Street trees would be impacted
Improve regional air quality & minimize adverse local effects	◕	Negligible change in emissions at local level, overall air quality is improved due to mode shifts to transit	◑	Slightly less congestion than mixed traffic option
Minimize adverse effects on corridor hydro geological, geological and hydrological conditions	◕	No Change in stormwater quantity from existing	◑	Additional lanes would increase run-off
PROMOTE SMART GROWTH/ECONOMIC DEVELOPMENT				
Minimize adverse effects on business activities	●	No change from current operations	●	Median transitway would reduce access R.O.W expansion would impact parking supply for employees and customers
Protect provisions for goods movement	◕	Maintains access for trucks	◑	Local access for trucks would be more onerous due to access restrictions; turning radii at intersections may be reduced due to median intrusions
Promote transit-oriented development	◑	Absence of permanent infrastructure does not create incentives for development/redevelopment	●	Provides permanent transit service for development to focus on
PROVIDE AN EFFECTIVE TRANSPORTATION SERVICE				
Influence on transit service, speed safety and ride comfort	◑	Buses will be delayed by regular traffic	●	Buses are not impacted by congestion and high speeds can be maintained
Ability to maintain adequate level of service for road vehicles	◕	Regular vehicles may be delayed by buses, but impacts are likely to be small	◑	Maintains current number of traffic lanes but forces vehicles to make left turns at signalized intersections. Additional left turns at signalized intersections will impact level of service.
Maximize convenience of access to rapid transit system	◕	Pedestrians required to walk across more lanes	◕	Allows for full median transit stations
MAXIMIZE COST-EFFECTIVENESS OF RAPID TRANSIT				
Minimizes capital costs	●	$4 million excluding vehicle costs	◑	$22 million excluding vehicle costs
Minimizes cost effects of/on adjacent properties	●	No property required	◕	Property is required from all adjacent properties; costs will be incurred to replace parking supply lost
Minimizes adverse effects of alignment characteristics on operating and maintenance costs	●	Operating costs limited to stations	●	Operating and maintenance costs for regular traffic lanes will increase with widening
		Technically Preferred Alternative		