

Curb Versus Median Bus Lanes: The Yonge Street Case Study

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ABSTRACT

The City of Toronto is placing a greater emphasis and priority on the development of “higher-order” public transit operations to respond to increased travel demand in a sustainable fashion. This study is focused on addressing the short-term ten-year needs within the Yonge Street corridor, recognizing the adopted long-term proposal to extend the Yonge Subway. Although extension of the Yonge Subway is in the City of Toronto’s long-term plan, the TTC has identified other corridors as priorities for subway extensions. Over the next ten years, significant growth in population north of Steeles Avenue is expected. In order to identify surface transit opportunities for improvements on Yonge Street between Steeles Avenue and Finch Avenue, the City of Toronto, together with the TTC and GO Transit have initiated a Class Environmental Assessment, which is being carried out according to Schedule C. The impact assessment recognized that the preferred alternative should allow for the integration of transit services with the proposed Yonge Street Transitway north of Steeles avenue by York Region.

The Study, at the time of writing this paper, has not concluded which approach to implementing surface transit improvements will be used. This paper focuses on the constraints, analyses, and trade-offs between competing objectives that occurred during the development of design concepts, and identify practical lessons and generic conclusions that can be applied to similar studies.

The initial screening process of assessment factors revealed that the design alternatives exhibit significant differences in the following assessment factors:

- transit system performance;
- disruption of present land use development;
- traffic infiltration into the adjacent residential neighbourhoods;
- traffic delay;
- road safety;
- access to adjacent businesses;
- fire, police and emergency services access; and
- construction cost

The procedures applied to quantify the implications of alternative design concepts appear to have been successful in providing reasonable estimates of the potential impacts and communicating these potential impacts in meaningful terms to the various stakeholders.

1.0 INTRODUCTION

Study Background and Purpose

The City of Toronto is placing a greater emphasis and priority on the development of “higher-order” public transit operations to respond to increased travel demand in a sustainable fashion. The Yonge Street corridor from south of Steeles Avenue to Finch Avenue has been identified as a high priority to enhance the attractiveness of public transit by a number of municipal and provincial agencies, including the Central Ontario Smart Growth Panel, the Toronto Transit Commission (TTC), the Greater Toronto Services Board (GTSB), GO Transit and York Region. The City’s recently adopted Official Plan places major emphasis on increasing transit ridership and Council has determined improved transit operations need to be examined both to potentially alleviate current conditions but also to respond to the forecast growth in demand.

This study is focused on addressing the short-term ten-year needs within the corridor recognizing the adopted long-term proposal to extend the Yonge Subway. Although extension of the Yonge Subway is in the City of Toronto’s long-term plan, the TTC has identified other corridors as priorities for subway extensions. Over the next ten years, significant population growth north of Steeles Avenue is expected. In order to identify surface transit opportunities for improvements on Yonge Street between Steeles Avenue and Finch Avenue, the City of Toronto, together with the TTC and GO Transit have initiated a Municipal Class Environmental Assessment, which is being carried out according to Schedule ‘C’. The impact assessment recognized that the preferred alternative should allow for the integration of transit services with the proposed Yonge Street Transitway north of Steeles Avenue by York Region.

The Study, at the time of writing this paper, has not concluded which approach to implementing surface transit improvements will be used. This paper will rather focus on the constraints, analyses, and trade-offs between competing objectives that occurred during the development of design concepts, and identify practical lessons and generic conclusions that can be applied to similar studies.

Present Corridor Conditions

Within the Study Area (illustrated in Figure 1), Yonge Street is a 7-lane road comprised of three lanes in each direction plus a median two-way left-turn lane. Sidewalks and paved boulevards are provided on each side of the road. All of these features are provided within a 33m right-of-way. The curb lanes operate as High Occupancy Vehicle (HOV 3+) lanes in peak hours. The HOV lanes were implemented in 1993 to increase the person-trip capacity of the roadway while improving transit operations. For the most part, the initiative has proven effective.

Local, or all-stop, buses operate in the curb HOV lanes in peak hours allowing them to bypass some congestion and serve passengers at curbside stops. However, operations in the curb HOV lanes can, at times, be hampered by the inherent conflicts with right-turning vehicles accessing the many private establishments fronting onto Yonge Street. Express buses tend to operate in the mixed traffic lanes to avoid delays caused by local buses stopping to serve passengers and allow an easier transition into the northbound left-turn lane at Steeles Avenue and the southbound left-turn lane at Bishop Avenue. Local buses typically experience difficulty in accessing the left-turn lanes at these points due to the need to cross over two lanes of congested traffic in peak periods.

A number of transit routes are operated by the Toronto Transit Commission (TTC), GO Transit, York Region Transit (YRT), and Brampton Transit (BT) within the Yonge Street corridor. The TTC operates a number of regular transit routes on Yonge Street, Bathurst Street, Finch Avenue, Steeles Avenue, Cummer Avenue, Moore Park Avenue and Hilda Avenue. Many of these bus routes connect with the northern terminus of the Yonge Subway line at the Finch station. This terminal acts as a major transfer point, particularly for north-south commuters, providing a connection between bus and subway operations. Two commuter parking lots are located within the adjacent Hydro Electric Power Corridor (HEPC) providing a total of 2,900 parking spaces as well as a passenger pick-up/drop-off facility.

GO Transit and York Region Transit also operate buses on Yonge Street. These buses originate in York Region and travel north-south via Bathurst Street, Yonge Street, and Bayview Avenue to Steeles Avenue. South of Steeles Avenue, all GO Transit and YRT buses operate on Yonge Street. The GO Finch Bus Terminal is located on the east side of Yonge Street, north of Bishop Avenue adjacent to the TTC Finch Subway station.

In total, 117 buses are operated southbound during the AM peak hour on Yonge Street carrying approximately 3,000 passengers to the TTC Finch Subway station, and 1,500 passengers to the GO Finch Bus Terminal. During the AM peak hour, 57% of the approximately 7,900 southbound person trips use transit. Future residential and commercial development forecasts indicate that the demand in the corridor from the north will reach levels of approximately 17,200 in the AM peak hour, to be shared between Bathurst Street, Yonge Street, and Bayview Avenue and the intermediate collector/local roadways. The existing roadway network provides a capacity of approximately 9,600 person-trips per hour, per direction. If transit mode-share remains as is today, the resulting roadway capacity deficiency of 1,100 person-trips per hour, per direction is expected.

Problem Statement

Based on the analysis of existing conditions and future transportation deficiencies, transportation solutions are necessary to improve current transit operations along Yonge Street between Steeles Avenue and Finch Avenue and address projected capacity deficiencies in the Yonge Street corridor by 2011.

2.0 DEVELOPMENT OF ALTERNATIVE DESIGN CONCEPTS

The development of a wide range of alternative design concepts reflected the input of members of the public and technical advisory staff. Early concepts included operational changes such as one-way conversion of Yonge Street, reversible lanes, and physical changes such as roadway widening, curb Reserved Bus Lanes (RBLs), median RBLs and contraflow RBLs. A preliminary screening of these preliminary options was conducted based on their operational benefits and drawbacks.

It was determined that one-way conversion of Yonge Street through the study area would be operationally infeasible due to the two-way operation of segments upstream and downstream of the study area. Roadway widening was considered to be extremely expensive due to property requirements, and too disruptive to the established businesses and residents in the corridor. Barrier-separated curb RBLs were discarded, as they would have a significant impact on adjacent businesses. The guided median RBL concept was eliminated from further consideration due to the barrier effect on emergency vehicle access. Through the preliminary screening process, the curb and median RBL design concepts appeared to offer the greatest potential to address the transportation requirements while minimizing the negative impacts to the community.

Selected Design Concepts

Curb Reserved Bus Lanes

Given that Yonge Street currently features curb HOV lanes within the Study Area, the change to full Reserved Bus Lanes (RBLs) would largely be an operational change, with minor physical modifications to address location-specific issues.

The existing curb lanes would be re-painted and re-signed to full RBLs 24-hours a day, 7-days a week. Although this would displace users of the HOV lanes in peak hours — estimates indicate that there are approximately 400 vehicles operating in the curb lanes during the peak hour (including legitimate HOVs, taxis, buses, and violators) which would be redistributed to the other two general traffic lanes or to alternative routes. The potential impact of the reassignment of this traffic was not considered sufficient to preclude consideration of this concept.

In order for Curb RBLs to function effectively, they need to be able to accommodate both all-stops and express bus services. Curbside bus bays would therefore be introduced to allow all-stops buses to serve passengers outside of the stream of express buses, thereby minimizing the delays to express buses and avoiding forcing them to move into the general purpose lanes. The Curb RBL concept is not a “pure” Curb RBL operation, as median reserved bus lanes would be provided northbound at Steeles Avenue and southbound at Bishop Avenue to facilitate the left-turning movements of transit vehicles through these congested intersections.

The curb lane, although intended for use only by transit vehicles, would allow for general traffic use strictly for those vehicles making right turns into private accesses or at crossing streets. Toronto's current by-law allows these vehicles to enter the curb lane within 50m in advance of their turn. At key intersections, notably those with heavy right-turning movements, additional right-turn lanes would be provided to accommodate some queuing right-turning vehicles without delaying the through transit vehicles. This would require that right-turning vehicles cross the stream of buses to enter the right turn lane. This configuration is illustrated in Figure 2.

Median Reserved Bus Lanes

The Median RBL concept was developed to provide an alternative design concept that would separate buses from general traffic operations to the maximum feasible extent. This concept would see the median two-way left-turn lane replaced by a raised median, adjacent to which would be placed reserved bus lanes. This configuration is illustrated in Figure 3. Similar to many streetcar lines (Spadina Avenue or Queen's Quay, for example) in the City of Toronto, this concept would require the construction of median island stops/platforms to allow passengers to wait safely within the roadway to access bus services operating in the median. Again, the existing curb HOV lanes would be re-assigned to the general traffic lanes.

By relocating bus operations to the median of the roadway, the access/egress movements to and from private establishments fronting onto Yonge Street, would not impact transit operations. Left-turn movements for general traffic across the facility would be physically restricted by the centre boulevard at all locations except signalized intersections.

3.0 APPROACH TO IMPACT ASSESSMENT ANALYSIS

Identification of Assessment Factors

The approach taken to identify key issues for the study involved a number of sources. These included public consultation, agency contacts, recent similar investigations within the City of Toronto, and the relevant experience of the consultant.

Early in the study, a Public Information Centre was held, allowing potentially affected residents, business owners, and commuters the opportunity to provide input into the study regarding the analysis, development and selection of a preferred solution, as well as voice concerns regarding changes that may occur in the study area. This public consultation process formed a valuable method for gathering information and identifying potential areas for improvement to the transportation network in the study area, and formed a vital component in establishing comparison factors and determining the significance of impacts of alternative design concepts.

City and other technical advisory staff provided input throughout the study process. The technical advisory staff provided expertise and guidance in all aspects of public transportation, traffic operations, pedestrian and cyclist environment, and urban planning as they relate to the study.

The City of Toronto has carried out similar studies in recent years for the development of median Light Rail Transit (LRT) facilities, most notably the Spadina Streetcar line and the St. Clair West Streetcar line. Both of these studies examined the impacts of developing a median transit facility in a fully developed urban arterial corridor, and thus provided a background in the potential impacts that could result from the construction of a median facility on Yonge Street.

McCormick Rankin Corporation (MRC) has been involved in Bus Rapid Transit projects in Canada, the United States, Australia, New Zealand, and in the United Kingdom. These projects have included a variety of situations, both in exclusive rights-of-way and on arterial streets, and in rural and urban settings. These previous studies provided an extensive knowledge base and experience applicable to this investigation.

The Key Issues

The initial screening process of assessment factors indicated that the decision-making process must address the impacts of the design concepts under the following assessment factors:

- transit system performance;
- disruption of present land use development;
- traffic infiltration into the adjacent residential neighbourhoods;
- traffic delay;
- road safety;
- access to adjacent businesses;
- fire, police and emergency services access; and
- construction cost

The impact assessment procedures applied in quantifying these factors are highlighted in the remainder of this paper.

4.0 SUMMARY OF IMPACT ASSESSMENT OF ALTERNATIVE DESIGN CONCEPTS

The preliminary impact assessment examined the broad range of assessment factors. These included impacts to the transportation network, social environment and City policies, economic environment, natural environment, and costs. Each of these broad factors was comprised of a series of sub-factors, resulting in a total number of 30 assessment factors. Each design concept was assessed under each criterion to determine the magnitude of the impact, the incidence of the impact and the significance of the impact.

The impact assessment procedure allowed the Project Team to screen out those factors that exhibited similar impacts under all alternatives and therefore did not provide a basis for selecting a preferred concept or impacts that were not considered significant. This screening process then resulted in a comparison of only those factors that exhibited significant and varying impacts between design alternatives, thereby streamlining and clarifying the assessment procedure.

Transit System Performance

The existing transit travel times, based on average travel times collected during site surveys, have shown that transit trips throughout the corridor can vary within a range of approximately +/- 3 minutes. This is due to localized queuing for turning movements at both the Steeles Avenue intersection and the Bishop Avenue intersection. Queuing in these areas can affect both northbound and southbound buses, and result in an overall reduction in transit service reliability.

The Yonge Street Corridor was analyzed using micro-simulation modelling software (VISUM/VISSIM) and reflected the anticipated dynamics of the traffic conditions during the AM peak period (6AM-9AM). This model was quite extensive, covering an area of approximately 20 km², and included the future North York Service Road – a ring road covering the southern half of the study area and beyond, designed to enhance access to developments along the Yonge Street corridor. The “base-case” model was validated according to observed travel times between Steeles Avenue and Finch Avenue/TTC Finch Terminal/GO Finch Bus Terminal in order to establish a basis to assess future transit operations and the impact on the general traffic.

Following validation of the “base-case” model, the existing configuration, Curb, and the selected design concepts were input and simulated for a future scenario, using forecast traffic volumes for a horizon year of 2011. Future traffic volumes were established based on a VISUM travel demand model developed by McCormick Rankin Corporation, and validated against the City of Toronto’s EMME/2 travel demand model for the 2011 AM peak period scenario. This allowed the impacts of these alternative facility concepts to be compared against the future scenario without any improvements.

The results identified opportunities to provide localized improvements to the design concepts to address areas of concern. Given the number of traffic signals in the corridor (7), the length of the study area (2 km), and the peak hour traffic volumes (approximately 2,900 vehicles during the peak hour in the peak direction, 2003) to compete with, it is expected that the travel time savings under either alternative would be minimal – somewhere in the order of 60-90 seconds per trip. Under a curb RBL alternative, by not ultimately separating transit operations from general traffic operations – general traffic could legitimately use the lane to access private establishments and crossing streets – the uncertainty of arrival times currently experienced in the HOV lanes would remain. Implementation of a Curb RBL would not address the issue of delays caused by queuing at both Steeles Avenue and Bishop Avenue as transit vehicles would be required to enter the general purpose lanes to access left-turn lanes at these specific intersections. Overall, the Curb RBL concept would have a marginal increase in the current transit system operating capacity.

The median RBL option which minimizes conflicts with general traffic provides predictable and reliable travel times through the corridor. This plays a significant role in attracting ridership – surveys have shown that one of the key factors affecting a person’s decision to use public transit is (along with travel time) the reliability of the transit service (Source: *TTC – Building a Transit City, 2005*). Importantly, the introduction of a Median RBL concept would have a significant impact on transit system capacity; upwards of 50%.

Traffic Infiltration In Adjacent Residential Neighbourhoods

The transportation analysis, conducted using the expanded VISSIM micro-simulation model, was focussed on the level-of-service implications for general area traffic patterns, with particular attention being paid to the possible diversion of traffic away from Yonge Street and other arterial roads to collector and local streets. The impact of the alternative design concepts with respect to forced relocation of turning movements and access to adjacent businesses is addressed elsewhere in this paper.

The 24-hour travel demand data was examined to isolate the through and destined trips within the corridor based on the estimated zonal trip interchanges. The destined trips were then examined by trip purpose to identify the magnitude of trips destined within the adjacent residential neighbourhoods and the employment/shopping/ personal business trips with an origin/destination to the development fronting on Yonge Street. These estimates were compared with the current traffic volumes along the arterial and collector street network through the use of the micro simulation model. The degree of the traffic diversion was inferred through an analysis of traffic patterns on the local street network. On the basis of the forecast intensification of development combined with the future level of service provided, the magnitude of the diversion of through vehicle trips from Yonge Street was predicted.

Traffic Delay/Level-of-Service

Level-of-service may be evaluated in several different ways, depending upon the context. For this analysis, three separate measures were used to assess traffic level of service changes along Yonge Street.

- *Delay-based level-of-service at key intersections.* This measure has emerged as a *de facto* norm for level-of-service analyses, as evidenced by the primary methodologies and outputs of the Highway Capacity Manual (HCM 2000) and the SYNCHRO suite, the most commonly used methodologies today. For this analysis, the macroscopic delay-estimation procedures in HCM 2000 and SYNCHRO were replaced by the microscopically-simulated delays from the VISSIM model. Although delay is a measure that is relatively easily understood by transportation system users, it has several deficiencies as an exclusive performance measure. The key drawback of delay-based level-of-service as a measure is that it does not behave in a linear fashion and therefore provides little indication of how close an intersection is to capacity conditions. Delay increases relatively slowly until capacity levels are approached and exceeded, at which point it increases at higher-than-exponential rates. Other complications involve the role that cycle length plays in determining average delay. With longer cycle lengths, despite the fact that the street may be practically free of traffic, good levels-of-service cannot be achieved.
- *Travel time changes along the corridor.* This provided a good overall measure of the ability of vehicular traffic to traverse the corridor. Travel times were assessed using the VISSIM microsimulation software to identify the impacts of implementing a median transit facility on both transit and general traffic travel times between Steeles Avenue and Finch Avenue. Given the minor operational changes involved in converting the curb lanes from HOV to complete Reserved Bus Lanes (RBLs), travel time changes were estimated to be minimal.
- *Volume/capacity ratios at key intersections.* To address the shortcomings of delay-based level-of-service as a performance measure, it was considered beneficial to combine it with volume-capacity ratios. This type of analysis enables the identification of how much capacity “headroom” is available, in a linear fashion, and gives a clearer indication of where an intersection sits with respect to its absolute vehicular capacity. For this analysis, the overall intersection volume/capacity ratio as reported by HCM 2000 was used. Key advantages are that it accounts for all critical (conflicting) lane groups and it is independent of signal timing, requiring only a suitable phasing arrangement to be decided upon.

When the levels-of-service for the northbound and southbound (through-traffic only, in this case) approaches to the intersections along Yonge Street are considered, based on micro-simulation, the only truly critical situations across the four scenarios involve the Yonge/Steeles intersection, in particular with respect to the southbound movement.

In addition, the metering effect of the intersections at the north and south limits of the corridor must be recognized in the assessment of the impacts. The Yonge/Steeles intersection meters southbound traffic entering the portion of the Yonge Street corridor of interest to this study. This metering effect will be increased with implementation of a median transit facility as intersection green-time will be required to accommodate exclusive transit phases. The net result of this metering effect will be significant southbound queues north of Steeles Avenue.

Similarly, the Yonge/Avondale intersection meters northbound traffic entering the Yonge Street corridor within the study area.

Disruption of Present Land Use Development

The Yonge Street corridor imposes many physical constraints on the development of transportation improvements. Properties along Yonge Street and adjacent communities are fully established, leaving little available property for the development of transportation improvements. To a certain degree, these constraints controlled the physical attributes of design concept elements such as: lane widths; stop configurations; intersection configurations; and sidewalk/boulevard treatments. Every effort was made to limit the disruption to present development in the corridor.

Measures taken to limit the disruption to existing development included:

- the removal of the boulevard at bus stops in place of bus bays and at intersections in place of localized widening for additional turning lanes;
- selecting a minimum lane width of 3.5m for all through lanes;
- limiting median widths in median RBL design concepts to 3m;
- limiting sidewalk/boulevard width to a maximum of 4m, and incorporating streetscaping elements with limited width requirements; and
- the removal of 1.5m curb cycle lanes from early design concepts – an analysis of cyclist level-of-service determined that, under either a Curb or Median RBL facility, installation of 1.5m wide standard curb cycle lanes would not provide a significant improvement to cyclist comfort in the corridor.

Through these measures, the impact of the design concepts was minimized in an absolute and relative sense. The impacts of either a curb RBL facility or a median RBL facility were determined to be approximately equal. However, as the property impacts of the alternatives are situated in different locations, the Median RBL facility would result in the elimination of approximately 350 private parking spaces throughout the corridor. The Curb RBL design concept would affect approximately 270 private parking spaces. Given that the corridor contains in the order of 6400 private parking spaces, the impact of these alternatives (of approximately 5%) was not considered significant. However, by looking

at each property individually it became evident that some businesses with limited parking may experience significant impacts, and therefore mitigation measures (such as side-street parking) would have to be developed.

Road Safety

The objectives of the road safety analysis were to examine existing operational and geometric conditions of the study area to establish the factors which contribute to a higher than average collision rate for all modes of transportation, including pedestrians and cyclists, and to identify what, if any, impacts the alternative design concepts would have on the collision rates. Given that the Curb RBL alternative would result in no significant operational change, it was determined that it would have little impact on the corridor's collision rates. To determine the impacts of the Median RBL alternative, collision experience from a similar recent study was drawn upon for guidance.

Collision experience on Spadina Avenue was reviewed for a period of three years prior to and following the construction of a median Light Rail Transit (LRT) system. The effects of implementing this type of facility on Spadina Avenue on vehicular operations would be similar to those experienced on Yonge Street under a median RBL facility alternative, and therefore could be used as a basis for forecasting the safety implications of such a facility on Yonge Street. The "before and after" review of the Spadina Avenue experience suggested that the frequency of collisions have not changed, rather the type and location of collisions have been affected. As expected, the introduction of positive separation between the transit lanes and the general traffic lanes has reduced the right angle and left-turn collisions at mid-block locations. The introduction of a median transit facility appears to have increased the sideswipe/overtaking collisions. This may be attributable to the varied horizontal alignment necessary to introduce the transit boarding platforms. However, physical changes at the intersection have reduced the right angle collisions significantly.

Access to Adjacent Businesses

The fundamental point is whether any of the proposed surface transit improvements would potentially affect the viability of the present commercial developments. Traffic diversion could result from the elimination of turning movements or access restrictions, forcing drivers to find alternative routes to their destinations. The analysis concentrated on the implications of the various design concepts that restricted present turning movements at the unsignalized intersections and the mid-block entrances to the commercial and residential development.

Detailed traffic counts were taken over a 12-hour period (7:00 AM to 7:00 PM) measuring the volumes of traffic generated by the selected developments along the corridor. The traffic counts also provided data at the un-signalized intersections to estimate the distribution of traffic destined to local businesses and the vehicle volumes

generated by the adjacent neighbourhood. The current signalized intersections would not be affected by the proposed options.

To forecast the possible implications on the businesses, the assessment was completed within segments of the corridor. The severity of the impact was also stratified by the type of business and/or development. If the development was residential or if the trip was non-discretionary (doctor/lawyer/car dealership), it can be postulated that the individual would be familiar with the access and adjust his/her route to allow a “right-in” manoeuvre. The implications are considered more severe where the access is being restricted to a discretionary type of trip (coffee shop, variety store, fast food operation). In these cases it is likely the customer would proceed to another location rather than consider out-of-the-way travel to access the location. However, a number of these types of businesses have a regular clientele. Accordingly, the customers plan their trip similar to a non-discretionary trip and adjust their approach to the location.

The Curb RBL option was considered neutral related to business impacts and traffic infiltration, as it would not introduce any changes to the current accesses or intersections. Accordingly, the investigation related solely to the possible implications of the Median RBL design concept. Preliminary analyses indicated that the redistribution of trips under a Median RBL facility concept could potentially result in some traffic diversion. In order to mitigate this, the Median RBL concept was modified to allow drivers to perform U-turn manoeuvres at signalized intersections on protected left-turn phases. The revised analysis indicated that this treatment would provide an attractive alternative to infiltration through neighbouring communities, thereby minimizing the traffic diversion of access-related trips expected as a result of constructing a Median RBL facility.

Fire, Police, and Emergency Services Access

This impact assessment factor was focused on the degree to which the movement of emergency vehicles would be restricted in comparison to the present situation. A Curb RBL facility would have minimal impact on emergency vehicle circulation. Although a Median RBL facility would not allow unrestricted access for emergency vehicles *across* the facility, it would provide emergency vehicles (though use of the RBLs) a less-congested path along the length of the corridor. In order to provide access across the facility, the intent under this concept would be to introduce median openings at regular intervals to minimize the implications.

Construction Cost

A series of typical sections were developed covering the range of cross-sections used in both the curb and median RBL concept. Each section was assigned a cost on a per-metre basis. Item unit costs were taken from recently completed projects in the Greater Toronto Area. These costs were applied to typical cross-sections assuming that the existing road base could be salvaged with complete re-paving and roadway widening. No significant excavation was assumed necessary in the corridor given the existing Yonge Street

vertical alignment would not have to be changed. Cost estimates were developed based on 1:1000 functional plans.

An overall 25% contingency was applied to all construction costs to cover minor non-specified items and to recognize the uncertainty connected with cost estimates made at this stage in the planning process. A further allowance of 40% was added to the construction cost to cover project management (10%), engineering (15%), and project contingency (15%).

The Curb RBL facility was estimated to cost approximately \$8M, exclusive of property. This would include a complete resurfacing of the roadway itself, construction of bus bays at stops, and installation of new sidewalk/boulevard treatment. The Median RBL facility was estimated to cost approximately \$17M, exclusive of property.

5.0 CONCLUSION

The procedures applied to quantify the implications of alternative design concepts appear to have been successful in providing reasonable estimates of the potential impacts and communicating these potential impacts in meaningful terms to the various stakeholders.

FIGURE 1 – Study Area

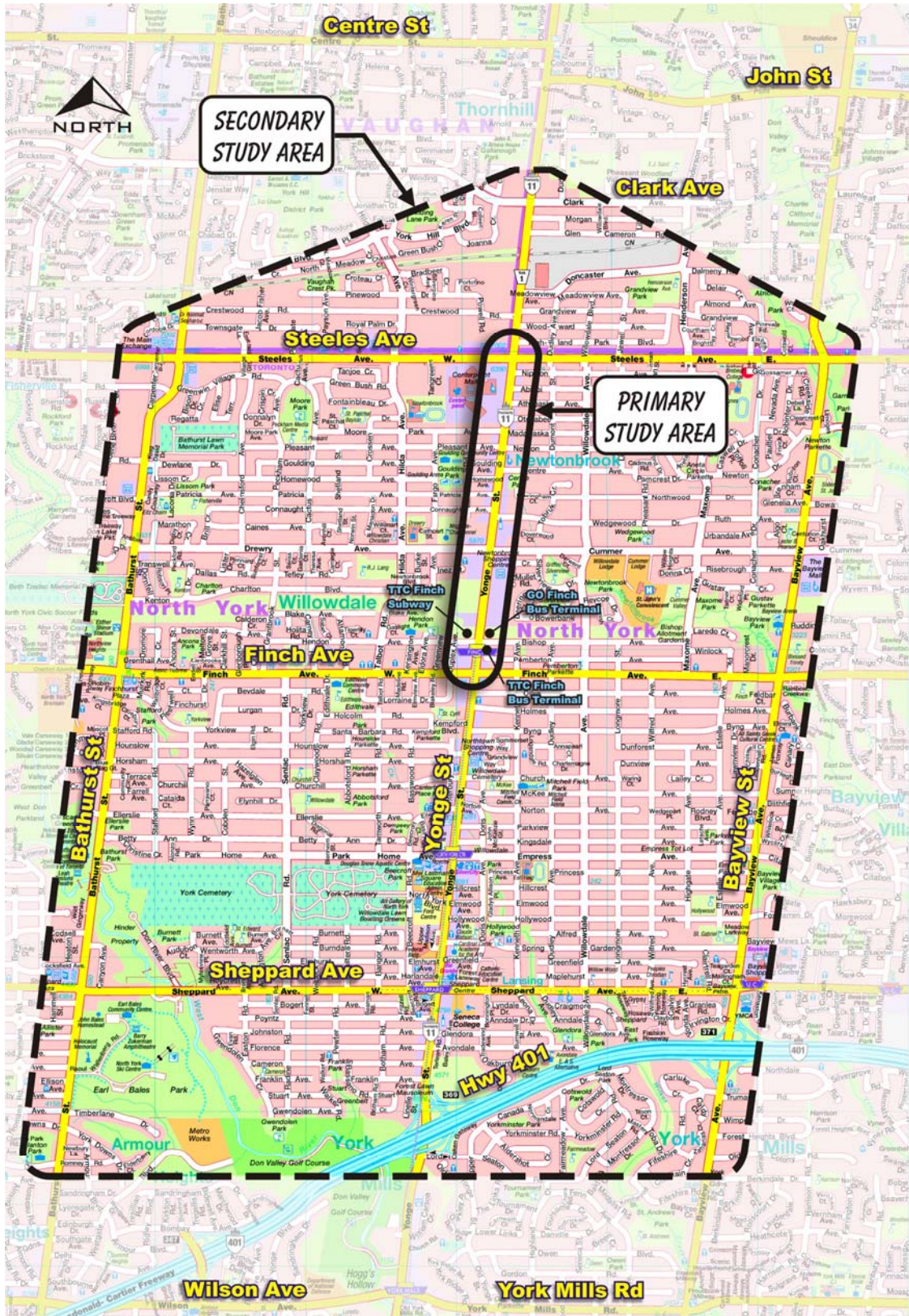
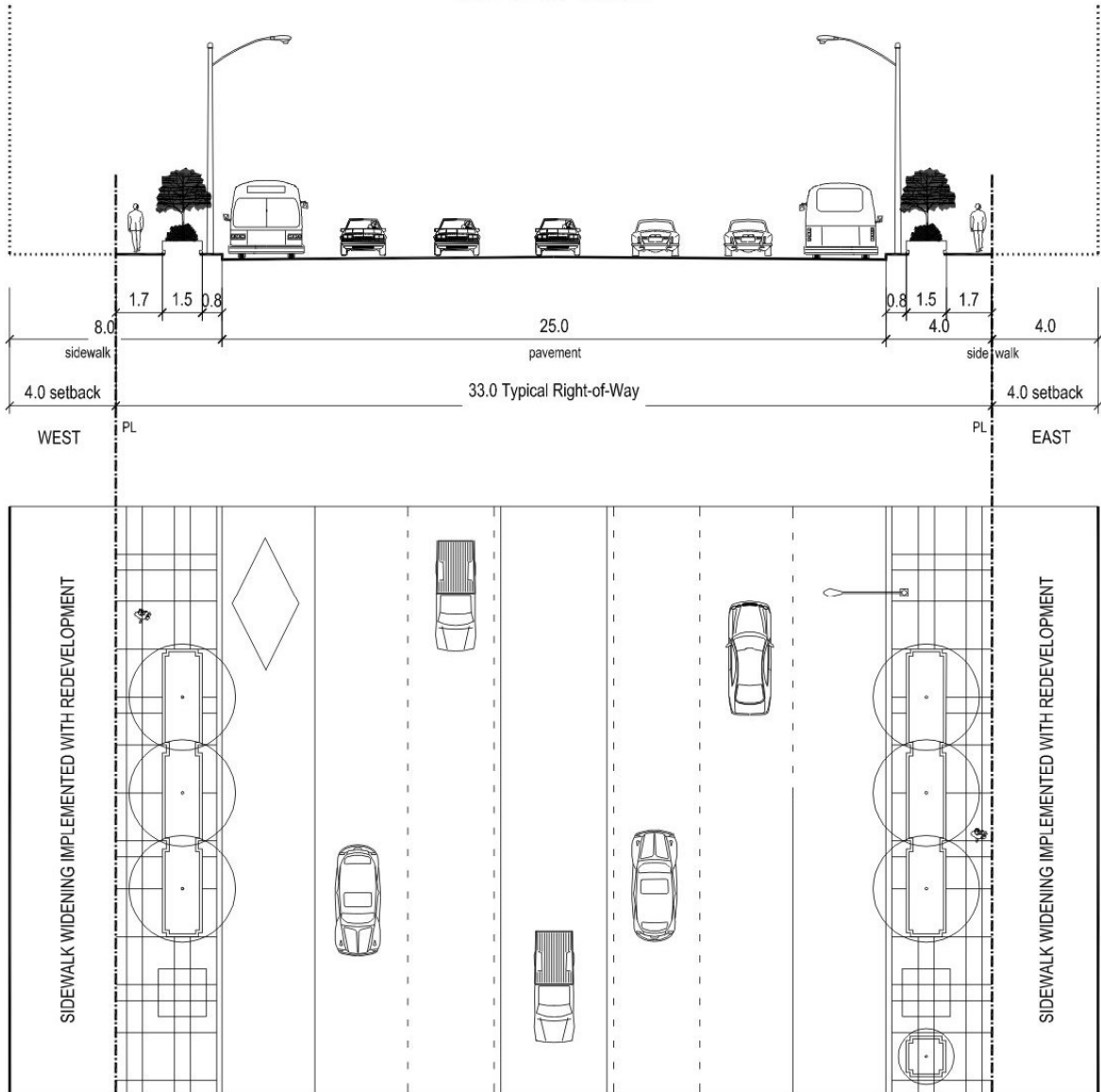


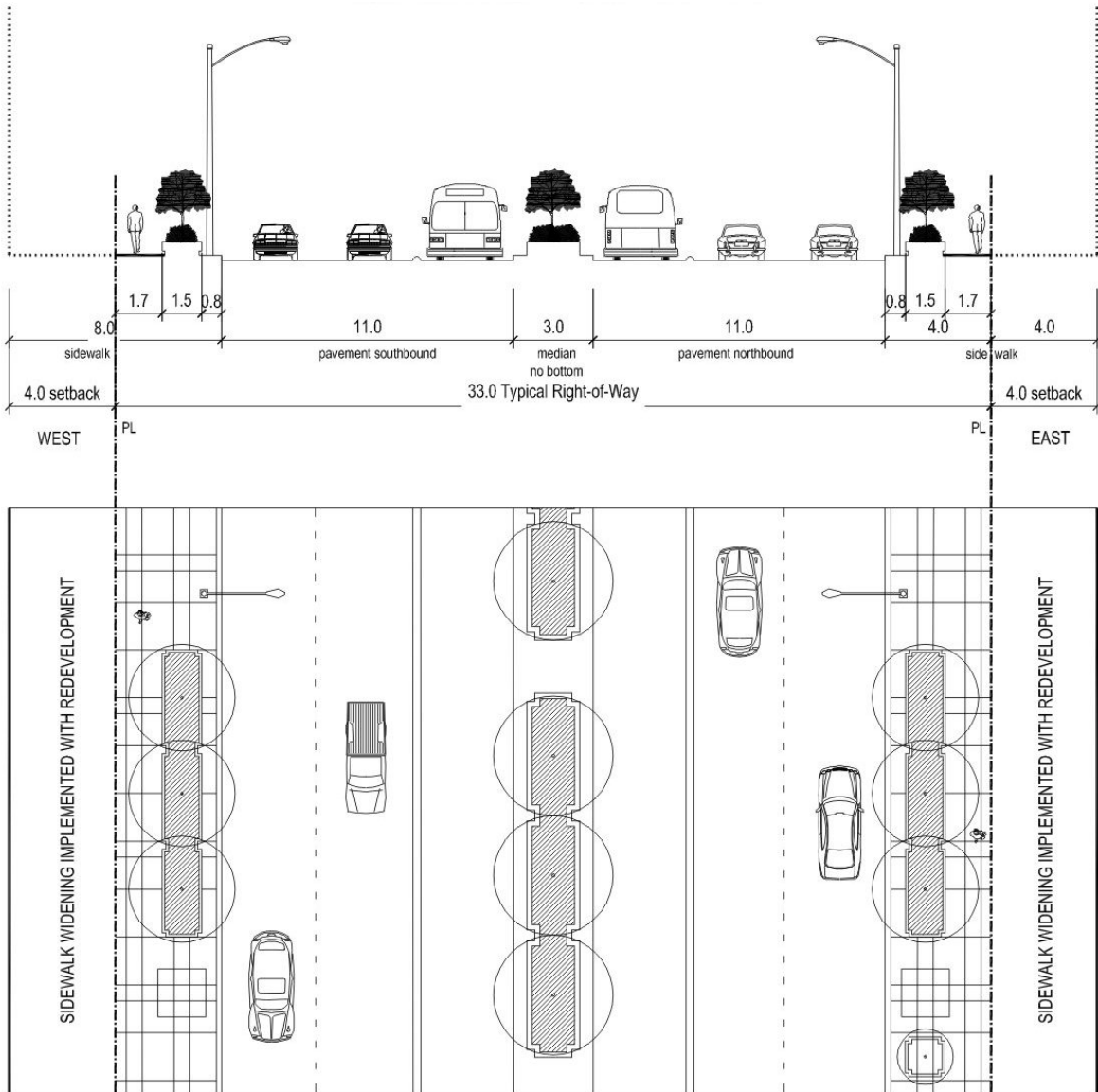
FIGURE 2 – Curb Reserved Bus Lane Design Concept



NOTE: 4.0m Setback required between Finch Ave. and Cummer/Drewry Ave. (according to North York Secondary Plan)

4.0m Setback recommended between Cummer/Drewry Ave. and Steeles Ave. (according to City of Toronto Urban Design)

FIGURE 3 – Median Reserved Bus Lane Design Concept



NOTE: 4.0m Setback required between Finch Ave. and Cummer/Drewry Ave. (according to North York Secondary Plan)
 4.0m Setback recommended between Cummer/Drewry Ave. and Steeles Ave. (according to City of Toronto Urban Design)
 Barrier treatment to be determined.