REPORT FOR ACTION

Eglinton East LRT Project Update and Next Steps

Date: May 7, 2018
To: Executive Committee
From: Interim Deputy City Manager, Cluster B and Chief Planner and Executive Director, City Planning Division
Wards: All

SUMMARY

This report has been prepared in consultation with the Toronto Transit Commission (TTC) and Metrolinx. It seeks direction on findings of technical work on the Eglinton East Light Rail Transit (EELRT) project concept:

- Inclusion of grade separation at the intersection of Kingston Road, Lawrence Avenue East and Morningside Avenue;
- Integration with University of Toronto Scarborough (UTSC); and
- Extension of EELRT to Malvern.

This direction will enable City staff to proceed to the project's Transit Project Assessment Process (TPAP) Addendum, and focus the project's cost estimates and business case analysis (BCA) on phasing of the project. Staff anticipate reporting results of the project's BCA to City Council in Q1 2019.

Inclusion of a grade separation (LRT in a tunnel) is recommended at the intersection of Kingston Road, Lawrence Avenue East and Morningside Avenue. Analysis of this potential grade separation at a constrained intersection shows that strategic factors based on the City's Rapid Transit Evaluation Framework (RTEF) and economic benefits of improved travel time outweigh the capital costs to the project. These economic benefits are largely due to removing the impact that EELRT trains turning through this busy intersection would have on the transportation network in an at-grade alignment scenario.

After careful consideration of three alternative alignments through the University of Toronto Scarborough (UTSC), including two different grade separations, an at-grade alignment similar to the 2009 EA-approved alignment is recommended. The stops included in this alignment best serve UTSC and best align with the planned growth of the campus. A pedestrian underpass below Ellesmere Road and the LRT track is included in the project concept to connect the south campus and north campus, and to remove pedestrians from the busy Ellesmere-Military Trail intersection.

This report further recommends the inclusion of an extension of the LRT from UTSC to Malvern, via Sheppard Avenue East and Neilson Road, in the project's scope. Inclusion of this extension in the planning, preliminary engineering and analysis of the full project concept will enable City Council to consider the entire project, and how it could be funded and phased, in the upcoming BCA.

This report also recommends that City Council request Ontario's Ministry of Transportation (MTO) to accommodate the LRT crossing the 401 via Morningside Avenue in all upcoming rehabilitation work on that structure. City staff have consulted with MTO and determined that a scope change to planned rehabilitation work may be required to accommodate 90-metre long EELRT trains crossing the overpass.

This report also provides City Council with updates on related work, including

- the alignment through the Eglinton Avenue East and Kingston Road intersection; and
- the Durham-Scarborough Bus Rapid Transit line (DS-BRT) currently being planned by Metrolinx.

RECOMMENDATIONS

The Interim Deputy City Manager, Cluster B and Chief Planner & Executive Director, City Planning Division recommend that;

1. City Council direct the Chief Planner and Executive Director, City Planning Division to include a tunnelled alignment through the Kingston-Lawrence-Morningside intersection with a single stop in the project scope and for further consideration through the project's updated cost estimate and Business Case Analysis.

2. City Council direct the Chief Planner and Executive Director, City Planning Division in consultation with the Toronto Transit Commission (TTC) and Metrolinx, to include an at-grade alignment through the University of Toronto, Scarborough along Ellesmere Road and a realigned Military Trail consistent with the proposed University of Toronto, Scarborough Secondary Plan and as described in this report, in the Eglinton East Light Rail Transit (EELRT) project's Environmental Project Report Addendum.

3. City Council request the Ministry of Transportation to include provision for the Eglinton East Light Rail Transit (EELRT) trains in future rehabilitation work on the Morningside-401 overpass.

4. City Council direct the Chief Planner and Executive Director, City Planning Division, in consultation with the Toronto Transit Commission (TTC) and Metrolinx, to include an extension to Malvern via Sheppard Avenue East and Neilson Road with up to six stops including a terminus stop in the vicinity of the Malvern Town Centre, in the project scope and land use study, and for further consideration through the project's updated cost estimate and Business Case Analysis.

FINANCIAL IMPACT

There is no financial impact of this report at this time. City Council previously approved funding required to advance the Eglinton East Light Rail Transit through initial planning and design to 5%. Through the federal Public Transit Infrastructure Fund – Phase 1, partial funding has been allocated to this project to advance design to 5%.

The Acting Chief Financial Officer has reviewed and agrees that there is no financial impact at this time.

DECISION HISTORY

On January 28, 2016, Executive Committee considered a report from the Chief Planner and Executive Director, City Planning, EX11.5 Scarborough Transit Planning Update, which outlined a recommended plan for a Scarborough Transit Network that includes an express subway to Scarborough Centre, an extension of the Eglinton Crosstown LRT east to UTSC, and SmartTrack, including a station at Lawrence Avenue East. Executive Committee directed the Chief Planner and Executive Director, City Planning, to continue technical work on remaining issues for the recommended Scarborough transit network and to report back with findings.

On March 31, 2016, City Council considered EX13.3 Developing Toronto's Transit Network Plan: Phase One. City Council directed the Chief Planner and Executive Director, City Planning in consultation with the TTC, to complete the review of corridor options and related work for the SSE, including integration of an Eglinton East LRT into the UTSC as part of the Scarborough Transit Network plan. City Council also requested that the Chief Planner & Executive Director, City Planning to identify areas on the Eglinton East LRT corridor in need of an Avenue Study to facilitate intensification, and to create an expedited project delivery schedule.

In July, 2016, City Council adopted EX16.1 Developing Toronto's Transit Network Plan to 2031, requesting the City Manager and CEO of the TTC, in partnership with Metrolinx and in consultation with UTSC, to advance the Eglinton East LRT between Kennedy Station and the UTSC to five percent design, including the connection to Kennedy Station and its interface with the preferred SSE alignment, the potential realignment of Military Trail through UTSC and the requirements of the next phase of the EELRT extension to Malvern. City Council also requested the City Manager and CEO of the Toronto Transit Commission, in consultation with Metrolinx, to complete a business case analysis for the Scarborough Rapid Transit Network.

In November, 2016, City Council adopted EX19.1 Transit Network Plan Update and Financial Strategy, confirming that the TTC will be responsible for operating the proposed EELRT and that the City will be responsible for the operating and regular (i.e., all non-lifecycle) maintenance costs of the EELRT.

In December, 2016, City Council adopted EX20.4 Federal Infrastructure Funding - Phase 1 and 2, which identified the Eglinton East LRT as a Key Priority for Phase 2 Federal Infrastructure Funding (2017-28).

On March 28, 2017, City Council adopted EX23.1 Next Steps on the Scarborough Subway Extension, directing City staff to consider the Eglinton East LRT and SSE as one network.

ISSUE BACKGROUND

EX11.5 Scarborough Transit Planning Update identified two key priorities for the rapid transit network in Scarborough:

> **Priority 1:** Support the development of Scarborough Centre as a vibrant urban node.
>
> **Priority 2:** Support the development of complete communities along the Avenues and improve local accessibility.

The Scarborough Transit Network solution (Figure 1) was endorsed by City Council to address these two priorities. A key component of that plan is the Eglinton East LRT, extending Line 5 from Kennedy Station to UTSC.

Figure 1: Scarborough Transit Network

Eglinton East LRT

The Eglinton East LRT concept is based on the Scarborough-Malvern LRT (SMLRT), approved under Ontario's *Environmental Assessment Act* in 2009 (Figure 2). The SMLRT contemplated an LRT service between Kennedy Station and Sheppard Avenue East via Eglinton Avenue East, Kingston Road and Morningside Avenue, directly serving UTSC by diverting east from Morningside Avenue along Ellesmere Road and Military Trail before rejoining Morningside.

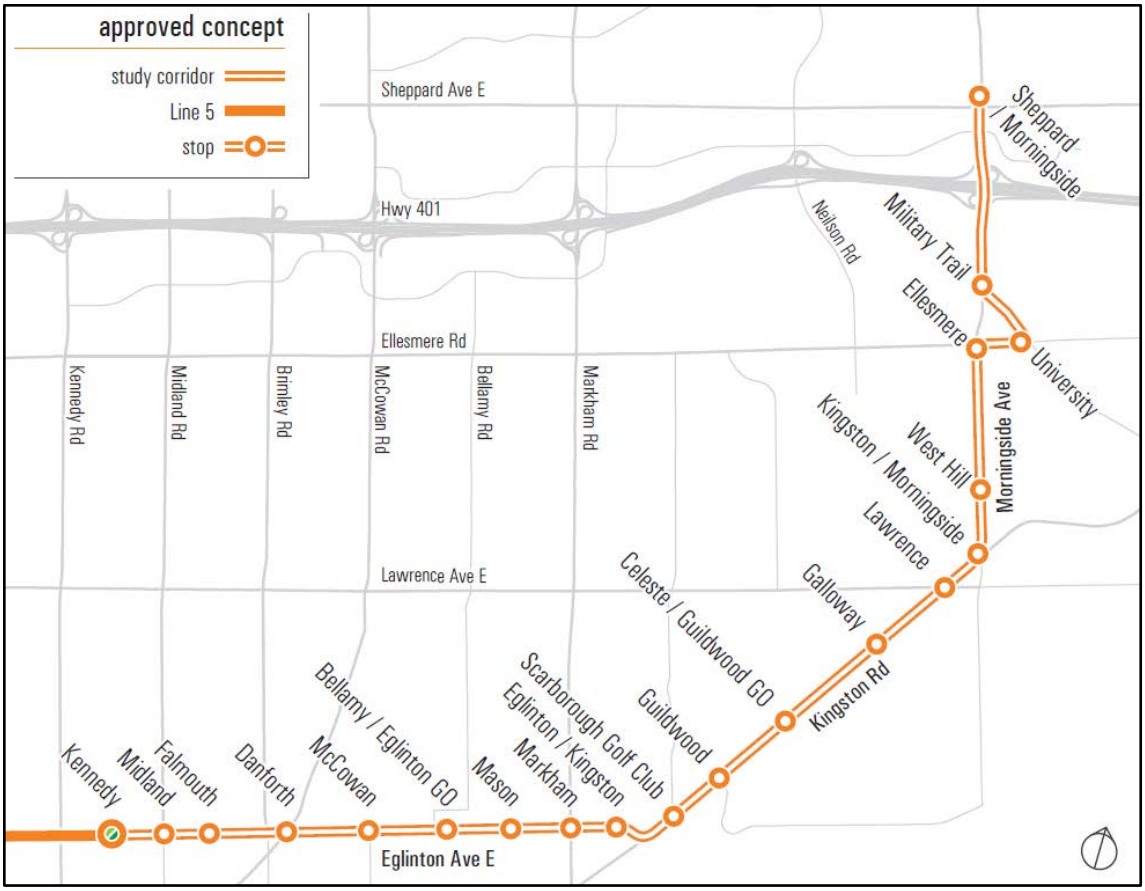

Figure 2: SMLRT alignment approved under the Environmental Assessment Act *in 2009*

The SMLRT project concept is an at-grade LRT in a semi-exclusive right-of-way in the centre of Eglinton Avenue, Kingston Road and Morningside Avenue south of Beath Street and north of Military Trail. The concept along Morningside Avenue between Beath Street and Ellesmere Road is for a side-running LRT. This alignment is on a new structure spanning the Morningside Creek and elevated on earthworks between Morningside Creek and Ellesmere Road.

Although the SMLRT would connect to Kennedy Station, it was not designed for service to operate through Kennedy Station, continuing Line 5 (Eglinton Crosstown). The conceptual design of the connection to Kennedy Station was not determined as part of the SMLRT project concept. The SMLRT was designed for 60m trains instead of the 90m trains Line 5 is designed for. The SMLRT fleet of vehicles would be serviced and

stored at a Maintenance and Storage Facility (MSF) at Sheppard Avenue East and Conlins Road. This MSF would be shared with the Sheppard East LRT (SELRT).

In July, 2016, City Council requested that staff advance the updated project concept of the Eglinton East LRT, including full integration with Line 5, to five percent design, and include updated cost estimates in the Scarborough Transit Network business case analysis (BCA). This report updates City Council on the Eglinton East LRT and seeks direction on several key issues that will appropriately scope the project concept(s) that are considered in that BCA. The emerging preferred alignment of the Eglinton East LRT is shown in Figure 3.

The SMLRT concept is the "base case." Wherever practical, the base case design is maintained. When accommodation of 90m trains or updated design specifications are required to be consistent with Line 5 currently under construction, reasonable options have been developed. A robust set of evaluation criteria, consistent with the City's Rapid Transit Evaluation Framework (RTEF), has been applied to identify the preferred option.

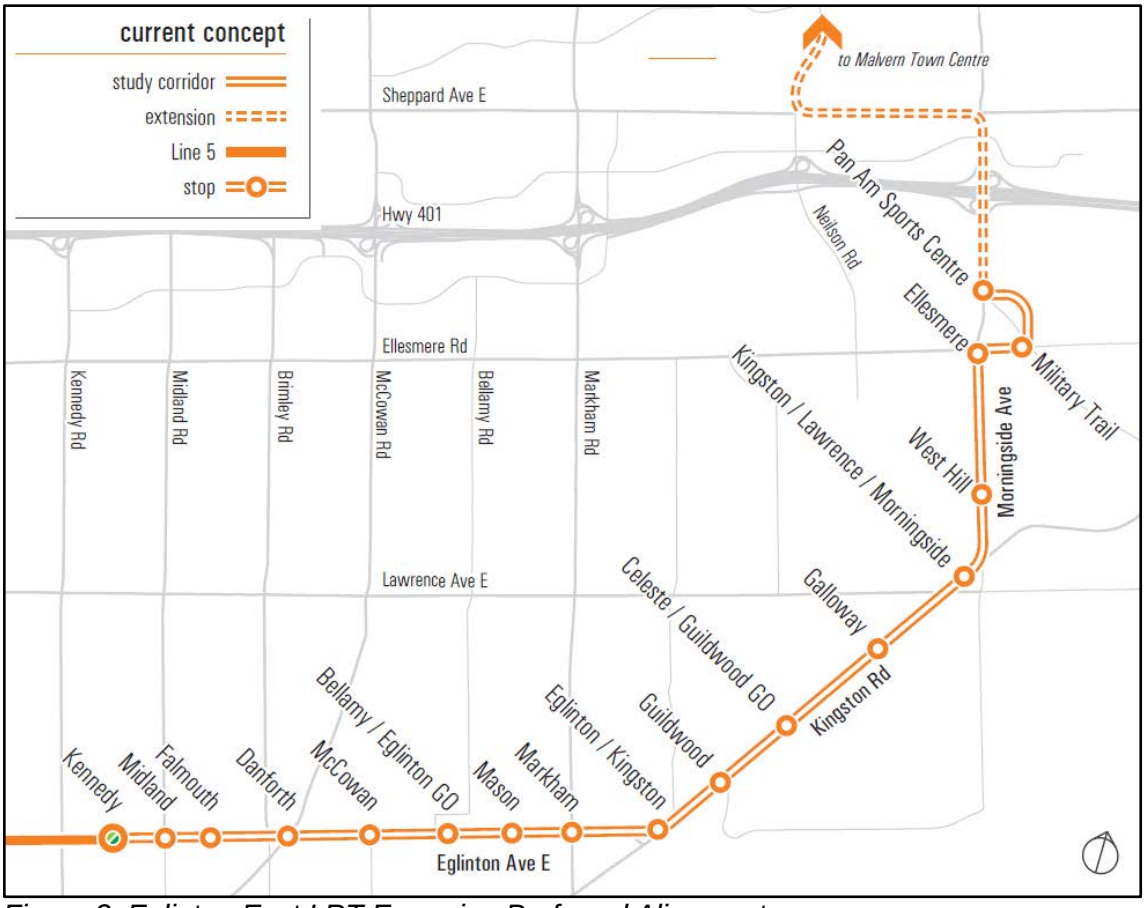

Figure 3: Eglinton East LRT Emerging Preferred Alignment

Subject to City Council approval of the recommended options, staff will continue to advance the Eglinton East LRT project concept and refine these recommended options. Updated cost estimates will be developed and reported as part of the Scarborough Transit Network Business Case Analysis, a refined construction timeline and funding strategy, and other related findings in Q1 2019.

Staff will also undertake a comprehensive planning study aimed at ensuring that the investment in the rapid transit project achieves broad City objectives related to land use, economic development and social development.

COMMENTS

The Eglinton East LRT concept is based on the Scarborough-Malvern LRT, which was approved under Ontario's *Environmental Assessment Act* in 2009. Refinement of the EELRT concept includes integration with Line 5 (Eglinton Crosstown) currently under construction and the potential extension to Malvern.

The full integration with Line 5 represents a significant opportunity to achieve greater benefits in terms of transportation accessibility and ridership. The integration also represents challenges in design to ensure that trains can efficiently travel on both the central section of Line 5 that is under construction and the extension to UTSC and/or Malvern.

These comments provide support for the report's recommendations as well as an update on aspects of the project not related to the recommendations.

1. Option Evaluation Tools

In several areas, different options for refining the EELRT project concept were considered. These include the area around Kingston Road, Lawrence Avenue East and Morningside Avenue, the area around the UTSC and the potential Malvern extension. Third-party subject matter expert consultants have been contracted to identify and compare options. Consultant work has been reviewed by the City, TTC and Metrolinx.

In these cases, the City's Rapid Transit Evaluation Framework (RTEF) is used to compare options and identify a recommended concept. The RTEF is a framework that is used to articulate a wide range of criteria related to rapid transit planning. The RTEF focuses on how rapid transit could serve people, strengthen places and support prosperity. Detailed traffic simulation and robust comparison of costs and benefits are tools that are used to inform the comparison of options through the RTEF.

For more information on the RTEF, please see 2014.PG34.12 - "Feeling Congested?" Update on Progress to Date.

Detailed Traffic Simulation

The SMLRT project concept requires the replacement of existing mixed traffic lanes, median left turn lanes, and/or peak period reserved transit lanes with LRT guideway along Eglinton Avenue East and Kingston Road. Introducing the LRT will increase the capacity of the corridor for moving people and will provide community members with more choice in how they move around their neighbourhood and the city. At the same time, the EELRT alignment runs on major arterial roads that are critical to Toronto's

overall transportation network, and reducing the number of lanes available for mixed traffic will reduce the capacity of these roads to move cars and trucks.

Detailed computer simulation has been undertaken to represent the existing transportation network and multi-modal traffic movements. This model has been used to predict future multi-modal traffic conditions associated with various scenarios, including configurations of potential grade separations at both Kingston-Lawrence-Morningside and UTSC. Results from this model are a critical component of the comparison of options.

Once the inclusion of potential grade separations at both UTSC and Kingston-Lawrence-Morningside has been determined, the model will be used to identify smaller-scale opportunities to optimize multi-modal operation within the LRT corridor. Optimization for all road users will result in the best range of choices for moving along the corridor and around the community, and will maximize the number of people who can travel in the corridor. Optimization of the corridor will be part of the final project recommendations anticipated in Q1 2019.

Comparison of Costs and Benefits

Some design concepts, such as potential grade separations, have benefit as well as a high capital cost. Due diligence has included a robust comparison of estimated costs and estimated monetized benefits over the assumed 60-year life-cycle for the transit infrastructure. This analysis has been built on the methodology used previously to evaluate potential grade separations for the Eglinton West LRT (EX29.1 - SmartTrack Project Update and Next Steps).

Grade separating the EELRT alignment at key locations has the potential to reduce conflicts between the LRT, automobiles and other modes of transportation. This is particularly true when the LRT turns a corner, where the time required for a 90m long train to turn through the intersection would affect the capacity available for other road users. Monetizing the reduction in delay provided by a grade separation, compared to an at-grade alignment, allow for a direct comparison to the estimated costs of that grade separation over the life-cycle of the infrastructure.

Costs of a grade separation being considered are the estimated incremental costs compared to an at-grade alignment. These include base capital, operating and maintenance costs over the 60-year life-cycle for the grade separation. Capital cost estimates presented are Class 5, and documented in corresponding Technical Memos. The net present value (NPV) of life-cycle costs, net of the costs of the at-grade concept, are then compared to the benefits of the grade-separated concept.

Benefits of the potential grade separation are estimated by comparing the simulation results for both the at-grade and grade separated concepts. In other words, the simulation is used to calculate the difference in travel time for people using all modes of transportation in the two scenarios. The reduction in travel time for all people travelling in the grade-separated scenario, compared to the at-grade scenario, is the estimated benefit of that grade separation. This benefit is projected over the 60-year life-cycle of

the infrastructure and monetized. The net present value (NPV) of the benefits are then compared to the costs of the grade-separated concept.

All costs and benefits are reported as ranges to account for reasonable uncertainty in estimation.

If the NPV of benefits exceed the NPV of costs, the concept is favoured from an Affordability perspective. A detailed memorandum on the methodology for this work is included as Attachment 1.

2. Eglinton East LRT Project Concept Refinement

The following comments document updates to the EELRT project concept, from Kennedy Station in the west to Malvern in the north.

Integration with Line 5 and Service Concept

The service concept refers to how the transit service will be operated, including how frequently trains will run, where they can turn back, and the operational flexibility available to the transit operator. The central section of Line 5, between Mount Dennis Station (Weston Road) and Kennedy Station, is currently under construction and expected to open in 2021. The City, in partnership with the TTC and Metrolinx, is currently advancing the planning and preliminary engineering for the Eglinton West LRT extension from Mount Dennis Station to Pearson International Airport, as well as the Eglinton East LRT extension. The three segments are shown in Figure 4.

EELRT integration with Line 5 means that a physical connection respecting the existing plans for the future Line 5 platforms at Kennedy LRT Station needs to be designed. Specifications used for Line 5 to allow for use of 90m trains also need to be incorporated into the Eglinton East LRT concept, and special track work that allows for trains to efficiently service the entire line needs to be planned.

Work to date has confirmed that track infrastructure to facilitate service to regularly turn back west towards Kennedy Station must be provided in the area around the Kingston Road, Lawrence Avenue East and Morningside Avenue intersections. Crossovers (allowing trains to switch tracks if required) must also be accommodated along the route. These requirements have been considered constraints in the concept refinement work, and will be finalized as part of the final project concept recommendation, anticipated in Q1 2019.

Figure 4: Line 5 (Eglinton) alignment currently under construction (Mount Dennis Station to Kennedy Station) and being planned (Pearson International Airport to Mount Dennis Station and Kennedy Station to UTSC or Malvern)

Stops and Alignment Review

The Scarborough-Malvern LRT (SMLRT) concept, designed to accommodate 60m trains, serves as the base condition for the EELRT. As an extension of Line 5, the SMLRT concept needs to be updated to extend platforms and provide track elements to facilitate operation of 90m trains.

Most of the stops approved in the original concept can be extended to accommodate the required track work and extended platforms without significant modification.

Stops that cannot easily accommodate extended platforms and additional track work include the areas around:

- Eglinton Avenue East and Kingston Road
- Kingston Road, Lawrence Avenue East and Morningside Avenue
- University of Toronto Scarborough Campus

These stops that cannot accommodate extended 100m platforms are highlighted on Figure 5.

For each of these areas, more detailed analysis of options was undertaken.

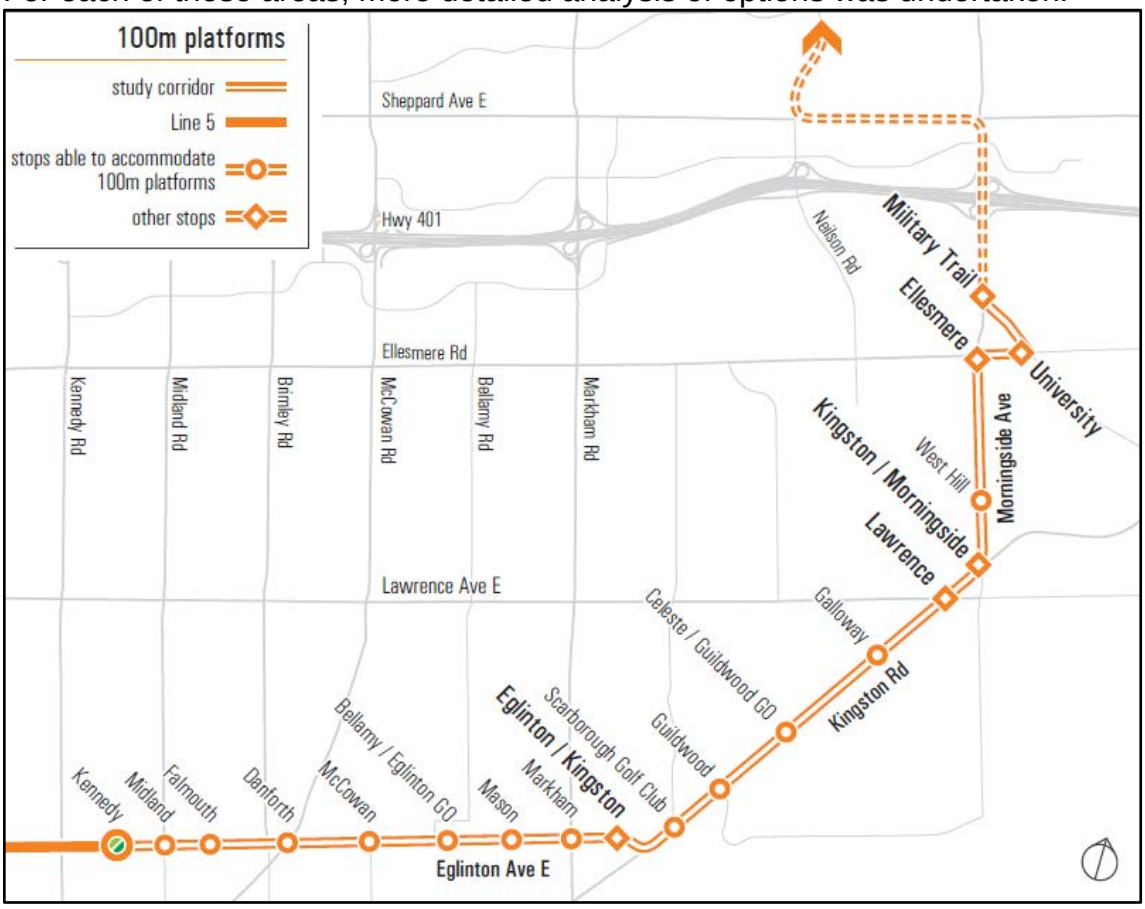

Figure 5: Planned stops that cannot accommodate lengthening to 100m platforms

2. Eglinton Avenue East and Kingston Road

The approved SMLRT concept included stops at both Eglinton Avenue East and Kingston Road, and Kingston Road and Scarborough Golf Club Road. These stops were 310m apart, with special track required for operational flexibility between, as illustrated on Figure 6A.

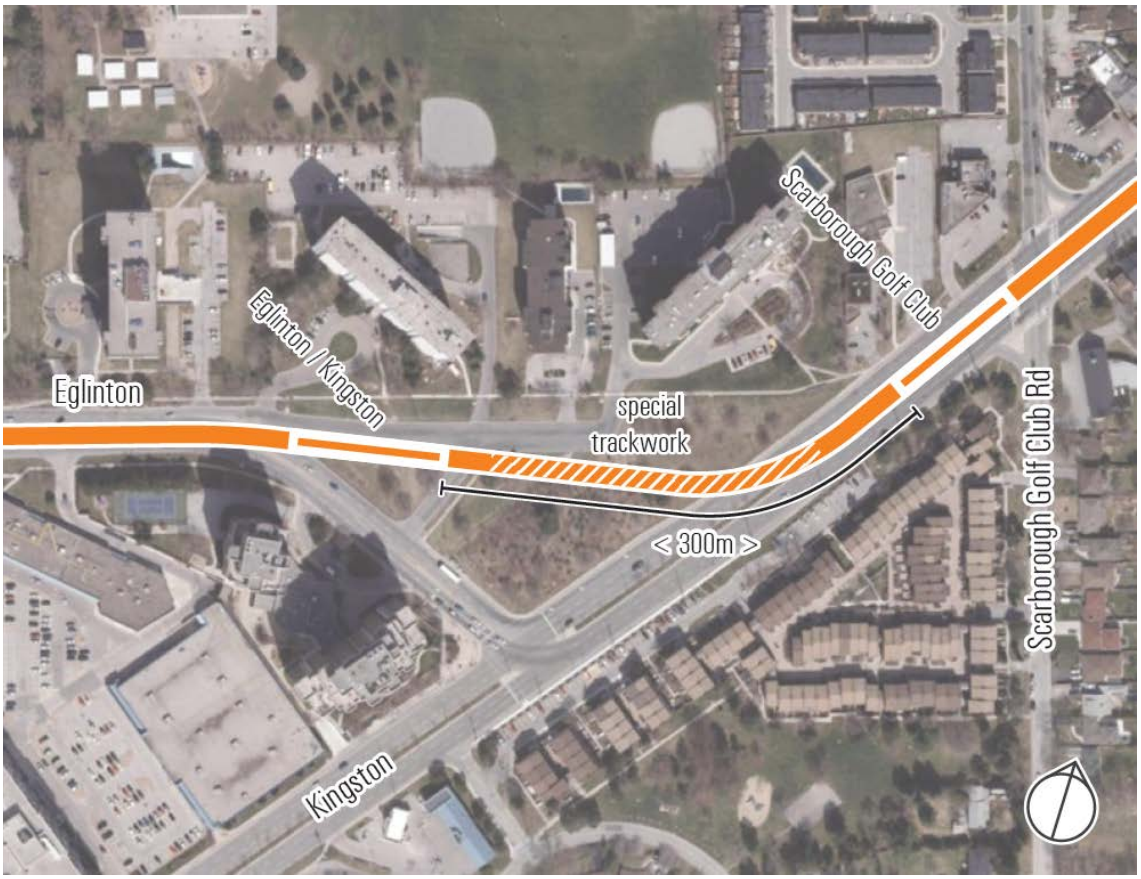

Figure 6A: Approved SMLRT alignment at Eglinton Avenue and Kingston Road

To extend these platforms and track work to accommodate 90m trains, the track work and Eglinton/Kingston stop would need to switch places, pushing the Eglinton/Kingston stop further east. The Scarborough Golf Club Road stop would require an extension of the platform towards the west. These modifications to the two stops would result in the eastern end of the Eglinton/Kingston stop becoming located within 100m of the western end of the Scarborough Golf Club Road stop (Figure 6B). The close proximity of these stops would create significant impacts to traffic and slow the LRT for minimal benefit. As a result, a single stop is planned for the area as shown on Figure 6C. The single stop is placed to maximize the number of residents and jobs within walking distance.

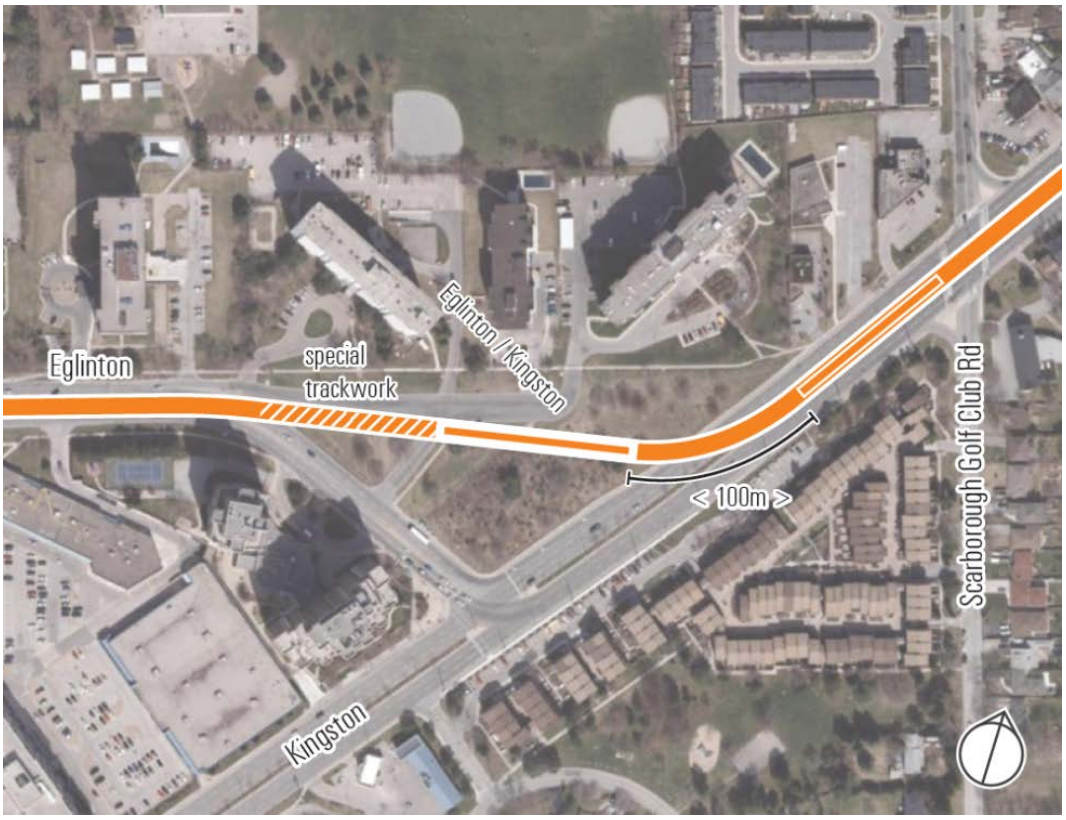

Figure 6B: Required modifications to approved SMLRT alignment with extension of platforms for Eglinton/Kingston and Scarborough Golf Club Road stops

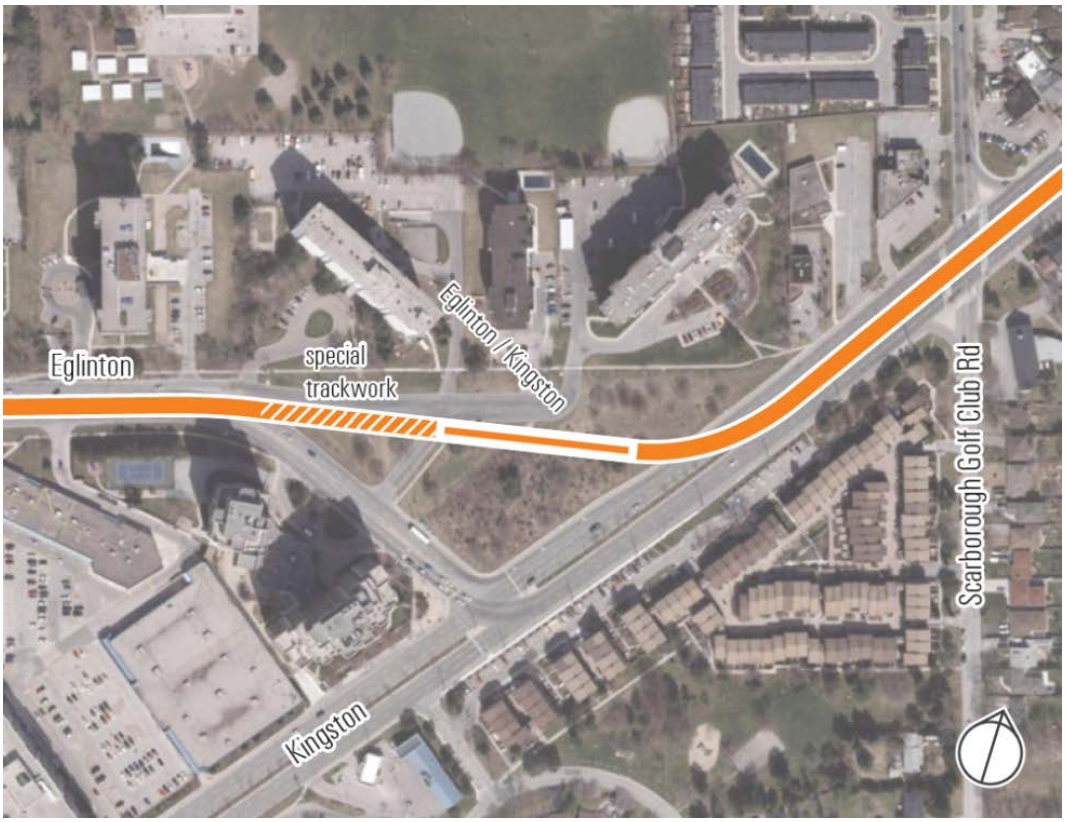

Figure 6C: Recommended single stop concept in the area of Eglinton Avenue East and Kingston Road

3. Kingston Road, Lawrence Avenue East and Morningside Avenue

The approved SMLRT concept included two at-grade stops within the Kingston-Lawrence-Morningside (KLM) area as shown in Figure 7. Options for this area have been created and evaluated because two extended stops and the required track work for turning service back west towards Kennedy Station at this location are not feasible.

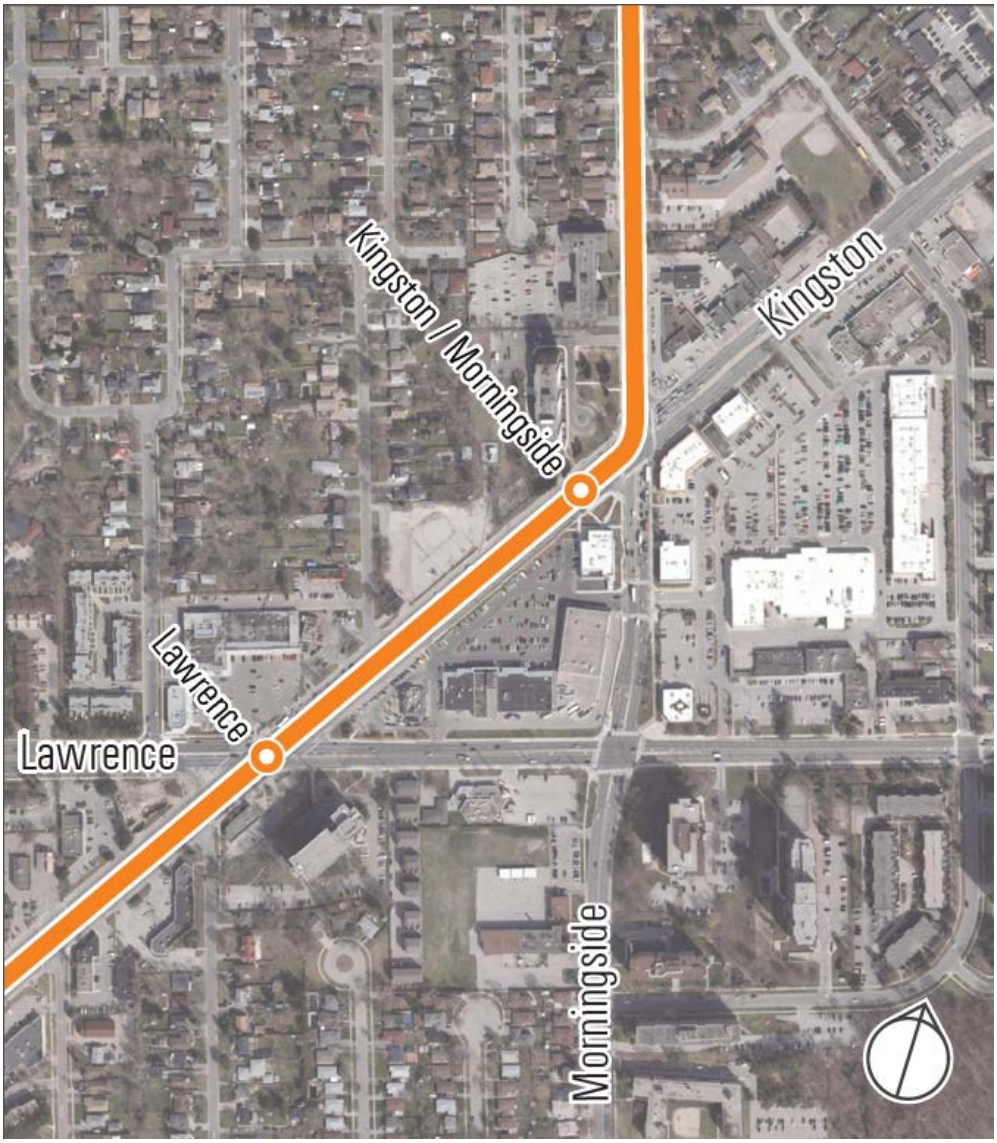

Figure 7: Approved SMLRT concept within the Kingston-Lawrence-Morningside area

Three at-grade and two below-grade concepts were developed along Kingston Road and Lawrence Avenue East. These five options are illustrated in Attachment 2. Multi-modal simulation confirmed that mixing the LRT and traffic would delay all modes and restrict the capacity of the intersection, while an early comparison of options determined that LRT alignments along Kingston Road performed better than alignments along Lawrence Avenue East. As a result, the Kingston Road alignments, both at-grade (Figure 8) and below-grade (Figure 9), were the subject of detailed evaluation using the RTEF, including a detailed comparison of economic benefits and costs.

Figure 8: Kingston Road Single Stop at-grade (surface)

Figure 9: Kingston Road Single Stop below-grade (tunnel)

Figure 10 summarizes the findings of the evaluation of these two options. The affordability criteria compares the net costs and benefits of the King Road tunnel option as described below.

Figure 10 - Comparison of Kingston-Lawrence-Morningside concepts

The at-grade concept performs better from some perspectives, including

- Less complex stop design and fewer barriers to people with mobility challenges, as they do not have to change levels;
- Less construction impact than a below-grade concept; and
- Below-grade concept will require some property acquisition to accommodate entrances and portals.

The below-grade concept is preferred from other perspectives, including

- Faster travel time for the LRT and less delay to mixed traffic;
- Better connections to surface transit (buses); and
- At-grade concept would reduce access to commercial and mixed-use properties by restricting left-turns in and out of driveways and loading facilities.

Affordability

The most significant factors in the comparison of the at-grade and below-grade concepts are costs and impacts to traffic and LRT travel time. The below-grade option has higher capital cost but would avoid conflicts between the turning movement of the LRT and general traffic (cars and trucks) using this already congested intersection.

Capital cost of the below-grade concept is estimated to be $249M - $466M (2018$, Class 5, as documented in the Technical Memo on Kingston-Lawrence-Morningside Options found at https://eglintoneastlrt.ca/reports-documents/klm/). Total Net Present Value (NPV) of all incremental costs of the below-grade concept is estimated as $207M - $387M (2018$) as documented in Attachment 1.

Total NPV of benefits of the below-grade option is estimated as $408M - $444M (2018$) as documented in Attachment 1.

Based on the analysis, the estimated benefits exceed the estimated incremental costs of the below-grade concept, demonstrating good value-for-money. These final results are presented in Figure 11.

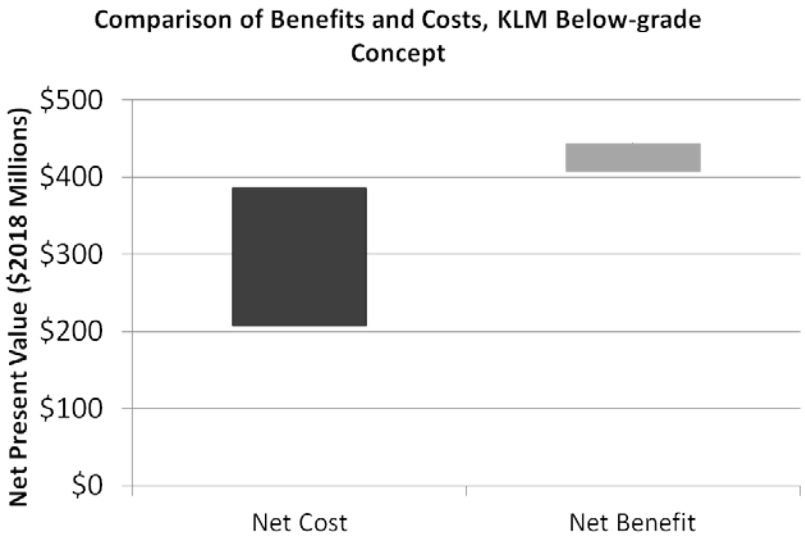

Figure 11: Range of total NPV of costs versus range of total NPV of benefits for below-grade concept at Kingston/Lawrence/Morningside

This analysis conservatively assumes that every second train turns back west towards Kennedy Station at this area, and therefore does not turn through the Kingston Road/Morningside Avenue intersection in the at-grade scenario. Should it be determined in the future that all trains should continue north to Morningside Avenue and beyond, benefits of the grade-separation would approximately double.

Conclusion

Based on the above assessment, a below-grade alignment along Kingston Road with a single stop is recommended. A tunnel along Kingston Road minimizes LRT travel time, and minimizes impacts to traffic.

For further detailed analysis of options, please see the Technical Memo on Kingston-Lawrence-Morningside Options found at https://eglintoneastlrt.ca/reports-documents/klm/.

4. Integration with the University of Toronto, Scarborough (UTSC)

At UTSC, the SMLRT concept included a side-running LRT guideway on the south side of Ellesmere Road, a stop at the southeast corner of Ellesmere and Morningside Ave; a stop on the southwest corner of Ellesmere and Military Trail and a centre-running LRT in a semi-exclusive right-of-way along Military Trail through North Campus. This alignment is shown in Figure 12.

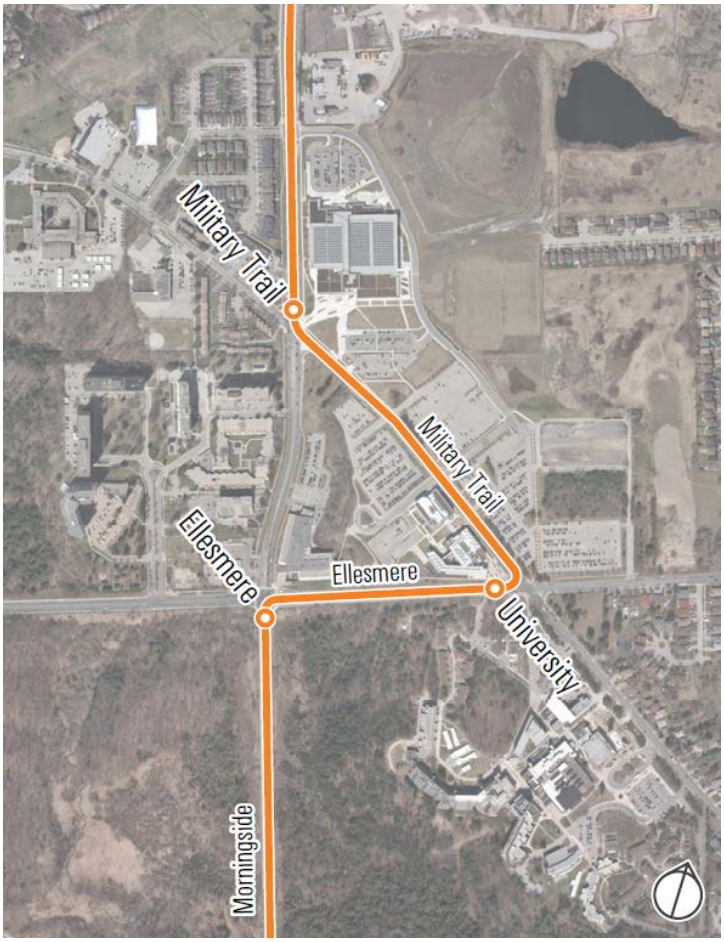

Figure 12: SMLRT concept through UTSC

This concept is not compatible with the proposed Secondary Plan submitted as part of the University's Official Plan Amendment (OPA) application and currently under review by the City. The University's proposed Secondary Plan includes a refined at-grade EELRT concept including a realignment of Military Trail between Ellesmere Road and Morningside Avenue as shown in Figure 13.

In this concept, the LRT would run in the centre of the realigned Military Trail in a semi-exclusive right-of-way, with a stop at the southeast corner of Ellesmere and Morningside Ave; on the south-west corner of Ellesmere and Military Trail; and another stop in front

of the Toronto Pan-Am Sports Centre (TPASC). This concept is a key part of UTSC's vision for future development on the campus, providing a rapid transit corridor on campus and a key link to downtown.

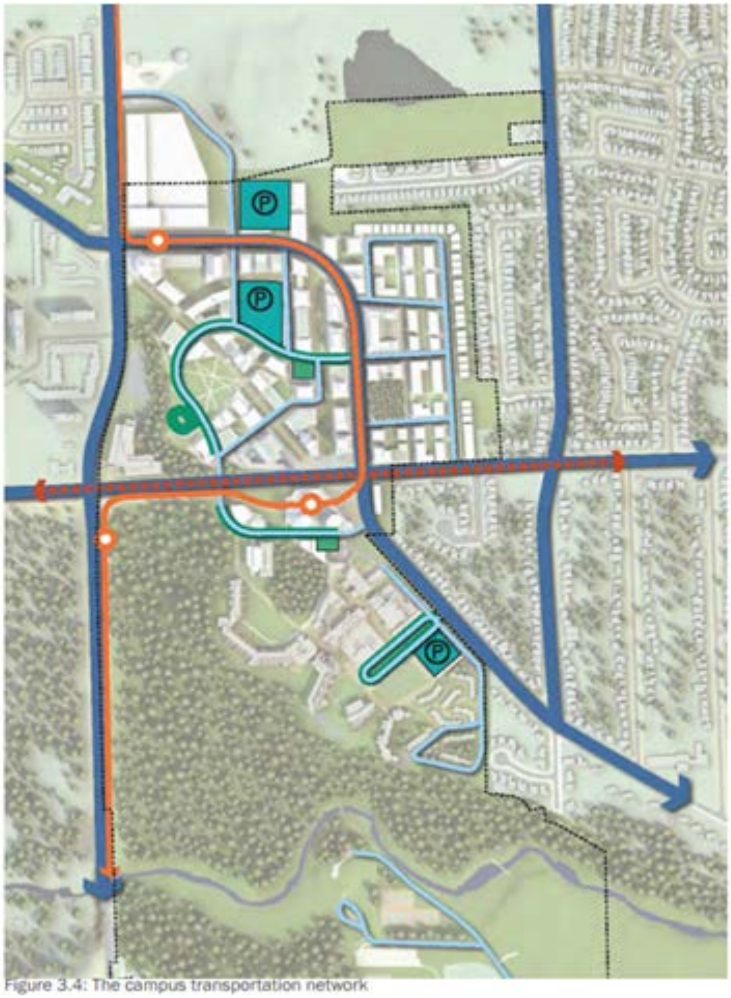

Figure 13: Proposed UTSC Secondary Plan street and block pattern, including proposed alignment of the EELRT

The City has undertaken a review of the University's Military Trail and LRT realignment. This review examined how the UTSC proposed Secondary Plan and LRT operational requirements interrelate, given the need to accommodate longer trains and platforms consistent with the Line 5 concept. Both the Eglinton East LRT concept and any approved Secondary Plan must also achieve Official Plan policies.

The potential interface with the Durham-Scarborough Bus Rapid Transit line (DS-BRT) currently being planned by Metrolinx was also part of this review. See Attachment 3 for more information on the DS-BRT.

The review process concluded that:

- Running the EELRT at-grade as indicated in the Secondary Plan application is expected to be technically feasible, but serious pedestrian barriers and

potentially unacceptable operational constraints at the realigned Military Trail and Ellesmere intersection would be likely;

- The significant number of bus bays and facilities required by TTC and GO to both serve the campus and connect to LRT services would result in a single traditional facility with negative impact on the placemaking objectives articulated in the proposed Secondary Plan; and

- Aligning the LRT in the centre of the realigned Military Trail would require widening the street and creating barriers to keep pedestrians off of the LRT guideway which does not align with the proposed Secondary Plan.

Given these conclusions, the City and TTC worked with Metrolinx and UTSC to develop three alternative concepts for how the Eglinton East LRT could better integrate with campus. These concepts were:

1. Enhanced at-grade concept, refining the concept articulated in the proposed Secondary Plan;
2. Fully tunnelled concept through campus to best meet the objectives of the UTSC's proposed Secondary Plan, and
3. Elevated concept direct along Morningside Avenue with enhanced pedestrian connections into campus, to optimize operations

These concepts were then compared using evaluation criteria consistent with the City's RTEF.

Enhanced At-grade Concept

The enhanced at-grade concept follows the alignment of the refined at-grade EELRT concept articulated in the UTSC proposed Secondary Plan (Figure 13). It retains all three of the stops originally part of the SMLRT concept, while presenting refinements to resolve issues identified in the City's review. On the east side of Morningside Avenue and the south side of Ellesmere Road, the alignment is built on top of an earthwork berm before meeting existing grade near the central (University) stop. The enhanced at-grade concept is shown in Figure 14.

To address the barriers to pedestrian movement and conflicts with other modes of travel at the intersection of the realigned Military Trail and Ellesmere Road, a pedestrian underpass is added. This high-quality pedestrian underpass would become part of the pedestrian "spine" connecting north and south campus envisioned by the UTSC proposed Secondary Plan. The result of eliminating pedestrian movements from the west side of this intersection is improved intersection operations and pedestrian experience.

Figure 15 shows how this concept could provide high quality transfers between the EELRT, surface transit routes and the DS-BRT. Through routes, including the DS-BRT would stop on Ellesmere Road allowing passengers to transfer to the LRT through the pedestrian underpass. Bus routes terminating at UTSC would be accommodated in a bus facility that could wrap around a parcel that may have development potential.

Figure 14: Enhanced at-grade concept (street and block pattern as articulated by the UTSC proposed Secondary Plan)

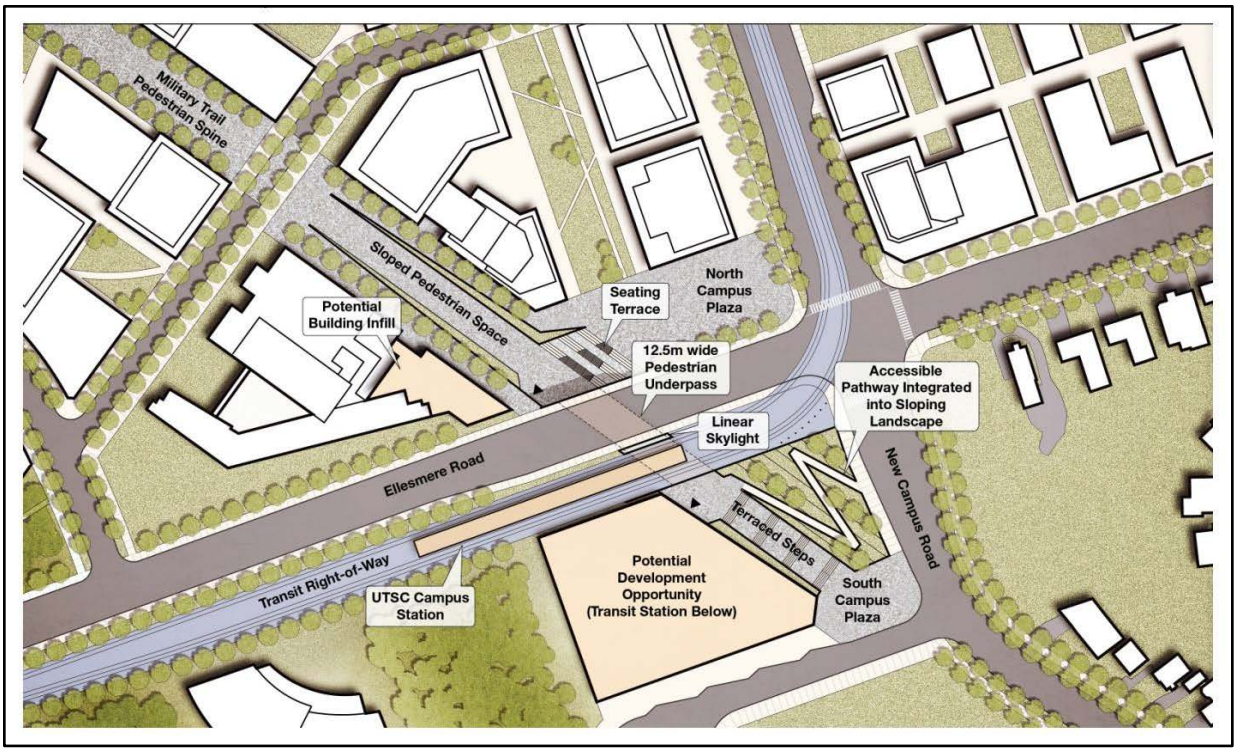

Figure 15: Enhanced at-grade concept - University stop

Campus Tunnel Concept

The campus tunnel concept features a below-grade EELRT alignment through the north campus (north of Ellesmere Road), which is the focus of future growth for the University. This concept focuses on a single below-grade stop near the planned centre of the north campus. The EELRT alignment is on top of an earthworks berm on the east side of Morningside Avenue as in the enhanced at-grade option, but takes advantage of the slopes by entering a portal and going below grade just east of Morningside Avenue. The alignment remains below-grade until it re-emerges from a portal in the centre of Morningside Avenue, north of Military Trail. The Ellesmere Road/Morningside Avenue stop is eliminated and the second stop is located on Morningside Avenue just north of Tams Road. The campus tunnel concept is illustrated in Figure 16.

This concept removes all conflicts between LRT operations and other modes on campus, including pedestrian movements. It focuses on a below-grade stop which could be integrated with future development of buildings. It does not provide good service to the south campus (South of Ellesmere Road), which is where the majority of campus activity exists today. While this concept does not require a large bus terminal, it provides poor connectivity with frequent bus routes using Ellesmere Road. Terminating surface routes would need to use an off-site layby facility.

Estimated incremental capital cost (2018$) of this concept, over the enhanced at-grade concept, is approximately $550M. Operational costs would be similar to the enhanced at-grade concept.

Figure 16: Campus Tunnel Concept (Street and Block pattern as articulated by the proposed UTSC Secondary Plan)

Elevated Morningside Concept

The elevated Morningside concept proposes a partially-elevated alignment that runs directly up Morningside Avenue with only two stops adjacent to UTSC north campus. Taking advantage of grades, the EELRT alignment would remain on an elevated structure on the east side of Morningside Avenue between the Morningside Creek and Ellesmere Road. The elevated structure would then shift to the centre of Morningside Avenue and come to grade south of Military Trail. Elevating the LRT would eliminate LRT turning movements and conflicts between the LRT and other modes of travel at intersections.

The first stop would be located adjacent to Centennial College just north of Ellesmere Road on Morningside Avenue. Due to a slope from Morningside Avenue to UTSC's planned north campus, the stop would be elevated above Morningside Avenue, but roughly level with the north campus. The second stop would be at-grade just north of Military Trail.

An elevated pedestrian pathway would provide a level connection between the Centennial College LRT stop with the centre of the north campus. Stairs and elevators would be needed to connect the LRT stop to Morningside Avenue and neighbourhoods on the west side of Morningside Avenue. The elevated Morningside concept is shown in Figure 17.

Figure 18 illustrates the area around the main campus stop. Frequent through-service bus routes including the DS-BRT would need to stop on Ellesmere Road, requiring transferring riders to walk approximately 150m to board the LRT. Terminating surface bus routes would be accommodated adjacent to the LRT stop in a terminal facility constructed on the existing Centennial College parking lot, with additional layby facilities on-street along Morningside Avenue. In this concept, service to south campus is poor.

Estimated incremental capital cost (2018$) of this concept, above the capital cost of the enhanced at-grade concept, is approximately $125M. Operational costs would be much less than the enhanced at-grade concept due to its shorter length and reduced travel time.

Figure 17: Elevated Morningside Concept (Street and Block pattern as proposed by the UTSC Secondary Plan application)

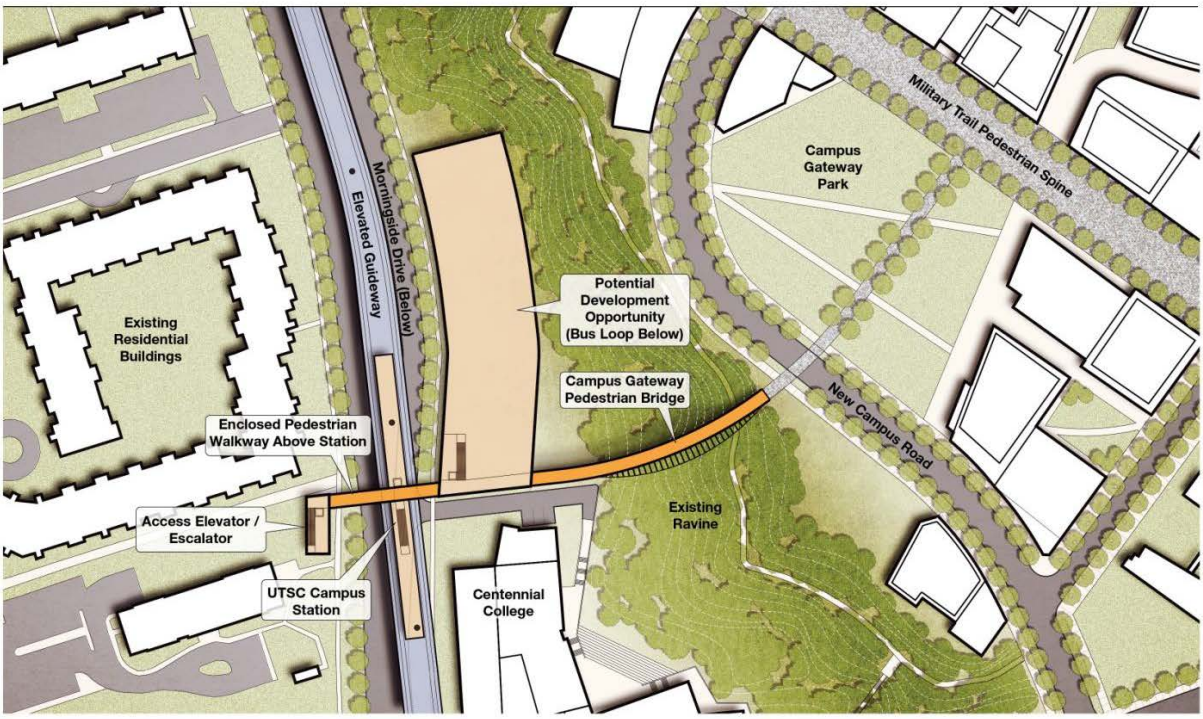

Figure 18: Morningside Elevated - Centennial College stop and north campus connection

Evaluation of Concepts

The high estimated capital cost and low net benefits of the campus tunnel concept (see discussion below) represents a poor return on investment to the project. As a result, this concept was removed from further consideration. The enhanced at-grade concept and Morningside elevated concept were subject to more detailed evaluation using the RTEF.

Figure 19 summarizes the findings of the evaluation of these two options. The Affordability criteria is based on the net costs and benefits of the Morningside elevated concept.

Grade Options and Location		Enhanced at-grade	Elevated Morningside
	Social Equity	=	=
	Experience		✓
	Healthy Neighbourhoods	✓	
	Shaping the City	✓	
	Public Health and Environment		✓
	Choice	✓	
	Supports Growth	✓	
	Affordability		✓
LEGEND	= Performs the same	✓ Performs better	

Figure 19: Comparison of UTSC concepts

The enhanced at-grade concept

- Best serves destinations on north and south campus;
- Best facilitates transfers between the LRT and surface transit routes including planned DS-BRT and other through routes;
- Minimizes operation noise and vibration due to elevated alignment close to residential buildings; and
- Presents a less complex stop design, as there is no grade change.

The Morningside elevated concept

- Reduces environmental impact on Morningside ravine and woodlot east of the realigned Military Trail;
- Better serves communities on the west side of Morningside Avenue, which include a Neighbourhood Improvement Area;
- Minimizes impacts to traffic; and
- Minimizes construction and operational impacts to UTSC by moving the LRT alignment and bus facilities to the edge of campus.

Affordability

Operational costs are a significant factor in the comparison of benefits and costs for the two UTSC concepts.

Capital cost of the campus tunnel concept is estimated to be $571M - $1,065M (2018$, Class 5, as documented in the Technical Memo on UTSC Integration Options found at https://eglintoneastlrt.ca/reports-documents/utsc/). Total NPV of all incremental costs of the below-grade concept is estimated as $417M - $778M (2018$) as documented in Attachment 1.

Total NPV of benefits of the campus tunnel concept is estimated as $148 - $171M (2018$) as documented in Attachment 1.

Based on the analysis, the estimated costs far exceed the estimated benefits of the campus tunnel concept, not demonstrating good value-for-money. The ranges of costs and benefits are shown in Figure 20.

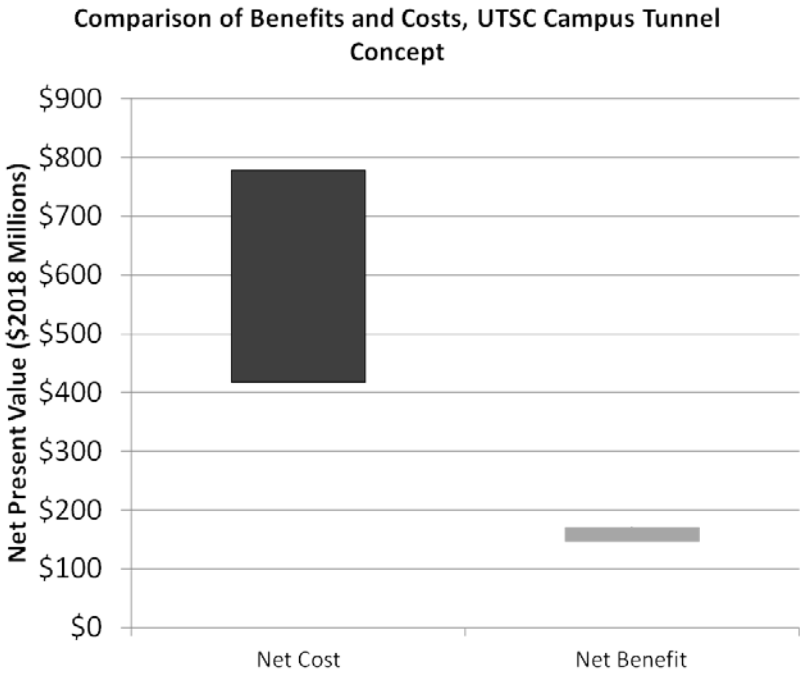

Figure 20 - Range of Net Costs versus Range of Net Benefits for campus tunnel concept

The elevated Morningside concept has a higher estimated capital cost than the enhanced at-grade concept, but significantly lower operational costs due to shorter length and reduced travel time by approximately 3 minutes each way.

Capital cost of the elevated Morningside concept is estimated to be $244M - $256M (2018$, Class 5, as documented in the Technical Memo on UTSC Integration Options found at https://eglintoneastlrt.ca/reports-documents/utsc/). Total NPV of all incremental costs of the above-grade option is estimated as $80M - $149M (2018$) as documented in Attachment 1.

Total NPV of benefits of the elevated Morningside concept is estimated as $166 - $187M (2018$) as documented in Attachment 1.

Based on the analysis, the estimated benefits exceed the estimated costs of the Morningside elevated concept, demonstrating good value-for-money. The ranges of costs and benefits are shown in Figure 21.

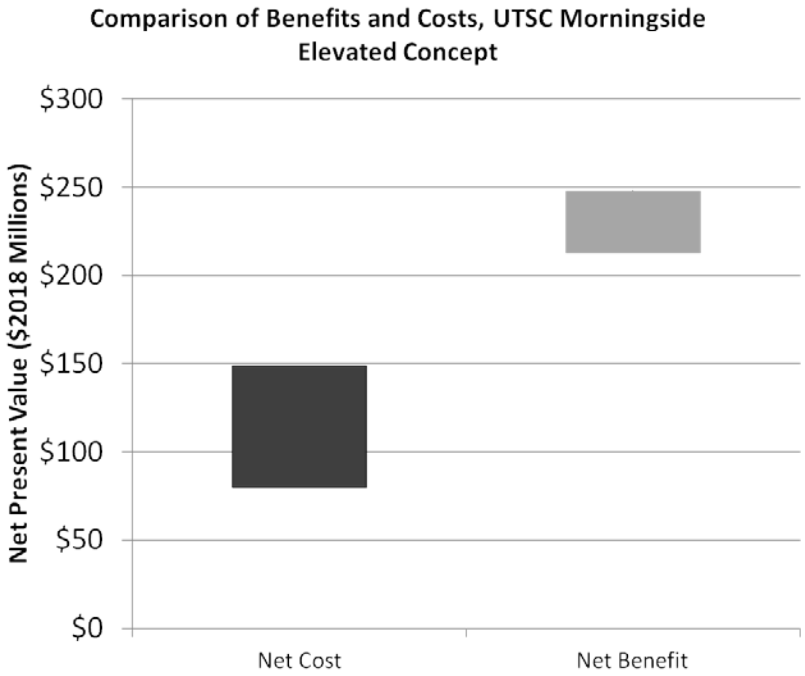

Figure 21 - Range of total NPV of costs versus range of total NPV of benefits for Morningside elevated concept at UTSC

Conclusion

The elevated Morningside concept minimizes LRT travel time and impacts to traffic, demonstrating good value-for-money in a direct comparison with the enhanced at-grade concept. The reduction in LRT travel time is important for any riders that will be using the LRT to travel past the UTSC campus (e.g. from Sheppard Avenue to Kingston Road). On the other hand, riders destined for UTSC, particularly the south campus, or wishing to transfer to other routes at UTSC would be better served by the enhanced at-grade concept.

The enhanced at-grade concept also better supports the anticipated growth on the UTSC campus, and is more consistent with the UTSC proposed Secondary Plan.

Based on the above assessment, the enhanced at-grade concept through UTSC with three surface stops is recommended. UTSC is supportive of the recommended option. This concept best supports the anticipated growth on the UTSC campus and better serves riders destined for the university.

For further detailed analysis of options, please see the Technical Memo on UTSC Integration Options found at https://eglintoneastlrt.ca/reports-documents/utsc/.

5. Malvern Extension

The SMLRT concept terminated at Sheppard Avenue East at Morningside Avenue, where it would connect to the Sheppard East LRT (SELRT). City Council directed staff to identify the requirements for the next phase of the EELRT to Malvern in July 2016.

Five options for extending the EELRT to the vicinity of the Malvern Town Centre were developed and evaluated. The five options are:

- Morningside Avenue - Hydro Corridor - Neilson Road
- Morningside Avenue - 401 north side boulevard / Cinemart Drive - Neilson
- Morningside Avenue - Milner Avenue - Neilson Road
- Morningside Avenue - Sheppard Avenue East - Neilson Road
- Morningside Avenue - Sewells Road

The Hydro Corridor option was eliminated due to significant constraints associated with any construction in the hydro corridor. The 401 boulevard and Milner Avenue options were also eliminated, due to conflicts with the Neilson Road - 401 interchange. The Sheppard Avenue East and Sewells Road options were carried forward to detailed analysis using the RTEF. These two alignments are shown on Figure 22.

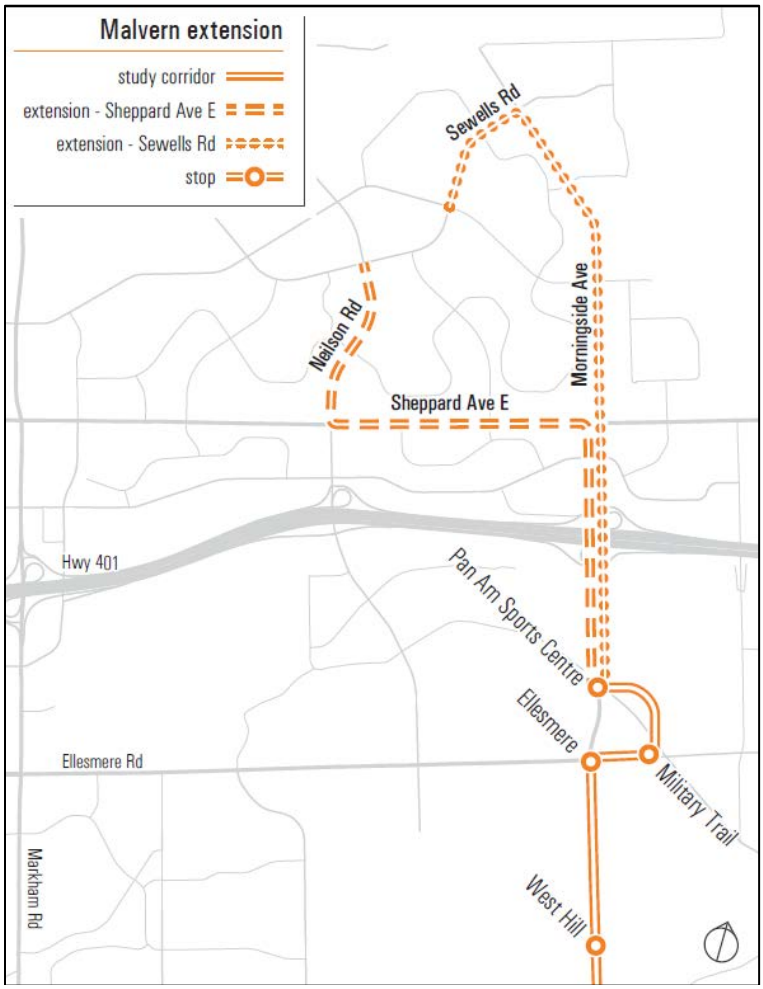

Figure 22: Potential Malvern Extension Alignments

Figure 23 summarizes the findings of the comparison of options.

Grade Options and Location		Morningside - Sheppard - Neilson	Morningside - Sewells
	Social Equity		✓
	Experience		✓
	Healthy Neighbourhoods	=	=
	Shaping the City	=	=
	Public Health and Environment	✓	
	Choice	✓	
	Supports Growth	=	=
	Affordability	✓	
LEGEND	= Performs the same	✓ Performs better	

Figure 23: Comparison of Malvern extension options

The Sewells Road alignment avoids making turns at two busy intersections (Sheppard / Morningside and Sheppard / Neilson) but is longer and right-of-way constraints on Sewells Road north of Malvern Town Centre could require mixed traffic operations or significant property impacts.

The Sheppard Avenue East alignment would build on the future SELRT, with track between Morningside Avenue and Neilson Road being used for both lines. The Neilson Road alignment would offer the opportunity to provide a branch service of the SELRT to Malvern, and the southerly connection to Morningside would offer the opportunity to provide an SELRT branch service to UTSC.

For further detailed analysis of options, please see the Connecting Malvern Recommendations Report found at https://eglintoneastlrt.ca/reports-documents/malvern/.

Conclusion

The Sheppard Avenue East alignment is recommended due to the ability to use future track that will be constructed as part of the SELRT, and the opportunities for operational flexibility in both the EELRT and SELRT.

It is recommended that the Malvern extension be included in the EELRT five percent design, cost estimate and business case analysis anticipated to be reported to City Council in Q1 2019. Inclusion of the extension in the project concept will allow City Council the opportunity to consider the entire project at once. Inclusion of the Malvern extension in the project scope does not preclude the phasing of the project. Final recommendations regarding implementation will be made in Q1 2019 based on the business case analysis.

Morningside Overpass

Ontario's Ministry of Transportation (MTO) has indicated that the Morningside overpass over Highway 401 will be rehabilitated in the near- to medium-term. The City is already working with MTO to confirm the specifications to be included in this rehabilitation work to protect for the use of the overpass as part of the Eglinton East LRT alignment. This report recommends that City Council formally request that MTO protect for the EELRT in its rehabilitation work.

6. EELRT Public Consultation

The first phase of public and stakeholder consultations on the EELRT was held in November and December, 2017. The purpose of Phase 1 consultation was to solicit feedback on the options to address each issue area.

Consultation activities were designed to reach a broad and diverse audience using both online tools and in-person events. The following are the key consultation activities undertaken during Phase 1 consultation:

- Public Meetings, 3 events in three different locations along the corridor;
- In-Formal In-Person Pop-Up Events (Planners in Public Spaces (PiPS));
- Online Consultation;
- Social Media, including Twitter and Facebook; and
- Project website, with over 9,000 website hits since October 2017.

A Stakeholder Advisory Group (SAG) has been established for the project, with over 45 local and city-wide organizations invited to participate in meetings. The SAG's role is to provide feedback to the project team, comment on the public-facing materials and provide strategic advice about reaching interested communities.

More than 150 people provided comment during the first phase of consultation. 61 individuals responded to the online survey available on the project website.

Feedback Received

The public made it clear that they feel rapid transit connections have been poor in Scarborough and improvements are important to the community.

There was strong support for the project overall, with particular interest in timing, funding commitments, and potential traffic impacts. There was a stronger desire to see the project through to construction than any preference for a particular solution to each issue area. With respect to potential grade separations, there was concern that a recommendation for a grade separation would drive up the project cost and thus potentially risk the implementation of the LRT. The input received was considered in refining and assessing the options for each issue area.

Eglinton – Kingston Road Intersection:

- Make sure the design considers walkability and safe pedestrian connections for stops and transfers to bus service; and
- No concerns raised regarding the removal of the proposed Scarborough Golf Club Road stop.

Kingston – Lawrence – Morningside Intersection:

- There was concern that a tunneled option would be too costly and may risk the project becoming unaffordable; however it was felt that a tunnel would be better from a traffic impact perspective.

UTSC Integration:

- Support for design concepts was varied between running the LRT line through campus (the enhanced at-grade concept) or extending the line straight up Morningside beside campus (elevated Morningside);
- There was interest in the LRT providing good connection with UTSC and serving the UTSC population; and
- There was interest in receiving more information about the cost of the options and if connecting through UTSC would slow down the service.

Malvern Extension

- Significant support for extending the line to Malvern Town Centre;
- Interest was mostly focused on getting an extension to Malvern rather than specific alignment preferences; and,
- The Morningside-Sheppard-Neilson and Morningside-Sewells alignments received the most interest from participants.

7. Next Steps

Work that will be undertaken in partnership with TTC and Metrolinx to advance the EELRT before reporting a final recommended project concept to City Council in Q1 2019 is summarized below.

Refinement of design concepts and public consultation

Subject to approval by City Council, the project team will further refine the recommended concepts. Phase 2 of public consultation, anticipated to be held in June 2018, will seek public and stakeholder input on the final recommended concepts.

LRT Portal connection to Kennedy Station

The project team will ensure that the Scarborough Subway Extension (SSE) and EELRT designs are coordinated east of Kennedy Station. Any cost of coordinating the two designs will be reported to City Council as part of the Class 3 SSE cost estimates and updated EELRT cost estimates in Q1 2019.

Corridor Planning Study

Investing in rapid transit along the Eglinton East LRT corridor is expected to incent growth and change in the neighbourhoods adjacent to the corridor. To help manage this change, and ensure that the City is able to realize benefits from the investment in this rapid transit line, a comprehensive planning study will be undertaken.

This work will aim to answer the following questions:

- What are the land use, public realm, built form, economic development and social development objectives in these neighbourhoods?
- What economic development and social development objectives can be achieved through planning policy, building infrastructure and creating and enhancing public spaces?
- How can the investment in rapid transit in this corridor can be leveraged to achieve equitable outcomes?

The planning study will consider the route of the Eglinton East LRT and an approximately 500 metre area on either side of the corridor, and will be supported by a robust public consultation process.

The study will be carried out in multiple phases. Phase 1 of the study will establish an overall vision for the corridor area, develop guiding principles and create a public realm concept plan that will be the foundation for the streetscape designs for the EELRT. It will also make recommendations for next steps required to further develop and test detailed ideas in land use, public realm, built form, community services and facilities and other aspects of the corridor area in order to achieve the overall vision.

Updated Cost Estimate

Subject to City Council approval and following consultation on the recommended concept, an updated cost estimate will be prepared, as per Council direction (EX16.1 Developing Toronto's Transit Network Plan to 2031). The updated cost estimate will narrow the range of cost uncertainty.

A construction timeline and funding plan for the EELRT will also be developed consistent with City Council direction (EX23.1 Next Steps on the Scarborough Subway Extension).

Business Case Analysis

Business case analysis of the Scarborough Rapid Transit Network, including the EELRT, will be completed based on updated cost estimates and construction timing, in Q1 2019 (EX16.1 Developing Toronto's Transit Network Plan to 2031).

University of Toronto Scarborough Campus Secondary Plan Application

Staff will be providing formal comments on the proposed UTSC Secondary Plan, and incorporate City Council direction on the LRT alignment through the UTSC campus along Ellesmere Avenue and realigned Military Trail. Staff will continue to work with UTSC, TTC and Metrolinx project partners to refine the integration of the LRT alignment, supporting transit infrastructure and the draft Secondary Plan.

Transit Project Assessment Process (TPAP)

Changes to the SMLRT concept as described in this report require an amendment to the SMLRT TPAP that was completed on December 15, 2009. The project team will prepare an addendum to the SMLRT Environmental Project Report, issue public notice and consult the public on the content of the amendment.

The amendment will document changes to the previously-approved concept and identify any changes to anticipated environmental impacts. If appropriate, new or additional mitigation measures will be identified.

The project team anticipates undertaking the TPAP amendment in Q4 2018 and Q1 2019.

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ATTACHMENTS

Attachment 1 – Comparison of Benefits and Costs for KLM and UTSC Grade Separations

Attachment 2 – Options for Kingston Road, Lawrence Avenue East and Morningside Avenue

Attachment 3 - Update on Durham-Scarborough Bus Rapid Transit (DS-BRT)