2. PROJECT DESCRIPTION

The objective of the study is to find the best way to provide a fast, reliable and safe transit service to connect Kennedy Station and the north-eastern Scarborough Community in a manner that:

1. Makes transit a much more attractive travel option relative to the private auto so that more people will choose to use transit instead of their cars;
2. Is affordable;
3. Supports the City's growth objectives of a better variety and density of transit-oriented developments, particularly on the sections along Eglinton Avenue and Kingston Road which are designated in the Official Plan as 'Avenues'; and
4. Gives appropriate consideration to other important City objectives such as good urban design, and an improved walking and cycling environment.

In addition, the recommended design must be developed in a manner that respects other road users, adjacent properties, and the natural environment.

2.1 Background Studies

This section describes the studies undertaken to determine the design of the Scarborough-Malvern LRT.

2.1.1 TECHNOLOGY SELECTION

A transit system will be considered successful if it can maintain existing transit ridership and attract new riders by offering a fast, reliable and safe transit service. In order to attract new riders, the transit service should act as a better alternative so that the private automobile users will alter their travel habits. The existing bus services in the Scarborough-Malvern Corridor operate in mixed traffic and therefore do not provide enough incentive, from a travel time and reliability perspective, to become an attractive alternative.

2.1.1.1 Identification of Alternative Transit Methods

Various potential methods for supplying transit services were identified and evaluated in previous TTC studies, including Do Nothing – with or without Transit Priority Improvements, Travel Demand Management/Transportation System Management, High Occupancy Vehicle (HOV) or reserved curb bus lanes, Bus Rapid Transit, Light Rail Transit etc.

Previous studies concluded that, in order to attract more people to use public transit, the new transit system must be faster than the existing transit system, and more reliable when compared to using private automobiles. Hence, the 'Do Nothing' option with buses operating in mixed traffic represents a continuation of current trends with no significant infrastructure or operational improvements and does not satisfy the principal objectives of the City's program.

Travel Demand Management (TDM) / Transportation System Management provide measures to reduce the number of vehicles, primarily single-occupant vehicles operating on the roadway especially during peak periods. Examples include increasing transit usage and encouraging carpooling. The travel forecasting and modeling developed for this and other Transit City projects shows that TDM alone cannot fully address the projected future demand, existing traffic operation concerns, and safety issues. However, TDM should still be utilized in conjunction with the preferred transit methods for this study.

To achieve the study objective, transit service must have a much greater degree of "protection" from the delays associated with mixed traffic operation. HOV lanes in tandem with bus transit may improve the reliability of bus service, especially during peak periods, but examples from existing Eglinton Avenue East and other locations in Toronto have shown that HOV lanes are extremely difficult to enforce because of the lack of physical separation between the transit lane and general traffic lanes. Also, transit reliability would remain poor during off-peak periods and weekends if the HOV lanes were enforced only in peak hours.

For these reasons, the option of curb HOV and bus lanes, as used in other parts of the City, was not carried forward for further consideration.

There are two key elements when designing transit lanes to protect them from the effects of traffic congestion:

- The lanes must be reserved for transit only and not shared with other traffic; and
- There must be some form of physical separation to ensure that motorists do not travel in the transit lanes illegally. Experience has shown that enforcement without such separation is difficult.

Given the above criteria, three alternative transit methods were considered for the Scarborough-Malvern corridor:

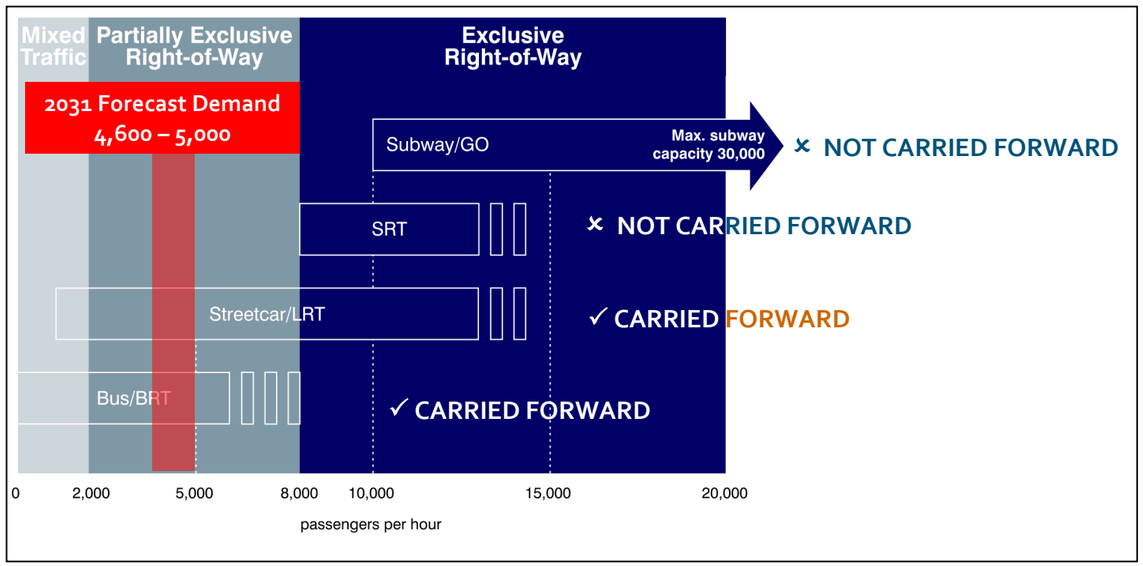
1. Subway / Rapid Transit Technology – Electrically powered rail vehicles that operate on a fully exclusive right-of-way – such as a subway or the elevated Scarborough Rapid Transit (SRT) line. With no at-grade operation across any roadways, there is no influence from other traffic. These systems are capable of carrying high volumes of people.
2. Light Rail Transit (LRT) – Electrically powered vehicles that operate on a partially exclusive right-of-way (reserved lanes) with traffic crossings at signalized intersections. These systems are capable of carrying medium to high volumes of people.
3. Bus Rapid Transit (BRT) – Diesel or hybrid powered buses that operate on a partially exclusive right-of-way (reserved lanes) with traffic crossings at signalized intersections. These systems are capable of carrying medium volumes of people.

In the following sections the remaining alternatives are evaluated.

2.1.1.2 Elimination of Subway/SRT Technologies

Based on the population and employment forecasts in the Scarborough-Malvern Corridor, the City and the TTC have projected that the transit demand in the corridor will increase to the range of 4,600 to 5,000 persons per hour in the peak direction at the busiest point on the line. A subway with higher speeds might attract some additional riders but the total demand would still be in this area. Subway / Rapid Transit technology is not justified if the peak hour demands are not approaching the range of 10,000 people per hour during peak hour in the busiest direction (as shown in Exhibit 2-1). It is estimated that subways cost four to five times more than LRT. Therefore, the expected future travel demand on Scarborough-Malvern corridor is well below what would be required to justify the high costs of subway or elevated transit-ways. As such, subway or elevated rapid transit (i.e. the Scarborough Rapid Transit or SRT) technologies were screened out and not carried forward as alternative transit solutions.

Exhibit 2-1: Transit Forecast Demand and Technology Requirements



The remaining alternatives, LRT and BRT, were evaluated with respect to four factors:

1. Air Quality – Must utilize sustainable technologies – Air quality impacts must be minimized in order to achieve the City's design objectives of a walkable, distinctive, and beautiful community;

2. Capacity – Capable of accommodating forecast travel demand – In order to support the development aspirations of the City, the proposed transit systems must be able to satisfy the anticipated transit demand resulting from the forecasted development;

3. Land Use – Must meet City's Official Plan Policies and Principles – This project builds on considerable planning and policy decisions that have already been made for the area and therefore a solution that is in conflict with one or more of these previous decisions are not considered reasonable; and,

4. Costs - Reduce operational and maintenance costs while simultaneously improving ridership.

2.1.1.3 Bus Rapid Transit (BRT)

In this section and the next, the attributes of Bus Rapid Transit and Light Rail Transit are compared.

Bus Rapid Transit vehicles operate on reserved lanes or separate rights-of-ways.

Air Quality

BRT would result in less improvement in emissions at point source locations than LRT, as it is normally provided by bus vehicles powered by diesel or hybrid systems.

Capacity

Buses are smaller than rail vehicles and cannot be "coupled" together to operate in trains. As such, a local BRT service – one that services all stops - has less carrying capacity than LRT. High BRT capacities would only be feasible with by-pass lanes to allow some buses to operate express and pass one another at stops, but there is not sufficient space for a 3.5 metre by-pass lane in the Scarborough-Malvern Corridor Right-of-Way while providing a "comfortable" walking environment, bicycle lanes, four through lanes and left turn lanes for general traffic.

A standard 12 metre bus typically has a peak period design load of 50 people per vehicle. Given the transit forecast demand is between 4,600 and 5,000 customers, approximately 92 to 100 buses would be required, per hour to service the demand. Even if the new articulated buses were purchased, it would only reduce the minimum number of buses to 52 per hour, which would result in buses operating close together and would lead to one catching up to another – creating a "bunching" situation.

Land Use

While sufficient study data is not available to conclude that there is a significant difference between BRT and LRT with respect to encouraging development, there is a 'school of thought' that suggests that BRT is not as effective at influencing sustainable land use patterns as is LRT because BRT is not fixed and is therefore not perceived as a permanent investment that would support development.

According to the former U.S.A. Deputy Secretary of Transportation, Edson Tennyson PE., LRT attracts many more passengers than BRT since buses are generally the less preferred options of travel. Tennyson testifies to this by concluding in a 2003 Discussion Paper that ***"…busways (BRT) have attracted only one-third of the riders promised, but LRT has attracted 122%" (Source: E. L. Tennyson, "New York considering light rail***", personal discussion paper (edited), 9 Nov 2003).

While TTC staff would tend to agree with the preference for LRT over BRT with respect to encouraging better land use development, there is insufficient data available to support this being a critical difference between the two modes.

Cost

BRT costs less than LRT to implement – roughly $10 million per kilometre.

2.1.1.4 Light Rail Transit (LRT)

In this study, the LRT technology being considered is significantly different than the streetcar operation that is in place on several streets in Toronto. The LRT will operate on its own lanes. Vehicles will be very different. The TTC and the City of Toronto have begun the process of acquiring a new type of vehicle to replace the existing streetcar fleet. The basic vehicle technology is the same for the LRT as for the streetcar replacement fleet – they are both light rail vehicles, using electrical power from overhead wires that allows them to operate in, or across, traffic lanes. The basic design and operation of the LRT right-of-way at signalized intersections are also the same as streetcars but with dedicated lanes. The new light rail vehicles will be significantly different than the existing streetcars in service today. With a modern European design, they will be twice as long as a standard streetcar, with level loading from platforms – i.e. no steps – and a new fare system that will allow loading from all doors to significantly speed-up passenger loading and alighting. In addition, for the light rail lines, the new vehicles will be bi-directional – i.e. with operating cabs at both ends and doors on both sides – eliminating the need for turning loops.

Air Quality

Since LRT vehicles are electrically powered, no emissions would be produced on the street.

Capacity

The new Light Rail Vehicles that will be designed for the TTC has a much higher carrying capacity than BRT. A 30.0 metre LRT can comfortably carry an average of 130 people. A peak point demand of 4,600 people per hour would require a vehicle about every 1 minute, 40 seconds. This frequency would likely be difficult to operate and may result in vehicle 'bunching'. Therefore, when approaching this demand, the Light Rail Vehicles would be 'coupled' together and operated in pairs (i.e. 60.0 m trains), so that the time between vehicles would be about 3 minutes 30 seconds, which makes for a more-manageable operation.

Land Use

LRT technology supports the Toronto Official Plan objectives with respect to creating transit-oriented development in the corridor and removing vehicles from the road. A recent study, based on a review of BRT and LRT experience in the U.S., by the Region of Waterloo concluded: "Rail transit…is recognised to be a planning tool that can support and encourage the development of more sustainable land use patterns. LRT, like subways, has been shown to influence land development in part because, being tied to tracks, it is both distinct and perceived to be permanent." On this basis LRT would be more effective than BRT in supporting the City's vision for the creation of a more urban 'Avenue', as is planned on Eglinton Avenue and Kingston Road.

Cost

While it costs more to construct than BRT – roughly with a total cost of over $30 million per kilometre, LRT can be more efficient than BRT in operational costs.

LRT outperforms BRT in lifespan of vehicles as well. Buses generally last around 15 years, after which they either require major improvements or complete replacement. LRT vehicles have records of operating smoothly for 30 to 40 years thereby being twice as efficient in the long run.

2.1.1.5 Recommended Transit Method

LRT was recommended as the preferred transit method over Subway/SRT and Bus Rapid Transit mainly due to its passenger carrying capacity. The City forecast peak point demand for the Scarborough-Malvern Corridor ranges between 4,600 and 5,000 people per hour which is well below the threshold of 10,000 people per hour that is normally required to justify the very high cost of construction of Subway/SRT facilities. BRT would not adequately accommodate the forecast peak hour demand of 4600-5000 people and address other City objectives (i.e. attractive walking and cycling environment). Therefore, BRT is not the preferred transit solution.

LRT makes transit a more attractive travel alternative to the private auto, particularly in the future with increased travel demand and congestion. It also supports the City's objectives, for development in the corridor related to urban design and providing a more attractive walking and cycling environment.

LRT is the recommended Transit Solution as it fulfills passenger requirements, integrates with the physical environment, and provides flexibility for future growth. Also, it supports to the City's vision – a better integrated transit system, reduced car dependency on roads (thereby lowering emissions), growth in general infrastructure, and increased ridership along this corridor.

New Vehicles for the Scarborough-Malvern LRT

The Light Rail Vehicles (LRV) that will be used in the Scarborough-Malvern corridor (examples are shown in Exhibit 2-2) will have the following features:

- Larger capacity – about twice as the long as the existing standard streetcars in Toronto;
- Enhanced accessibility – low-floor vehicles with level loading from on-street platforms;
- Doors on both sides – platforms can be located on either side of the vehicle;
- Loading on all doors – significantly reduces the time spent serving stops;
- Operator cabs on both ends – the vehicle can operate in either direction and not require a loop to turn around, reducing infrastructure and space need, as well as noise and vibrations; and
- Modern design – attractive design will be conducive to the long-term goals for the corridor to be a distinct identity area with pleasing streetscapes and public spaces, making the community a distinctive, vibrant, and beautiful area.

TTC's LRT cars will have a length of approximately 30 m and a width of 2.54 m. Trainsets of two cars result in a train length of approximately 60m. The design load for such an LRT train is 260 passengers. Maximum operating speed is 60 km/hr. Trains are powered by electrical power from overhead wires. Train operations, and opening / closing of doors, are controlled by on-board staff.

The track technology to be used is a combination of a continuously welded rail embedded in a concrete road bed with a rubber sleeve that isolates the rail from the concrete. This elimination of rail joints combined with the isolating sleeve provides a smooth operation with limited noise and vibration that is no different than the noise levels of a busy street.

Exhibit 2-2: Examples of LRT Vehicles

Porto, Portugal

Enhanced Accessibility

Valencia and Alicante, Spain

Minneapolis, USA

Drawing of Toronto Streetcar Replacement Vehicle

2.1.2 STOP SPACING

LRT stops are selected based on the right balance between good local access and high route speed. The greater the distance between stops, the higher the speed of travel. There were two general scenarios considered for stop separation for the Scarborough-Malvern Corridor:

1. LRT stops every 800 - 1,000 metres like a 'surface subway', with stops at major intersections with parallel bus service (such as every 20 minutes) serving bus stops in between. At LRT stops, customers can transfer to the centre LRT platform from the side of road bus stop.

2. LRT stops more closely spaced, every 400-600 metres, with no parallel local bus service.

TTC developed a micro-simulation to examine the impacts of stop spacing on the Sheppard East LRT. A stop spacing of 800 metres resulted in a route speed of 26-27 km/h, while a stop spacing of 400 metres had a route speed of 22-23 km/h. The wider spacing did not result in as much of a speed advantage as expected; while the LRT stopped less often, the time for customers to board took twice as long per stop (same number of passengers collected at half the stops) and the LRT still had delays due to red lights at signalized intersections in between stops (although the model accounted for possible signal priority to reduce such delays).

The wider spacing scenario was not selected because the full impact of the increased speed of the LRT applies only to those walking directly to LRT stops. Those boarding local buses at bus stops in between LRT stops have a shorter walk, but a longer waiting time for service and a transfer to the LRT after a very short bus ride.

The recommendation for stop spacing for the Scarborough-Malvern line is in the order of 400 to 600 metres, depending upon the pattern of development and the location of cross-streets, with an expected average speed of 22 to 23 km/h; this is considered to be the best balance between the overall route speed and good local access. The stop spacing may be greater at some locations for the Scarborough-Malvern LRT due to the presence of undeveloped zones along corridor such as the crossings of Highland Creek and Highway 401. For purposes of comparison, during peak operating conditions, the average speed of the Bloor-Danforth subway line is 30 km/h, the 85 Sheppard East bus service is 17 km/h, and the 510 Spadina streetcar service is 14 km/h.

2.1.3 DESIGN CRITERIA

Design criteria for both LRT alignment and existing roadways geometry were established for developing the conceptual plan. The criteria were developed based on the TTC - Design and Supply of the Low Floor Light Rail Vehicle – Technical Specification and the Transportation Association of Canada (TAC) – Geometric Design Guidelines.

2.1.3.1 Transit Elements

In January 2008, TTC developed a set of technical specifications named “Design and Supply of the Low Floor Light Rail Vehicle – Technical Specification” to replace the existing streetcars and to support the proposed Transit City network. This technical specification provides the vision for the future Toronto LRT network and the basic design criteria for the vehicles to be used. As the procurement of the new Light Rail Vehicle (LRV) is still underway, the design criteria as listed in Exhibit 2-3 will be updated when the preferred vehicles is selected in the future.

Exhibit 2-3: LRT Design Criteria

Design Parameters	Proposed Standards
Maximum Operating Speed	60 km / h
Right-of-way Width	7.4 m – Midblock 7.0 m – Intersection
Median Width	TBD
Minimum Grade	0.5 %
Maximum Grade (LRT)	5.0 %
Minimum Curve Radius	25.0 m
Platform Width	Side platform – 3.0 m Centre Platform – 6.0 / 5.0 m (desirable / minimum)
Platform Length	60.0 m
Platform Area Grade	Desired – 0.0% (provided that adequate drainage can be provided) Maximum – 2.0%
Operating Height	Maximum – 6.7 m from Top of Rail (TOR) Nominal – 5.5 m from Top of Rail (TOR) Minimum – 4.0 m from Top of Rail (TOR)

2.1.3.2 Road Elements

Due to the implementation of the LRT, the existing roads along the Scarborough-Malvern corridor will require modifications. Exhibit 2-4 summarizes the design criteria for roads accommodating a LRT line that were used during this study.

Exhibit 2-4: Roadway Design Criteria

Design Parameters	Proposed Standards
Design / Posted Speed	80 / 60 km/h
Pavement Width	2 x 3.3 m 2 x 1.6 m for delineated cycling lane
Left Turn Lane	1 x 3.0 m
Median	7.4 m for LRT
Minimum Grade	0.5 %
Maximum Grade (Roadway)	5.0 %
Minimum Curve Radius	230 m

2.1.3.3 Urban Design

The TTC and the City will enhance the urban design environment on all the Transit City project rights-of-way. The proposed Scarborough-Malvern LRT would present an opportunity to support the City's objectives to transform the Scarborough-Malvern corridor into identifiable 'great streets' appreciated by all who live in, work in and visit the area.

A great street is defined as much by the quality and character of its edges and the buildings and landscaped open space that frame it, as by the design features of the street itself. Ensuring that all these defining elements come together in the right way will enhance the area's image, generate investment, and encourage walking, cycling and transit use. Great streets come in many shapes and forms, but attributes they commonly share include:

- Distinguishing design or architectural characteristics;
- High quality streetscapes;
- Interesting, safe and comfortable pedestrian environments; and,
- Appropriate land uses that frame and animate the street.

Detailed urban design including layout and selection of streetscaping elements will be developed as part of the detailed design stage. Urban Design is the process of shaping changes to the total physical setting to enhance the liveability of the city and respect and enhance the existing character of the area where appropriate. It coordinates the design and configuration of streetscapes with parks and opens spaces, buildings, groups of buildings, to create great streets, vital and interesting neighbourhoods as part of the larger city. Urban Design deals with how a person experiences the neighbourhood and requires one to think not only in 'plan' but also in three dimensions. This perspective is necessary to understand how it will feel to stand at a bus stop or transit platform and walk on the sidewalks. Street Furniture, including TTC shelters, litter / recycling receptacles, bench, newspaper boxes, etc., can be provided at the LRT stop areas to provide convenience to the patrons. Streetscape elements with co-ordinated street furniture and landscaping will be incorporated into the project during the design phases.

Tree planting and landscape architectural design decisions will create a more contiguous and healthier tree canopy than currently exists as it is being envisioned as one complete unit as opposed to numerous disparate entities. Tree planting along the Scarborough-Malvern corridor will primarily focus on the placement of trees in areas where it is possible to obtain the City of Toronto minimum soil volume target of 30m³/tree. An uncompacted soil volume the most important factor (along with adequate irrigation) contributing to urban tree health. It is with this in mind that the proposed tree planting is being designed. The tree planting rationale within the Scarborough-Malvern corridor is linked to Toronto Urban Forestry Service's higher-level goals. The City of Toronto currently has 18% forest canopy cover. This is below the target of 30-40% canopy cover target set by Urban Forestry Services. Research by such agencies as American Forests indicates that the minimum urban forest cover necessary to achieve a socially, ecologically and economically sustainable urban condition, is 40%. Tree planting within the Scarborough-Malvern corridor is attempting to contribute to this objective, and will utilize species that will create a resilient urban canopy.

In order to achieve a healthy urban forest condition that is resilient to biotic (i.e. pests and pathogens) and abiotic (i.e. salt and temperature extremes) influences there needs to be a diversity of species. Traditionally in Toronto there has been an over-reliance on Maples (Acer spp.) as the primary street-tree which has contributed to an imbalance in the species diversity of the urban tree canopy. Tree planting efforts will enhance the character along Scarborough-Malvern corridor through the pragmatic placement of trees. The spatial arrangement of trees will consist of an appropriate mix of species and sizes that aim to optimize the social, ecological, and economic capacity of the corridor. The details of the planting scheme in the Scarborough-Malvern corridor will be determined based on the above noted principles during the detailed design stage.

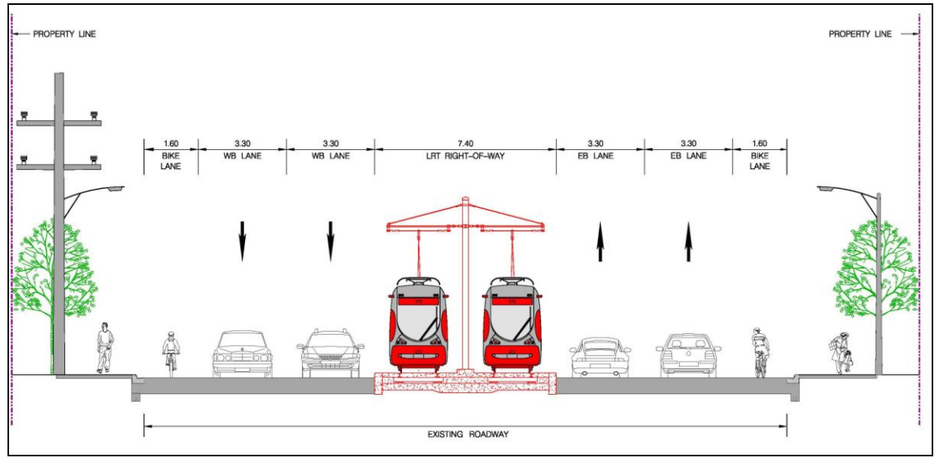
2.1.3.4 Typical Cross Sections

The Transit City program consists of seven LRT lines. Most of these corridors follow existing major roads where a 36 m right-of-way is available. In most cases, separate right-of-way is not available. In these road corridors the most commonly used alignment for the LRT is in centre reserved lanes. Centre lanes offer the following major advantages:

- They do not block access to property and to minor streets and in turn transit vehicles are not blocked by right-turning automobiles, and;
- LRT vehicles in centre lanes are more easily and more safely controlled at intersections when they are in the centre of the road rather than on either side.

On the basis of these arguments a median corridor was selected as being the normal alignment. Both Eglinton Avenue East and Kingston Road are major commercial thoroughfares and the central alignment was selected for these parts of the right-of-way. A centre alignment was also selected for parts of Morningside Avenue and on Military Trail.

Exhibit 2-5: Typical Mid-Block Section



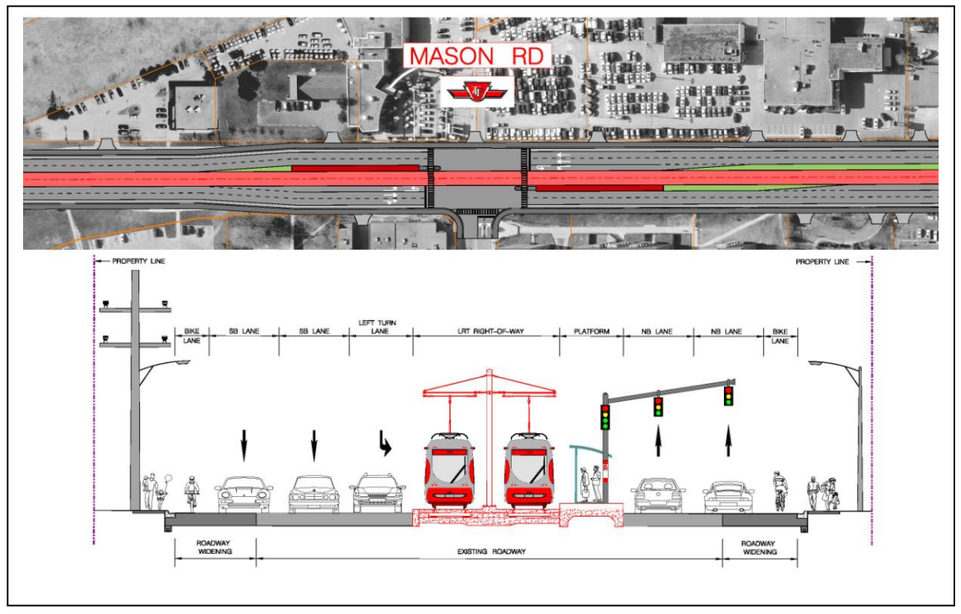
A typical 36 m cross-section for mid-block and at intersections was developed as part of the overall Transit City program. The basic elements including LRT right-of-way, vehicular travel lanes, bicycle lanes, sidewalks are to be provided within the roadway corridor. Depending on the overall available right-of-way width, streetscaping features could be provided where there is sufficient space. The recommended cross-section elements for the midblock section as shown in Exhibit 2-5 include:

- 7.4 m dedicated LRT right-of-way with raised curbs for LRT tracks and median;
- 2 x 3.3 m vehicular traffic lanes in each direction;
- 1.6 m bicycle lane in each direction; and
- 6.1 m boulevard, including the sidewalk, on each side of the street.

Exhibit 2-6 shows the typical intersection layout with far side platform along the Scarborough-Malvern Corridor for the preferred design solution. In the signalized intersection areas, platform and left turn lanes are being proposed at most locations. While the actual dimensions may be subject to some minor modifications during detailed design, the recommended design includes:

- 7.4 m dedicated LRT right-of-way for LRT tracks and median;
- 3.0 m station platform on the farside of the intersection;
- 3.0 m left turn & U-Turn lane on the nearside;
- 2 x 3.3 m through vehicular traffic lanes in each direction;
- 1.6 m for a bicycle lane in each direction; and
- 3.1m boulevard, including the sidewalk, on each side of the street.

Exhibit 2-6: Typical Section at Intersection



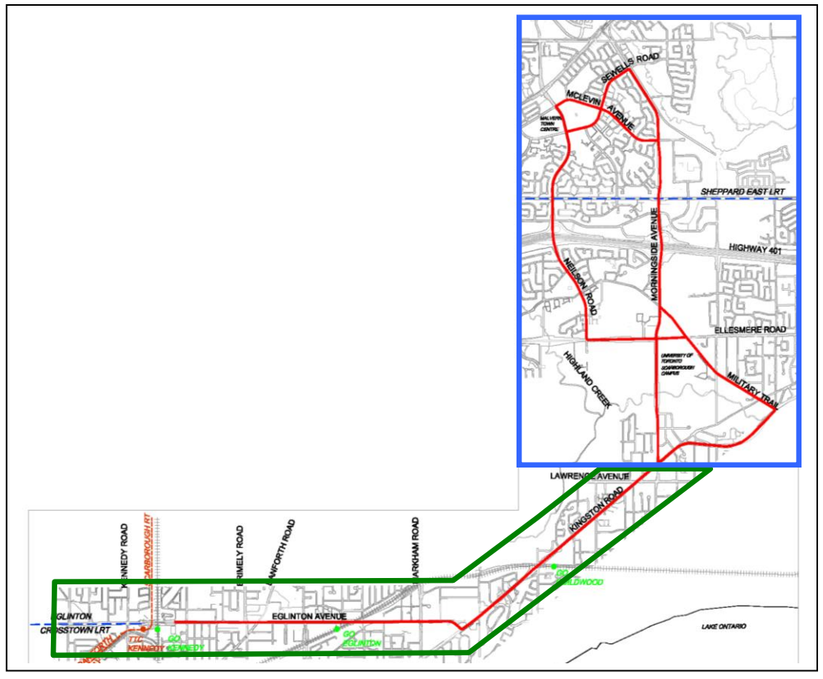
2.1.4 FEASIBILITY STUDY

As mentioned previously, a Feasibility Study was undertaken in 2008 to examine routings and the attributes of the Scarborough/Malvern LRT. The various issues that were decided during this Feasibility Study are discussed below. The Feasibility Study itself is included as Appendix A to this document.

2.1.4.1 Alternative Study Corridor Analysis

Alternative Study Corridors were developed at the beginning of the study, during the feasibility stage. As noted in Section 1, the original study area of Scarborough-Malvern LRT Transit Project Assessment Study included a connection to Malvern Town Centre as part of the study corridor. This study area is shown in Exhibit 2-7. However, during the later stage of the study, the TTC determined that the proposed Scarborough Rapid Transit (SRT) extension would better serve the Malvern Community. As a result, it was decided that the SMLRT would terminate on Morningside Avenue, just north of the Morningside Avenue and Sheppard Avenue East intersection. Although the terminus is different, the Corridor Alternative Evaluation that was undertaken in the early stage is still valid. The evaluation is summarized in the following sections.

Exhibit 2-7: Corridor Study Area



2.1.4.1.1 Eglinton Avenue and Kingston Road Corridor

The objective for the Scarborough-Malvern LRT (SMLRT) line is to provide a high quality transit service, connecting Kennedy Subway Station with north-eastern Scarborough. The Toronto Official Plan has designated both Eglinton Avenue and Kingston Road in the study area as part of the surface transit priority network and as rapid transit corridors (to the Guildwood GO station). Both streets are also identified as "Avenues" or streets along which more intense development is to be encouraged.

Both streets carry a variety of existing TTC bus routes leading to the Kennedy station. An LRT route along this corridor would link with these routes and provide a good level of connectivity. It would also link with three GO stations, Eglinton , Guildwood and Kennedy.

There are few alternative corridors in this section of the route. One possibility might be to use the CN Rail alignment between Eglinton and Guildwood GO station but this corridor is being expanded to handle more intensive GO Transit rail service. In addition a routing on this corridor would miss important sections of future intensification including the Eglinton-Kingston Road intersection where connections will be made with the planned Kingston Road BRT.

As a result of these considerations, corridor alternatives in the Eglinton Avenue East and Kingston Road area, the area bounded by green in Exhibit 2-7, were not investigated in more detail.

2.1.4.1.2 Corridors North of Kingston Road

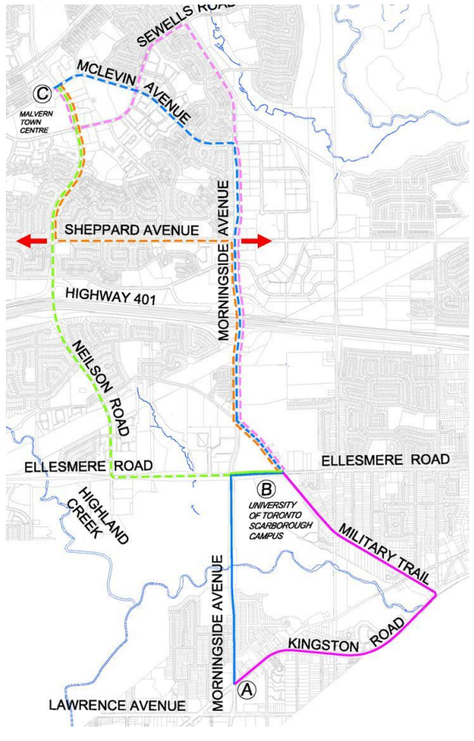
Opportunities for alternative corridors were investigated from the Kingston Road / Morningside Avenue intersection to north-eastern Scarborough and the Malvern Community, as illustrated by the area bounded by blue in Exhibit 2-7.

From the Kingston Road / Morningside Avenue intersection to north-eastern Scarborough, there are two key areas that support and need high quality transit service, University of Toronto Scarborough Campus (UTSC) Centennial College Ellesmere Campus (CCEC) and the Malvern Town Centre (MTC).The educational institutions generate significant all-day ridership with extensive planned expansion and development on UTSC property, north of Ellesmere Road. The Malvern Town Centre includes existing and significant community and health care facilities, and the potential to connect to the proposed SRT extension.

Based on the established City planning policies and the overall project objectives, alternative corridors were identified, developed, and assessed between:

- Kingston Road / Morningside Avenue Intersection (Point A) and the University of Toronto (Point B):
  - Scarborough Campus (Point B), as illustrated as by solid lines in Exhibit 2-8 ;
  - north along Morningside Avenue to Ellesmere Road, and east along Ellesmere Road to UTSC (solid blue line);
  - east along Kingston Road to Military Trail, and north along Military Trail to UTSC (solid magenta line);
- University of Toronto Scarborough Campus (Point B) and the Malvern Town Centre (Point C), as illustrated by dashed lines on Exhibit 2-8:
  - west along Ellesmere Road to Neilson Road, and north along Neilson Road to the vicinity of MTC (dashed green line);
  - north along Military Trail and Morningside Avenue to McLevin Avenue, and west along McLevin Avenue to the vicinity of MTC (dashed blue line);
  - north along Military Trail and Morningside Avenue to Sewells Road, and west along Sewells Road to the vicinity of MTC (dashed pink line); and
  - north along Military Trail and Morningside Avenue

Exhibit 2-8 : Alternative Corridors



to Sheppard Avenue, integrate westerly with the Sheppard East LRT service to Neilson Road, and north along Neilson Road to the vicinity of MTC (dashed gold line).

For each of the identified alternative corridors, functional design plates (i.e. plans and profiles) for a centre of the roadway alignment were developed applying the established design criteria at that time in order to complete the evaluation. Platforms at proposed stop locations were placed at the major intersections, and at other potential ridership generators (i.e. UTSC). In addition, corresponding cross-sections were prepared at regular intervals or at critical locations, such as potential stop locations, existing narrow right-of-way, or at significant features (i.e. ESA natural features along Morningside Avenue in the Highland Creek valley). These plans and cross-sections were utilized as the basis for the assessment of the alternative corridors.

2.1.4.1.3 Evaluation Criteria

Based on the investigation and documentation of the existing conditions, key issues, potential impacts, opportunities and constraints were identified. Appropriate screening criteria were identified to reflect the existing conditions. To comparatively assess and differentiate the alternative corridors, the screening criteria were consistent with the project's objectives. The description and rationale of the identified screening criteria are summarized as follows:

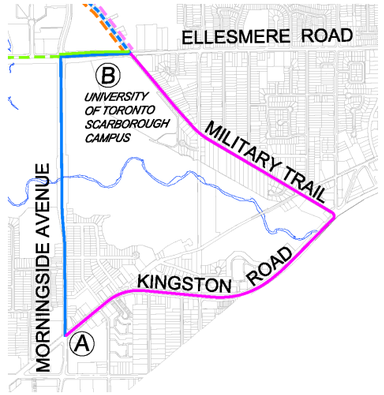
- Transit Service
  - quality of connection at UTSC or Malvern Town Centre
  - compatibility with potential routes to the Malvern Community (for the Kingston Road / Morningside Avenue Intersection to UTSC segment) or compatibility with potential northerly extension (for the UTSC northward segment)
  - level of transit service (accessibility, potential ridership, alignment geometrics)
- Environmental Impacts
  - potential impact on natural areas
  - potential impact on neighbourhoods / businesses (Social Impact) during construction
  - potential impact on neighbourhoods / businesses (Social Impact) during LRT operation
  - property requirements
- Traffic
  - potential impact on traffic operations and access during construction
  - potential impact on traffic operations and access during LRT operation
- Construction Cost
  - property acquisition cost
  - construction cost (including consideration of major utility impacts)

For each corridor, the screening criteria were applied and findings were documented, including quantitative measurements wherever possible. A comparative assessment was then undertaken for the alternative corridors, identifying the differences, the degree of sensitivity and significance of the impact, and whether or not reasonable mitigation is available to reduce the impact. Finally, the recommendation for the preferred corridor, if all other criteria and assessment were considered comparatively equal, was based on the project's objectives of providing high quality transit service at an affordable cost.

2.1.4.1.4 Evaluation

<u>Assessment of the Kingston Road / Morningside Avenue Intersection to UTSC Alternative Corridors</u>

The two corridors under consideration between the Kingston Road / Morningside Avenue Intersection (Point A to the right) and the University of Toronto Scarborough Campus (Point B) were the Morningside / Ellesmere corridor and the Kingston / Military Trail corridor.



Following the comparative assessment, the Morningside / Ellesmere corridor was recommended. A summary of the comparative assessment is presented in Exhibit 2-9. Key advantages of the recommended corridor are:

- significantly reduced property impacts;
- less impact on the local community, particularly traffic operations and access to properties;
- environmental impacts in the Highland Creek valley can be minimized and mitigated; and
- a shorter and more direct route to UTSC and CCEC, presenting both lower construction costs and a higher quality of transit service.

Exhibit 2-9: Alternative Corridor Assessment – Kingston Road / Morningside Avenue to UTSC

TWO ROUTE ALTERNATIVES	Morningside / Ellesmere	Kingston / Military
CHARACTERISTICS		
Route Length	2.1 km	3.5 km
Number of Potential Stops	3	7
Population within 500m (approx. #'s)[1]	8,200	12,300
Employment within 500m (approx #'s)[2]	3,700	5,800
SCREENING CRITERIA		
Potential Impacts on Traffic Operations and Access During Construction	High	Very High
Potential Impacts on Traffic Operations and Access During LRT Operation	Moderate	Very High
Property Requirements	High	Very High
Potential Impacts on Neighbourhoods / Businesses (Social Impact) During Construction	Moderate	Very High
Potential Impacts on Neighbourhoods / Businesses (Social Impact) During LRT Operation	Low	Very High
Potential Impacts on Natural Areas	Moderate	Moderate
Construction Cost	Moderate	Very High
Property Acquisition Cost	Moderate	Very High
QUALITY OF TRANSIT SERVICE		
Quality of Connection at UTSC	Good	Very Good
Compatibility with Potential Routes to Malvern Community	Good	Very Good
Level of Transit Service for Riders	Good	Good
RECOMMENDATION	✓	

Assessment of the UTSC to Malvern Town Centre Alternative Corridors

The four corridors under consideration between the University of Toronto Scarborough Campus (Point B) and the vicinity of the Malvern Town Centre (Point C) were:

- Ellesmere / Neilson;
- Military Trail / Morningside / McLevin;
- Military Trail / Morningside / Sewells; and
- Military Trail / Morningside / Sheppard / Neilson.

Following the qualitative assessment, the Military Trail / Morningside / Sheppard / Neilson corridor was recommended. A summary of the qualitative assessment is presented in Exhibit 2-10. Key advantages of the recommended corridor are:

- reduced property impacts;
- less impact to the local community, particularly traffic operations and access to properties;
- crossing of Highway 401 is less complicated;
- overall construction costs are lower; and
- provides greater flexibility for the overall transit network.

Terminating the line at Sheppard Avenue East does not change this conclusion.

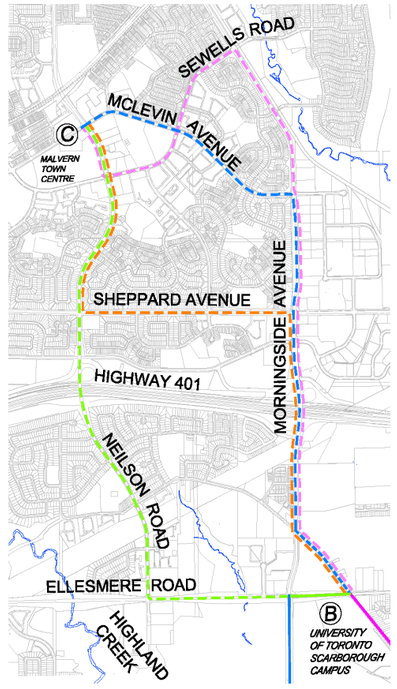


Exhibit 2-10: Alternative Corridor Assessment – UTSC to Malvern Town Centre

FOUR ROUTE ALTERNATIVES	Ellesmere / Neilson	Morningside / McLevin	Morningside / Sewells	Morningside / Sheppard / Neilson
CHARACTERISTICS				
Route Length	4.3 km	4.2 km	5.2 km	4.5 km (1.5 km shared with Sheppard East LRT)
Number of Potential Stops	9	6	9	8
Population within 500m (approx. #'s)[1]	26,200	22,300	22,900	26,300
Employment within 500m (approx. #'s)[2]	30,900	27,600	27,600	31,600
SCREENING CRITERIA				
Potential Impacts on Traffic Operations and Access During Construction	Moderate	Moderate	Moderate	Moderate
Potential Impacts on Traffic Operations and Access During LRT Operation	High	High	High	Moderate
Property Requirements	Very High	High	High	Low
Potential Impacts on Neighbourhoods / Businesses (Social Impact) During Construction	High	High	High	Low
Potential Impacts on Neighbourhoods / Businesses (Social Impact) During LRT Operation	Low	Low	Low	Low
Potential Impacts on Natural Areas	Moderate	Moderate	Moderate	Low
Construction Cost	Very High	High	High	Moderate
Property Acquisition Cost	Very High	High	High	Low
QUALITY OF TRANSIT SERVICE				
Quality of Connection at Malvern Town Centre	Very Good	Very Good	Very Good	Very Good
Compatibility with Potential Northerly Extension	Very Good	Good	Moderate	Very Good
Level of Transit Service for Riders	Good	Moderate	Moderate	Good
RECOMMENDATION				✓

Sources: 1) Census of Canada 2006; 2) Toronto Employment Survey 2007

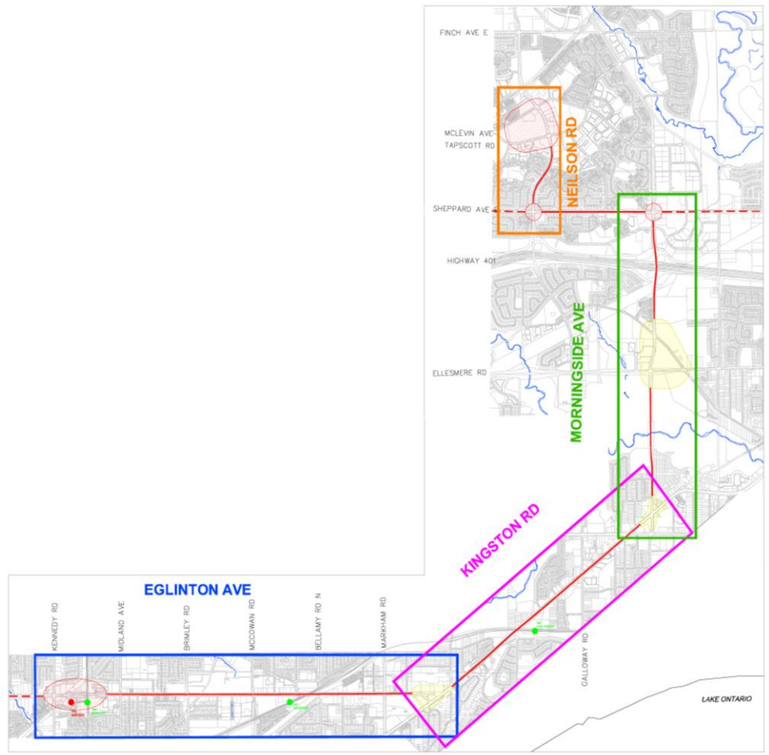
2.1.4.1.5 Recommended Corridor

Based on the assessment of the alternative corridors, the preliminary study corridors **Error! Reference source not found.**recommended in the feasibility stage are as follows:

- Eglinton Avenue;
- Kingston Road;
- Morningside Avenue including the deviation via Ellesmere Road and Military Trail to serve the UTSC;
- Sheppard Avenue (part of the Sheppard East LRT EA study); and
- Neilson Road.

This is shown on Exhibit 2-11.

Exhibit 2-11: Recommended Corridor - Feasibility Stage

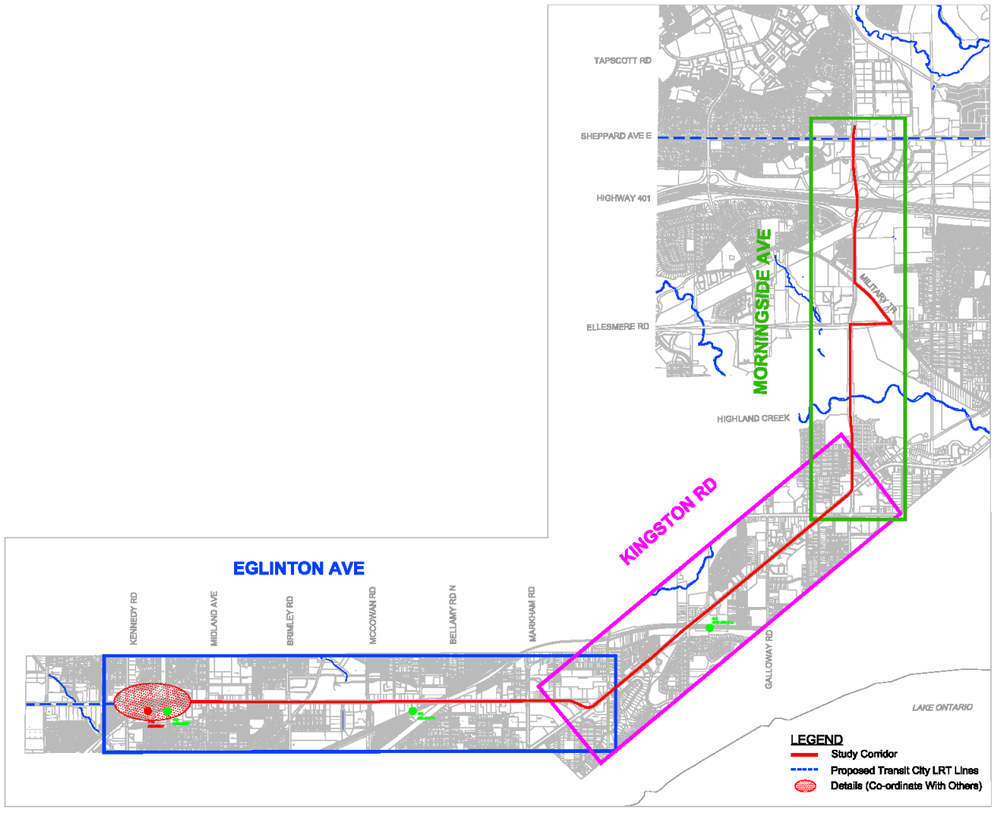


When the decision was taken to terminate the SMLRT at Sheppard Avenue East, the recommended corridor for the Scarborough-Malvern LRT that was carried forward for design alternative analysis became as follows:

- Eglinton Avenue East - from Kennedy Subway Station, east along Eglinton Avenue to Kingston Road;
- Kingston Road - from Eglinton Avenue, northeast on Kingston Road to Morningside Avenue; and
- Morningside Avenue - from Kingston Road, north on Morningside Avenue to just north of Sheppard Avenue to connect with the Sheppard East LRT, via Ellesmere Road and Military Trail to provide direct transit service to the University of Toronto Scarborough Campus

This is shown on Exhibit 2-12.

Exhibit 2-12: Final Recommended Study Corridor



2.1.4.2 Rationale for Choosing Stop Locations

Initial stop locations were identified by the study team based on the following:

- Transit City overall customer service plan of providing LRT stop spacing in the 400 m to 600 m range as noted before, based on the analysis and assessments to provide a balance between good local access and high route speed;
- placement at major signalized intersections and at other potential transit ridership generators, including the University of Toronto Scarborough Campus, Centennial College Ellesmere Road Campus, GO Transit stations, and local bus routes.

The initial stop locations were reviewed and assessed by:

- City of Toronto East District staff, providing local insight on existing conditions (land use, traffic operations, etc.) and proposed development opportunities;
- SMLRT Project Team, considering local conditions (proximity to adjacent intersections, roadway gradient, physical constraints such as overpass piers, etc.), and likely LRT service operation requirements (i.e. special trackwork for crossovers and storage tracks)

Exhibit 2-13 identifies the recommended stop locations for the SMLRT, including key comments.

Given the close proximity of, and potential for the LRT to interface with GO Transit rail stations on the Lakeshore East line, a GO representative was invited to participate as part of the Scarborough Malvern LRT Technical Agencies Committee. As the details of the preferred route were developed, the project team opted to maintain on-street stops adjacent to the GO stations as opposed to introducing off-street connections because of the increased capital cost and the relatively small volume of transfers. As a result, while the walking distance at Eglinton Station is in the order of 75 metres, patrons transferring at Guildwood GO Station will be required to walk approximately 200 metres between the LRT stop and the GO station.

GO Transit initiated discussions with the project consultant to determine if the LRT stop could be relocated (to the bridge over the rail corridor, for example) to allow for a reduced walking distance, but various technical and operational circumstances were identified that would preclude such a modification. GO has indicated that they would be willing to explore additional direct interface opportunities if this was deemed to be desirable, although the findings to date suggest that this would not be feasible.

Exhibit 2-13: Recommended Stop Locations

Location	Recommendation	Comments
Kennedy Subway Station	✓	▪ not part of this study, but co-ordination activities have been initiated and issues identified
Midland Avenue	✓	▪ recommendations of the Kennedy Station study may impact stop, alignment, property requirements, etc. ▪ assuming an at-grade alignment, farside / side platforms
Falmouth Avenue	✓	▪ farside / side platforms
Brimley Road	X	▪ given that the bus routes operating on Brimley Road will likely continue to Kennedy Station, the Danforth bus route is a continuous north-south route, and the close proximity to the Danforth intersection, a stop is not recommended
Danforth Road	✓	▪ farside / side platforms
Barbados Boulevard	X	▪ given the local land use and existing local bus boarding volumes, the Project Team did not recommended this location ▪ to be noted, the preliminary traffic assessment has recommended that this intersection be signalized in order to provide access to this cul-de-sac with industrial / commercial land uses, and to provide U-turn opportunities along Eglinton Avenue, therefore a stop could be easily added
McCowan Road	✓	▪ farside / side platforms
Bellamy Road N / Eglinton GO	✓	▪ centre platform on the west side due to roadway gradient and CN Overpass pier constraints
Mason Road	✓	▪ farside / side platforms
Beachell Street	X	▪ The Project Team believe the resultant stop spacing between this stop and adjacent stations became considerably reduced (approx. 250m) and local bus boarding volumes were not significant
Markham Road	✓	▪ farside / side platforms
Cedar Avenue	X	▪ placement of platforms right at the intersection would provide a significantly reduced stop spacing of approx. 270m (see Kingston Road)
Eglinton / Kingston	✓	▪ given the requirement for special trackwork for service operations, and its desirable location, the Kingston stop has moved westerly towards Cedar Avenue (a walkway from the Cedar intersection is proposed) ▪ centre platform due to the service operations and connection to local bus routes and the Kingston Road BRT
Scarborough Golf Club Road	✓	▪ farside / side platforms
Guildwood Parkway	✓	▪ farside / side platforms
Livingston Road	X	▪ poor pedestrian environment, not recommended
Celeste Drive / Guildwood GO	✓	▪ farside / side platforms
Overture Road	X	▪ within 200m of Celeste Drive, low local bus boarding volumes
Galloway Road	✓	▪ farside / side platforms
Poplar Road	X	▪ within 200m from Lawrence Avenue
Lawrence Avenue	✓	▪ farside / side platforms
Kingston / Morningside	✓	▪ centre platforms (due to turn in alignment)
Beath Street	✓	▪ north side / side platform to minimize property impact on the south side and to facilitate access to West Hill Collegiate
Ellesmere Road	✓	▪ south side / centre platform to facilitate bus connection and turn in alignment
UTSC	✓	▪ west side / centre platform to facilitate bus connection and turn in alignment
Military Trail	✓	▪ north side / side platform to facilitate bus connection and turn in alignment
Cinemart Drive	X	▪ Impacts on the Highway 401 structure
Milner Avenue	X	▪ proximity too close to Sheppard Avenue
Sheppard Avenue	✓	▪ farside / side platforms

2.1.4.3 Issues Requiring Further Analysis

At the end of the feasibility study some major issues remained. These included:

- Crossing of the Highland Creek;
- Alignment adjacent to the University of Toronto Scarborough Campus;
- Need for further analysis of traffic solutions for major intersections; and
- Design of interchanges with other major transit facilities.

2.1.5 ALIGNMENT EVALUATION

Subsequently further analysis was undertaken of the alignment. The dedicated transit alternative located in the center of the roadway was chosen as the preferred alignment for SMLRT, with the exception of the alignment along Morningside Avenue and Ellesmere Road where there is a need for a new bridge structure to be built over Highland Creek. The details of the selection of the preferred alignment of the LRT along Morningside Avenue between Kingston Road and Ellesmere Road and on Ellesmere Road are described in the following Sections 2.1.5.1 and 2.1.5.2.

2.1.5.1 Morningside Avenue

The LRT alignment on Morningside Avenue is generally located in the centre of the roadway with the exception of the section crossing Highland Creek. The following sections describe the details of the LRT alignment selection in the Highland Creek area of the Morningside Corridor and in the section adjacent to West Hill Collegiate Institute..

2.1.5.1.1 Highland Creek Structure

The existing Morningside Avenue crossing of Highland Creek is located 1.0 km north of the Kingston Road and Morningside Avenue intersection following a 5.0% downhill grade; after the structure, Morningside Avenue continues north on a 5.0% uphill grade. Ellesmere Road is located 600 m north of the bridge and connects to UTSC.

The existing Highland Creek bridge pavement width is 15.24 m with a 2.2 m raised sidewalk on each side of the structure. With the proposed LRT facilities, the minimum pavement would be 20.4 m if bicycle lanes are not constructed or 23.6 m with a 1.6 m bicycle lane on each side. Therefore, widening of the existing structure, constructing a new structure or combination of the two options would be required.

Discussion with the Toronto Region Conservation Area confirmed that widening to the west side of Morningside Avenue would pose environmental concerns between the north side of the structural abutment and Ellesmere Road. Therefore, widening toward the west side was not considered. The description of each structure option is described below. For each alternative, a preliminary structural general arrangement was prepared and is included in the Structural Report shown in Appendix D.

The alternatives that were developed for evaluation include:

- Option 1A – LRT right-of-way (ROW) in the median with bicycle lanes.
- Option 1B – LRT ROW in the median without bicycle lanes
- Option 2A – LRT ROW on the east side with bicycle lanes on both sides
- Option 2B – LRT ROW on the east side with without bicycle lanes
- Option 2C – LRT ROW on the east side on a separate structure and with the provision of bicycle lanes on the existing structure.

<u>Option 1A: LRT ROW in the median with bicycle lanes</u>

The existing structure would be widened by 7.5 m to accommodate the proposed LRT right-of-way in the median. This would require additional girders and widening of superstructure, substructure and foundations to support the widened superstructure. The structural system would be similar to the existing structure. Construction could be carried out in 2 stages:

- Stage 1: Construct the structure widening while maintaining 2 lanes of traffic in both northbound and southbound directions on the original structure.
- Stage 2: Divert the north bound traffic to the new widened structure and construct LRT track bed. This would involve extensive traffic staging works and roadway protection works for the construction of abutments.

<u>Option 1B: LRT ROW in the median without bicycle lanes</u>

This alternative is similar to Option 1A except for reduced area of deck widening by 4.3 m due to the elimination of bicycle lanes.

<u>Option 2A: LRT ROW on the east side with bicycle lanes on both sides</u>

The existing structure would be widened on the east side by 11.3m to accommodate the LRT right of way and bicycle lanes. Construction of additional girders and widening of superstructure, substructure and foundations to support the widened superstructure would be required. The structural system would be similar to the existing structure.

Construction would be carried out in a single stage, while maintaining 2 lanes of traffic in both the northbound and southbound direction on the original structure.

This would involve minimum traffic staging works and roadway protection works for the construction of abutments.

<u>Option 2B: LRT ROW on the east side without bicycle lanes</u>

This alternative is similar to Option 2A except for reducing the width of deck widening due to the elimination of bicycle lanes.

<u>Option 2C: LRT ROW on the east side on a separate structure with the provision of bicycle lanes on the existing structure</u>

The existing structure would be widened on the east side by 1.7 m to accommodate the proposed bicycle lanes. The new structure in this option would be 9m wide. It could be constructed without affecting the existing traffic conditions significantly. Minimal traffic staging works and roadway protection works would be required during the construction of the deck widening for the addition of bicycle lanes, and could be performed during the next scheduled bridge rehabilitation.

Evaluation

The evaluation of the Morningside Avenue alignment between Highland Creek and Ellesmere Road is shown on Exhibit 2-14. Option 1B and Option 2B were eliminated from the evaluation as they do not provide bicycle lane opportunities and therefore are not consistent with the objectives of the study.

For the remainder, consideration was given to the LRT and traffic operations, natural environment and construction impacts. The evaluation of the alternatives considered the impacts generated by each alternative. The evaluation of alternatives was conducted based on a comparative evaluation, i.e. differences in impacts between alternatives are compared based on the relative significance of the impacts.

The existing roadway grades on Morningside Avenue from the north abutment of the existing structure to Ellesmere Road and on Ellesmere Road from Morningside Avenue to Military Trail are slightly greater than 5.0%. A LRT stop would be required at the Morningside Avenue/Ellesmere Road intersection to provide service to Centennial College. However, the allowable maximum grade of the LRT platform is 2.0% according to the design criteria. Given the above requirement, a separate LRT vertical alignment is required. Therefore, Option 1A is not a preferable option.

The widening of the existing structure to accommodate the LRT facilities would require significant structural modification, including the strengthening of 6 girders and widening of the superstructure, substructure and foundations to support the widened superstructure. The future rehabilitation of the existing structure will be more complicated and would have significant impacts to the LRT operations. Therefore, both Option 1A and Option 2A are not recommended.

The preferable alignment option on Morningside Avenue between Highland Creek and Ellesmere is Option 2C – Widening the existing structure for bicycle lanes and constructing a new structure for LRT right-of-way. Option 2C would provide an appropriate LRT profile so that a LRT stop could be constructed at the Ellesmere Road intersection. It would also create lesser disruption during rehabilitation of the existing Highland Creek bridge structure than the other options.

Exhibit 2-14: Highland Creek Structural and Alignment Alternatives

Criteria	Option 1A	Option 2A	Option 2C	Comments
Environmental Impacts				
Compatible with Land Use / Future Planning Objectives	Yes	Yes	Yes	Options 1B and 2B do not provide bicycle lane and therefore were eliminated.
Potential Impacts on Natural Areas	Low	Low	Moderate	Options 2A and 2C would result in approximately the same loss to vegetation units. However, Option 2C would have a higher potential environmental impact due to the construction of a new structure.
Property Requirements	Moderate	High	High	Options 2A and 2C would result in similar property impacts on the east side of Morningside Avenue due to the grading for the separate LRT facility. Option 1A would require widening north of the structure to accommodate the LRT right-of-way.
Transit Services				
Complexity to provide LRT Stop at Morningside Avenue and Ellesmere Road	High	Low	Low	The existing 5% grade on Morningside Avenue does not allow a service stop opportunity at the Ellesmere Road/Morningside intersection. Option 1A would require a separate LRT profile in the middle of the road. Options 2A and 2C could provide an appropriate LRT profile more easily as the LRT is on a separate right-of-way.
Technical				
Potential Impacts on Traffic Operations During Construction	High	Low	Low	Option 1A would result in greater traffic disruption at the Ellesmere Road / Morningside intersection during construction.
Potential Impacts on Traffic Operations During LRT Operation	High	Low	Low	Option 1A would result in greater traffic operation disruption at the Ellesmere Road / Morningside intersection during operation.
Construction Staging Complexity	High	Moderate	Low	Option 1A would have a higher construction staging complexity due to the structural widening and the grade on Morningside Avenue. Option 2C has a minimal structural widening for bicycle lane and the LRT structure would be constructed separately.
Existing structure Rehabilitation Complexity	High	High	Low	Option 2C would minimize the LRT disruption during existing structure rehabilitation.
Potential Impacts on Utility	Moderate	Moderate	Low	Existing utilities on the east side of the structure would require relocation before construction.
Cost				
Overall Construction Costs	Low	Moderate	High	Option 2C is more costly than the other options due to the new structure construction and a separate LRT right-of-way.
RECOMMENDATION			✓	

2.1.5.1.2 West Hill Area

The existing Morningside Avenue from 90 m north of Kingston Road to Fairwood Crescent passes residential areas on both sides and West Hill Collegiate Institute on the west side approximately 140 m north of Warnsworth Street. The existing right-of-way is generally 26 m wide whereas the City of Toronto Official Plan designates this section as 30m. The City is planning to amend the Official Plan in early 2010 to widen the designated right-of-way to 36 m. Given the constrained right-of-way, an assessment was undertaken to determine the preferred design to minimize property impacts while providing a reasonable level of service for both LRT and vehicular traffic.

In considering the functional plan for both LRT and vehicular traffic movements and the minization of property impacts in the area, numerous alignment/stop alternatives were developed with different locations and the types (i.e. far side, road side or centre) of LRT platforms, the LRT alignment alternative, bicycle lane locations and traffic operation arrangements on Tefft Road, Beath Street, Warnsworth Street and West Hill Collegiate Institute.

The alternatives were developed by varying a number of elements. The nomenclature for ach option has a three digit code as shown in Appendix F. The first digit is the family of the option (1 through 6); the second letter indicates the configuration of intersections at Beath Street and West Hill and the third digit shows the variations in platform locations and configuration. The definition of the families is as shown below:

Option Family	LRT Alignment	Bike Lanes	Intersection at Tefft Road
1	Central of Right-of-Way	On Morningside	Signalized
2	Central of Right-of-Way	On Morningside	Unsignalized
3	Central of Right-of-Way	On local streets	Unsignalized
4	East side of Right-of-Way	On Morningside	Signalized
5	East side of Right-of-Way	On Morningside	Unsignalized
6	East side of Right-of-Way	On local streets	Signalized

The alternatives are listed and their evaluation is included in Appendix F.

Relevant factors that were considered in the evaluation include:

- Community Impacts;
- Property Impacts;
- Transit Services (LRT Operations and Platform Accessibility);
- Safety (Pedestrians/Vehicular – Roadway, Driveway);
- Bicycle Operations; and
- Traffic Accessibility Impacts (Pedestrian/Vehicular).

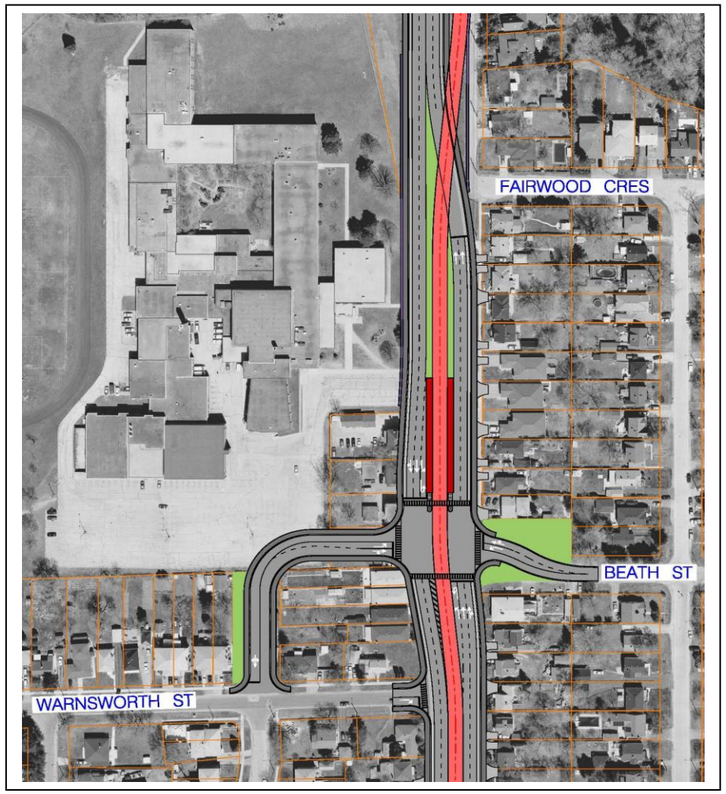
The solution finally adopted was a hybrid of these alternatives. This hybrid includes the following features:

- Location of the LRT on the east side of Morningside Avenue north of West Hill Collegiate Institute;
- Two side platforms of the north side of Warnsworth Street to serve the neighbourhood and the Collegiate;
- Traffic signal at Tefft Road;
- Construction of bicycle lanes on both sides of Morningside Avenue; and
- Construction of a realigned Beath Street to West Hill Collegiate Institute and Warnsworth Street on the west.

The preferred alternative is shown as Exhibit 2-15. It was found that most options may affect 10 properties in the area. A new access road from Beath Street to Warnsworth Street is provided to ensure the linkage, from Morningside Avenue to both sides of the road and between the areas on either side of Morningside Avenue, is maintained.

A signal on the northbound lanes of Morningside Avenue north of the new intersection is required to permit the Light Rail Vehicle (LRV) to transition between side running and centre running.

Exhibit 2-15: Preferred Design Alternative at West Hill C.I. Area on Morningside Avenue



2.1.5.2 Ellesmere/Military Trail

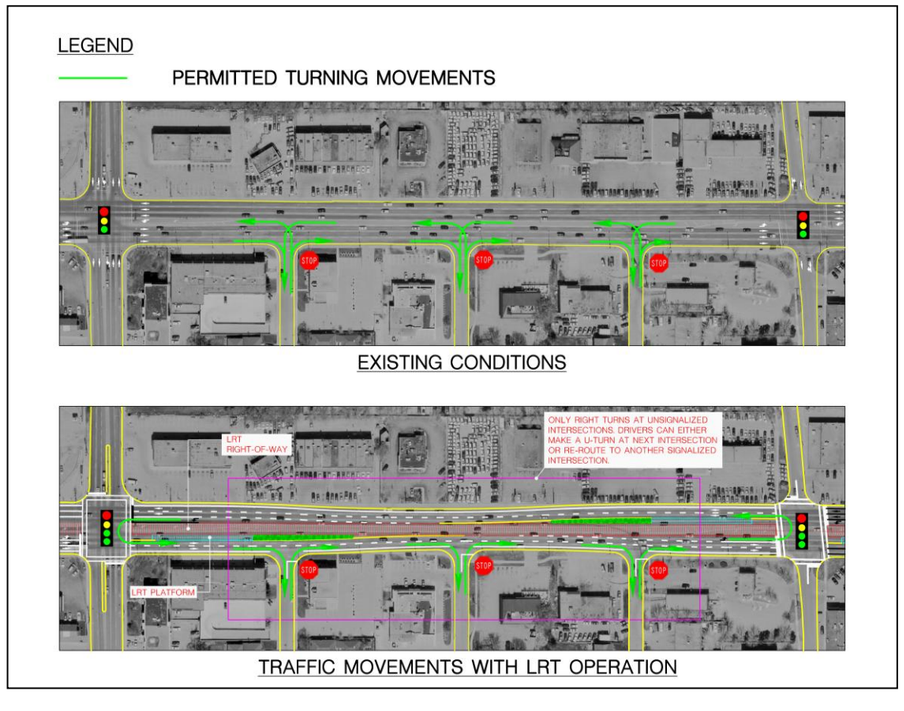
The preferred design for the crossing of Highland Creek is to have the LRT on its own structure adjacent to the Morningside Avenue bridge. After considering a number of options the preferred course of action for the Ellesmere Road section was to continue this private right-of-way south of the existing roadway. This was selected for the following reasons:

- No transition between side and centre lanes is required;
- The steep grades on Ellesmere Road could be mitigated for the LRT; and
- An off-street station could be provided to serve the UTSC.

2.1.6 TRAFFIC ANALYSIS

Left turns across the Scarborough-Malvern LRT tracks will only be permitted at signalized intersections. Left turn access to driveways/streets located between traffic signals will be provided at the closest signalized intersection where "U" turns will be permitted to allow motorists to return to their final destination, as shown in Exhibit 2-16.

Exhibit 2-16: Typical Turning Movement Restrictions



Improvements to traffic operations required by future Light Rail operations are recommended based on detailed traffic analysis. The analysis was conducted using Synchro 6.0 Traffic Signal Coordination Software, following the Highway Capacity Manual (HCM) methodology and 95th percentile queues with the City-provided turning movement, pedestrian and bicycle volumes, signal timings and lane configurations (field confirmed). The detailed traffic analysis consisted of two steps, namely:

1. Analysis of the existing and future conditions to identify problematic locations where more detailed analysis was required; and
2. Detailed analysis to develop a strategy to provide for the effective operation of LRVs in the area of capacity constraints. These treatments will be refined during preliminary and detailed design.

The recommended improvements are summarized in Sections 2.1.6.1 to Section 2.1.6.5. The detailed traffic report describing the traffic assessment and the development of the recommended operational improvements is included in Appendix B.

To evaluate LRV operation, the following priority scheme was used at signalized intersections, while ensuring a safe system for pedestrians, cyclists, transit (bus and LRV) and general traffic.

1. Ensure high quality LRT operations (i.e. speed, reliability);
2. Facilitate the movement of pedestrians;
3. Facilitate bus operation and, where passengers transfer between bus and LRT, treat with a priority equivalent to 2; and
4. Facilitate the movement of vehicles at the signalized intersections.

The analysis process analyzed the existing and future traffic conditions. Where impacts were identified, various mitigating measures were developed and analysed and a preferred alternative was selected.

To establish future conditions, the analysis was conducted with existing traffic conditions. Intersection lane configurations were modified to conform to future roadway layouts with the LRT in operation. Similar to existing conditions, intersections were classified and intersections with poor conditions were identified, as well as the significant differences from the existing conditions (i.e. "area selected for more detailed analysis").

This analysis assumed that traffic, pedestrian and bicycle volumes will remain static between the existing and future conditions (i.e. no growth rate has been applied). Additionally, it was assumed that signal timings will remain relatively unchanged between the existing and future conditions, with the exception of introducing protected left-turns and U-turns at intersections.

Three areas were identified as needing more detailed traffic analysis:

1. Eglinton Avenue at Brimley Road and Danforth Road;
2. Eglinton Avenue at Kingston Road; and
3. Kingston Road and Morningside Avenue.

In addition, a detailed analysis was conducted at the Morningside Avenue and Highway 401 area to determine the traffic impacts on the Highway 401 ramp terminals due to the implementation of the LRT on Morningside Avenue.

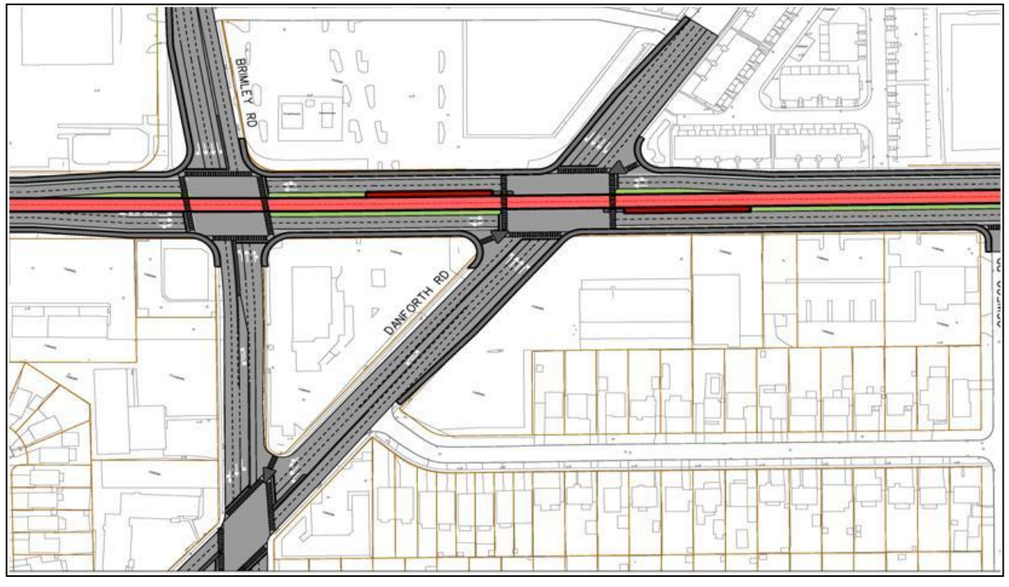
2.1.6.1 Eglinton – Brimley to Danforth

A detailed traffic analysis was conducted for the Eglinton Avenue at Brimley Road and Danforth Road area. Three iterations were developed in consultation with City of Toronto and TTC staff. Based on the results of the 3-iteration traffic analysis, the preferred scenario (Exhibit 2-17) provides the most overall benefit to the LRT operation while providing acceptable service for other traffic.

The preferred scenario is to implement all of the following:

- Four phase signal operation at Brimley/Eglinton and Danforth/Eglinton, with restricted east-west left turn movements at these intersections;
- The current minimum cycle length is 85 seconds, but 110-120s cycle length is recommended based on current conditions; and
- East-west green time should be a minimum of 57 seconds to allow coordinated progression for LRT through both intersections.
- Introduce a signalized intersection at Barbados Boulevard (east of Danforth road) to permit U-turns to provide for eastbound left turns not permitted at Danforth Road and local access; and
- Provide farside platforms at Danforth Road.

Exhibit 2-17: Preferred Design - Eglinton Avenue at Brimley Road and Danforth Road

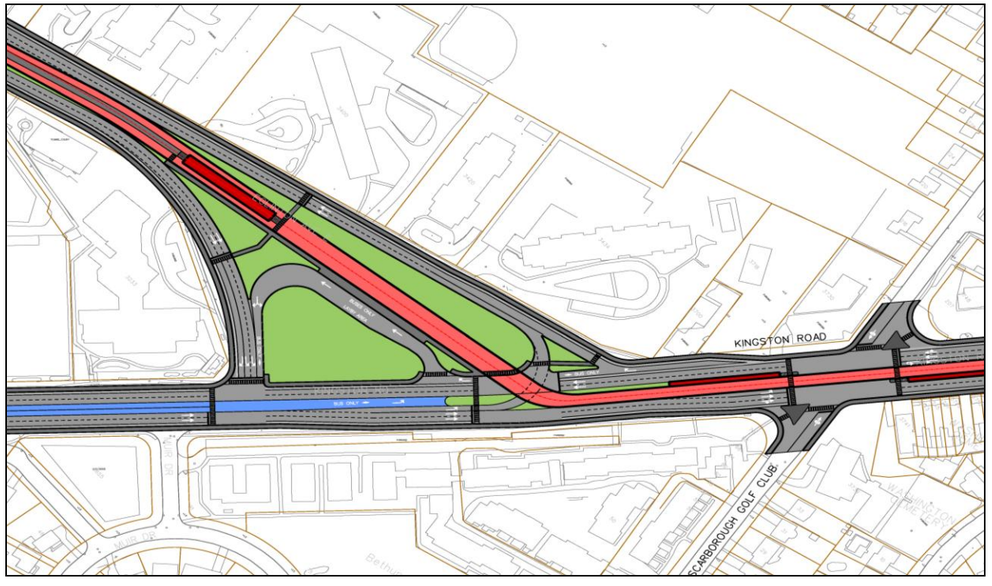


2.1.6.2 Eglinton Avenue / Kingston Road Intersection

A detailed traffic analysis was conducted for the Eglinton Avenue/Kingston Road area. Again, three traffic scenarios were analysed. Each scenario assumed a new transit mall would be in place at Kingston Road and Eglinton Avenue (on Eglinton Avenue) to facilitate the transfer of passengers between the LRT and bus. Based on the results of the Synchro analysis, the preferred scenario (Exhibit 2-18) provides the most overall benefit to the LRT operation. The preferred scenario is to implement all of the following.

- A three phase signal operation at the Eglinton Avenue at Kingston Road intersection;
- Provide southbound right-turns with a channelized lane to access Eglinton Avenue from Kingston Road;
- Synchronize all priority transit movements to occur simultaneously;
- All buses will access the bus layby area via the bus access located at Kingston Road;
- Add a protected/permitted phase that permits vehicles to make northbound left-turns at the Eglinton Avenue at Kingston Road North intersection;
- Physically relocate the bus only lane to the south end of the Eglinton Avenue at Kingston Road intersection, thus shortening the north pedestrian crossing “don’t walk” time to 16 seconds; and
- Separate the north pedestrian crossing into two-stages with a “don’t walk” time of 32 seconds.

Exhibit 2-18: Preferred Design - Eglinton Avenue and Kingston Road Intersection



The existing Eglinton Avenue is an east-west arterial road which veers to the southeast after Cedar Drive and ends at Kingston Road. Due to the future traffic operations considerations in the area, including the Scarborough-Malvern LRT and the proposed Kingston Road transit improvements facility, the existing intersection will be fully redeveloped to address the future traffic and LRT operation demands. The modifications, as previously shown in Exhibit 2-18, include:

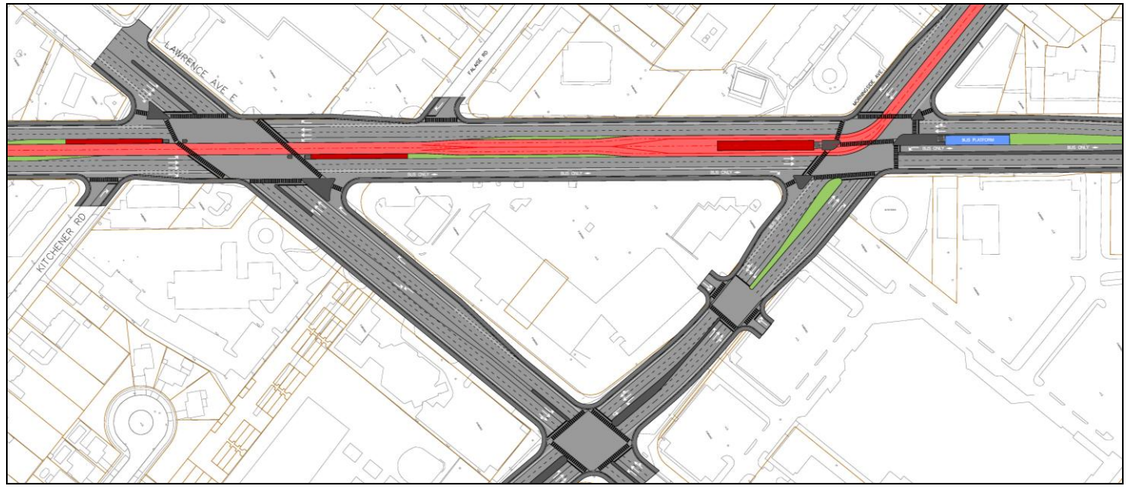
- Realign westbound lanes to receive traffic from Kingston Road.
- Convert the section of the existing Eglinton Avenue between east of Cedar Drive and Kingston Road to eastbound only.
- Construct a new bus lay-by area between the eastbound and westbound lanes to provide a transfer between Scarborough-Malvern LRT, the planned Kingston Road bus rapid transit and other local bus services. The final design of the lay-by area is subject to modification in accordance with the on-going Kingston Road Transit Project Assessment Study.

2.1.6.3 Kingston Road / Morningside Avenue Intersection

A detailed traffic analysis was conducted for the Kingston Road/Morningside Avenue area. Alternative scenarios were developed in consultation with City of Toronto and TTC staff. Based on the results of the Synchro analysis, the preferred alternative provides the most overall benefit to the over capacity movements, without expanding the roadway. The preferred scenario (Exhibit 2-19) is to implement all of the following:

- Provide a four phase signal operation at the Kingston Road / Morningside Avenue intersection;
- Restrict all left turn movements (except for the LRT) at the Kingston Road / Morningside Avenue intersection;
- Overlapping eastbound vehicle and pedestrian phase or northbound vehicle and pedestrian phase with LRV phase;
- Add a northbound to eastbound right turn lane at the Kingston Road /Lawrence Avenue intersection;
- Add a southbound to westbound right turn lane at the Kingston Road /Lawrence Avenue intersection;
- Add a southbound right-turn lane at the Kingston Road/Lawrence Avenue East intersection and allow protected southbound right-turns during LRT phases;
- Split north/south pedestrian crossing into a two-stage crossing and provide a mid-intersection pedestrian crossing for pedestrians traveling north-east/south-west;
- Restrict eastbound to southbound right-turns at the Kingston Road/Morningside Avenue intersection to buses only; and
- Add a northbound right turn lane at the Kingston Road/Morningside Avenue intersection.

Exhibit 2-19: Preferred Design - Kingston Road and Morningside Avenue Intersection



Kingston Road is designated as a major arterial road, continuing into the Region of Durham. Kingston Road/Highway 2, as identified in the Durham Region plan, is the most significant inter-municipal transit corridor within Durham Region. A bus rapid transit route is proposed by the Region as part of the MoveOntario2020 program on Highway 2 between Pickering and Oshawa. It is planned that this service would extend into Toronto to UTSC and/or Scarborough Town Centre. It would connect with the Scarborough-Malvern LRT at the Kingston Road / Morningside Avenue intersection (or at the UTSC). Therefore, it is anticipated that the Kingston Road/Morningside Avenue intersection will have high volumes of transit activities for LRT, buses and passenger transfers. With the consideration of the traffic operation improvement recommendations as described above, the following improvements for transit operations, as shown in Exhibit 2-19, are proposed:

- A centre LRT platform with LRT crossovers on Kingston Road west of Morningside Avenue.
- Reserved bus lanes on both sides of Kingston Road east of Morningside Avenue proposed as part of the Surface Transit Priority Network identified in the City's Official Plan.
- A bus platform located in the centre of Kingston Road east of Morningside Avenue to allow westbound bus unloading adjacent to a transit only left turn lane.
- Transit signal priority at the intersection of Kingston Road with Collinsgrove Road so that buses travelling on the westbound curb lane can transfer to the centre lane.
- Centre platforms for both LRT and bus facilities will provide the shortest transfer distance between bus and LRT services and minimize pedestrian crossing traffic and signal timing requirements.

2.1.6.4 Beath Street

A new intersection is proposed on a relocated Beath Street to provide full movement access for the area. By introducing the new intersection, impacts to local vehicular traffic will be minimized. A half traffic signal signal north of Beath Street will permit LRVs to access the right-of-way on the east side of Morningside Avenue. The use of transit signal priority when the train approaches will reduce the likelihood that a train would have to stop on a slope.

2.1.6.5 Highway 401 Area

Consultation with the Ministry of Transportation (MTO) was undertaken. A detailed traffic report with the proposed measures was submitted to MTO for review. No major concerns were raised from the MTO with regard to this study but a number of operational issues were identified. The future commitments to MTO within regard to this project are provided in Section 7.1. A detailed traffic analysis was also conducted at the Highway 401 area. A number of improvements to improve traffic operations have been recommended. These proposed measures are intended to demonstrate the scope and feasibility of the improvements required to meet the project objectives. They will be finalized in detailed design. The preferred design is shown in Exhibit 2-20. The adjustments to traffic operations are listed in Exhibit 2-21.

Exhibit 2-20: Preferred Design - Highway 401 interchange area

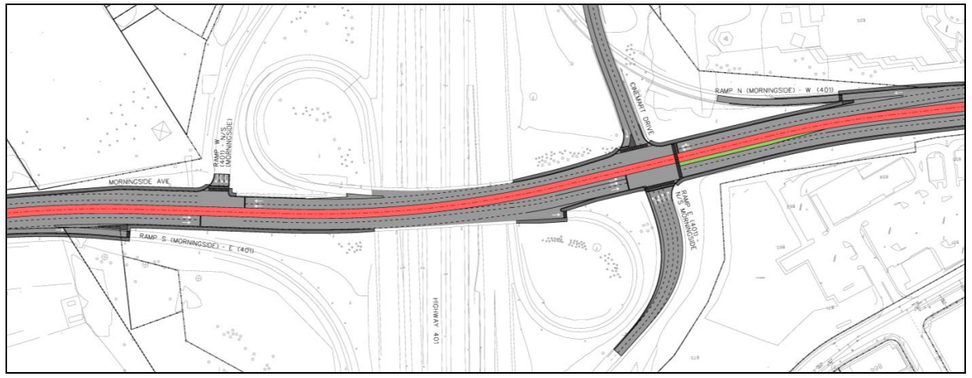


Exhibit 2-21: Potential Improvements at the Highway 401 Area

Mitigation Measures	Morningside Avenue and Military Trail	Morningside Avenue and Highway 401 Eastbound Off-Ramp	Morningside Avenue and Highway 401 Westbound Off-Ramp / Cinemart Drive	Morningside Avenue and Milner Avenue
AM Peak Hour	▪ shift 18 seconds of green time from the northbound movements to the southbound left-turn movement; and, ▪ shift 5 seconds of green time from the northbound and southbound through movements to all the eastbound and westbound movements.	▪ shift 14 seconds of green time from the northbound and southbound through movements to all eastbound movements.	▪ shift 5 seconds of green time from the northbound and southbound through movements to the northbound left-turn movement; and, ▪ shift 10 seconds of green time from the northbound and southbound through movements to all westbound movements.	▪ shift 5 seconds of green time from all eastbound and westbound movements to the northbound and southbound through movements; and, ▪ increase the cycle length from 90 seconds to 100 seconds by adding 10 seconds of green time to the northbound and southbound left-turn phases.
PM Peak Hour	▪ convert the northbound left-turn lane turn type from permitted to protected and permitted; and, ▪ shift 5 seconds of green time from the northbound and southbound through movements to the northbound and southbound left-turn movements.	▪ shift 5 seconds of green time from the northbound and southbound through movements to all eastbound movements.	▪ mitigation measures were not required.	

Mitigation Measures	Morningside Avenue and Military Trail	Morningside Avenue and Highway 401 Eastbound Off-Ramp	Morningside Avenue and Highway 401 Westbound Off-Ramp / Cinemart Drive	Morningside Avenue and Milner Avenue
Geometric Improvements	▪ increase the length of the westbound right-turn lane (existing 75 m) by 100 m for a total of length of 175 metres.	▪ add an additional eastbound right-turn lane for a total of two eastbound right-turn lanes, and maintain the outside third lane as an away lane.	▪ mitigation measures were not required.	▪ increase the length of the eastbound left-turn lane (existing 112 m) by 40 m for a total of length of 152 m; ▪ increase the length of the westbound left-turn lane (existing 90 m) by 34 m for a total of length of 130 m; ▪ increase the length of the northbound left-turn lane (existing 140 m) by 60 m for a total of length of 200 m; and, ▪ increase the length of the southbound left-turn lane (existing 38 m) by 10 m for a total of length of 48 m.

Beside the proposed operational improvements for the Highway 401 interchange with Morningside Avenue as noted above, it is proposed that a minor lane realignment for 150 m at the entrance area of the southeast entry ramp to Highway 401 be undertaken to accommodate the future LRT right-of-way. It is anticipated that the realignment will have no impacts on Highway 401 operations. The proposed improvements will be designed in accordance with the MTO geometric standards.

2.1.7 TRANSIT INTERFACE CONSIDERATIONS

2.1.7.1 Kennedy Subway Station

The TTC is undertaking a separate study to expand the existing Kennedy Station in order to provide a better interconnection between transit services including Bloor-Danforth Subway, Scarborough RT, existing bus services, Eglinton Crosstown LRT, Scarborough-Malvern LRT and the GO Transit Stouffville line. Kennedy Station is the third busiest station in the system and serves over 115,000 people daily. The connection between the Scarborough-Malvern LRT and the Kennedy Subway Station will be the subject of an Environmental Assessment Amendment. This study will define the preferred strategy to affectively integrate all of the services into the station.

2.1.7.2 Kingston Road BRT

The City of Toronto has initiated a Transit Project Assessment Study to identify potential transit improvements along the Kingston Road and Danforth Avenue Corridor. The study is to investigate how to improve transit service along Kingston Road and Danforth Avenue between Victoria Park subway station and Eglinton Avenue. The preferred technology is Bus Rapid Transit (BRT). A transit lay-by area at the Eglinton Avenue and Kingston Road intersection has been developed in this study to accommodate future BRT vehicles and to facilitate transfers between Scarborough-Malvern LRT, local bus services and the proposed Kingston Road / Danforth Avenue BRT service.

2.1.7.3 Sheppard LTR

The Sheppard East LRT (SELRT) will operate along Sheppard Avenue East from Don Mills station to Meadowvale Road. The connection between the SELRT and the Scarborough-Malvern LRT is located at the intersection of Sheppard Avenue and Morningside Avenue. A track connection is proposed to provide a link between the two LRT lines for access to light rail vehicle maintenance facilities and for possible through operations.

2.2 The Preferred Design

2.2.1 DESCRIPTION OF THE ALIGNMENT

Following the identification of preferred alternative design elements as noted in Section 5, a conceptual design was prepared for the project. The following chapter describes the project as proposed in this environmental assessment study. While changes may occur during the preliminary design or detailed design stages, any changes should not alter the intent of the recommended undertaking. The preliminary plan and profiles for the Scarborough-Malvern LRT Corridor with the associated road improvements have been developed and are provided in this section.

As noted previously, the purpose of this study is to provide a high-quality transit service to connect Kennedy Station and the north-eastern Scarborough area, in order to meet the future transit demands and to support the future development growth along the Scarborough-Malvern study corridor. The recommended undertaking includes the following:

1. Construction of the LRT in the centre of the roadway with a raised median to separate vehicular traffic and at-grade at the intersection areas as shown in Exhibits 6.3 & 6.4, with the exception of the areas adjacent to Highland Creek and UTSC where a separate LRT right-of-way will be provided;

2. Construction of 3.0 m wide farside platforms or a minimum 5.0 m wide centre platform with stop spacing of 400 – 600m, in general;

3. Provision of a 1.6 m delineated cycling lane on both sides along Eglinton Avenue, Kingston Road and Morningside Avenue with the exception of the Highway 401 area;

4. Provision of two through vehicular traffic lanes in each direction in the Scarborough-Malvern corridor;

5. Provision of left turn lanes at signalized intersections except at locations where these turns have to be restricted;

6. Provision of U-turn opportunities at signalized intersections where there are no significant adverse traffic impacts;

7. Reallocation of the high occupancy vehicle (HOV) lane in each direction on Eglinton Avenue to LRT use;

8. Reallocation of one general purpose lane in each direction of Kingston Road to LRT use;

9. Construction of a new bridge over Highland Creek for the LRT line parallel to the existing Morningside Avenue structure;

10. Reconfiguration of the following intersections to minimize adverse traffic impacts: Eglinton Avenue & Kingston Road, Kingston Road & Morningside Avenue and Lawrence Avenue & Kingston Road;

11. Provision of a new access road connection between Warnsworth Street and Beath Street across Morningside Avenue to ensure the linkages to the communities adjacent to Morningside Avenue are maintained; and

12. A minor lane realignment of the south-east ramp of the Highway 401/Morningside Avenue interchange, for 200 m, at the entrance area to accommodate the proposed LRT facility.

LRT Alignment

The Scarborough-Malvern LRT alignment will follow the existing roadway alignments along the study corridor, with the exception of the section on Morningside Avenue between Beath Street and Ellesmere Road and on Ellesmere Road.

The Scarborough-Malvern LRT will begin at Kennedy Station on the Bloor-Danforth subway. A separate study is currently ongoing to investigate the reconfiguration of Kennedy Station; therefore, the SMLRT alignment for this study begins 200 west of Midland Avenue. The LRT will travel eastward along the existing centrelines of Eglinton Avenue, Kingston Road and Morningside Avenue from Kingston Road to just north of Beath Street. The alignment will then cross Morningside Avenue northbound lanes to the east side of the road north of Beath Street and tie into a new Highland Creek bridge structure located on the east side of the existing Highland Creek bridge.

The LRT will turn east at the Morningside Avenue and Ellesmere Road intersection and run the south side of Ellesmere Road to serve the University of Toronto Scarborough Campus. It will then turn north into the centre of Military Trail from Ellesmere Road to Morningside Avenue. From this point, the LRT alignment will continue north into the centre of Morningside Avenue, pass over Highway 401, cross Sheppard Avenue East and terminate just north of Sheppard Avenue East.

Roadway Alignment

The existing horizontal alignments of Eglinton Avenue and Kingston Road will remain the same, except at the Eglinton Avenue and Kingston Road intersection which will be reconfigured to provide transfer facilities with the proposed Kingston Road BRT and local bus services. Morningside Avenue will be widened on both sides between Kingston Road and north of Warnsworth Street. The alignment will be realigned slightly to the west from Warnsworth Street to tie into the existing Highland Creek bridge structure. The Morningside Avenue widening will be along the existing east side edge of pavement from Warnsworth Street in order to accommodate the existing travel lanes, the proposed LRT right-of-way and bicycle lanes.

Vertical Alignment

The vertical alignment for the roadway section will be the same as the existing roads. The LRT alignment will be designed to match the existing profile with a maximum grade of 5.0%. For the new Highland Creek structure and the adjacent sections along Morningside Avenue and Ellesmere Road, the new profile will be designed to accommodate the LRT requirements, particularly the maximum 5% grade.

Typical Cross Section

The typical cross-sections along Scarborough-Malvern Corridor were developed for both mid-block and intersection areas at the beginning of the study. Typically the LRT alignment is located in the middle of the corridor on a 150 mm raised median to separate the LRT traffic and the general traffic between traffic signals. At intersections, the track will be constructed at the same elevation as the crossing road.

The cross-section on Morningside Avenue between Highland Creek and Ellesmere Road will be customized due to the changes of the LRT alignment location. A detailed analysis and design for both the alignment and streetscape conditions will be undertaken at the detail design stage.

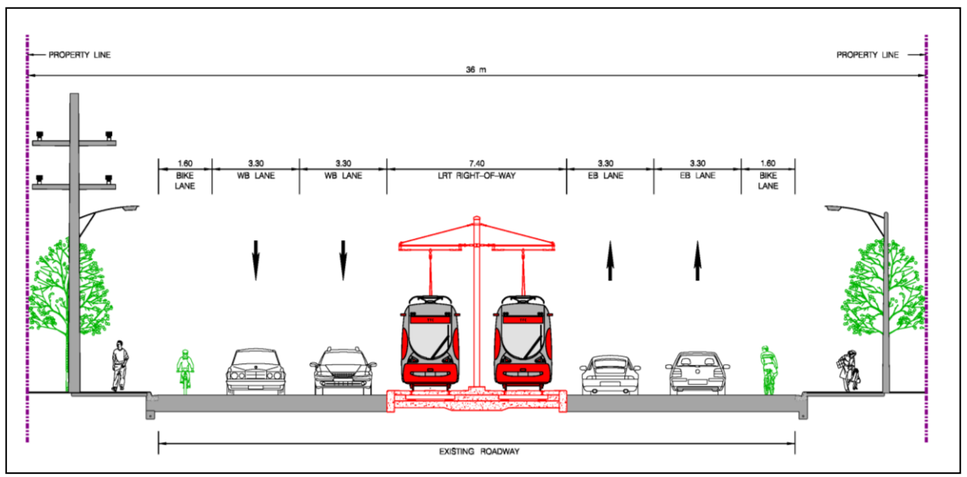
Light rail vehicles (LRVs) will be operating on TTC rail gauge embedded track. The proposed system will be double-tracked throughout, providing a separate track for each direction. Generally, a cross-section of at-grade double tracks for the LRT alignment requires a 7.4 m right-of-way. The minimum vertical clearance is approximately 4.0 m from top of rail. Crossovers to allow trains to cross from the opposite tracks will be provided at strategic locations for LRT operations at specific locations.

Centre poles for the traction power transmission are recommended from an urban design perspective (removal of visual clutter from the street), and because they cost less to construct and are less prone to damage and maintenance requirements. However, location of the poles is subject to ongoing discussions with the Toronto Fire, police, and EMS representatives to make the LRT alignment accessible to their vehicles. A final recommendation will be made during detailed design.

Eglinton Avenue

The existing Eglinton Avenue consists of a 7-lane cross-section (four general purpose lanes, two HOV lanes and a median two-way-left-turn lane). With the new LRT implementation, two traffic lanes will be maintained in each direction with additional left-turn lanes where required. The LRT will operate in the centre between the traffic lanes; bicycle lanes will be added adjacent to the curb lanes as shown in Exhibit 2-22.

Exhibit 2-22: Typical Mid-Block Cross Section – Eglinton Avenue and Kingston Road



Kingston Road

The existing Kingston Road has a 6-lane cross-section with a raised median between Eglinton Avenue and Morningside Avenue. With the new LRT implementation, the existing raised median and two inner travel lanes will be replaced by the LRT right-of-way with the construction of bicycle lanes on both sides of Kingston Road as shown in Exhibit 2-22. Two traffic lanes will be maintained in each direction with left-turn lanes as required.

Morningside Avenue

The existing Morningside Avenue has a 4-lane cross-section with a 26.0 m right-of-way between Kingston Road and Warmsworth Road. With the new LRT implementation, the existing right-of-way will be widened to 30.0 m through property acquisitions at the section south of Beath Street to accommodate the LRT right-of-way and the bicycle lanes as shown in Exhibit 2-23. It is planned to increase the right-of-way width as designated in the Official Plan to 36.0 m.

The existing Highland Creek structure will require widening by 1.7 m on the east side to accommodate the proposed bicycle lanes as shown in Exhibit 2-24. A new 10.0 m wide structure is proposed east of the existing bridge structure on Morningside Avenue to accommodate the LRT. This can be accommodated with the existing right-of-way.

Exhibit 2-23: Mid Block Cross Section – Morningside Avenue

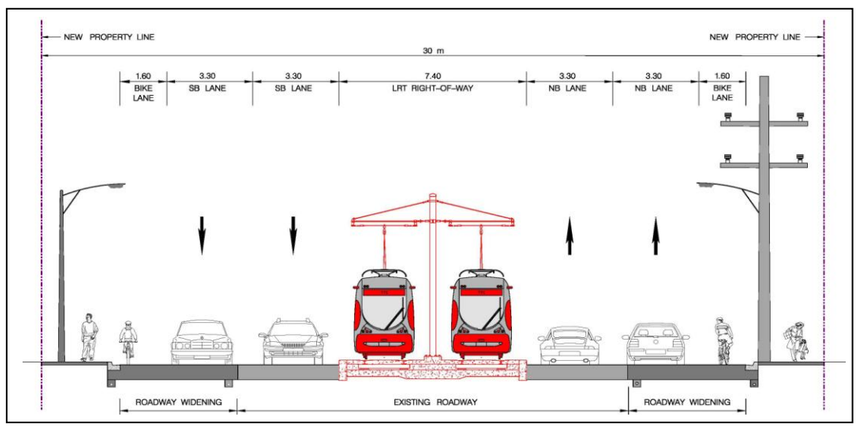
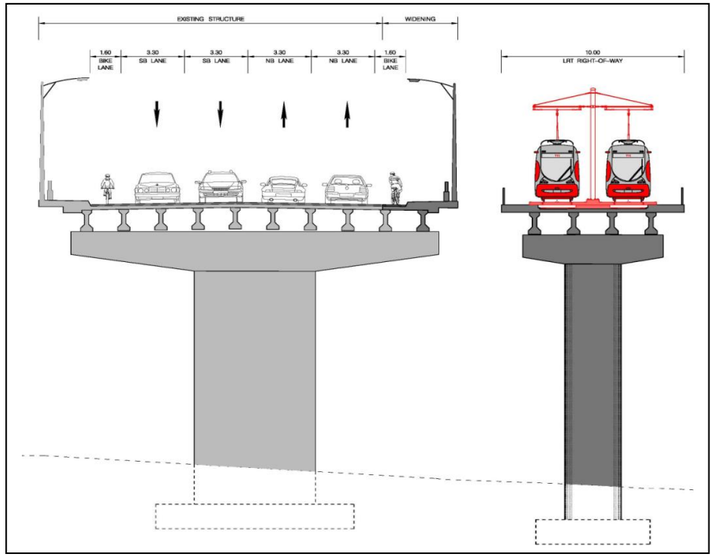


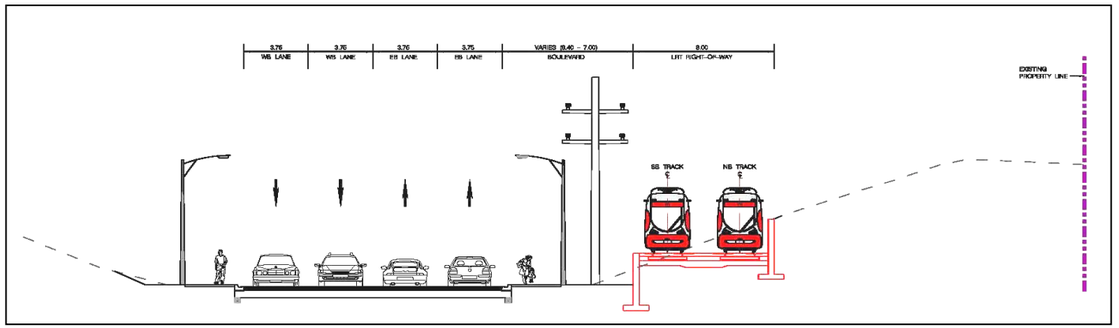
Exhibit 2-24: Cross Section – Morningside Avenue Bridge over Highland Creek



Ellesmere Road

The existing Ellesmere Road has a 4-lane cross section with no median and a sidewalk on the south side. With the LRT implementation, the existing roadway cross-section will be maintained. The LRT will be located on the south side of Ellesmere Road, therefore the roadway will not be widened. No bicycle lanes are being proposed on Ellesmere Road, as the roadway will not be reconstructed as part of this project. This section of alignment is included in the City's Bike Plan; therefore, the opportunity to construct bicycle lanes can be provided in the future. The cross section of the proposed Ellesmere Road cross-section is shown in Exhibit 2-25.

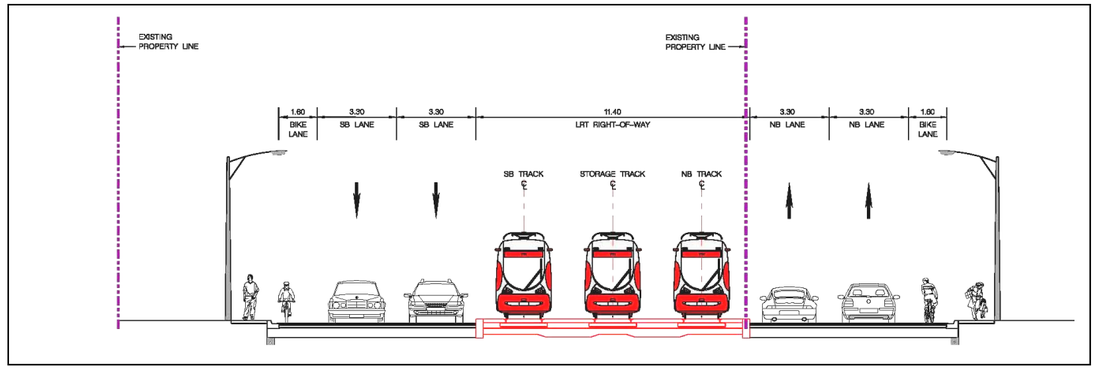
Exhibit 2-25: Cross Section – Ellesmere Road



Military Trail

The existing Military Trail has a 3-lane cross section, one lane in each direction with a median two-way left-turn lane. With the new LRT implementation, the existing Military Trail will become a four lane road with the LRT facilities located in the median as shown in Exhibit 2-26. The LRT right-of-way along Military Trail is wider than other normal locations due to the special trackwork (two-track to three-track transition crossovers and a turnback track) required at this location.

Exhibit 2-26: Storage Track Cross Section – Military Trail



2.2.2 PREFERRED STOPS

As listed in Exhibit 2-27, 19 stops with passenger boarding platforms are being proposed within the corridor. Boarding platforms will be approximately 60 m long to accommodate two-car trains. Depending on the future LRV design, the platform will be approximately 150 mm above the top of rails to allow for level boarding into a low-floor vehicle. Each stop will consist of either two 3.0 m far-side (opposite side) loading platforms, two 3.0 m split-side loading (i.e. same side) platforms or one 5.0 m centre-loading platform. The stop locations and the associated types are shown in Exhibit 2-17. In general, each platform will be furnished with a canopy and windscreen for weather protection. Other passenger amenities, including signs, seating, trash receptacles and self-service fare equipment will be included on the platform. The proposed stops will be designed to be compliant with accessibility requirements; accessibility ramps are being proposed at the end of the platform near the intersection to connect to the crosswalks. Exhibit 2-28 provides the spacing of the stops.

2.2.3 SPECIAL TRACKWORK

To allow the LRT vehicles to change directions for operational purposes, special trackwork is provided at strategic locations. The types of special tracks that are proposed within the corridor include two-track to three-track transitions at four locations to provide operational and emergency turnback facilities, a connection at Sheppard Avenue to connect with the Sheppard LRT and a tail track north of Sheppard. In general, the LRT right-of-way will increase from 7.4 m to the maximum of 13.2 m at three-track areas.

The two-track to three-track transition will link with a storage track located between the two operating lines. This allows disabled vehicles to be moved off-track and operating trains to be turned around. Crossovers and storage tracks are being proposed at the Eglinton Avenue / Kingston Road intersection on Eglinton Avenue, at the Kingston Road / Morningside Avenue intersection on Kingston Road, the Morningside Avenue / Ellesmere Road intersection on Morningside Avenue, the Ellesmere Road / Military Trail intersection on Military Trail, and the Military Trail / Morningside Avenue intersection also on Military Trail. Tail tracks with a double crossover are also proposed on Morningside Avenue north of Sheppard Avenue as the LRT line terminates at this location.