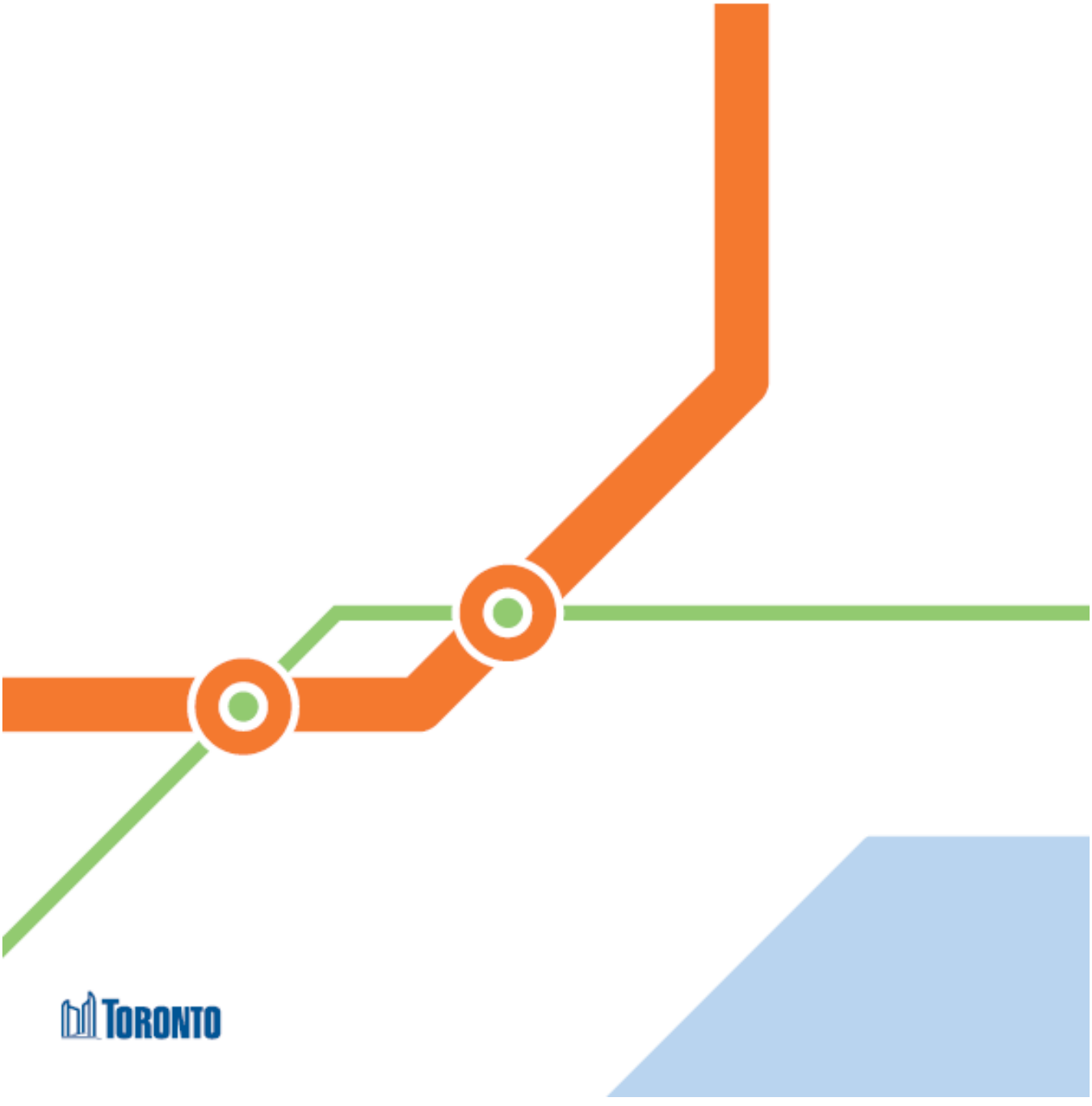
Re: EX16.1

Eglinton East LRT

Preliminary Options Analysis

June 2016



TORONTO

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1. Executive Summary

The Eglinton East LRT was first introduced as the Scarborough-Malvern LRT through the TTC's Transit City program in 2007[1]. The project is envisioned to run along designated avenues in Scarborough, support the growth of complete communities, and improve transit access in Scarborough. It has since been included in several municipal and provincial expansion plans including the Province of Ontario's *MoveOntario 2020*, and Metrolinx's Regional Transportation Plan, *The Big Move.* Although this project is one of the top five performing projects in the City of Toronto's preliminary assessment of the transit network through *Feeling Congested?*, project funding has never been committed by any level of government.

The Eglinton East LRT project was recently reintroduced as a potential priority, due to changes to the transit planning context in Scarborough, which includes the introduction of SmartTrack and Regional Express Rail, and the delay in timing of the Sheppard East LRT. In January 2016, Toronto's Executive Committee considered a report from the Chief Planner & Executive Director, City Planning that proposed a transit network solution for Scarborough that includes a modified Eglinton East LRT to the University of Toronto Scarborough (UTSC) (2016.EX11.5). The project would improve transit accessibility in Scarborough by providing a rapid transit option to several Neighbourhood Improvement Areas and promote the growth of designated avenues of Eglinton Avenue and Kingston Road.

The preliminary options analysis evaluated two rapid transit options for serving this corridor against a base case scenario of continuing with existing bus services (Table 1). The analysis evaluated the options from a strategic, financial, and deliverability case perspective.

Table 1: Eglinton East LRT Options

Option 1	Option 2	Option 3
Bus service along Eglinton from Kennedy station to Sheppard	Approved EA alignment to Sheppard from Kennedy Station along Eglinton Avenue East with modifications. The approved EA for the LRT includes direct service to the UTSC, with its terminus connecting with the proposed Sheppard East LRT at Morningside and Sheppard Avenue.	Shortened Eglinton East LRT to UTSC.

[1] http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2007/Mar_21_2007/Other/Toronto_Transit_City.pdf

From the **Strategic Case** perspective, the Eglinton East LRT will provide enhanced transit service and transportation accessibility to the Eglinton East – Kingston Road corridor, and to UTSC. This enhanced accessibility will stimulate residential and employment growth throughout the corridor and act as a catalyst to renew these neighbourhoods. On balance, both LRT options are equally preferred to the base case scenario of existing bus service. An LRT would enhance service to Neighbourhood Improvement Areas (NIAs), improve transit accessibility in Scarborough, and enhance the connection to the UTSC.

The strategic case concludes that the Option 2 LRT extension to Sheppard Avenue East provides minimal additional benefit compared to an LRT terminating at UTSC (Option 3) due to the uncertain timing of the Sheppard Avenue East LRT. Without the Sheppard East LRT, there would likely be minimal ridership demand at the Sheppard Avenue East stop. However, it is important to note that Option 3 would not preclude future extension of the LRT to Sheppard Avenue East and north to Malvern as envisioned under the original Transit City proposal. The planning, engineering and design work for the LRT will consider the potential for future extension.

Table 2: Strategic Case Summary

Criteria	Option 2 (SMLRT)	Option 3 (Eglinton East LRT)
Choice	●	●
Experience	●	●
Social Equity	●	●
Shaping the City	●	●
Healthy Neighbourhoods	●	●
Public Health and Environment	◕	◕
Neighbourhood Impact	◑	◑
Supports Growth	●	●
Strategic Case Summary	●	●

In the **Financial Case** evaluation, the shortened LRT terminating at UTSC (Option 3) performs better as the cost would be proportionally less due to the shortened length of the alignment. The costs presented in this analysis were developed based on 0% level of design (Class 5 estimate). Further technical and planning analysis to address issues identified in the deliverability case will be required to refine the project scope and costs.

Table 3. Eglinton East LRT Capital Cost Estimates (Class 5) ($millions)

	Option 1 Base Case	Option 2 Terminating at Sheppard	Option 3 Terminating at UTSC
Constant 2016$	-	$1,617 - $1,832	$1,331 - $1,412
YOE/Escalated $	-	**$1,917 - $2,172**	**$1,578 - $1,674**

Notes:

- Cost estimates developed by a third party consultant.
- Assumes line in service by late 2023, with construction taking approximately 4 years (2020-2023)
- Cost estimates have been developed at 0% design and are a Class 5 cost estimate (per AACE guidelines). Class 3 estimates are required to establish the project budget baseline.
- Cost estimates do not include financing, lifecycle, and operations/maintenance (see attachment 5).
- The estimate for Option 3 terminating at UTSC includes storage tracks, but does not include a maintenance facility; the low estimate for the option terminating at Sheppard includes some modification to the Crosstown MSF and storage tracks; the high estimate for the option terminating at Sheppard includes a stand-alone MSF, but not connecting tracks along Sheppard to Conlins.
- Project timeline, funding source and procurement method still to be determined.

The preliminary **Deliverability and Operations case** identified several technical and engineering considerations requiring further analysis, including the connection at Kennedy Station, the Military Trail re-alignment, traffic impacts, and the maintenance and storage facility (MSF) requirements. These issues require further analysis in partnership with Metrolinx and the TTC. The cost estimates identified in the financial case section will be refined as key scope elements are clarified, including:

- The approved EA for the Scarborough-Malvern LRT did not contemplate a through connection at Kennedy Station. This critical hub is currently undergoing detailed design in order to accommodate the Eglinton Crosstown LRT. Kennedy station will also be impacted by the preferred SSE alignment.
- Maintenance and storage requirements need further review if the LRT terminates at UTSC. Cost estimates presented in the Financial Case section for Option 3 do not include an MSF.
- Integration with the UTSC Master Plan (2011) which was envisioned two years following completion of the 2009 Scarborough Malvern LRT EA, will need to be undertaken. Specifically, the Master Plan proposes the realignment of Military Trail, which forms the LRT alignment through the campus.

This evaluation has identified a number of issues that should be carried forward to the next phase of work on the Eglinton East LRT extension. The timing for delivery of the project depends on the outcomes of this further work, and decisions regarding roles and responsibilities and project ownership.

Conclusion & Next Steps

The initial analysis of the Eglinton East LRT recommends Option 3 with the extension terminating at UTSC. However, there are a number of unknowns with respect to the project scope given the number of interfaces with other transit expansion projects at Kennedy station (e.g. Crosstown LRT and SSE). More detailed analysis on the Eglinton East LRT, including a detailed business case is a required next step.

The analysis in this report will feed into a more comprehensive business case analysis of the preferred network solution for Scarborough that will assess the strategic, economic, financial and operational benefits and costs associated with different network configurations. The network scenarios will include express subway options between Kennedy and Scarborough Centre, and an LRT on Eglinton East.

2. Background and Context

The long term urban structure of Scarborough is envisioned to be dominated by Neighbourhoods and Employment Areas as documented in Toronto's Official Plan. The Official Plan protects the character of neighbourhoods from change, and there is little desire to increase density in these areas. While growth and development is permitted and encouraged in Employment Areas, Scarborough's Employment Areas are primarily meant to accommodate low density employment related to highway and rail infrastructure such as light industrial, warehousing and logistics. The potential for development of high density employment (e.g. office buildings) is limited.

Even though the character and built form of much of Scarborough is likely to remain stable, there is an important role for Scarborough to play in accommodating expected future growth in the Toronto region. Improvements in transportation options will support and enhance the long term urban structure of Scarborough.

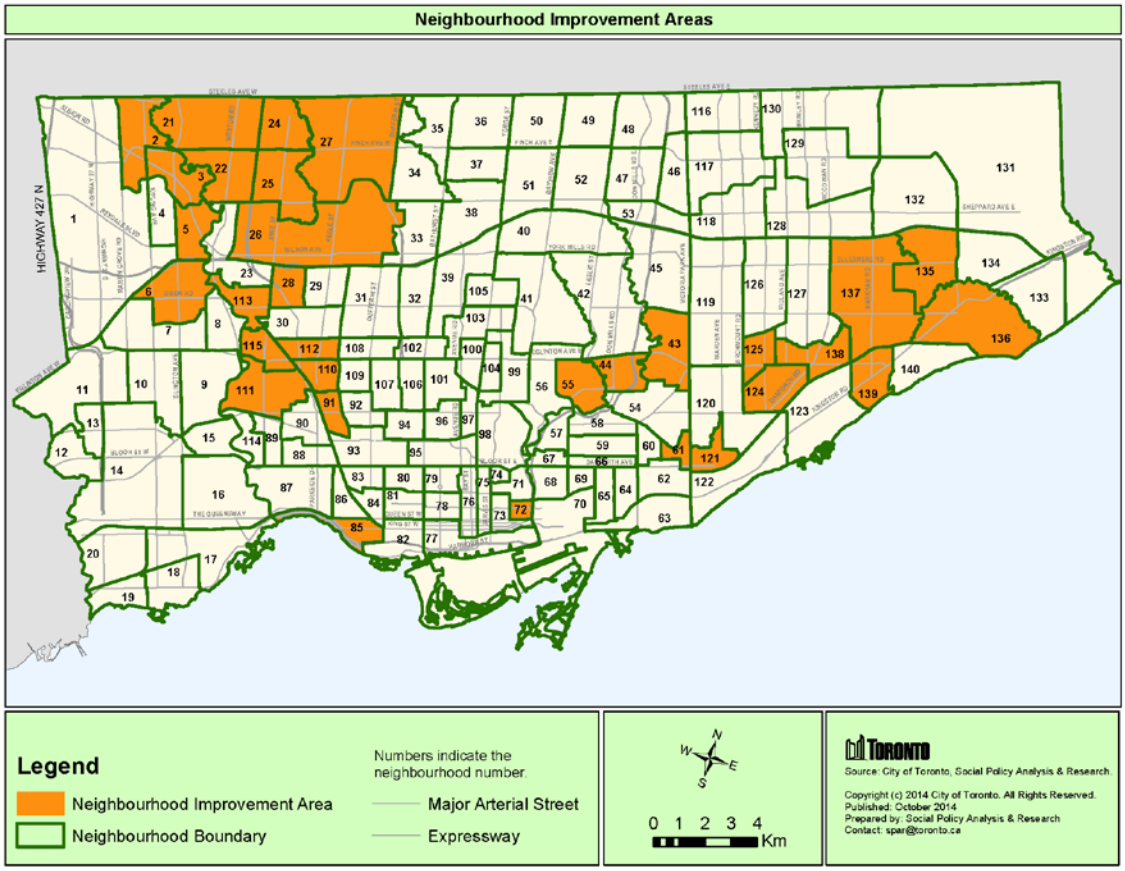
Transit Accessibility in Scarborough

Scarborough is home to 625,000 Torontonians making up 24% of Toronto's population.[2] Scarborough is also home to a disproportionate number of the City's Neighbourhood Improvement Areas (NIAs) defined by the City of Toronto's Strong Neighbourhoods Strategy 2020 (TSNS 2020).[3] Eight of the thirty-one NIAs are clustered in central and southern Scarborough south of Highway 401 and east of Victoria Park Avenue (see Figure 1).

Access to transit options, particularly rapid transit, in Scarborough is lower than in other parts of the City. The average Scarborough resident can access approximately half the number of jobs the average Toronto resident can access using transit. Yet, transit use is higher than average for residents living within NIAs; in areas of Eglinton Avenue East and Kingston road, 45% of residents use transit to commute to work, compared to a City of Toronto average of 37%.[4] Transit facilitates access to key destinations such as community services, jobs and educational opportunities is particularly important for communities that already experience equity scores falling below Toronto's benchmark defined by TSNS 2020. Introducing rapid transit to these NIAs will improve access and is an opportunity to improve outcomes for NIAs in Toronto. Additionally, preliminary findings from a planning study of NIA neighbourhoods suggest that poor pedestrian experience and weak character of the urban environment hinders marketability for higher density residential investment.

[2] Statistics Canada, 2011 Census
[3] City Council adopted this strategy in 2014, which identifies thirty one NIAs as areas that experience inequitable outcomes.
[4] Statistics Canada, 2011 Census

Figure 1: Designated Neighbourhood Improvement Areas in the City of Toronto



An objective of Toronto's Official Plan is to reduce auto dependency, which can be done by improving transit accessibility. Auto dependency is particularly high in Scarborough due to the lack of rapid transit alternatives. For example, the transit mode share in Scarborough is much lower[5] than in Toronto and East York Community Council areas, where the transit mode share for internal trips is 33%. In contrast, approximately 14% of internal trips in Scarborough are made using public transit during an average day.[6] Shifting behaviours from private to public transit usage will require improvements in access to reliable, frequent, and rapid transit options in Scarborough.

The growth of Scarborough communities will require investments in building connections to key destinations. A key destination that requires improved connections is the UTSC, which is a significant regional destination and its importance will continue to increase as the campus grows and develops. The lack of transit access constrains the potential success of the campus and the University as a whole. Transit service to the UTSC is limited to the TTC's U of T Scarborough Rocket between Kennedy Station and UTSC, Durham Region Transit's PULSE service

[5] Transit mode share for the commute to work is higher than average among residents of Neighbourhood Improvement Areas in Scarborough compared with NIA residents across the City. Taking account of all trips, not just the commute to work, and taking account of all residents of Scarborough, the transit mode share is lower than the City of Toronto average.

[6] EX11.5 Scarborough Transit Planning Update: http://www.toronto.ca/legdocs/mmis/2016/ex/bgrd/backgroundfile-87737.pdf

connecting downtown Oshawa to downtown Pickering and UTSC, and local TTC buses. While it is estimated that 59% of students travel to campus by local transit, many experience long travel times and the connection between UTSC and the main St. George campus of the University is extremely long (approximately 50 minutes via a TTC express bus from Kennedy Subway station)[7]. UTSC has ambitious plans for expansion and need expanded transit capacity with shorter travel times to enable this development.

Developing Complete Communities along Avenues

Land adjacent to some arterial roads in the City of Toronto is designated in the Official Plan for smaller-scale, mixed-use growth and economic development. These areas are called Avenues. The longest contiguous Avenues in Scarborough are Eglinton Avenue East (Victoria Park Avenue to Kingston Road) and Kingston Road (Victoria Park Avenue to Highland Creek). Smaller sections of Sheppard Avenue East and Lawrence Avenue East are also designated as Avenues. Investment in better transit, particularly along the designated Avenues, contributes to the creation of complete communities that meet people's needs for daily living, provides transportation choice and reduces auto dependency.

The type and scale of development planned for Avenues contributes to local neighbourhoods and adjacent stable residential communities creating more complete, walkable communities in contrast to the regional-scale development planned for Scarborough Centre. Rapid transit options encourage this type of community development along Avenues, as they are capable of carrying large numbers of people while providing convenient access to local amenities. Line 5 (Eglinton Crosstown LRT) with its relatively high capacity and frequency and short stop spacing is the rapid transit solution best suited to support the intensification and creation of complete communities along Eglinton Avenue as articulated in the Eglinton Connects study (*PG32.4 Eglinton Connects Planning Study - Final Directions Report*).

While development along the Avenues would benefit all adjacent Scarborough neighbourhoods, Eglinton and Kingston bisect the areas of central Scarborough that have also been identified as NIAs. These neighbourhoods would particularly benefit from the introduction of rapid transit.

Problem Statement

Neighbourhoods, Employment Areas, and Avenues are key components of land use in Scarborough envisioned in Toronto's Official Plan. Eglinton Avenue and Kingston Road are designated avenues in the Official Plan for smaller-scale, mixed-use growth and economic development. Investment in better transit, particularly along these Avenues, contributes to the creation of complete communities that meet people's needs for daily living, provides transportation choice and reduces auto dependency.

Additionally, access to transit options in Scarborough is low relative to the rest of Toronto, which has a disproportionate impact on communities more likely to experience inequitable outcomes in Toronto. Nearly all neighbourhoods along the Eglinton East – Kingston Road corridor, between Kennedy Station and Morningside Avenue, have been identified by the

[7] See: University of Toronto Inter-Campus Transportation Survey (2014)

Toronto Strong Neighbourhoods Strategy 2020 as "Neighbourhood Improvement Areas" (NIAs). Although there is extensive bus service in the corridor, rapid transit is limited to two GO Transit stations (Eglinton GO and Guildwood GO).

Given the planning context, the objectives of the Eglinton East LRT are to:

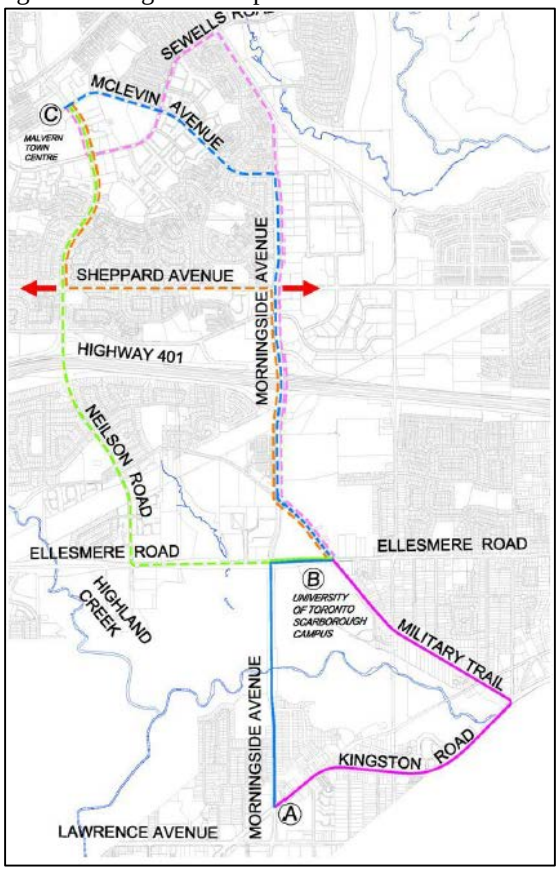
1. Support the development of complete communities along the Avenues and improve local accessibility along the Avenues
2. Support the Toronto Strong Neighbourhoods Strategy and improve transit access to Neighbourhood Improvement Areas (NIAs)
3. Integrate transit with UTSC as the campus grows and develops into a vibrant place of learning and community in accordance with the UTSC Master Plan (2011) and Secondary Plan (currently under development).

Decision History on Options Development

On March 21, 2007 the TTC Board endorsed the Transit City Program, which proposed a rapid transit network of seven light rail transit lines across the City of Toronto. The Scarborough-Malvern LRT, now known as the Eglinton East LRT, was one of the seven transit lines introduced through this program envisioned to connect Kennedy Station and Northern Scarborough, Malvern, and the Morningside Heights community. As proposed in Transit City, a key destination for the LRT was direct service to the UTSC, with its terminus connecting with the proposed Sheppard East LRT at Morningside Avenue and Sheppard Avenue East. The project was subsequently included in the Province of Ontario's *MoveOntario 2020* rapid transit plan, and Metrolinx's Regional Transportation Plan, *The Big Move*.

On September 20, 2009, Toronto City Council approved the Scarborough-Malvern LRT Transit Project Assessment and authorized submission of the Environmental Project Report to the Ministry of Environment (2009.PG31.3). A Notice to Proceed was issued by the Minister of Environment on December 15, 2009. The Scarborough-Malvern LRT EA evaluated alignment options for the portion of the route between Kingston Road and Malvern Town Centre (shown in Figure 2), although approval was only sought on the alignment as far north as Sheppard Avenue East. Several factors were considered in the evaluation of alignment options for the route, including impacts to traffic operations during and after construction, property requirements, impacts on neighbourhoods and businesses, impacts on Natural Areas, construction cost and property acquisition costs. The approved Environmental Assessment (EA) included 18-stops and a maintenance and storage facility to be shared with the Sheppard East LRT located at Sheppard Avenue East and Conlins Road. The approved line did not offer through service at Kennedy Station.

Figure 2: Alignment Options that were considered



In June 2010, City Council considered the Scarborough Rapid Transit (SRT) Transit Project Assessment Study (2010.EX44.23). The study included recommendations for the replacement of the SRT but also addressed Kennedy Station improvements, including the alignments of the Scarborough-Malvern LRT and Eglinton Crosstown LRT lines into Kennedy Station. Given the convergence of a number of transit expansion projects at Kennedy Station, coordination between the projects has been a key consideration in transit planning for Scarborough. City Council approved recommended amendments to the approved EA for the Scarborough-Malvern LRT to provide an underground connection to Kennedy Station via a portal located immediately west of Midland (2010.EX44.23).

Several developments since 2010, including the introduction of GO Regional Express Rail and SmartTrack, the change in City Council direction for the replacement of the SRT Line from an LRT to a subway (2013.CC37.17), and timing of the Sheppard East LRT resulted in a re-evaluation of transit priorities for Scarborough. On January 28, 2016, Toronto's Executive Committee considered a report from the Chief Planner & Executive Director, City Planning, that presented an updated Scarborough transit network that would include an express subway extension of Line 2 from Kennedy Station to Scarborough Centre to support the development of Scarborough Centre as a vibrant urban node. The proposal introduced the Eglinton East LRT (a shortened version of the Scarborough-Malvern LRT) to support the development of complete communities along the Avenues and assumed SmartTrack stations at Lawrence Avenue East and Finch Avenue East. Executive Committee directed staff to continue analysis of this recommended solution and to report back in June 2016 (2016.EX11.5).

The Eglinton East LRT is envisioned as an extension of the Eglinton Crosstown LRT to UTSC. The LRT has been a key feature of the UTSC Master Plan, and a Secondary Plan is currently under development to more fully articulate the aspiration for the campus. By terminating at UTSC and providing through-service at Kennedy Station, it is possible that the Eglinton East LRT may not need the Maintenance & Storage Facility at Sheppard Avenue East and Morningside Avenue, significantly reducing project costs with minimized reduction of benefits.

Options under Assessment

The options in this preliminary options analysis include two options for the Eglinton East LRT against a base case scenario (Option 1) of continuing with existing bus services for the corridor (Figure 3).

Option 2 is the EA-approved Scarborough-Malvern LRT (SMLRT) alignment with modifications as shown in Figure 4. The EA would require an amendment to update the LRT route to ensure it is integrated with the UTSC master plan in addition to other modifications (noted below).

Option 3 is the Eglinton East LRT, which is a modified SMLRT based on the EA-approved LRT that would terminate at UTSC instead of at Sheppard Avenue and Morningside Avenue and be integrated with the UTSC Master Plan.

Figure 3: Option 1 (Base Case)

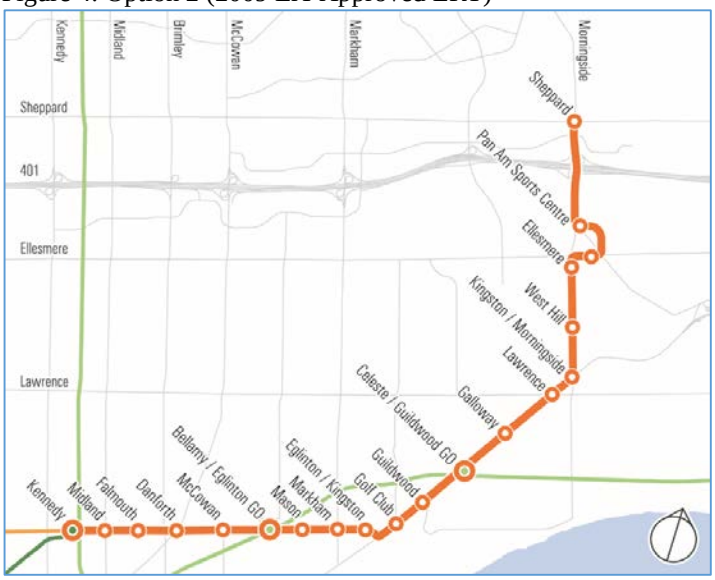
Option 1 the base case scenario where existing bus routes that currently serve the Eglinton Ave East corridor, Kingston Road, Morningside continue to serve the area. These routes include:

- #86 Scarborough
- #116 Morningside
- #198 U of T Scarborough Rocket
- #95 York Mills (on Ellesmere Road)

Option 2 is the 2009 EA-approved alignment for the SMLRT but with modifications to address:

- Integration with UTSC Master Plan (2011)
- Re-alignment of Military Trail (per UTSC Master Plan 2011)
- Connection at Kennedy Station, which had not been developed in the approved EA
- Service integration with Eglinton Crosstown, including 2- or 3- car trains, platform lengths

Figure 4: Option 2 (2009 EA-Approved LRT)



Option 3 is the Eglinton East LRT, a shortened LRT that would terminate at UTSC, and includes modifications to address:

- Integration with UTSC Master Plan (2011)
- Re-alignment of Military Trail (per UTSC Master Plan 2011)
- Connection at Kennedy Station, which had not been developed in the approved EA
- Service integration with Eglinton Crosstown, including 2- or 3- car trains, platform lengths
- Storage requirements
- Terminus station serving UTSC and Toronto Pan Am Sports Centre

Figure 5: Option 3 – Shortened Eglinton East LRT to UTSC

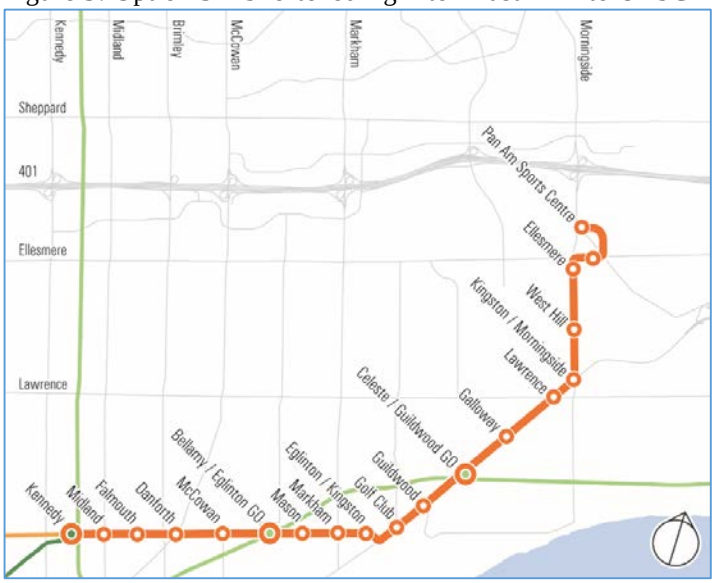


Table 4: Summary of Options

	OPTION 1 (Base)	OPTION 2	OPTION 3
Summary Description	Bus service along Eglinton from Kennedy station to Sheppard	Approved EA alignment to Sheppard from Kennedy Station along Eglinton Avenue East. The approved EA for the LRT includes direct service to the UTSC, with its terminus connecting with the proposed Sheppard East LRT at Morningside and Sheppard Avenue.	Shortened Eglinton East LRT option to UTSC.
Corridor & Alignment	Eglinton Avenue East – Kingston Road – Morningside Avenue – Ellesmere Avenue – Military Trail – Ellesmere Avenue	Eglinton Avenue East – Kingston Road – Morningside Avenue – Ellesmere Avenue – Military Trail – Morningside Avenue	Eglinton Avenue East – Kingston Road – Morningside Avenue – Ellesmere Avenue – Military Trail
Length of Alignment	N/A	LRT 12.15 km on street	LRT 10.5 km on street
Station Locations	Existing TTC bus stops	18 Stops	17 or fewer LRT stops
Service Concept	Current bus service levels	Continuation of Crosstown LRT	Continuation of Crosstown LRT
Additional Infrastructure Requirements	None	• 57 LRT vehicles (19 3-car trains) • MSF at Sheppard/ Conlins (shared with Sheppard East LRT), including end-of-line operations building, access route, storage tracks	• 54 LRT vehicles (18 3-car trains) • End of line operations building, storage tracks, access route

Base Network Assumptions

The evaluation of the options assumed the following base network assumptions:

- Eglinton Crosstown LRT from Mount Dennis to Kennedy Station (currently under construction)
- Toronto-York-Spadina Subway Extension (currently under construction)
- Sheppard Avenue East LRT (funded)
- SmartTrack Option C with 7-8 new stations (in planning phase)
- Express Scarborough Subway Extension (3-stop SSE, funded)
- Removal of buses in LRT corridor
- Complimentary bus routes and service levels adjusted to minimize duplication with LRT, some other re-routings of buses to ensure good network connections, particularly at UTSC.

3. Strategic Case Evaluation

The Strategic Case is an assessment of the options based on alignment with the project objectives and broader City building objectives. It captures considerations that are not easily monetized and are therefore not captured in the Financial or Economic cases. The City-building objectives included in this analysis were developed through extensive consultation as part of the *Feeling Congested?* Official Plan Review. The framework focuses on three principles—*Serving People, Strengthening Places, and Supporting Prosperity.* These three principles are further articulated as eight criteria outlined below:

Serving People

- *Choice* - Develop an integrated network that connects different modes to provide for more travel options
- *Experience* - Capacity to ease crowding / congestion; reduce travel times; make travel more reliable, safe and enjoyable
- *Social Equity* - Allow everyone good access to work, school and other activities

Strengthening Places

- *Shaping the City* - Develop an integrated network that connects different modes to provide for more travel options
- *Healthy Neighbourhoods* - Changes in the transportation network should strengthen and enhance existing neighbourhoods; promote safe walking and cycling within and between neighbourhoods
- *Public Health & Environment* - Support and enhance natural areas; encourage people to reduce how far they drive; mitigate negative impacts

Supporting Prosperity

- *Affordability* - Improvements to the transportation system should be affordable to build, maintain and operate
- *Supports Growth* - Investment in public transportation should support economic development: allow workers to get to jobs more easily; allow goods to get to markets more efficiently

Choice

A great transit network is an integrated one that connects different routes and modes to provide for more travel options. This can be measured by the number of transfer opportunities, accessibility to rapid transit options, and number of major connections to other transportation modes (i.e. walking and cycling infrastructure).

The future implementation of GO Regional Express Rail (RER) will make GO Stations increasingly important connection points for riders destined for downtown Toronto and

elsewhere in the city. GO Stations in Scarborough include Scarborough, Eglinton, Guildwood and Rouge Hill on the Lakeshore East corridor, and Kennedy, Agincourt and Milliken on the Stouffville corridor. The Eglinton East LRT would connect to GO RER at three stations – Guildwood, Eglinton and Kennedy. Further connections to SmartTrack and Line 2 would be provided at Kennedy Station. The Eglinton East LRT is also envisioned as a direct extension of Line 5, offering access to destinations across midtown Toronto and connections to Line 1 and other RER stations outside of Scarborough.

The Sheppard East LRT is relevant to the evaluation of options for Eglinton East LRT, particularly from a Choice perspective, as it would provide additional opportunities to transfer to rapid transit for Option 2 but not Option 3. The Sheppard East LRT is funded but the timing of its implementation is uncertain. With unclear timelines for Sheppard Avenue East LRT, it is very difficult to evaluate the value of this connection opportunity. However, it is important to note that Option 3 does not preclude a future extension to Sheppard Avenue.

An assessment of Options 2 and 3 indicates that both options perform equally from a Choice perspective.

Table 5: Choice Measures

Measure	**Option 1 – Base**	**Option 2 – Terminating at Sheppard**	**Option 3 – Eglinton East LRT**
Change in Transit Travel Times	0	Impact will depend on passenger origin and destination and complementary bus network (yet to be developed)	
Change in number of transfer stations* / Change in number of connections available	0	Total: 3 Eglinton (GO) Guildwood (GO) Kennedy (TTC, GO)	Total: 3 Eglinton (GO) Guildwood (GO) Kennedy (TTC, GO)
Reliability	n/a	Dedicated ROW facilitates improved reliability of transit service	Dedicated ROW facilitates improved reliability of transit service
Average number of daily transfers per person across TTC system (2031)	1.8	1.8	1.8
% change from base	n/a	-	-

* Rapid transit stations only. Further work is needed to identify the bus network that complements and supports the LRT.
**Timing of Sheppard Avenue East LRT is uncertain. This connection is considered a long-term future connection and is not anticipated to be available in the short-to-medium term.

Experience

Evaluating how a transit project improves a traveller's experience is directly related to how many people choose to take transit, given that they will choose to take transit if it offers a better experience than a different mode of travel. Experience can further be understood in terms of change in travel time between origins and destinations, how many destinations a rider can access using the transit network and the ability to mitigate crowding on transit.

Initial modelling results were developed with the assumption that all bus services along the corridor would be removed once the LRT is operational. This scenario results in an overall degradation of transit service and reduction in system-wide transit riders as shown in Table 4. In addition, it is anticipated that at minimum, 37,600 people will use the service daily in 2031 and 41,600 people will use the LRT is 2041.

Further work is needed to identify an appropriate bus network to complement and support any LRT. Projected ridership is expected improve as further work on the bus network is undertaken. From the experience perspective, both LRT options perform similarly.

Table 6: Experience Measures

Measure	**Option 1 Base Case**	**Option 2 Terminating at Sheppard**	**Option 3 Eglinton East LRT**
Transit Ridership Change (change in daily riders attracted to transit system) in 2031	n/a	-2,000*	-2000*

* The transit ridership change assumes that all buses would be removed from the Eglinton-Kingston corridor once the LRT is operational. Further work is required to identify the local bus transit routes and service that would complement and support the LRT. It is expected that with further work defining the local bus network, there will be a gain in net new riders.

Social Equity

Social equity is an important City building objective when considering major transit investments. Some populations more heavily rely on public transit than others, with the incidence of the reliance on public transit greater in Neighbourhood Improvement Areas than other areas of the City. Social equity objectives include providing convenient, affordable and reliable transit options to those who need it, increasing access to jobs, and increasing the size and diversity of the labour-force available to existing or potential employers. Within 500m walking distance from the stations, the LRT would directly serve nearly 26,000 residents of NIAs, providing enhanced access to destinations across Scarborough and the rapid transit network.

Options 2 and 3 are preferred over the base case and both perform similarly by improving access to enhanced service to five Neighbourhood Improvement Areas. While several of the measures documented in Table 6 suggest that Option 2 is slightly preferred, the difference in most of the benefits is very small, and largely predicated on the implementation of the Sheppard East LRT

(since it is included in the base network assumptions). Uncertainty about timing of the Sheppard East LRT makes it difficult to draw conclusions about these measures.

Table 7: Social Equity Measures

Measure	Option 1 – Base	Option 2 – Terminating at Sheppard	Option 3 – Eglinton East LRT
Change in number of residents of NIAs who live within walking distance of a stop	n/a	25,900 people	25,900 people
Average number of jobs within 60 min travel time for the average individual residing in Neighbourhood Improvement Areas	141,400	144,700	144,500
Change in the number of jobs accessible within 60 min for individuals living within NIAs	n/a	+ 4,400 (+3.1%)	+ 4,200 (+3.0%)
Average number of people accessible within 60 min travel time for individuals residing in Neighbourhood Improvement Areas	521,300	543,700	542,200
Change in the number of people accessible within 60 min for individuals living within NIAs	n/a	+ 19,200 (+3.7%)	+17,700 (+3.4%

Supporting Growth

Transit investments can play a very significant role in the employment development in the city. Rapid transit may be constructed to serve areas of high employment density, or rapid transit can be built in areas planned for higher employment density in order to increase transportation accessibility and thus incent businesses to locate high density employment like offices in appropriate areas.

Existing employment density can be used as a proxy for what future employment density will be, and models can be used to project future employment density. It is noted that these projections are based on observed trends. They may not be able to predict some employment growth as they do not capture the positive incentives that rapid transit infrastructure would provide to businesses in the future.

The evaluation of a project's impact on supporting growth relates to how the project would serve employment growth areas. Studies have consistently demonstrated the value that LRT brings to city-building and growth. There is evidence that implementation of LRT can provide an uplift in property values[8], investment and associated economic activity, particularly if it is coordinated with other planning initiatives.

[8] 'The North American Light Rail Experience: Insights for Hamilton' (2012), Higgins, C., Ferguson, M. McMaster Institute for Transportation and Logistics, McMaster University, Hamilton, ON. April 2012.

Both Options 2 and 3 support growth and development within the mixed-use Avenues along Eglinton East and Kingston. Large parcels front onto Eglinton Ave East and Kingston Road, providing space for street-facing redevelopment that will be critical to cultivating Eglinton Ave and Kingston Road into complete communities. In contrast, many other corridors in the City have land parcels that back on to the street, effectively removing potential for redevelopment in support of a complete street[9].

Options 2 and 3 would increase the number of jobs the average person in the Greater Toronto and Hamilton Area can access by transit by between 600 and 700.

Options 2 and 3 are equally preferred from the perspective of Supporting Growth.

Table 8: Supporting Growth Measures

Measure	**Option 1 – Base**	**Option 2 – Terminating at Sheppard**	**Option 3 – Eglinton East LRT**
Service to Employment Growth Areas	n/a	12 Stops planned within mixed-use growth areas along Eglinton Avenue East and Kingston Road Avenues	12 Stops planned within mixed-use growth areas along Eglinton Avenue East and Kingston Road Avenues
Area of land within walking distance of stations designated for Employment growth	n/a	1.0 km^2 (mixed use) 0.6 km^2 (Employment Lands)	1.0 km^2 (mixed use) 0.6 km^2 (Employment Lands)
Proportion of land within walking distance (500m) of stations designated for employment growth	n/a	8.3%	8.3%
Existing Jobs within walking distance (500m) of the stations	n/a	7800 jobs	7800 jobs
Projected Job Growth within walking distance (500m) of stations	n/a	1600 jobs	1600 jobs
Projected Future Jobs within walking distance (500m) of stations	n/a	9300 jobs	9300 jobs
Existing Employment Density within walking distance (500m) of the stations	n/a	1000 jobs/km^2	1000 jobs/km^2

This paper provides a review of the academic literature examining the impacts of LRT on property values. Up to 23% uplift in value for commercial properties, and up to 10% uplift in property values for homes, depending on place.

[9] Sorensen, Hess, 2015, "Choices for Scarborough: Transit, Walking, and Intensification in Toronto's Inner Suburbs" University of Toronto Transportation Research Institute. CitiesLab

Measure	Option 1 – Base	Option 2 – Terminating at Sheppard	Option 3 – Eglinton East LRT
Projected Increase in Employment Density within walking distance (500m) of the stations	0 jobs/km^2	200 jobs/km^2	200 jobs/km^2
Projected Future Employment Density (500m) within walking distance of the stations		1300 jobs/km^2	1300 jobs/km^2
Access to Jobs (number of jobs accessible to the average person within 60 min transit travel)	89,300	90,200 jobs	90,100 jobs
Change in Jobs Accessibility	0	+700 (+0.7%)	+600 (+0.7%)

Shaping the City

Similar to the Supporting Growth perspective, transit investments can play a very significant role in the residential development of the city. Existing population density can be used as a proxy for what future population density will be, and models can be used to project future population density. It is noted that these projections are based on observed trends and do not capture any incentive that rapid transit infrastructure would provide to developers in the future.

As with the Supporting Growth perspective, studies have consistently demonstrated that LRT can provide an uplift in property values[10] and increase residential development.

Both Options 2 and 3 support growth and development within the mixed-use Avenues along Eglinton East and Kingston. Large parcels front onto Eglinton Ave East and Kingston Road, providing space for street-facing redevelopment that will be critical to cultivating Eglinton Ave and Kingston Road into complete communities. In contrast, many other corridors in the City have land parcels that back on to the street, effectively removing potential for redevelopment in support of a complete street[11].

Options 2 and 3 would place rapid transit stops within walking distance of more than 40 000 people. In addition, these options would place 12 rapid transit stops in residential growth areas, which could encourage transit-oriented development.

[10] 'The North American Light Rail Experience: Insights for Hamilton' (2012), Higgins, C., Ferguson, M. McMaster Institute for Transportation and Logistics, McMaster University, Hamilton, ON. April 2012.
This paper provides a review of the academic literature examining the impacts of LRT on property values. Up to 23% uplift in value for commercial properties, and up to 10% uplift in property values for homes, depending on place.

[11] Sorensen, Hess, 2015, “Choices for Scarborough: Transit, Walking, and Intensification in Toronto’s Inner Suburbs” University of Toronto Transportation Research Institute. CitiesLab

From a Shaping the City perspective, Options 2 and 3 are strongly preferred.

Table 9: Shaping the City Measures

Measure	**Option 1 – Base**	**Option 2 – Terminating at Sheppard**	**Option 3 – Eglinton East LRT**
Service to Residential Growth Areas	N/A	12 Stops planned within mixed-use growth areas along Eglinton Avenue East and Kingston Road Avenues	12 Stops planned within mixed-use growth areas along Eglinton Avenue East and Kingston Road Avenues
Area of land within walking distance (500m) of stations designated for population growth	0 km^2	1.0 km^2 (mixed use)	1.0 km^2 (mixed use)
Proportion of land within walking distance (500m) of stations designated for population growth	0%	13.2%	13.2%
Existing Population within walking distance (500m) of the stations	0 people	41,400 people	41,400 people
Projected Population Growth within walking distance (500m) of stations	0 people	5,600 people	5,600 people
Projected Future Population within walking distance (500m) of the stations	0 people	47,000 people	47,000 people
Existing Population Density within walking distance (500m) of the stations	0 people/km^2	5,600 people/km^2	5,600 people/km^2
Projected Increase in Population Density within walking distance (500m) of the stations	0 people/km^2	800 people/km^2	800 people/km^2
Projected Future Population Density within walking distance (500m) of the stations	0 people/km^2	6300 people/km^2	6300 people/km^2

Public Health & Environment

Transit has a very positive impact on public health and the environment due largely to enabling travel by modes other than private automobiles, which contribute significantly to air quality issues and encourage sedentary lifestyles. However, large infrastructure projects like rapid transit may also have detrimental impacts to natural features, which must be avoided or mitigated.

The Eglinton East LRT would enable a savings of 2,600 vehicle-kilometres travelled (Option 2) to 11,000 vehicle-kilometres travelled (Option 3). Option 3 performs slightly better, however differences for both options compared to the base are small (see Table 9).

The Highland Creek system is a significant natural feature in Scarborough. The LRT would cross the creek and its significant ravine along Morningside Avenue between Kingston Road and Ellesmere Road. To accommodate this crossing, the LRT guideway would be on its own structure on the east side of Morningside Avenue. The impacts of Options 2 and 3 on the Highland Creek system are identical.

Option 3 performs slightly better than the other options with respect to Public Health & Environment.

Table 10: Public Health & Environment Measures

Measure	**Option 1 – Base**	**Option 2 – Terminating at Sheppard**	**Option 3 – Eglinton East LRT**
Significant Environmental Challenges	None	Significant crossing of the Highland Creek and ravine	
Change in Auto Mode Share*	n/a	+0.02% (relative to base)	+0.02% (relative to base)
Change in vehicle-kilometres-travelled (VKT)**	n/a	2,600	11,000

* The change in auto mode share and change in vehicle-kilometres-travelled (VKT) assumes that all buses would be removed from the Eglinton-Kingston corridor once the LRT is operational. Further work is required to identify the local bus transit routes and service that would complement and support the LRT.
** The VKT is anticipated to decline as further work on the local bus network is developed. Option 2 incurs a smaller increase in VKT owing to the assumed connection it provides to the Sheppard Ave East LRT. The timing of the Sheppard East LRT is unclear, and the connection may only be available in the longer-term future. Without a connection to the Sheppard East LRT, the change in VKT will be more similar between Options 2 and 3.

Healthy Neighbourhoods

Just as transit investments can be a powerful force in shaping the city, they can also have long-term detrimental impacts on existing, stable neighbourhoods.

The majority of the potential LRT corridor is recognized as Avenues – designated for mixed use growth. Some of the land use within station areas (but set back from the roadway) is designated as stable neighbourhoods. This land amounts to 45% of the area within walking distance of station areas, and may see some development pressure in the long term. Along Morningside Avenue, much of the corridor is designated as open space. The LRT would pass over the ravine on an elevated structure and no stations would be built in the open space area.

The base case is preferred from the perspective of Healthy Neighbourhoods as it would have no impact on existing stable neighbourhoods.

Table 11: Neighbourhood Impact Measures

Measure	Option 1 – Base	Option 2 – Terminating at Sheppard	Option 3 – Eglinton East LRT
Area of land within walking distance of stations designated as Neighbourhoods	n/a	3.4 km^2	3.4 km^2
Proportion of land within walking distance of stations designated as Neighbourhoods	n/a	45%	45%

Strategic Case Summary

The Eglinton East LRT will provide enhanced transit service and transportation accessibility to the Eglinton East – Kingston Road corridor, and to UTSC. It is anticipated that at minimum, 37,600 people will use the service daily in 2031 and 41,600 people will use the LRT in 2041. This ridership projection is expected to increase as further work on the local bus network is undertaken. This enhanced accessibility will stimulate residential and employment growth throughout the corridor and act as a catalyst to renew these neighbourhoods. As demonstrated throughout this assessment, the LRT extension to Sheppard Avenue East provides minimal additional benefit compared to an LRT terminating at UTSC. Options 2 and 3, are equally preferred from a strategic case perspective.

Table 12: Strategic Case Summary

		Base Case	Option 2 Terminating at Sheppard	Option 3 Eglinton East LRT
Project objectives				
1. Support the development of complete communities along the Avenues and improve local accessibility along the Avenues		○	●	●
2. Support the Toronto Strong Neighbourhoods Strategy and improve transit access to Neighbourhood Improvement Areas (NIAs)		○	●	●
3. Integrate transit with UTSC as the campus grows and develops into a vibrant place of learning and community in accordance with the UTSC Master Plan (2011) and Secondary Plan (currently under development)		○	●	●
Feeling Congested? objectives				
Choice	Develop an integrated network that connects different modes to provide for more travel options	○	●	●
Experience	Capacity to ease crowding/congestion; reduce travel times; make travel more reliable, safe and enjoyable	○	●	●
Social Equity	Do not favour any group or community over others; allow everyone good access to work, school and other activities	○	●	●
Shaping the City	Use the transportation network as a tool to shape the residential development of the City	○	●	●
Healthy Neighbourhoods	Changes in the transportation network should strengthen and enhance existing neighbourhoods; promote safe walking and cycling within and between neighbourhoods	○	●	●
Public Health and Environment	Support and enhance natural areas; encourage people to reduce how far they drive; mitigate negative impacts	◑	◕	◕
Neighbourhood Impact	Changes in the transportation network should strengthen and enhance existing neighbourhoods; promote safe walking and cycling within and between neighbourhoods	●	◑	◑
Supports Growth	Investment in public transportation should support economic development; allow workers to get to jobs more easily; allow goods to get to markets more efficiently	○	●	●
Summary			●	●

4. Financial Case Evaluation

The Financial Case evaluation assessed the costs associated with each option. The services of a third party consultant were retained to assist in developing the cost estimates included in Table 12. The estimates are based on 0% design, resulting in Class 5 cost estimates according to industry standards (See Appendix 2: Cost and Schedule Estimate Classification).

Capital Cost Estimates

The preliminary cost estimates indicate that Option 3 is cheaper than Option 2, due to key differences such as the shortened length of the alignment. Option 3 also does not include a maintenance and storage facility (MSF). More detailed analysis is also required to determine the maintenance and storage requirements for Option 3. Currently, the cost estimate includes in-line storage tracks, but assumes maintenance functions would be accommodated at Mt. Dennis MSF. The estimates for maintenance and storage included in the cost ranges presented below should be considered a minimum cost. Costs will be impacted as more detailed design and simulation modelling is completed.

For Option 2, the low estimate includes some modification to the Mt. Dennis MSF to accommodate extra vehicles, as well as in-line storage tracks along the route for overnight storage of vehicles to expedite line loading at the beginning of service. The high estimate includes a stand-alone MSF to serve the Eglinton East LRT line, but not connecting tracks along Sheppard to Conlins MSF (the MSF for this line was originally to be shared with the Sheppard East LRT, and located in the vicinity of Sheppard Avenue East and Conlins Road).

The connection at Kennedy station also requires additional analysis that will have implications for the cost estimates included below. The estimates do not include any mitigation of potential conflicts with the extension of Line 2 east of Kennedy Station. More detailed design of the eastern portal for Kennedy Station must be undertaken in order to refine costs.

Table 13: Total Capital Cost Estimates (Class 5) (2016$, millions)

	Option 1 Base Case	Option 2 Terminating at Sheppard	Option 3 Terminating at UTSC
Constant 2016$	-	$1,617 - $1,832	$1,331 - $1,412
YOE/Escalated $	-	**$1,917 - $2,172**	**$1,578 - $1,674**

Notes:

- Cost estimates developed by a third party consultant.
- Assumes line in service by late 2023, with construction taking approximately 4 years (2020-2023)
- Cost estimates have been developed at 0% design and are a Class 5 cost estimate (per AACE guidelines). Class 3 estimates are required to establish the project budget baseline.
- Cost estimates do not include financing, lifecycle, and operations/maintenance (see attachment 5).
- The estimate for Option 3 terminating at UTSC includes storage tracks, but does not include a maintenance facility; the low estimate for the option terminating at Sheppard includes some modification to the Crosstown MSF and storage tracks; the high estimate for the option terminating at Sheppard includes a stand-alone MSF, but not connecting tracks along Sheppard to Conlins.
- Project timeline, funding source and procurement method still to be determined.

5. Deliverability and Operations Case Evaluation

The Deliverability and Operations Case considers key challenges to implementing a project. Implementation challenges have been highlighted for each option from a technical/engineering perspective, operational perspective, and governance perspective. As the project progresses and the preferred option is selected and further refined through more design and project risk assessment, the Deliverability and Operations Case will be further developed. This section also identifies areas where further analysis is required.

Engineering/Technical Considerations

Each option was assessed based on several engineering and technical considerations including the connection at Kennedy Station, the Military Trail re-alignment, traffic impacts, and the maintenance and storage facility requirements.

Kennedy Station

The Scarborough-Malvern LRT EA did not include a direct connection at Kennedy to the Eglinton Crosstown LRT. The EA left the question of the connection to a future EA amendment. Detailed design for a new Kennedy Station is currently underway to accommodate the Eglinton Crosstown LRT. The station has been designed to allow for a future through-service connection.

Challenges for Options 2 and 3 are identical in terms of the potential connection into Kennedy Station. Both Options 2 and 3 envision a through-service to remove the need to transfer at Kennedy Station. Roles and responsibilities for amending the EA to include a through-service will need to be defined.

Military Trail Re-alignment- UTSC Master Planning Study

The re-alignment of Military Trail as set out in the UTSC Master Plan (2011) was envisioned two years following completion of the 2009 SMLRT EA. Both Options 2 and 3 would involve the realignment of Military Trail to ensure the LRT can support the development of the UTSC campus. Option 2 would take the LRT line further north, whereas Option 3 would terminate at the UTSC campus. This may affect design.

Interface with Guildwood GO Station

The approved SMLRT placed a stop at the intersection of Kingston Road and Celeste Drive. This stop would be more than 200m from Guildwood GO station. As a redevelopment of the Guildwood GO station is being planned as part of GO RER, further discussion is required to explore opportunities for enhancing the connection between the Eglinton East LRT and the Guildwood GO station. The connection will be addressed through development of 5% design.

Maintenance and Storage Facility Requirements

The approved SMLRT included a Maintenance and Storage Facility (MSF) at Conlins (to the north-east of Morningside/Sheppard). Option 2 assumes that either a stand-alone MSF would be required or the Mt. Dennis MSF would need to be expanded. It is envisioned that a through-service at Kennedy Station will allow the maintenance facility at Mt Dennis to be used.

Option 3 assumes that an MSF is not required, but accounts for storage tracks along the alignment to facilitate loading the line at the start of service and storage of dead vehicles when necessary. Requirements for all options will need to be confirmed through 5% detailed design of the project. Since the timing of the Sheppard East LRT is uncertain, the availability and cost of the Conlins MSF is unknown. Clarity regarding the Sheppard East LRT will be needed before finalizing MSF requirements for the Eglinton East LRT.

Operation and Service Planning Considerations

The EA contemplated 2-car trains along the route, and designed for 2-car train length platforms at each stop. Options 2 and 3 contemplate 3-car platforms to allow through-service at Kennedy Station. The appropriateness of this assumption is subject to confirmation through discussions with Metrolinx, as the change to 3-car trains has a significant impact on the required level of service on the Eglinton Crosstown LRT.

Additional impacts of expanding platforms along the alignment will need to be addressed by an EA Amendment. Fitting three car platforms and required crossover tracks at the terminus station at the Toronto Pan Am Sports Centre in Option 3 may be a challenge.

The length of a potential LRT from Mount Dennis to UTSC would be approximately 36km if the Eglinton East LRT is implemented as a through-service at Kennedy Station. The LRT may potentially be even longer since the Eglinton West LRT is envisioned as a through-service west of Mount Dennis to Pearson International Airport. The Eglinton East LRT will be in a semi-exclusive right-of-way and is therefore subject to delays caused by traffic and potential collisions with other vehicles at intersections. As such, the potential for delay increases as the length of the LRT route is lengthened. Mitigation measures will need to be considered if a through-service emerges as the preferred service concept. Both Options 2 and 3 will need to address this issue.

Traffic conditions

As established in the SMLRT EA, it is anticipated that there will be traffic impacts at particular intersections along the route. Both Options 2 and 3 will have similar impacts, with Option 3 being preferred as it removes any impact to traffic at the intersection of Morningside and Sheppard Avenue East. Through the EA Amendment process, both Options 2 and 3 will require revisiting the traffic impacts at particular intersections with the possibility of developing new recommendations. The intersection of Kingston Road and Morningside Avenue will be of particular importance due to the significant traffic impacts identified in the SMLRT EA.

Impacts on Surface Network Service

Both options would require further work to identify the appropriate surface transit network to complement and support an LRT on Eglinton Avenue East and Kingston Road.

Project Governance and Capital Project Delivery Considerations

Establishing the roles and responsibilities between Metrolinx, the City and TTC are required for both options 2 and 3 as both options envision through-service at Kennedy Station. The relationship between the Eglinton Crosstown and the Eglinton East LRT extension is subject to further discussion and will have implications for project proponency and the project procurement method. Detailed design is required to confirm the project scope and other issues identified above.

6. Conclusions & Next Steps

Table 14: Options Analysis Summary

	Criteria	Option 2 (LRT Terminating at Sheppard)	Option 3 (Eglinton East LRT)
Strategic	Choice		
	Experience		
	Social Equity		
	Shaping the City		
	Healthy Neighbourhoods		
	Public Health and Environment		
	Neighbourhood Impact		
	Supports Growth		
	Strategic Case Summary		
Financial	Total Capital Cost (YOE/Escalated $, millions)	**$1,917 - $2,172**	**$1,578 - $1,674**
Deliverability		Several issues requiring further analysis including the Connection at Kennedy, updating the platforms to integrate service with Eglinton Crosstown, a review of traffic impacts, and re-alignment of Military Trail.	Several issues requiring further analysis including the Connection at Kennedy, updating the platforms to integrate service with Eglinton Crosstown, a review of traffic impacts, and re-alignment of Military Trail, and maintenance and storage facility requirements.

Next Steps

Findings from this preliminary options analysis recommend that the proposed Eglinton East LRT (Option 3) be carried forward for further technical and planning analysis to refine project scope and cost. Refining the project scope will include modifications to the approved EA including:

- Connection at Kennedy Station and through-service;
- Integration of the LRT with the UTSC Master Plan; including proposed re-alignment of Military Trail;
- New terminus station serving UTSC and the Pan Am Sports Centre;
- Identifying and addressing maintenance and storage requirements; and
- Re-evaluation of traffic impacts and required mitigation.

Given the uncertain timing of the Sheppard East LRT, further analysis will consider the potential extension of the Eglinton East LRT to Sheppard Avenue East. Key deliverability and operations challenges highlighted in this options analysis will require close collaboration with Metrolinx and the TTC.

Appendix 1: Background Documents

March 21, 2007 TTC Report - Transit City Program
https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2007/Mar_21_2007/Other/Toronto_Transit_City.pdf

Environmental Project Report – Scarborough-Malvern LRT Transit Project Assessment Study
http://www.scarboroughsubwayextension.ca/assets/scarboroughmalvernlrt-epr-final2009-appendices.pdf

September 30, 2009 PG31.3 Request for Approval of the Scarborough-Malvern LRT Environmental Assessment Study
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2009.PG31.3

June 8, 2010 EX44.23 Scarborough Rapid Transit - Transit Project Assessment Study Recommendations http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2010.EX44.23

July 16, 2013 CC37.17 Scarborough Rapid Transit Options
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2013.CC37.17

January 28, 2016 EX11.5 Scarborough Transit Planning Update
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2016.EX11.5

March 31, 2016 EX13.3 Developing Toronto's Transit Network Plan: Phase 1
http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2016.EX13.3

Appendix 2: Cost and Schedule Estimate Classification

Classification of Cost Estimates

Cost estimate classification systems are used throughout the estimating industry to categorize cost estimates based on the maturity level of project definition. As project development proceeds; estimate accuracy ranges narrow. This is due to the fact that as project design becomes further developed, more is known about the project and there is a corresponding reduction in risk and uncertainty in the cost estimate.

The Association for Advancement of Cost Engineering (AACE) provides the most generally accepted industry guidelines for cost estimate classification systems. Table 14 depicts AACE's Cost Estimate Classification system which provides general principles for using cost estimates to evaluate, approve and/or fund projects.[12] Table 14 illustrates typical ranges of accuracy. The +/- represents typical variation of actual costs from the cost estimate after application of contingency for given scope. A Class 5 cost estimate is based on the lowest degree of project definition, and a Class 1 cost estimate is based on a the highest maturity of project definition (full project definition). In addition to the degree of project definition, estimate accuracy is also driven by other systemic risks such as familiarity with the technology in the project; complexity; quality of reference cost estimating data; unique nature of the project, etc.

Table 15. AACE International Recommended Practice- Cost Estimate Classification Matrix (AACE 18R-97), 2016)

Estimate Class	Maturity of Project Definition *Expressed as % of complete definition*	End Usage *Typical purpose of estimate*	Methodology *Typical estimating method*	AACE Classification Expected Accuracy Range *Typical variation in low and high ranges*	MOTI BC Classification Expected Accuracy Range *Typical variation in low and high ranges [a]*
Class 5	0% to 2%	Concept Screening.	Parametric models; judgement or analogy	L: -20% to - 50% H: +30% to +100%	+/- 35%
Class 4	1% to 15%	Study or feasibility.	Parametric; Elemental factored	L: -15% to -30% H: +20% to +50%	
Class 3	10% to 40%	Budget authorization or control.	Semi-detailed unit costs	L: -10% to -20% H: +10% to +30%	+/- 20%
Class 2	30% to 75%	Control or bid/tender.	Detailed costing	L: -5% to -15% H: +5% to +20%	
Class 1	65% to 100%	Check estimate or bid/tender.	Detailed costing	L: -3% to -10% H: +3% to +15%	+/- 10%

Notes [a] Confidence interval 90% (i.e. expected accuracy 90 times out of 100)

[12] The Association for the Advancement of Cost Engineering (AACE), (2016) http://www.aacei.org/toc/toc_18R-97.pdf

The estimate level is important in terms of when it is appropriate to establish the project budget. The Ministry of Transportation and Infrastructure (MOTI), Government of British Columbia (MOTI BC Guidelines) has an established guideline that indicates at minimum 10 to 40% design should be complete (Class 3, AACE Estimate) in order for the estimate to become the basis for developing the project budget. This also is consistent with AACE Cost Classification Standards (AACE RP No.17R-97).

Further refinement of the cost estimates for the recommended scope of each project is required once further design has been completed, including undertaking project risk assessment processes.

Schedule Estimate Classification

The estimated project schedule also has an impact on estimated project cost. Assumptions based on historical project information were made with respect to the schedule for constructing each project in order to calculate the present value cost for each project.

AACE has published guidelines on recommended practice for the development of project schedules for the purpose of improving the understanding among stakeholders involved with preparing, evaluating and using project schedules for decision-making purposes. Table 15 outlines the AACE Schedule Classification Matrix, which uses the degree of project definition as the primary characteristic to define "Schedule Class". A Class 5 schedule is based on the lowest degree of project definition, and a Class 1 schedule is based on the highest maturity of project definition (full definition).

Table 16. AACE International Recommended Practice- Schedule Classification Matrix[13]

Schedule Class	Maturity of Project Definition *Expressed as % of complete definition [1]*	End Usage *Typical purpose of estimate*	Methodology *Scheduling Methods Used*
Class 5	0% to 2%	Concept Screening.	Top down planning using high level milestones and key project events.
Class 4	1% to 15%	Study or feasibility.	Top down planning using high level milestones and key project events.
Class 3	10% to 40%	Budget authorization or control.	"Package" top down planning using key events. Semi-detailed.
Class 2	30% to 70%	Control or bid/tender.	Bottom up planning. Detailed
Class 1	70% to 100%	Check estimate or bid/tender.	Bottom up planning. Detailed.

Note [1] AACE RP NO. 18R-97 provides the range in percentages for each class.

[13] AACE International Recommended Practice No. 27R-03, (2010), "Schedule Classification System". http://www.aacei.org/toc/toc_27R-03.pdf