STAFF REPORT
ACTION REQUIRED

Next Steps on the Scarborough Subway Extension

Date:	March 22, 2017
To:	TTC Board
From:	Chief Executive Officer

Summary

The purpose of this report is to inform the TTC Board on City Executive Committee Report EX23.1: Next Steps on the Scarborough Subway Extension (Appendix A).

EX23.1 outlines the recommended alignment and bus terminal for the Scarborough Subway Extension (SSE), and provides recommendations related to the SSE delivery strategy. EX23.1 was adopted, with amendments, by City Executive Committee on March 7, 2017 and will be considered by City Council at its meeting of March 28-29, 2017.

This report also seeks Board approval for staff to proceed with the delivery strategy requirements relevant to the TTC and in support of Item EX23.1.

Recommendations

It is recommended that the TTC Board:

1. Receive the City report;

2. Further to City Recommendation 3a, authorize staff to negotiate with Infrastructure Ontario, along with the City staff, at a cost not to exceed $15 million;

3. Further to City Recommendation 3b, authorize staff to proceed with a Design-Bid-Build model, in the event an agreement with IO is not reached, per recommendation 2;

4. Further to City Recommendation 3a, authorize staff to enter into an agreement with IO and the City;

5. Further to City Recommendation 5, direct staff to report back to the TTC Board, at such time as the SSE Project has reached a Class 3 cost estimate, for authority to proceed with procurement of the SSE, which report shall include an updated project budget and;

6. Approve forwarding this Item to the City Clerk, for consideration with Item EX23.1: Next Steps on the Scarborough Subway Extension, at the March 28, 2017 meeting of City Council.

Financial Summary

The TTC's 2017-2026 Capital Budget includes an estimated cost of $3.56 B for the SSE, including the SRT Life Extension and Demolition, as approved by the City of Toronto Council on February 15, 2017. Of the $3.56 B, City Council has approved $194.629 million to date and no work beyond what can be accommodated within the approved funding will be initiated, unless additional project approval funds are made available.

Contract work will be administered on a Work Assignment Release basis. Work will only commence as authorized by TTC staff in the form of a Work Assignment Release and payment for services will be based on the terms included in the Contract Documents.

The Chief Financial & Administration Officer has reviewed this report and agrees with the financial impact information.

Accessibility/Equity Matters

The Scarborough Subway Extension will be designed and constructed as an accessible extension to TTC Line 2.

Decision History

At its meeting on March 7, 2017, the City Executive Committee adopted, with amendments, Item EX23.1: Next Steps on Scarborough Subway Extension. The City of Toronto decision history, including the recommendations of the City Executive Committee to be considered by City Council at its meeting on March 28, 2017, can be viewed in Item EX23.1.

http://www.toronto.ca/legdocs/mmis/2017/ex/bgrd/backgroundfile-101444.pdf

The decision history of the TTC Board on the Scarborough Subway Extension project can be viewed in Appendix D to this report.

Issue Background

City and TTC Staff have worked to develop the preferred solution for the SSE. Report EX23.1, prepared by City staff in collaboration with the TTC, was submitted to the City Executive Committee on March 7, 2017 and is appended to this report. EX23.1 recommends the alignment and bus terminal for the SSE, and also provides recommendations as to the next steps regarding the SSE delivery strategy. This report also seeks Board approval for staff to proceed with the delivery strategy requirements relevant to the TTC and in support of Item 23.1.

In addition to the main report recommendations of Executive Committee, as set out in Item EX23.1, the following two Committee member motions were adopted at the March 7, 2017, City Executive Committee:

1. Request that the City Manager, in consultation with the Chief Executive Officer, Toronto Transit Commission, report directly to City Council with a further detailed list and a map of the 42 permanent property requirements identified based on the McCowan alignment.

2. Request that the City Manager, in consultation with the Chief Executive Officer, Toronto Transit Commission, report directly to City Council with the names and a map of the 34 bus routes that would use the proposed Triton bus terminal.

Responses to these motions are attached as Appendices B and C, respectively.

Contact

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Chief Project Manager – Scarborough Subway Extension
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Attachments

Appendix A – City Executive Committee Report EX23.1
Appendix B – Property Requirements
Appendix C – Bus Routes to Triton Terminal
Appendix D – Decision History

Appendix A

TORONTO

City Manager's Office
Peter Wallace, City Manager

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March 8, 2017

Mr. Vincent Rodo
Chief Financial & Administrative Officer
Toronto Transit Commission
1900 Yonge Street
Toronto, ON M4S 1Z2

Dear Mr. Rodo:

Subject: Executive Committee Report and Recommendations

The Executive Committee considered the report EX23.1 Next Steps on the Scarborough Subway Extension at its meeting on March 7, 2017.

The Executive Committee recommended that:

1. City Council approve, as described in Attachment 2 (Scarborough Subway Extension Draft Environmental Project Report Executive Summary) to the report (February 27, 2017) from the City Manager, the Deputy City Manager and Chief Financial Officer and the Deputy City Manager, Cluster B:

   a. the extension of Line 2 (Bloor-Danforth Subway) from Kennedy Station to Scarborough Centre via the McCowan alignment, including the station concept and tunnel at-grade facilities, and

   b. the Triton bus terminal concept.

2. City Council authorize the Chief Planner and Executive Director, City Planning, in consultation with the Chief Executive Officer (CEO), Toronto Transit Commission, to conduct the necessary Transit Project Assessment Process for the Scarborough Subway Extension project, issue the Notice of Commencement for the Transit Project Assessment Process by the second quarter of 2017, prepare the Environmental Project Report, as described in Attachment 2 to the report (February 27, 2017) from the City Manager, the Deputy City Manager and Chief Financial Officer and the Deputy

City Manager, Cluster B, and submit the Environmental Project Report to the Minister of the Environment and Climate Change.

3. City Council approve the procurement model for the Scarborough Subway Extension as:

   a. Design-Build-Finance, subject to successful negotiation by the City Manager and the Chief Executive Officer of the Toronto Transit Commission, in consultation with the Deputy City Manager and Chief Financial Officer and the City Solicitor and Toronto Transit Commission General Counsel upon such terms as may be satisfactory to them, of an agreement with Infrastructure Ontario and the Toronto Transit Commission for project procurement support services for a scope of work as substantially set out in this Report, and at a cost not to exceed $15 million; or

   b. in the event that an agreement with Infrastructure Ontario is not reached pursuant to Recommendation 3a, Design-Bid-Build, based on a single construction contract.

4. City Council direct that if an agreement is reached with Infrastructure Ontario pursuant to Recommendation 3a, the City Manager be authorized to enter into the agreement with Infrastructure Ontario and the Toronto Transit Commission on behalf of the City, in a form satisfactory to the City Solicitor.

5. City Council direct that the City Manager, in consultation with the Chief Executive Officer of the Toronto Transit Commission, report to Executive Committee at such time as the Scarborough Subway Extension Project has reached a Class 3 cost estimate for authority to proceed with procurement of the Scarborough Subway Extension, which report shall include an updated project budget.

6. City Council request the Province of Ontario and Government of Canada confirm the sources of funding for the provincial and federal commitments to the Scarborough Subway Extension.

7. City Council direct the City Manager, in consultation with the Chief Executive Officer, Toronto Transit Commission, as part of the refinement of the Triton bus terminal concept, to:

   a. incorporate a review of all possible options to design the bus terminal and adjacent developable lands in a manner that incentivizes and maximizes private sector involvement in the design, construction and financing of the bus terminal, and minimizes the cost to the taxpayer and maximizes the value to the City, such review to consider retail, residential and commercial uses of the site.

   b. give consideration to a design that will accommodate alternative fuel buses, including compressed natural gas (CNG) and electric.

In addition, the Executive Committee requested that the City Manager consult with the Chief Executive Officer, Toronto Transit Commission, and report directly to City Council with:

1. a further detailed list and a map of the 42 permanent property requirements identified based on the McCowan alignment, and,

2. the names and a map of the 34 bus routes that would use the proposed Triton bus terminal.

City Council will consider the report and the recommendations from Executive Committee, in addition to additional information provided to respond to the request to the City Manager, at its meeting of March 28-29, 2017.

The Executive Committee report and its attachments are attached for consideration at the TTC's Board meeting on March 22, 2017.

Sincerely,

Peter Notaro
Executive Director
Strategic & Corporate Policy

Attachments

TORONTO

STAFF REPORT
ACTION REQUIRED

Next Steps on the Scarborough Subway Extension

Date: February 27, 2017
To: Executive Committee
From: City Manager, Deputy City Manager & Chief Financial Officer, and Deputy City Manager Cluster B
Wards: All

SUMMARY

This report was prepared in collaboration with the Chief Executive Officer of the Toronto Transit Commission (TTC).

The Scarborough Subway Extension (SSE) project first approved by City Council in late 2013 has advanced through the initial concept development and early planning phase.

In July, 2016, City Council directed staff to continue work on an express option for the SSE and to retain services to undertake a third-party review of costs and risks to date, based on TTC cost estimates at less than 5% design.

Since July 2016, TTC and City staff have undertaken further assessment on the preferred alignment for the SSE. An updated Initial Business Case (IBC) (Attachment 1) concludes that the McCowan alignment best meets both transit operations needs and encourages the development of Scarborough centre into a dynamic urban node. The TTC has identified a cost for the McCowan alignment of $3.159 billion. This cost includes an at-grade bus terminal.

Through continued study, a concept for an optimal configuration of the bus terminal at the Scarborough Centre station, the "Triton bus terminal concept," has been developed by City and TTC staff that will enable better pedestrian connections in the area and unlock the greatest amount of development potential around the subway station. The Triton bus terminal concept has an added cost of $187 million.

The cost for the recommended alignment and Triton bus terminal concept is $3.346 billion (Year of Expenditure (YOE) $, Class 4 Estimate). This does not include any potential costs associated with procurement and financing.

In May, 2015, City Council directed City and TTC staff to examine two different procurement methods for the SSE project: a design-bid-build (DBB) approach, under which the TTC would complete design and tender the construction work, and a design-build-finance (DBF) approach, where a single contractor or consortium would complete the design and oversee construction of the project. This report recommends City Council approve a DBF procurement approach for the SSE, subject to negotiating an agreement with Infrastructure Ontario (IO) for project procurement services at a cost not to exceed $15 million. In the event an agreement is not reached with IO for procurement services, a single-contract DBB model should be pursued.

In summary, this report:

- provides an update on planning work for the SSE, and recommends an alignment along the McCowan corridor, as well as a preferred bus terminal configuration (Triton Bus Terminal Concept);
- summarizes the results of a third-party review of costs and risk assessment for the project (Attachment 5);
- outlines analysis of the DBF and DBB procurement options for the SSE, and recommends Council approve a DBF approach with conditions;
- seeks approval to initiate the Transit Project Assessment Process (TPAP), including the submission of an Environmental Project Report (EPR) to Ontario's Minister of the Environment and Climate Change; and
- recommends City Council request the province and federal governments to confirm funding for the project.

The next decision milestone for the SSE project will be to authorize procurement and construction of the project. City and TTC staff will report at approximately 30% design with a Class 3 cost estimate in order to establish and update the project budget and schedule baseline. This is in accordance with best practices recommended in the TTC Capital Program Delivery Review led by KPMG.

RECOMMENDATIONS

The City Manager, Deputy City Manager Cluster B, and Deputy City Manager & Chief Financial Officer recommend that:

1. City Council approve, as described in Attachment 2 (Scarborough Subway Extension Draft Environmental Project Report Executive Summary):

a. the extension of Line 2 (Bloor-Danforth Subway) from Kennedy Station to Scarborough Centre via the McCowan alignment, including the station concept and tunnel at-grade facilities, and

b. the Triton bus terminal concept.

2. City Council authorize the Chief Planner and Executive Director, City Planning, in consultation with the Chief Executive Officer (CEO), Toronto Transit Commission, to conduct the necessary Transit Project Assessment Process for the SSE project, issue the Notice of Commencement for the Transit Project Assessment Process by Q2 2017, prepare the Environmental Project Report, as described in Attachment 2, and submit the Environmental Project Report to the Minister of the Environment and Climate Change.

3. City Council approve the procurement model for the SSE as:

a. Design-Build-Finance, subject to successful negotiation by the City Manager and the CEO of the TTC, in consultation with the Deputy City Manager & Chief Financial Officer and the City Solicitor and TTC General Counsel upon such terms as may be satisfactory to them, of an agreement with Infrastructure Ontario and the TTC for project procurement support services for a scope of work as substantially set out in this Report, and at a cost not to exceed $15 million; or

b. in the event that an agreement with Infrastructure Ontario is not reached pursuant to (a).Design-Bid-Build, based on a single construction contract,

4. City Council direct that if an agreement is reached with Infrastructure Ontario pursuant to Recommendation 3(a), the City Manager be authorized to enter into the agreement with Infrastructure Ontario and the TTC on behalf of the City, in a form satisfactory to the City Solicitor.

5. City Council direct that the City Manager, in consultation with the Chief Executive Officer of the TTC, report to Executive Committee at such time as the SSE Project has reached a Class 3 cost estimate for authority to proceed with procurement of the SSE, which report shall include an updated project budget.

6. City Council request the Province of Ontario and Government of Canada confirm the sources of funding for the provincial and federal commitments to the Scarborough Subway Extension.

FINANCIAL IMPACT

Approved Budget

In 2013, City Council approved a budget for the SSE project for $3.56 billion. This estimate was established prior to confirmation of an alignment or station configuration and with no detailed engineering and design work having been completed. This includes the estimated cost to extend the life, and decommission the Scarborough Rapid Transit (SRT) (Line 3). Table 1 outlines the funding reflected in the 10 year Capital Plan.

Table 1 - 2013 Scarborough Subway Extension Funding Plan ($millions)

Overall Funding Sources	Amount YOE/Escalated $	% of Total
Federal Contribution	660	19%
Provincial Contribution	1,990*	56%
City Contribution	910	26%
Total Funding:	3,560	100%
Breakdown of City Contribution		
Estimated Development Charge Funding	165	18%
Estimated Tax Supported Funding - Debt - Reserves Funds - Total	 541 204 745	 82%
Total City Funding:	910	100%
*The Province has committed $1.48B (2010$), less sunk costs associated with the cancellation of the Scarborough LRT project ($74.8M).		

The City has not yet entered into contribution agreements with either the provincial or the federal government. This report recommends that City Council request confirmation of both the amount and source of the contributions from both funding partners.

*Capital Cost Estimat*e

This report provides additional information and recommendations with respect to alignment and design of the required bus terminal.

The TTC has provided updated costing of a possible Brimley alignment. This would reduce the overall project cost by approximately $214 million. This is not recommended because it does not provide the same ridership, growth potential or convenient location as the McCowan alignment.

The McCowan alignment is recommended in this report. The TTC has identified a base cost for this alignment of $3.159 billion. This base cost includes an at-

grade bus terminal. The report notes that the at-grade bus terminal does not achieve a number of important planning and urban design goals; see section 1.

The report recommends an incremental design change to the bus terminal concept to better achieve project objectives. The Triton bus terminal concept, with an added cost of $187 million, is expected to support the long-term development of Scarborough Centre into an area with a street network that enables denser development and improved connections.

The recommended option is shown in Table 2 below.

Table 2 – Alignment and Bus Terminal Options - Construction Cost Estimate ($ billions YOE)

Description	Estimate
McCowan alignment with At-Grade Bus Terminal at SCC	3.159
Triton Bus Terminal	0.187
Total Recommended Alignment and Triton Bus Terminal Option	**3.346**

This estimate:

- Incorporates a 30 percent project contingency, which is allocated towards design evolution. TTC advises that this level reflects a typical industry allowance based on the very early stage of design, as noted below. It is not a full reserve against potential scope changes or risks.
- Does not include costs for project delivery or construction financing.
- Does not include lifecycle and operations/maintenance costs.
- Incorporates cost escalation based on the preliminary schedule. The schedule reflects an in service date of Q2 2026, with construction taking approximately 6 years (2020-2026). Schedule based on March 2017 approval to proceed.

The estimates were developed based on less than 5% design, and is considered to be a Class 4 estimate per the Association for the Advancement of Cost Engineering (AACE) scale, with an accuracy of -30% to +50%. As design continues, the estimate will be further refined based on the higher level of design and project scope definition and will be considered to have a higher level of accuracy.

Per best practice guidelines, the project budget and schedule should be established once a Class 3 estimate has been achieved (approximately 10% to 40% design). Staff plan to report back with a revised project budget and schedule based on 30% design prior to proceeding with procurement.

Procurement Method

This report recommends that City Council direct the TTC to proceed with a 'Design Build Finance (DBF)' procurement model, in order to enhance

accountability to schedule and budget through efficient and competitive design decisions where the designer and contractor have discretion and shares in risk. A DBF procurement would involve procurement advisory fees and additional financing charges by the contractor as indicated in the table below.

As discussed in the body of this report, a key component of the DBF model is the requirement that the contractor self-finance a substantial portion of all initial project expenditures along with a smaller portion of all ongoing expenditures until these self-financed amounts are recovered from the owner (i.e., City/TTC) upon substantial completion of the project.

For the purposes of preparing a financing cost estimate for the SSE, it has been assumed that the contractor will self-finance the first 15% of required expenditures and then self-finance 15% of the regular monthly expenditure amounts thereafter (i.e. the TTC would begin to provide progress payments to the contractor after 15% of the project expenditures have been made by the contractor and the TTC's progress payments would then only compensate the contractor for 85% of the expenditures made until substantial completion). At substantial completion, the contractor would recover the self-financed amounts from the TTC.

This payment structure creates the need for the contractor to self-finance a maximum of approximately 27% of total costs. It is this financing requirement, and the resulting supervision by the contractor's lenders, that promotes careful adherence to project schedules.

While this approach allows the owner to defer its own payments to the contractor, it creates financing costs for the contractor, which would be incorporated in the bid price for the project. It is estimated that the total cost of the contractor's financing will be approximately $110 million. However, after taking into account the forecast interest cost savings for the TTC from deferred payments to the contractor, the net incremental cost to the TTC from this procurement model is estimated to be only approximately $40 million. This incremental cost exists because the contractor's cost of capital is expected to be higher than the City/TTC's cost of capital.

Table 3 – Construction Cost and Procurement Cost Estimate

Estimate	$ Billions
Project Advisory Fees	0.015
Financing Costs	0.110

Cost Estimate Best Practices Identified Through Third-Party Reviews

The report provides further information with respect to additional potential cost factors.

The TTC Board and City Council received a report from KPMG[1] with recommendations to improve TTC Capital Program Delivery. An implementation plan, which included recommendations to improve the development of capital cost estimates and budgets was approved by the TTC Board in December 2016. In addition, as directed by City Council in July, 2016, the City Manager and the CEO of the TTC retained the services of a third-party rail transit construction and a cost-estimation expert (Hanscomb) to complete a detailed cost review of the TTC's cost estimate for the McCowan at-grade alignment.

The following enhancements would respond to recommendations from third-party experts and represent an attempt to better capture potential related costs of capital projects from the outset.

TTC and the City are exploring how to incorporate these enhancements into the budgeting process. As the design of the SSE is only approximately 5% complete, early estimates indicated below should be considered illustrative and subject to change as design progresses to 30% completion, when a full budget estimate based on the Class 3 cost estimate will be prepared and presented for TTC Board and City Council approval.

Optional Scope Enhancements

Large, complex transit projects generally serve city-building and place-making objectives as well as increasing transportation options. One of the key objectives of the SSE is to support the development of Scarborough centre into a dynamic urban node.

KPMG recommended in its review that the TTC adopt holistic scoping in order to fully capture all the costs associated with the multiple objectives of major transit projects, such as improvements to the public realm, urban renewal, etc. In response to this recommendation, the TTC is establishing holistic scoping requirements for application to all of its capital projects. This requirement will be documented as a corporate standard as approved by the TTC Board in December, 2016, which will be used for all TTC projects. This will reduce the likelihood that major scope changes will be made after the budget has been set at 30% design.

City Council will be presented with costed options and be provided an opportunity to decide whether or not to implement public realm improvements when the revised budget for the SSE is approved at the Class 3 estimate stage. At this time, the TTC is working with City Planning staff to identify an appropriate allowance for public realm improvements. This may be higher or lower, depending on public realm improvements that are planned or requested. Past experience indicates that this could cost in the range of $11 million.

[1] http://www.toronto.ca/legdocs/mmis/2017/ex/bgrd/backgroundfile-98219.pdf

In 2015, City Council requested that the TTC consider the inclusion of platform edge doors for all future extensions or new lines, in order to improve passenger safety. City Council will have an opportunity to decide whether or not to include platform edge doors when the revised budget for the SSE is approved at the Class 3 estimate stage. This is another example of holistic scoping as recommended by KPMG. The TTC has developed an estimate of the cost of platform edge doors for the SSE station, based on possible conceptual plans. At this point in time, the additional cost estimate for the doors is approximately $14 million.

Management Reserve for Potential Scope Changes: Scope requirements will change over the life of a project, especially on a major project like the SSE that will be constructed over a number of years. Both the KPMG review and the Hanscomb review of the SSE cost estimate recommend that a separate budget allowance be established for a "Management Reserve" to capture project scope changes that cannot be foreseen or are requested after the scope of the project and budget (at 30% design) have been approved. This is intended to clarify the use of other contingency amounts (for design, and for risk, including construction risk) so they are not applied to scope changes. City Council will have an opportunity to consider whether to approve a management reserve, and the delegation of authority for that reserve, if requested, when approval of the updated budget for the SSE is approved at the Class 3 estimate stage.

A higher management reserve may never be fully drawn down, while a lower management reserve may turn out to be insufficient. Based on work to date in developing the preliminary project scope, the TTC believes a reserve allowance of approximately $100 million is appropriate. This is approximately half of what Hanscomb, the cost review consultant, recommended (a reserve of about 7.5% of construction costs).

Risk Allowances: All infrastructure projects face risks. There are many potential sources of risk that may result in added costs and/or schedule delays. Some can be mitigated before construction begins, while others remain possibilities throughout construction of the project. Once an alignment is confirmed, there will be opportunities to mitigate risk through design. Steps will also be taken to determine which party is best suited to carry the responsibility for each risk, which can be assigned as follows: those retained by the owner, those transferred to the contractor and those that are shared.

In developing the cost estimate for the SSE, the TTC performed a risk assessment and developed a preliminary risk register with approximately 200 risks, which included an initial, pre-mitigated assessment of the likelihood and impact of risks materializing. This analysis identified a risk allowance, as well as their potential schedule delay of up to 22 months. These allowances are considered to be upset limits and it is expected that they will be reduced as risks are mitigated.

Both KPMG and the risk expert from Gannett Fleming contracted as part of the Value Engineering exercise recommended including a risk contingency, or allowance. City Council will have an opportunity to consider whether to approve a risk allowance, if requested, when approval of the updated budget for the SSE is approved at the Class 3 estimate stage.

At this point, the TTC has developed a working estimate for potential risk to cost of construction of $115 million.

In addition the TTC has developed a working estimate for potential risk of schedule delays of $190 million.

These are both considered upset limits.

Opportunities to Optimize Costs

The SSE project is still at an early stage of design. A peer review exercise was performed that led to the single tunnel concept as a cost saving measure. An initial value engineering exercise was also undertaken (Attachment 4) that identified a number of ideas about staging and construction that might optimize delivery of the project. These ideas will be examined more closely in the detailed design phase. In addition, the TTC could carry out a second value engineering exercise at a later point in design, which would identify other opportunities to optimize the project. The VE team recommended design development be reviewed at 20% to focus on cost, risk assessment and innovation.

The Deputy City Manager & Chief Financial Officer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

In September, 2016, the TTC Board adopted the recommendations of the staff report from the City Manager and the TTC Chief Executive Officer on the KPMG TTC Capital Delivery Review.

In July, 2016, City Council adopted EX16.1 Developing Toronto's Transit Network Plan to 2031, and requested that the 3-stop McCowan SSE option no longer be considered, that a SSE Express option continue to be developed, and that the services of a third-party rail transit construction and cost expert be retained to undertake a risk assessment and detailed review of the TTC's cost estimate.

On March 31, 2016, City Council adopted EX13.3 Developing Toronto's Transit Network Plan: Phase 1, which included direction to the Chief Planner and Executive Director, City Planning to complete the review of corridor options and related work for the SSE to report a recommended preferred corridor and alignment that includes an update on whether all or portions of the SSE could be built at-grade along with the number and location of stations.

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 SSE to Scarborough Centre, an extension of the Eglinton Crosstown east to the University of Toronto Scarborough Campus (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 May 5-7, 2015, City Council considered EX5.6 Scarborough Subway Extension - Project Delivery Options, and directed the City Manager, in consultation with the CEO of the Toronto Transit Commission and the Deputy City Manager & Chief Financial Officer to report back with a recommendation on whether to proceed with a Design-Bid-Build (DBB) or Design-Build-Finance (DBF) option for project procurement. Additionally, Council directed the Board of the Toronto Transit Commission to continue to structure any contracts for design or other advance work for the SSE in a way that could accommodate either procurement model.

On October 8, 2013, City Council confirmed support for the SSE and directed staff to confirm the alignment and station locations through an Environmental Assessment process; authorized the City to amend the Master Agreement with Metrolinx to redirect $1.48 billion (2010$) to the SSE, and to negotiate a contribution agreement with the federal government for its commitment of $660 million. An initial budget estimate of $3.56 billion (YOE) was developed prior to the alignment or station concept being selected.

ISSUE BACKGROUND

In July, 2016, City Council adopted EX16.1, Developing Toronto's Transit Network Plan to 2031, which included direction to remove the 3-stop Scarborough Subway Extension from consideration, and to develop an express option as part of an optimized transit network for Scarborough. Planning and costing work for an express SSE to Scarborough Centre has continued since that time.

An important planning priority for the SSE is supporting Scarborough Centre as a vibrant urban node. The Official Plan envisions Scarborough Centre as the "urban focal point for eastern Toronto where employment, housing, institutional, cultural, recreational, commercial and community services and transit will be concentrated in a dynamic mixed-use environment."[2] City Planning and the TTC have worked together to assess a number of alignments for the extension that would connect Kennedy Station, the current terminus station of the Bloor-Danforth line, with Scarborough Centre.

From a transit network perspective, the extension of the subway to Scarborough Centre reinforces and further increases its role as the main hub for local and regional transit in Scarborough. City Planning has worked with TTC to identify the connecting bus network required to maximize ridership on the new subway extension, adapt to the decommissioning of Line 3, and support the optimized transit network for Scarborough.

Once the alignment is approved, the next step will be commencing the Transit Project Assessment Process (TPAP) and the beginning of the design phase of the project.

Scarborough Transit Network

In addition to the express SSE, the Scarborough Transit Network proposal includes several projects including new SmartTrack stations in Scarborough, and the Eglinton East LRT. Metrolinx has also initiated work in planning the Durham-Scarborough BRT. Below is a summary update on the other key projects that form part of the Scarborough transit network improvements:

SmartTrack- Lawrence and Finch Stations

In November 2016, City Council approved the SmartTrack concept subject to a conditional approval process outlined in the report EX19.1 Transit Network Plan Update and Financial Strategy. The SmartTrack concept includes new SmartTrack stations at Lawrence Avenue East and Finch Avenue West on the Stouffville Corridor. These station concepts are currently being refined by City Planning and Metrolinx. An update on station concepts will be presented to

[2] Policy 1.1, Scarborough Centre Secondary Plan

Council later in 2017 before proceeding to TPAP and preparation for the procurement process. The update will be included as part of a broader report on SmartTrack project planning and progress.

Eglinton East LRT

In July 2016, City Council received a preliminary options analysis for the project which identified an estimated capital construction cost of $1.58 to $1.67 billion (YOE$, Class 5 Cost Estimate). As identified in the report additional analysis is required on key technical issues such as the interface at Kennedy station and the potential realignment of military trail. The development of an initial business case for the project is also required, in consultation with Metrolinx.

Following Council's direction in July, 2016, to update the original Scarborough Malvern 2009 EA and bring the design to 5%, a scope of work has been developed, a working group has been established, and technical work to update the project concept has begun.

City Council approved $7 million in funding for the initial planning work to bring the project to 5% design.

There is currently no additional funding committed for the project in the 10-year capital plan, however, the City has identified the project as a priority for Phase 2 federal infrastructure funding.

Scarborough-Durham (Highway 2) BRT

Metrolinx has recently initiated a working group and steering committee to guide the development of an initial business case for the Scarborough-Durham (Highway 2) BRT. The business case is expected to be complete in late 2017. This project will interface with the SSE at Scarborough Centre Station and with the Eglinton East LRT at UTSC.

Procurement and Project Management

The SSE project provides an opportunity to incorporate best practices in both procurement and project management. In May, 2015, EX5.6 Scarborough Subway Extension - Project Delivery Options directed staff to develop a Procurement Options Analysis and a recommended procurement option**.**

In the meantime, KPMG has completed a review of the TTC's capital program delivery. The review recommends the use of a stage gate process to ensure decisions can be made at each stage as more information is available, and recognize changes in design and budget as projects progress. A high-level road map for the project in section 5 indicates the decisions that have already been made on the project, and the next decision points that are anticipated.

COMMENTS

1. Planning Update

Recommended Alignment - McCowan

City Council received an Initial Business Case (IBC) for the Scarborough Subway Extension (SSE) at its July 12-15, 2016 meeting. The IBC examined options from a four case perspective: strategic, economic, financial, and deliverability. The preferred option according to the IBC was the extension of Line 2 along the McCowan corridor via Eglinton, Danforth, and McCowan - express from Kennedy Station to Scarborough Centre (known as Option 2A).

Options that closed Line 3 (Scarborough RT) during construction were screened out of the evaluation in the Deliverability case, as this closure would mean that Scarborough Centre would not be served by rapid transit for several years and these options presented no compelling advantage relative to McCowan. The SRT closure would result in greater travel times, less convenient and reliable transit service and would likely result in a reduction in transit ridership in Scarborough Centre. Option 2A preserved operations of Line 3 during construction of the SSE. The July 2016 report identified a cost of approximately $171 million (2016$) to shut down the SRT during the construction of the SSE.

City Council directed staff to consider other possible express subway alignment options, including an alignment along the existing Line 3 corridor. In an update to the initial business case (Attachment 1) staff re-evaluated the preferred McCowan express alignment, and identified and assessed six additional express subway alignments in an effort to reduce capital costs, while still meeting the objectives of the project, i.e., to encourage the development of Scarborough Centre as a vibrant urban node.

The update to the IBC concludes that the express subway extension along McCowan is preferred as it best supports the development of Scarborough Centre into a vibrant urban node:

- It better serves existing destinations, population and employment on both sides of McCowan Road;
- It is close to the McCowan Precinct, where future growth is planned and development pressure is greatest; and
- It supports plans to orient development around the McCowan Road corridor and specifically the Bushby/Town Centre Court gateway, including the expansion of the Scarborough Town Centre to this central area.

The express options that were considered, and initial screening results, are summarized in the table below.

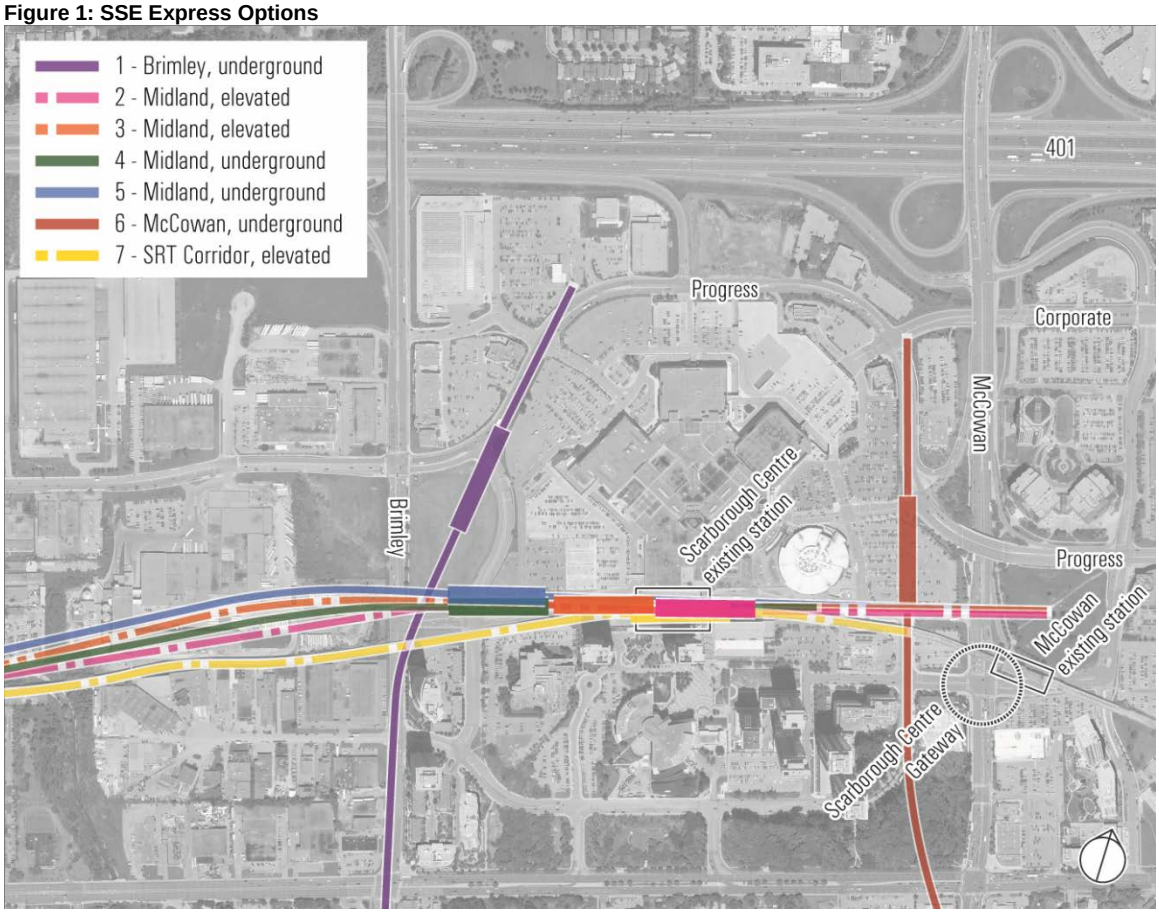
Table 4: Express Options – Initial Screening Results

Option	Screening Assessment	Cost Estimate ($B, YOE)
1. Brimley – Underground, north/south alignment	Carried forward for further analysis: Evaluation is included in this updated IBC	$2.945
2. Midland – Elevated, east/west alignment	Removed from consideration: Requires closure of SRT; cost savings not considered sufficient to justify impact to existing SRT customers	$3.013
3. Midland – Elevated, east/west alignment, station further west	Removed from consideration: Requires closure of SRT; inferior station location- i.e., further from centroid of existing and future customers; cost savings not considered sufficient to justify inferior station location and impact to existing SRT customers	$3.004
4. Midland – Underground, east/west alignment, station further west	Removed from consideration: Requires closure of SRT; cost savings not considered sufficient to justify impact to existing SRT customers	$3.129
5. Midland – Underground, east/west alignment, station further west	Removed from consideration: This option is approximately the same cost as the preferred McCowan alignment but has an inferior station location, i.e., further from centroid of existing and future customers	$3.316
6. McCowan– Underground, north/south alignment (previously preferred) **Recommended**	Carried forward for further analysis: Evaluation is included in update to IBC	$3.159; $3.346 with Triton bus terminal concept
7. SRT Corridor – Express subway to Scarborough Centre via SRT corridor (2.2km portion at-grade), with elevated east-west alignment into Scarborough Centre	Removed from consideration: Requires closure of SRT; cost savings not considered sufficient to justify impact to existing SRT customers	$2.966

Notes:
• SSE cost estimates prepared by the TTC. Estimates include cost to construct.
• Costs do not include costs for project delivery, management reserve or risk allowances. These costs are reflected in the staff report to the Executive Committee.
• Costs do not include lifecycle and operations/maintenance.
• Costs have been escalated based on the preliminary schedule. The schedule reflects in service by Q2 2026, with construction taking approximately 6 years (2020-2026). Schedule based on March 2017 approval to proceed.
• Cost estimates have been developed at approximately 5% design and are a Class 4 cost estimate (per AACE guidelines).

Figure **1** illustrates the alignment[3] and station location of all options evaluated.

Figure 1: SSE Express Options



Of the options evaluated, the previously-preferred McCowan alignment, and a new Brimley alignment were carried forward for further analysis in an update to the Initial Business Case (Attachment 1).

Brimley Express Alignment

The Brimley alignment emerged as an option because it would keep Line 3 operational during construction, and cost less than the previously-preferred McCowan option. An express extension along Brimley Road would place the station beneath Progress Avenue (oriented towards the north-east) east of Brimley Road and west of Scarborough Town Centre (Figure 2).

[3] East-west alignments overlap and are separated for illustrative clarity. Figure 3 provides a more accurate alignment for Option 7.

Figure 2: Brimley Express Alignment

The Brimley alignment is estimated to cost approximately **$**214 million (YOE) less than the McCowan alignment. Most of the cost savings can be attributed to the alignment being shorter and located on a less constrained station site. The station site is not encumbered by nearby buildings and has fewer roads or underground infrastructure; it is essentially an empty field and parking lot, not adjacent to any destinations. Further, significant growth in this area is not anticipated as it is in close proximity to successful industrial uses that are incompatible with a mixed use urban area.

Additional measures were added to the updated IBC to provide greater clarity regarding the differences between the Brimley and McCowan alignments. The updated IBC concludes that the express subway extension along McCowan is preferred as it best supports the development of Scarborough Centre into a vibrant urban node.

SRT Corridor

In July 2016, Council directed staff to assess and prepare a cost estimate for reusing the existing SRT corridor, using surface or above ground track from a point south of Lawrence. This option has been considered in the table above as "Option 7".

This option would be tunnelled east of Kennedy station, turn back to the west below a residential neighbourhood and meet the SRT corridor south of Lawrence Avenue. The alignment would emerge from the ground via a portal on the south side of Lawrence Avenue and north of Ellesmere Road; it would then rise on an elevated structure to cross over the Stouffville GO corridor. The alignment would remain elevated along the existing SRT corridor and into Scarborough station (Figure 3). This alignment differs from Option 2C that was part of the July IBC as it minimizes tunnelling while Option 2C was tunnelled beneath the Stouffville GO corridor and into Scarborough Centre station.

Figure 3: Elevated Option along SRT Corridor

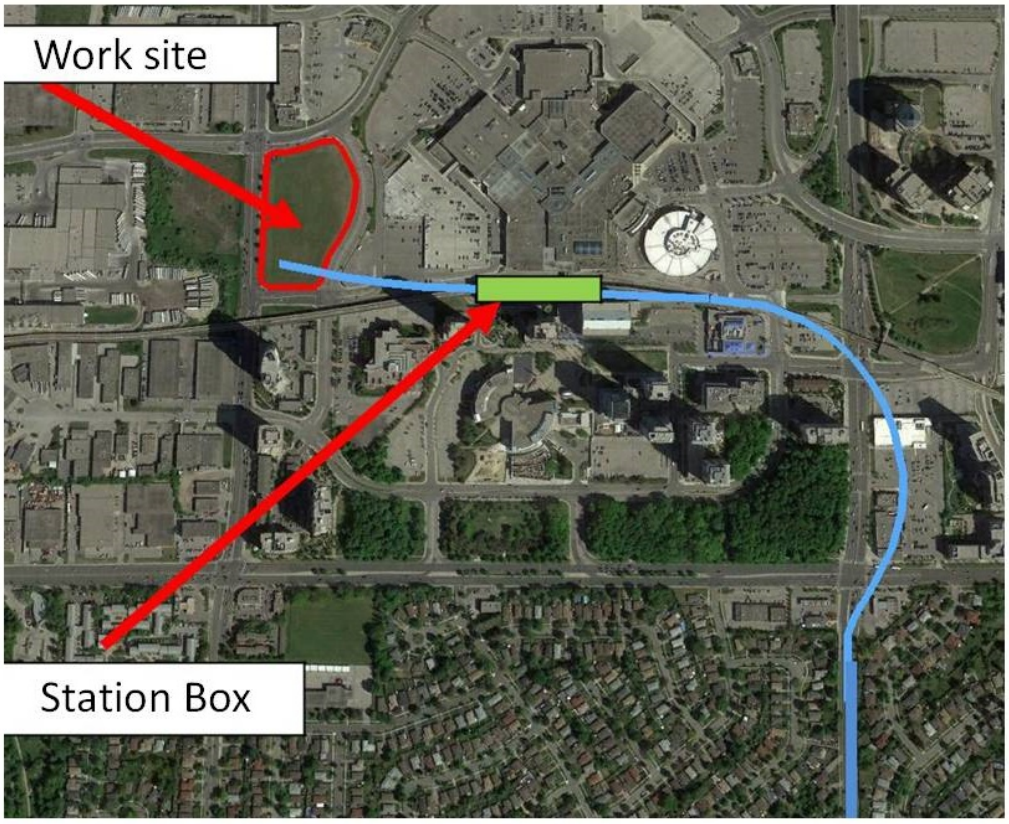
Further assessment has confirmed that this option would require the closure of the SRT during construction as the portal and elevated track would need to occupy the same area as the existing track.

Estimated cost for this option is $2.966 billion (YOE$). The SRT alignment has been removed from consideration because it would require the closure of the SRT.

The Big Bend

The project team reviewed an option introduced by the Glen Andrew Community Association (GACA). The alignment termed "the Big Bend" would be similar to the preferred McCowan alignment, but would turn west just north of Ellesmere Road, with a station located in the vicinity of the existing Scarborough Centre Station. The alignment's tail tracks would terminate in a vacant lot on the north-east quadrant of Brimley Road and Triton Road. An image of the group's proposal is shown below (Figure 4).

Figure 4: The Big Bend



Source: Glen Andrew Community Association

The GACA has suggested the Big Bend, if constructed using a large diameter tunnel, would:

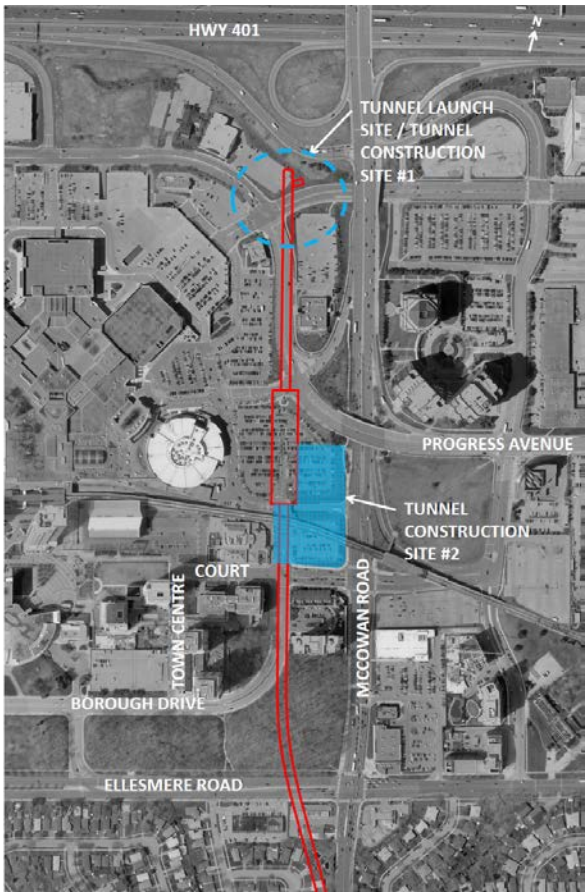
1. Place a station at the existing location of Scarborough Centre Station, without cut-and-cover construction or the decommissioning of the Scarborough RT;
2. Avoid tunnelling beneath 10 residential properties on Stanwell Drive; and
3. Avoid a tunnel work site location at Ellesmere/McCowan.The design and construction of a terminal subway station has significant complexities that require a width greater than the available space between the existing

Scarborough Centre Station and the Scarborough Town Centre. While TTC has undertaken significant work in this regard, it has not identified any station concept – regardless of tunnel diameter or construction method – that could be built in the area between the mall and the SRT structure without the closure of the SRT.

TTC staff identified two preliminary alternate alignments based on the Big Bend concept, by applying current design standards. It was determined that both of these alignments would cause much greater impact to private residences; one would require tunneling beneath 22 homes, while the other would require tunneling below two multi-storey buildings (YMCA and 300+ unit condominium at 61 Town Centre Court). Either of these alignments would impact more property owners than the recommended McCowan alignment.

Five potential tunnel work sites that each had significant community impacts were identified in the July 2016 report to Council. Based on outcomes of the Value Engineering workshop undertaken by TTC (see section 2), the tunnel construction site has been relocated to north of Town Centre Court, west of McCowan Road.

Figure 5: New Tunnel Construction Site Location



Although cost estimates have not been prepared for the alignments based on the Big Bend concept, both alignments were longer than the recommended McCowan alignment, which suggests that costs would be higher.

Analysis has shown the Big Bend alignment would require the removal of the SRT during construction and would affect more property owners than the preferred McCowan alignment. Additionally, TTC has found a feasible alternative tunnel work site away from the Ellesmere/McCowan intersection. Based on this analysis, the Big Bend concept is not recommended.

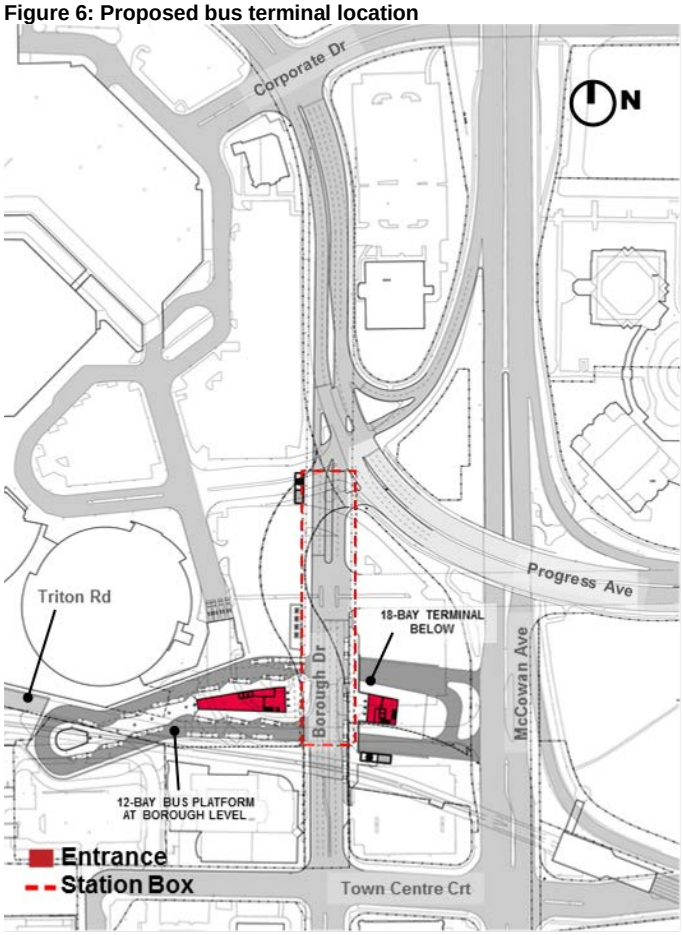
Bus Terminal for the Recommended McCowan Alignment

A key component of the SSE alignment is the station design, including all the elements needed for the station to operate as a transit hub. One significant station element is the bus terminal. The function of the bus terminal is integral to the success of the SSE as it provides a key transfer for many local and regional routes. A bus terminal that offers seamless transfers, with good connections, is essential to support existing riders, and can act as an incentive to attract new transit riders.

The future Scarborough Centre station will require a new bus terminal to accommodate an expansion of bus networks including TTC and GO Transit as well as Durham Rapid Transit (DRT) and private inter-city carriers. The terminal's proximity to the Scarborough Town Centre, and location in the core of Scarborough Centre, will provide fast and easy connections to this regional destination. Based on TTC design standards and the requirements of GO, Durham and the inter-city carriers, this terminal will require a total of 34 bus bays.

The bus terminal will be located in the vicinity of Triton Road and the preferred concept, while still under refinement, is proposed to be divided into two levels to reduce its overall footprint and protect future development potential near the subway station (Figure 6).

Figure 6: Proposed bus terminal location



City staff will continue to refine this concept to ensure the design supports growth and development in the area while potentially reducing cost. Examples of refinements include:

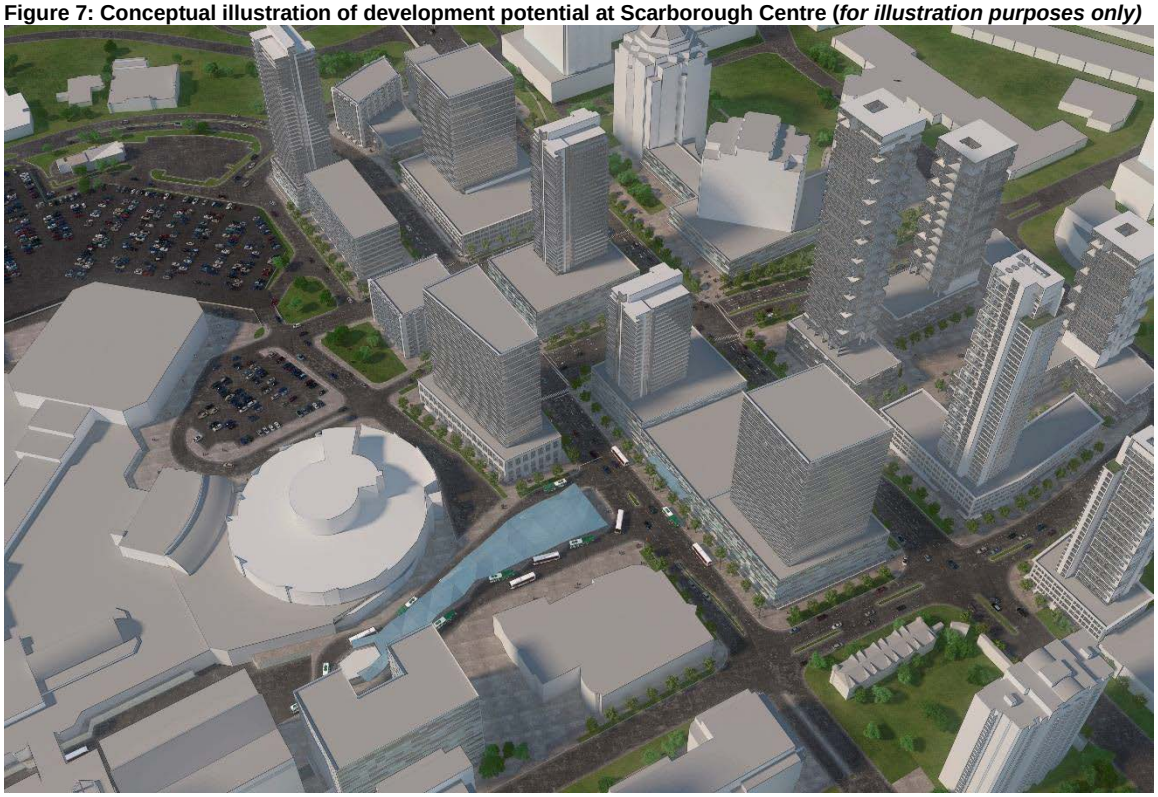
- footprint of stacked terminal to reduce property impacts
- design of entrances to bus terminal on both McCowan and Borough
- design of Borough Drive bus bays/stops
- cross section of Borough Drive
- public realm in the area surrounding the bus terminal

This conceptual design allows for a large bus terminal that also supports the development of Scarborough Centre into a dense downtown with an urban street network that enables denser development and improved pedestrian connections.

Figures 7 and 8 illustrate how Scarborough Centre could develop around the subway station and bus terminal. This illustration represents a long-term vision and has not taken specific plans of current land owners into account. This illustration also assumes that a street network consistent with approved planning policy is implemented. The street grid that will best support the development of

Scarborough Centre will be further articulated through the ongoing Scarborough Centre Transportation Master Plan.

Figure 7: Conceptual illustration of development potential at Scarborough Centre (*for illustration purposes only)*



The intersection of McCowan Road and Bushby Drive/Town Centre Court is envisioned as the gateway to the Centre. Today, McCowan Road is a challenging environment for pedestrians, including transit users. The road has been designed primarily for vehicles, with grade separated intersections at Progress Avenue and several free-flow access ramps. In order to achieve the vision for Scarborough Centre, it is critical to change the nature of McCowan Road in this area. Pedestrians must be able to access destinations, including the subway station, and they must feel safe walking along McCowan Road and crossing it.

Figure 8 shows how the bus terminal could enable the transformation of McCowan Road.

Figure 8 - Conceptual Illustration of McCowan Road Development *(for illustration purposes only)*

City and TTC staff will continue to refine this terminal concept to ensure the design supports growth and development in this area while minimizing cost and impact to private properties.

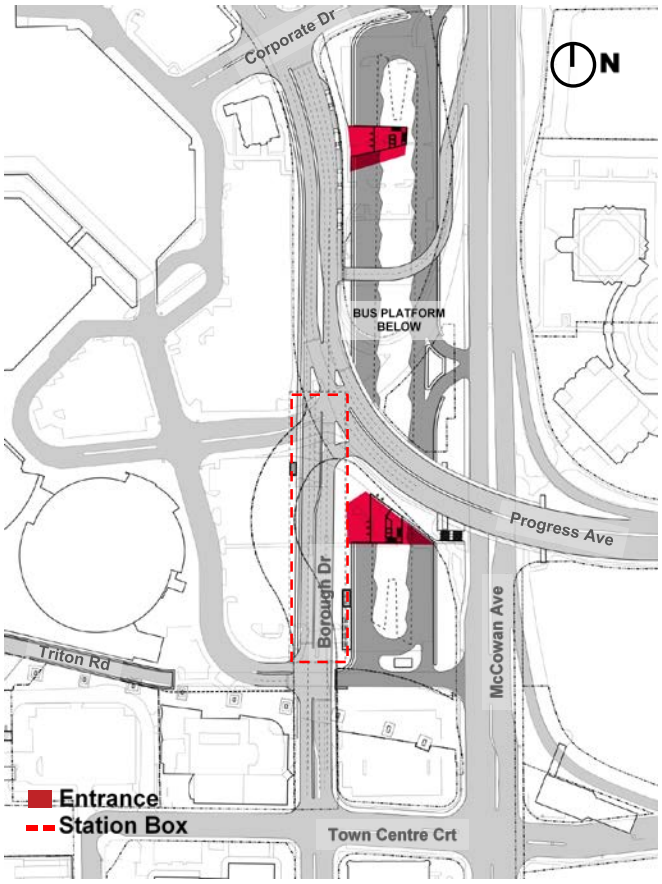
These issues will be addressed through the design stages of the project. Landowners in the area surrounding the bus terminal, including Oxford Properties and the Government of Canada, will be key stakeholders in further refinements. An update on the station concept will be provided to City Council at the same time as the Class 3 cost estimate for the project, prior to procurement.

The ongoing Scarborough Centre Transportation Master Plan (TMP) will be incorporating the selected bus terminal designs and associated bus movements to ensure the best future street network and design. The TMP will be advancing approval under the Environmental Assessment Act for street networks envisioned by approved planning policies. An information report on the progress of the TMP was discussed at Scarborough Community Council in February, 2017.

At-Grade Bus Terminal

The cost estimate presented to Council in July was based on an at-grade bus terminal concept. This concept would span approximately 400 metres from Triton Road to Corporate Drive, between McCowan Road and Borough Drive (Figure 9).

Figure 9: At-Grade Bus Terminal

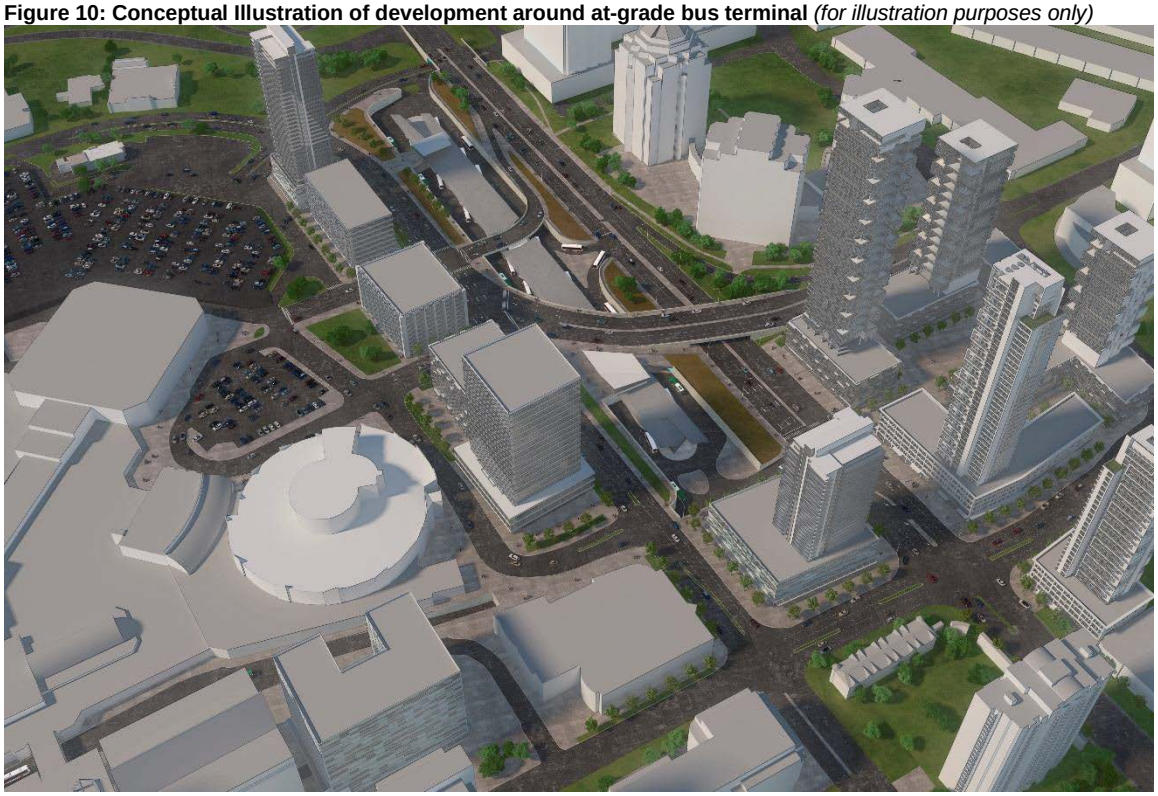


This terminal concept is not supported by City staff as it fails to deliver on project objectives:

1. Creates a physical barrier between the subway and the McCowan Precinct – where the greatest growth potential is anticipated;
2. Precludes a finer grain street grid needed to create a vibrant urban node; and
3. Eliminates prime development potential between Borough & McCowan (both future main streets).

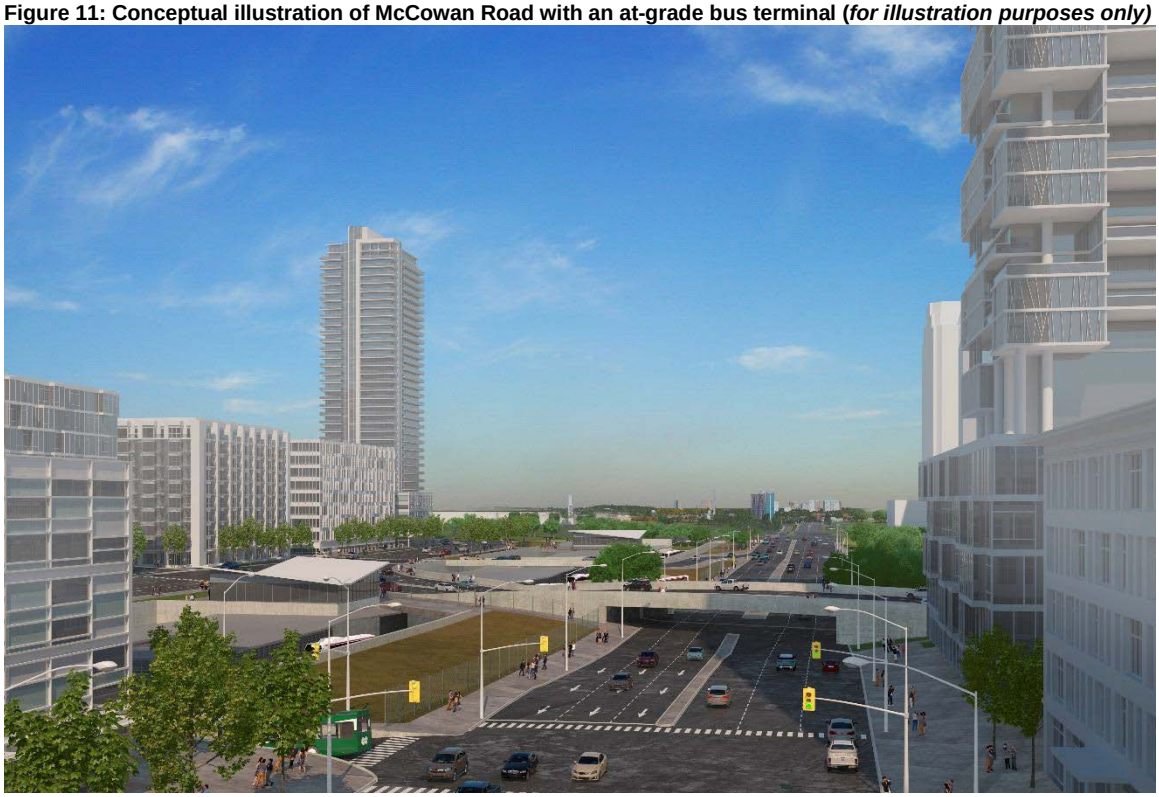
Figure 10 illustrates how this bus terminal would negatively impact development potential and create a barrier between the subway station and the McCowan Precinct, where future growth is planned and development pressure is the greatest.

Figure 10: Conceptual Illustration of development around at-grade bus terminal *(for illustration purposes only)*



The at-grade terminal design would preclude significant changes to the street grid around McCowan Road by requiring any new east-west streets to be built over top the terminal. The terminal would also reinforce McCowan's hostile environment for pedestrians, including transit users, by requiring more substantial free-flow ramps coming off of McCowan and completely sterilizing the western side of McCowan. Figure 11 illustrates how McCowan Road could look if an at-grade bus terminal was constructed.

Figure 11: Conceptual illustration of McCowan Road with an at-grade bus terminal (*for illustration purposes only)*



Additional renderings are shown in Attachment 3.

Bus Terminal Costs

The TTC has identified a cost for the McCowan alignment of $3.159 billion. The cost includes an at-grade bus terminal. The staff-recommended Triton Road bus terminal concept is estimated to cost $187 million (YOE) more than the at-grade bus terminal. Transforming Scarborough Centre into a denser urban node will benefit the city in many ways, and could encourage greater development around Scarborough Centre. Overall, ensuring that the Scarborough Centre Station is integrated with the surrounding urban neighbourhood will maximize the benefits realized from the investment in the SSE.

Property Requirements

The following 42 permanent property requirements have been identified based on the McCowan alignment:

1. Full property interest in one commercial property (for a traction power substation).
2. Partial property interests in 35 private properties and 6 properties under City of Toronto, provincial or federal ownership.

The temporary tunnel construction site is located on the Scarborough Town Centre lands. Further temporary property requirements for construction will be confirmed during design.

2. Value Engineering

Value Engineering

In July, 2016, City Council directed the City Manager and the CEO of the TTC to retain the services of a third-party rail transit construction and cost-estimation expert to assess the risks and complete a detailed cost review of the TTC's cost estimates for the express subway along the McCowan alignment.

In order to address this direction, in September, 2016, a value engineering (VE) team was convened to review the current design for the McCowan alignment, with the goal of investigating opportunities to reduce construction costs, simplify construction, or reduce maintenance. The scope included a review of the project risk assessment, schedule and cost estimate.

The exercise brought together a team of industry experts from across North America, specializing in the following areas:

- Tunnelling
- Architecture
- Structure
- Construction
- Risk Assessment
- Cost Estimating

The VE team evaluated the McCowan alignment, with an at-grade bus terminal, as the base case.

VE Workshop

A VE workshop was performed over a five-day period where, with support from the project team, the VE team worked to identify concepts that might address the noted goals. Pre-workshop activities included data collection and review and analysis of study materials prepared by the project's design team.

Workshop attendees identified and categorized the functions of the project to better understand which functions were most critical to the long term objective of the project of moving people. This exercise also ensured there could be a focus on generating ideas that might reduce the cost of the project.

The VE team proposed 62 items for consideration. Based on a preliminary assessment, the TTC will carry forward 29 ideas to be analysed or carried forward into detailed design. The items to be analysed touch on tunnel, station and bus terminal design, as well as construction staging. The items that were removed were either duplicates, were not acceptable or had no tangible benefit.

One VE item that has been adopted is based on staging of the tunnel construction. The concept has enabled the tunnelling construction site to be relocated north, into the mall area, away from the vicinity of McCowan and Ellesmere. In so doing, this addressed concerns of the local community.

Some other VE ideas associated with optimizing the at-grade bus terminal were examined. As the Triton bus terminal concept is being recommended, these ideas were not pursued past conceptual evaluation.

Risk Assessment

The VE team reviewed the TTC's initial risk register of approximately 200 risks, as well as the initial analysis of the likelihood and impact of certain risks materializing. The VE team identified 5 additional risks.

The VE review concluded that the work to date is in keeping with industry practice and developed beyond typical expectations at this early stage.

The review recommends:

- Incorporating VE-identified risks.
- Establishing a cost and schedule risk allowance. The need to establish these allowances was also captured in KPMG's recommendations.
- Establishing a Management Reserve that would be used to address unknown issues that will surface during the life of the project. For example, unknown issues could arise as changes in scope/stakeholder requirements, or unknown field conditions.
- Establishing a program risk committee that will actively evaluate and update the risk register during the life of the project.

Attachment 4 provides the Executive Summary of the Value Engineering Study Report.

3. Cost Review Findings

The VE team included a consulting firm that specializes in cost estimating. The cost consultant completed a peer review of the TTC's estimate for the McCowan alignment, with an at-grade bus terminal.

The TTC's estimate for the SSE project is based on per unit costing of some items, based on industry standards, quotes, and the TTC's own costs on past

projects such as the Toronto-York Spadina Subway Extension. Other elements of the estimate are allowance-based, calculated as a percentage of the hard costs.

The peer review confirmed the TTC estimate is valid and appropriate for the current level of design, which they believe to be 2-5% complete. At this level of design, cost estimates are anticipated to have a degree of accuracy of -30% to +50% according to AACE guidelines.

The peer review suggested a potential increase to the budget of approximately 5.7% from the TTC estimate. At the current level of design, this is considered to be equal.

A noted component of the suggested increase is the inclusion of a management reserve of 7.5% to address any changes in scope to the project outside the current concept. The establishment of a management reserve was also suggested as part of the VE review of the risk assessment. In its review of the TTC's delivery of its capital program delivery, KPMG also recommended that the TTC incorporate management reserve into its estimates to ensure that risk-based contingency is clearly associated with risks, and cost changes due to additional or altered scope can be clearly identified.

The Cost Review report can be found in Attachment 5.

4. Procurement options analysis

By adopting the recommendations set out in the staff report on Project Delivery Options in May, 2015, City Council directed City and TTC staff to:

- retain the services of Infrastructure Ontario ("IO") to carry out a Procurement Options Analysis ("POA");
- report back to Council with a recommendation on whether to proceed with a Design-Bid-Build ("DBB") or Design-Build-Finance ("DBF") option for procurement and also with recommendations with project management, delivery and governance; and
- structure preparatory work on the SSE so as to preserve the ability to proceed with whichever procurement and delivery option is recommended to Council.

Description and High-Level Comparison of Potential Procurement Options

The following is a high-level summary of the two options selected for further evaluation in the May, 2015 Council direction.

Design-Bid-Build

The TTC has traditionally used the DBB approach for all of its major capital projects. Under this approach, the infrastructure is designed by the TTC in collaboration with a team of private consultants. The TTC then initiates a competitive bidding process to select construction contractors to build the facility to the design specifications.

Debentures are issued by the City to raise the required funding and the TTC provides progress payments to the contractors throughout the project.

Although DBB is often described as a public sector approach, it is important to note that the vast majority of the project delivery under this approach is still provided through the private sector.

One of the principal benefits of the DBB approach is that the TTC, responsible for maintenance and operation of the infrastructure, can maintain a high level of input and control over the design. This may be a particularly important benefit in a project that involves the extension or expansion of an existing facility.

However, under a DBB approach, the contractors may not have a sufficiently high incentive to collaborate to achieve on-time completion because progress payments limit their exposure to financing costs, and delays by other contractors may entitle them to extra fees.

Finally, because the design is developed by a party separate from the contractors' team, the contractors might be more inclined to submit change orders for any deviations that add to the cost of construction.

This applies for the historical DBB approach with multiple construction contracts. DBB as a single contract is discussed later in this report.

Design-Build-Finance

Under the DBF approach, the TTC would work with various advisors to prepare high-level specifications that describe the desired outputs for the project rather than defining the specific design of the infrastructure.

The objective of this approach is to transfer design-related risks (additional costs resulting from design errors & omissions, unforeseen site conditions etc.) to the private partner and also to provide the private partner with the latitude to consider innovative design and construction approaches that could reduce the cost of the project.

This benefit arising from design latitude is potentially greatest in a project in which the private partner has a long-term stake in the project, such as a Design-

Build-Finance-Maintain ("DBFM") or Design-Build-Finance-Operate-Maintain ("DBFOM"). Under these project structures, the private partner will bear the responsibility if there are unforeseen maintenance or operation consequences arising from alternative approaches to the project design. However, under a DBF, the private partner will only have responsibility for the project until the end of a project warranty period (typically two or three years). Therefore, under a DBF, the output specifications may need to be more prescriptive to ensure that a quality project is delivered that meets the TTC's lifecycle requirements.

Under the DBF approach, the private partner will typically provide financing for a portion of the construction costs incurred until substantial completion of the project. This should result in a strong incentive for the private partner to achieve substantial completion at the earliest possible date. A failure to achieve the scheduled substantial completion date will result in substantial pressure on the contractor from the entities that have provided the necessary financing.

It should be noted that, although the private partner will be providing financing during the construction period, the funding for the project will still be provided through the City/TTC. Also, the City/TTC will be the owner of the project.

2016 Draft Procurement Options Analysis by Infrastructure Ontario

In accordance with Council's direction, Infrastructure Ontario was retained by the City and initiated work in the fall of 2015 on a POA based on the original 3-stop design for the SSE. The TTC provided IO with its available construction cost estimates based on a 2-3% level of design completion.

The analysis carried out by IO included the following steps:

- Assessment of Feasible Procurement Options
- Qualitative Assessment of Procurement Options
- Market Sounding
- Value for Money Analysis
- Summary of analysis
- Recommendation and considerations
- Next steps (e.g., costing)

The initial review of options confirmed the elimination of the DBFM and DBFOM P3 options from further assessment as the line will be an extension of the existing subway and the operation will have to be integrated with the TTC's operation of the existing subway. Consequently, the TTC will operate and maintain the extension.

With the comparison focused on DBB vs. DBF, the qualitative assessment highlighted certain important advantages for the DBF approach, such as higher

opportunity for budget and schedule certainty and improved innovation, which led to a higher overall qualitative score for DBF.

A Market Sounding sought opinions from general contractors, developers, and financiers with respect to their interest in the project, potential procurement models, and critical project risks. Feedback received indicated a preference for carrying out the project using an AFP (Alternative Financing and Procurement) model. Most feedback indicated there would be interest regardless of the delivery strategy.

The final element of the analysis carried out by IO was the Value for Money ("VFM") Analysis. This analysis compares the expected cost of delivering the project using a traditional public sector model (DBB in this case) with the expected cost of delivering the project using a P3 model (DBF in this case).

The fundamental principle underlying AFP is that the party which is best able to manage a given risk should assume that risk. In the VFM analysis, once the identified risks were quantified, the value of the risk retained by each party was added under each of the DBB and DBF models in order to compare procurement models on a risk-adjusted basis. In order to quantify the value of risk under each procurement model, a risk workshop was held with representatives from IO, the TTC, the City, PPP Canada and Ernst and Young. The VFM analysis indicated a preference for procuring the project through the DBF model.

Following Council's decision in July, 2016 to pursue the single-stop express model, a second quantitative VFM analysis for the new express scope was not undertaken as the scope changes were considered unlikely to result in a different outcome.

2016 TTC Contract Packaging Analysis

In the summer of 2016 the TTC coordinated a qualitative procurement options analysis based on the express one-stop SSE design option which was intended to complement the IO POA work done earlier on the original 3-stop design option. This analysis considered how to package the project elements under various delivery options and then evaluated the options using project-specific criteria, including schedule and risks.

The analysis on the express subway option was carried out in workshop format with members of the SSE project team who have:

- hands-on experience delivering large rail projects through DBB, DB and DBFM models;
- knowledge of risk allocation under the above models, and,
- experience carrying out delivery options and contract packaging analysis.

The analysis entailed the following stages:

- Project Definition
- Initial Screening of Delivery Options
- Contract Packaging Options Screening
- Selection of Preferred Option

The initial screening arrived at almost the same short list of delivery options as the IO POA. The analysis next considered various contract packaging options, which were narrowed down to single construction contract options: DB - one design and construction contract, and DBB - one construction contract. These options surfaced as they eliminate handover risks between contracts, and also simplify project management and dispute resolution.

DBB as a single contract differs from the DBB approach described above, which is the more historical approach of multiple contracts. As a single contract, the DBB contractor would have the benefit of having full control of the site and construction staging, similar to the DB contractor. DBB as one contract was also not contemplated in the IO review.

Financing, or the 'F' component, was included with each option based on the following benefits:

- increased contractor motivation for project completion because of the impact that delays have on financing costs, and
- additional oversight applied by the contractor's lender.

DBF and DBBF, both based on single construction contracts, were assessed on the following criteria:

- Schedule
- Budget
- Interface risk during construction
- Integration risk
- Requirements Definition Risk
- Design Errors & Omissions Risk
- Site Conditions Risk
- Construction Quality Risk
- Lifecycle Optimization

The analysis of these criteria concluded that there is a marginal benefit in choosing DBF over DBBF from the point of view of budget, integration risk, and site condition risks.

Other Considerations

This report recommends that a DBF approach be taken towards the procurement of the SSE. As discussed above, this approach has the potential to most effectively allocate project risks, particularly design risk.

However, it is anticipated that the basic nature of the project, as an extension of an existing subway line, will substantially constrain the scope for design innovation that is usually a principal benefit of P3 procurement. Many components of the SSE, such as control systems, will have to be tightly integrated with the existing systems on the rest of the Bloor Subway line. Therefore, these systems will have to be fully defined by the TTC in the contract documents, which will limit the potential for innovation by the contractor. This constraint results in the DBF approach only having a marginal benefit relative to a single-contract DBBF approach.

In addition, the TTC currently only has limited experience with the DBF form of procurement. In carrying out the procurement of the SSE, the TTC will already be adopting a number of other major changes to its methodology that address the issues and concerns that have been raised on recent projects.

As discussed above, the one-contract DBBF approach shortlisted in the TTC's Contract Packaging Analysis could allow the TTC to avoid the handover issues between contracts that have had negative schedule and project cost impacts on the Toronto York Spadina Subway Extension project.

The TTC will also, as discussed further below, be adopting a number of important recommendations made by KPMG as part of the broader TTC Capital Program Delivery Review. These include the creation of a Management Reserve, the adoption of a holistic approach to project budgeting, and the use a Stage-Gate approach for formal structuring of project approvals.

Finally, the TTC has also, through its Contract Packaging Analysis, implemented a much more formal and structured approach towards the budgeting for specific project risks.

Procurement Support for Design-Build-Finance Procurement

The TTC does not currently have significant experience with preparing high-level specifications that describe the desired project outputs as part of a DBF procurement. As discussed above, the TTC has previously carried procurement of major infrastructure projects through the DBB approach in which the full design of the project has been carried out by the TTC in collaboration with a team of private consultants.

IO has the greatest amount of experience in Ontario with preparing output specifications and procuring infrastructure through AFP methodology. Major construction companies are now familiar with the process and contract documentation that is commonly used by Infrastructure Ontario for AFP procurement. IO also has considerable experience in managing the various sub-consultants that support AFP procurement. It would be cost and time-prohibitive to replicate IO's capabilities within the TTC or to retain the services of another consulting firm to provide these capabilities.

Therefore, this report recommends that a critical condition for proceeding with a DBF procurement for the SSE be the successful negotiation of a project procurement support services agreement with IO. This agreement would provide the TTC with the support required with DBF procurement but still provide the TTC with the final authority to make all major project management decisions.

Under this agreement, it is anticipated that IO would:

- Provide and lead procurement coordination and transaction services up to and including the date of closing for the agreement with the successful proponent (Financial Close)
- In conjunction and coordination with the TTC, develop procurement documents and negotiate the terms and conditions of the project agreement and any other agreements entered into in respect of the contract
- In connection with the foregoing, provide Request for Qualification (RFQ), Request for Proposal (RFP) and other project documents based on Infrastructure Ontario standard processes and documents that shall, in conjunction and coordination with the TTC, be customized appropriately for this project
- Manage the development of the RFP, including the development of Project Specific Output Specifications (PSOS) incorporating planning, design, operations and background information as developed by the City and the TTC
- Provide support for the TTC for a substantial period following Financial Close to facilitate the orderly and effective transition of the project to the TTC

The agreement would recognize that the TTC, as operator of the project, with the responsibility to ensure that the project achieves the paramount objectives of public safety, efficient passenger transportation, and value for taxpayers, will have final approval authority on all decision-making during the entire project. Furthermore, the agreement and project delivery will also recognize other City Council approved objectives for the project, such as city building. It is anticipated that Infrastructure Ontario's relationship with the TTC will generally be based on the typical contractual arrangement for consulting advisors retained by the TTC.

5. Project governance

To date, an executive steering committee chaired by the City Manager and the CEO, TTC provides overall direction and oversight on the project.

The executive steering committee has overseen the work of a joint project team in developing the initial concept, early planning analysis and initial business case for the project. As the project moves from planning into detailed design, existing project oversight mechanisms will be refined.

In September, 2016, the TTC Board considered a review of the TTC's capital delivery process by KPMG. The report made 41 recommendations to improve delivery of the capital program at the TTC, all of which were accepted by the TTC. Several of the recommendations relate to enhancements to governance of major projects. The TTC is in the midst of implementing the recommendations through a plan approved by the TTC Board in December, 2016.

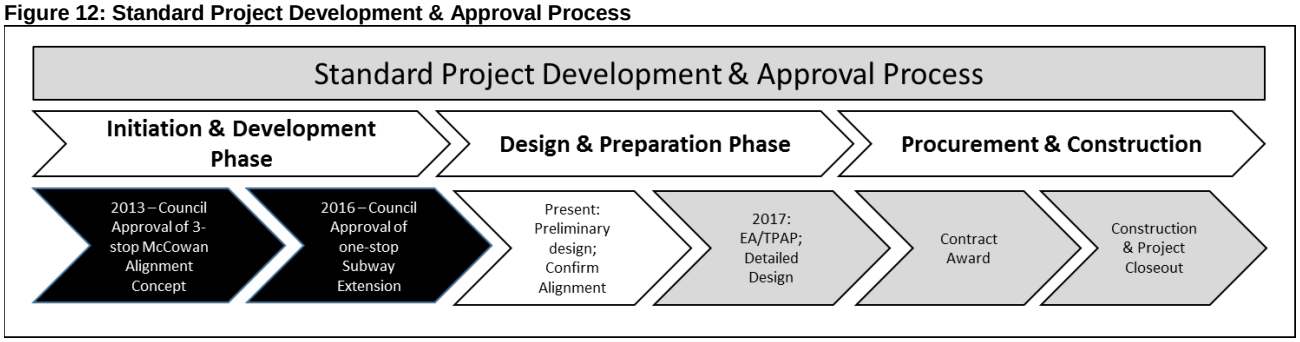
Stage Gate Process

A key recommendation of the KPMG review of the TTC Capital Program Delivery is to implement a stage gate process to introduce key decision points as new projects are developed and implemented.

The SSE was approved by City Council with a budget and schedule in 2013 prior to detailed due diligence on the project. Several reports to City Council and the TTC Board have reported on the development of the project from initial concept to more detailed feasibility and technical analysis, with an initial business case presented in 2016.

While work on the SSE is already underway, establishing subsequent decision points, or "gates", to guide subsequent stages of development and implementation of the SSE project will help to ensure that robust information and evidence is developed and shared on key aspects of the project to support decision-making. Formal check in points also offer an opportunity to confirm the project still achieves the intended benefits/objectives set out when first initiated. The diagram below shows the major gates the SSE project has already gone through, as well as the major decision points to come.

Figure 12: Standard Project Development & Approval Process



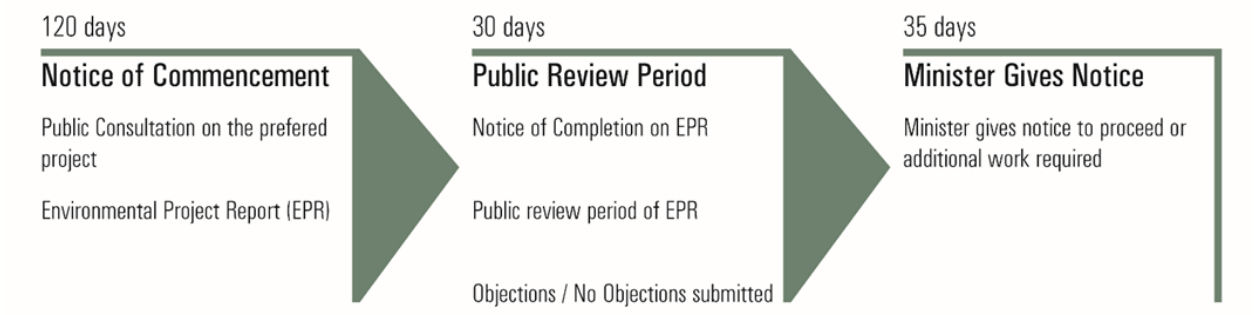
6. Next Steps

Transit Project Assessment Process

Once the preferred alignment is adopted by City Council, the project team will proceed to complete the Environmental Project Report (EPR). A Notice of Commencement will be issued in April 2017, with a public meeting to follow in early May. The project team will have 120 days to complete the EPR and issue a Notice of Completion.

Once complete, the EPR will be available for a 30-day Public Review Period. During this period, the public, regulatory agencies, aboriginal communities and other interested persons may submit objections. A 35-day Ministerial Review period will begin, where the Minister of Environment and Climate Change reviews the EPR and any submissions objecting to the project. Following the 35 day review period, the City and TTC will file a Statement of Completion, unless the Minister of the Environment and Climate Change gives notice that the project is subject to conditions or further steps.

Further information is available in the Guide to Ontario's Transit Project Assessment Process (https://dr6j45jk9xcmk.cloudfront.net/documents/1799/3-8a-6-ea-transit-projects-en-pdf.pdf)



Funding Commitments

The SSE project has received funding commitments from both the federal and provincial governments. These commitments comprise the majority of funding for the project. Neither commitment has progressed to a formal funding agreement.

The Province, through Metrolinx, has agreed to make available the funding allocation associated with the previous Metrolinx Scarborough LRT project that is part of the Master Agreement between Toronto, Metrolinx, and the TTC. The $1.48 billion allocation in 2010$ was estimated in 2013 by the City to be worth $1.99 billion against project cash flows, however, this total has not been confirmed through a funding agreement.

The federal funding commitment of $660 million was made under the Provincial-Territorial Infrastructure Component of the New Building Canada Fund program. In order to receive the federal funding, the Province must approve the allocation of the federal funding to the project under the program. A formal application was made by the City to the Province in 2014.

7. Conclusion

This report recommends City Council approve the McCowan express alignment following extensive due diligence on alternative options in the June 2016 Initial Business Case and the update to the IBC for the SSE (Attachment 1). The report also recommends approving a Triton bus terminal concept in order to support the project's planning objectives of supporting growth in the Scarborough Centre.

The report recommends an approach to procurement as the project moves into the next phases of detailed design and construction. City and TTC staff plan to report at the next key decision milestone for this project in late 2018 with the following:

- Class 3 cost estimate (approximately 30% design) suitable for establishing the project budget baseline;
- An updated budget to reflect the best practices recommended by KPMG (i.e. management reserve, risk-adjusted budget) and Council-directed scope additions (i.e. public realm, platform edge doors) in line with recommendations to include holistic scoping in the budget for major capital projects; and
- An updated funding and financing strategy to reflect the budget based on a Class 3 cost estimate, including status of the intergovernmental funding agreements with provincial and federal governments.

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Peter Wallace, City Manager

ATTACHMENTS

Attachment 1 - Update to the initial SSE business case
Attachment 2 - Draft Environmental Project Report Executive Summary
Attachment 3 - Additional Renderings of Scarborough Centre Station area
Attachment 4 - Value Engineering Report Executive Summary
Attachment 5 - Cost Estimate Peer Review report

EX23.1

ATTACHMENT 1:

Update to the Initial Business Case- Scarborough Subway Extension (SSE)

BACKGROUND

At its July 12, 2016 meeting, City Council (EX16.1) received Initial Business Case (IBC) reports for transit infrastructure projects identified as part of the City's rapid transit plan. An IBC for the Scarborough Subway Extension (SSE) provided evidence in support of an express subway extension from Kennedy Station to Scarborough Centre along the preferred McCowan alignment relative to the base case option (3-stop McCowan SSE). City Council directed staff to remove from consideration the 3-stop McCowan SSE, and to further develop the express option.

Through an exercise aimed at identifying opportunities to reduce the capital cost of the SSE in a way that would allow the project to still achieve its objectives, additional alignment options were identified in Q3 2016. Of these options, one emerged as a potential option to be brought forward for evaluation within the update to the IBC. This option included an express alignment between Kennedy Station and Scarborough Centre via Eglinton Avenue East and Brimley Road, with a station located on an undeveloped site on the western edge of Scarborough Centre. The station location for this option would be approximately 600m west of the proposed station location for the McCowan option.

Since the original IBC was developed in Q2 2016, the base network has been refined. The base network refers to all of the working assumptions about the transit network that are incorporated into the ridership model. Changes can include minor modifications such as transit travel speeds, and modifications to bus routes. The most significant change in the base network since the previous IBC is the refinement of the SmartTrack concept and GO RER. Several previously assumed stations, including Ellesmere SmartTrack Station, have been removed. GO RER Stations at Spadina and Lansdowne on the Barrie corridor have been added.

This update to the IBC is required to understand the impact of shifting the alignment from an express option via McCowan to an express option via Brimley. This document should be read as an addendum to the IBC that was considered by City Council on July 12, 2016.

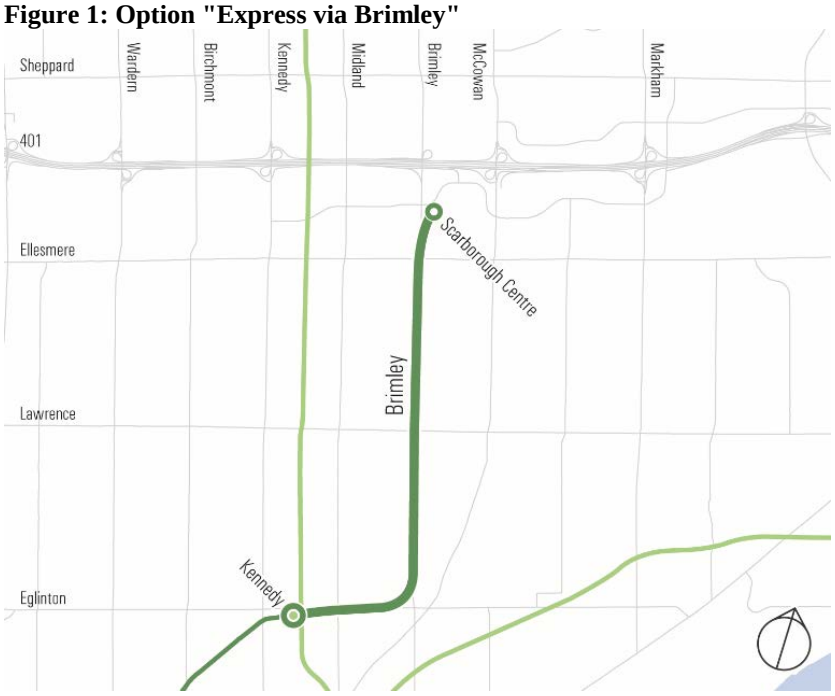
OPTIONS DEVELOPMENT

At its July 12, 2016 meeting, City Council directed staff to further develop an express option for the SSE to Scarborough Centre. An express SSE via McCowan was considered the most likely option to move forward as it would best achieve the project objectives, while keeping the SRT (Scarborough Rapid Transit Line 3) operational throughout the duration of the subway construction. Council directed staff to advance an express option and to explore other options

that may have lower capital costs, including the option of a partially at-grade alignment along the existing SRT corridor.

Through this process of developing options to reduce the capital cost of the SSE, an option emerged that considered an express extension via Brimley Road. Prior to the emergence of the express option, the Brimley corridor option had been removed from consideration as part of the '3-stop' scenario in June, 2015, as it did not perform as well as other '3-stop' alignments that were being considered at the time (Midland, McCowan and Bellamy)[1]. The Brimley option (Figure 1) re-emerged for consideration as a potential express alignment as it could reduce the capital costs while maintaining the operation of the SRT during subway construction.

Figure 1: Option "Express via Brimley"



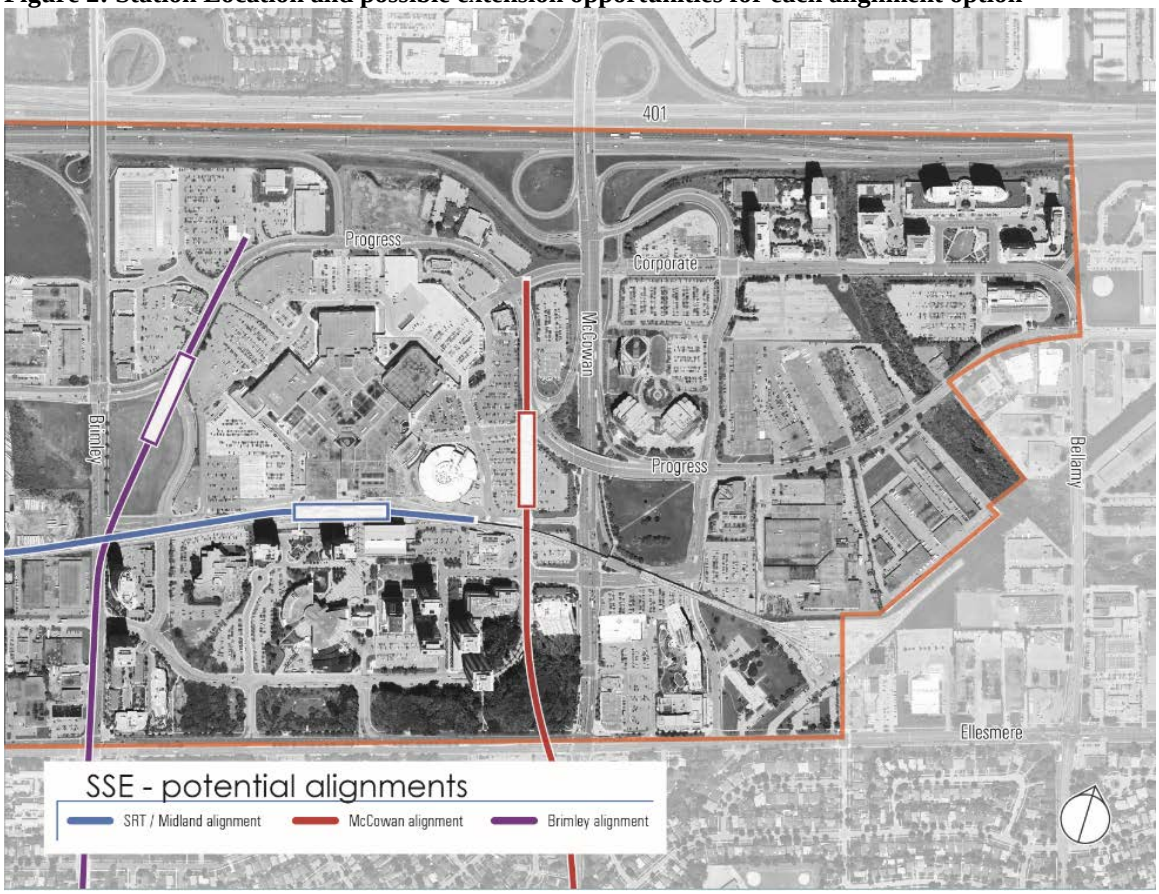
The express Brimley option is approximately a 6.0 km express connection via Brimley, with a station on the western edge of Scarborough Centre. Similar to other alignment options, this option assumes a continuation of Line 2 (Bloor-Danforth) subway service.

The difference in station location for the McCowan option and the Brimley option is shown in

[1] Public meetings between June 13 and 25, 2015 identified a short list of three corridors based on the project's evaluation criteria. At the time of the evaluation, the subway extension was contemplating three stations, and a station at Lawrence/Midland was preferred over a station at Lawrence and Brimley, and for this reason, Midland emerged as a preferred option over Brimley.

Figure 2. The Brimley option would see a terminus station located over half of a kilometre to the west, away from the geographic centre of Scarborough Centre.

Figure 2: Station Location and possible extension opportunities for each alignment option



Update to Options Development

A list of the alignment options in the July 12, 2016 IBC, and the subsequent development of potentially lower cost options are provided in Table 1.

Table 1: Express SSE options and initial screening results

Alignment Option	Screening Assessment
McCowan – 3 Stop McCowan to Sheppard Underground, north/south alignment, 3 stops ("Base Case") to Sheppard Ave	**Removed from consideration:** Other lower-cost options performed better in achieving objectives
McCowan – Underground, north/south alignment; SRT open during construction (previously preferred)	**Carried forward for further analysis:** Evaluation is included in this updated IBC
Express Midland to SC Underground, east/west alignment	**Removed from consideration:** Requires closure of SRT

Alignment Option	Screening Assessment
Express SRT Corridor to SC Express subway to Scarborough Centre via SRT corridor (1.4km portion at-grade)	**Removed from consideration:** Requires closure of SRT
Additional options that emerged in Summer 2016	
Midland – Elevated, east/west alignment	**Removed from consideration:** Requires closure of SRT
Midland – Elevated, east/west alignment, station farther west	**Removed from consideration:** Requires closure of SRT
Midland – Underground, east/west alignment,	**Removed from consideration:** Removed from consideration: Requires closure of SRT
Midland – Underground, east/west alignment, station farther west	**Removed from consideration:** This option is approximately the same cost as the preferred McCowan alignment but has an inferior station location
SRT Corridor – Express subway to Scarborough Centre via SRT corridor (2.2km portion at-grade), with elevated east-west alignment into Scarborough Centre (re-examined per Council direction on July 12, 2016)	**Removed from consideration:** Requires closure of SRT
Brimley – Underground, north/south alignment;	**Carried forward for further analysis:** Evaluation is included in this updated IBC

As the 3-stop subway extension via McCowan option was removed from consideration at the July 12, 2016 City Council meeting, this update to the IBC focuses on the differences between an express subway via McCowan, and an express subway via Brimley (see Table 1). This IBC considers the alignment and subway station platform location only. Bus terminal sizes and locations are not considered in this analysis of alignments. Summary descriptions of two options are provided in Table 2.

Table 2: Summary descriptions of the McCowan option and the Brimley option

	McCowan Option (Express McCowan to STC)	Brimley option (Express Brimley to STC-west side)
Corridor & Alignment	McCowan	Brimley
Length of Alignment	Approximately 6.2 km	Approximately 6.0 km
Station Locations	Scarborough Centre (station oriented North-South)	Scarborough Centre west side (station oriented south-west to north-east)
Service Concept	Continuation of all Line 2 services	Continuation of all Line 2 services

	McCowan Option (Express McCowan to STC)	Brimley option (Express Brimley to STC-west side)
Infrastructure Requirements	• 6.0 km tunneling • 0.2 km cut & cover • 1 new subway station with expanded off-street bus terminal • On line vehicle storage	• 5.8 km tunneling • 0.2 km cut & cover • 1 new subway station with expanded off-street bus terminal • On line vehicle storage
Network Assumptions	Bus network largely unchanged in north Scarborough, continuing to focus on Scarborough Centre Station; re-route some buses terminating at Lawrence to Kennedy; some other bus re-routings to ensure good connections to the subway.	Bus network largely unchanged in north Scarborough, continuing to focus on Scarborough Centre Station; re-route some buses terminating at Lawrence to Kennedy; some other bus re-routings to ensure good connections to the subway.

EVALUATION

Consistent with previous IBCs, the options were evaluated with respect to the Strategic Case, Financial Case, Economic Case and Deliverability Case.

Some analyses were not available for the updated Business Case. This includes the Accessibility analysis[2] that was included in the previous IBC. Additional analyses have been undertaken to provide a greater understanding of the differences between the McCowan option and the Brimley option. These additional analyses included the potential for transit-oriented development within walking distance of the proposed station at Scarborough Centre and developable hectares.

STRATEGIC CASE

As with previous IBCs, the strategic case makes use of the "Feeling Congested?" principles and criteria to organize the evidence and ensure all important facets of city building are considered.

Table 3: Summary of the Rapid Transit Evaluation Framework (RTEF)

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

[2] The accessibility analysis was undertaken by a consultant, whose contract has since been completed.

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 and Environment	Support and enhance natural areas; encourage people to reduce how far they drive; mitigate negative impacts
Supporting Prosperity	
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.
Affordability	Improvements to the transportation system should be affordable to build, maintain and operate.

Supporting Prosperity

Supporting Prosperity - Supporting Growth

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

The differences between the McCowan option and the Brimley option with respect to supporting growth are discussed below.

The McCowan option performed well in terms of supporting growth and providing access to a higher density of jobs. The McCowan option is projected to serve the highest density of jobs (18,500 jobs/km^2).

Scarborough Centre has significant development potential with the entire Centre designated mixed-use by the Official Plan. The station for the Brimley option is located approximately 600m farther away from both the geographic centre of Scarborough Centre and the Gateway at McCowan Road and Bushby Drive/Town Centre Court than the station for the McCowan option. If walking to or from the geographic centre to a station associated with the Brimley option, there would be an additional 8 to 9 minute walk. The station for the McCowan option would also be closer to the McCowan Precinct[3] where significant development is expected in the future, and would bring slightly more of the Centre within walking distance of a subway station. The McCowan option offers

[3] Scarborough Centre is designated for growth. The Centre is divided into four precincts, each with its own policy direction. McCowan Road is more centrally located within Scarborough Centre, with a policy framework and a development pipeline that supports greater intensification than the Brimley Precinct.

improved proximity to people's workplaces, and supports economic development significantly more than the Brimley option.

The McCowan option could yield approximately 130,000 square metres of transit-oriented employment development. The Brimley option is expected to facilitate approximately 115, 000 square metres of transit oriented employment development.

Table 4: Supporting Growth Measures

Measure	**McCowan Option (Express via McCowan)**	**Brimley Option (Express via Brimley)**
Service to Employment Growth Areas	Single station planned for Commercial Precinct of Scarborough Centre – a mixed-use growth area. Station will encourage residential intensification and urbanization of the Centre.	Single station planned for the western edge of Commercial Precinct of Scarborough Centre – a mixed-use growth area. Station will encourage some residential intensification and urbanization of the Centre, primarily in the western portion.
Proximity to geographic centre of Scarborough Centre	151 m	675m
Area of land within walking distance of stations designated for Employment growth	0.6 km^2 (mixed use) 0.06 km^2 (Employment, Institutional and Regeneration Lands)	0.5 km^2 (mixed use) 0.02 km^2 (Employment, Institutional and Regeneration Lands)
Proportion of land within walking distance of stations designated for employment growth	70.8% (mixed use) 7.2% (Employment, Institutional and Regeneration Lands)	70.2% (mixed use) 2.8% (Employment, Institutional and Regeneration Lands)
Existing Jobs within walking distance of the stations	10,900 jobs	7,100 jobs
Projected Job Growth within walking distance of stations	2,400 jobs	1,700 jobs
Projected Future Jobs within walking distance of stations	13,300 jobs	8,800 jobs
Existing Employment Density within walking distance of the stations	15,400 jobs/km^2	10,900 jobs/km^2
Projected Increase in Employment Density within walking distance of the stations	3,100 jobs /km^2	2,200 jobs/km^2

Measure	McCowan Option (Express via McCowan)	Brimley Option (Express via Brimley)
Projected Future Employment Density within walking distance of the stations	18,500 jobs/km^2	13,100 jobs/km^2
Potential for Transit-Oriented employment Development within 500m of Scarborough Centre Station	130,000m^2	115,000 m^2

Similar to *Shaping the City*, the same 800m radius and service area were used to compare the potential commercial space around the two station sites. As seen in the table below, the McCowan option could attract significantly more office development in Scarborough Centre. The McCowan option's proximity to the McCowan corridor and Bushby/Town Centre Court gateway will encourage more development than the Brimley option, creating a higher return on investment in the transit infrastructure.

Table 5: Potential area (m^2) of Commercial Space

Alignment	Potential area (m^2) of Commercial Space	
	800m Service Area	800m Buffer
McCowan option	159,800	222,700
Brimley option	148,500	166,100
Difference	**11,300**	**56,600**

Not evaluated in this study is the impact either option could have on existing local businesses. A major landowner around the McCowan option sees opportunity to integrate the station with future development at Scarborough Town Centre, and sees the Brimley option as potentially negatively impacting connectivity to Scarborough Town Centre. The Brimley option could have an adverse impact on another important local industrial landowner in this area to the west of Brimley. This land owner, whose business operation occupies over 10 ha of land between Brimley, Progress Ave, and the SRT corridor, has made significant investments in their facilities and has been a vocal opponent to subway alignments that would bring development pressure to the west side of Scarborough Centre. Current planning policies support development of mixed-use on the western edge of Scarborough Centre, including a strip immediately west of Brimley Road.

Strengthening Places

Strengthening Places - Shaping the City

Shaping the City considers the transportation network as a tool to shape the residential development of the City. It evaluates the opportunities created by the

station to encourage transit-oriented development within the vicinity of the station site.

The population of Scarborough Centre more than doubled between 2001 and 2011, expanding at a rate faster than that of either Etobicoke Centre, or Yonge-Eglinton Centre. Analysis undertaken as part of City Planning's Growing Up Study shows that Scarborough Centre houses the highest percentage of families with children of all the Centres (35%), and the highest percentage of families with children owning their own homes (73% compared with North York at 60%, Etobicoke at 26% and Yonge-Eglinton at 24%). Together these factors reveal Scarborough Centre to be more family-oriented and more stable than other Centres.

Both options are equal in the amount of land designated for population growth within walking distance of a station (0.6km^2).

Compared with the Brimley option, the McCowan option has slightly greater potential for transit-oriented residential development within 800m of Scarborough Centre Station, a greater projected future population density within walking distance of the stations, greater existing and future increase in population density around stations, and higher projected population growth around the stations.

The McCowan option serves a slightly larger existing population within walking distance of the station. The McCowan option also serves a larger projected population growth within walking distance.

Some figures have been refined from the previous Initial Business Case. For example, the centroid for the McCowan option station was shifted slightly west toward Borough Drive, to provide a more accurate representation of where the station would be located for this option. (Previously, the station centroid for analysis had been located within the McCowan right-of-way.)

A summary of findings is provided in Table 6.

Table 6: Shaping the City Measures

Measure	**McCowan option (Express via McCowan)**	**Brimley option (Express via Brimley)**
Service to Residential Growth Areas (see further detail in "Service to Employment Growth Areas")	Single station planned for Commercial Precinct of Scarborough Centre – a mixed-use growth area. Station will encourage residential intensification and urbanization of the Centre.	Single station planned for Commercial Precinct of Scarborough Centre – a mixed-use growth area. Station will encourage residential intensification and urbanization of the Centre.
Area of land within walking distance of stations designated for population growth	0.6 km^2 (mixed use)	0.6 km^2 (mixed use)

Measure	McCowan option (Express via McCowan)	Brimley option (Express via Brimley)
Proportion of land within walking distance of stations designated for population growth	70.8% (mixed use)	70.2% (mixed use)
Existing Population within walking distance of the stations (500m)	3100 people	2900 people
Projected Population Growth within walking distance of stations	1200people	900 people
Projected Future Population within walking distance of the stations (500m)	4300 people	3800 people
Existing Population Density within walking distance of the stations	4000 people/km^2	3700 people/km^2
Projected Increase in Population Density within walking distance of the stations	1600 people/km^2	1100 people/km^2
Projected Future Population Density within walking distance of the stations	5600 people/km^2	4800 people/km^2
Potential for Transit-oriented Residential Development within 800m of Scarborough Centre Station[4]	12 500 units	11 500 units

Additional analysis was undertaken to understand the differences between the McCowan option and the Brimley option. This analysis examined the localized development potential around each station location[5] in terms of both developable hectares and potential residents.

[4] A high-level analysis of potential transit-oriented development around the stations was undertaken and focussed on potential growth beyond the population projected by the population and employment models. It can be understood as the potential directly related to the construction of a subway station. Since it is not possible to determine a future proportion of residential and employment uses in a mixed use area, an assumption of 90 percent of all future development has been anticipated for residential uses. Applying the typical lot coverage for recent developments in Scarborough Centre to available land around the station associated with the McCowan option, suggests that it is possible to develop approximately 12 500 residential units within 800 metres of the station. These units include already-approved developments, sites in the pipeline, and underutilized sites but excludes the land inside the ring road around Scarborough Town Centre. This compares to the opportunity to develop approximately 11 500 residential units within 800m of the initial station associated with the Brimley option.

[5] To compare the development potential associated with the two options, an 800m radius from the centroid of each station that extends to the Centre's boundary was used. All soft sites without development approvals or active development proposals were identified in each 800m radius. An assumption of 4.7 times coverage

The McCowan option is expected to encourage greater development of residential units.

Table 7: Residential Development Potential for the McCowan option and the Brimley option

Alignment	800m Buffer	
	Developable Hectares	Potential Residents
McCowan option	41.1	40,800
Brimley option	29.1	28,700
Difference	**12**	**12,100**

This methodology provides a conservative estimate of the residential development potential. The McCowan option is expected to have greater intensification potential, as development of Scarborough Centre has been planned with an orientation around the McCowan corridor and specifically the Bushby/Town Centre Court gateway. The Scarborough Centre Secondary Plan further confirms the planning direction of the McCowan Precinct as having considerable development potential, with residential and employment uses being the focus for this area. These findings are supported by a similar analysis that considered 800m walking distance from the station (limited by the street and pedestrian path connections). There is greater potential to encourage intensification and residential development with the McCowan option.

When accounting for the approved residential pipeline developments within the vicinity of the two options, the McCowan option has approximately 500 more approved residential units than the Brimley option, with 3,036 and 2,559 approved residential units, respectively.

With respect to *Shaping the City*, the McCowan option is preferred over the Brimley option.

Serving People - Choice

The Choice criterion evaluates how the subway station location and design promotes access to destinations through seamless pedestrian connections and integration with the surrounding neighbourhood.

The McCowan option best achieves the objective of promoting quality connections to the surrounding area as it is located within the centre of Scarborough Centre and is located close to existing destinations and planned development east of McCowan Road. Through the development of the Scarborough Centre Transportation Master Plan, improved east-west connections will be identified to promote improved station access.

was applied to these parcels to create a conservative estimate of future residents that could be encouraged by implementation of the station.

The Brimley option would see a station along the western fringe of Scarborough Centre, further from existing destinations and resulting in few opportunities to create quality connections to areas east of McCowan Road. This would effectively reduce the attractiveness of using transit, as a greater number of people in the future would incur a longer walk to reach the station if it were located on the western edge of Scarborough Centre.

Today, there are approximately 3100 residents within a 500 metre radius of the proposed McCowan station location, approximately 7% more than around a proposed Brimley station (approximately 2900 residents). The McCowan option provides greater transportation choice as it serves more residents within walking distance, and will serve both the existing and future population of McCowan Precinct.

Serving People - Experience

A traveller's experience of transit, and the quality of that experience, has a direct impact on whether they will choose to take transit in the future. The better the experience, the greater the chance that transit becomes the preferred mode of travel in the future. 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.

The expected travel time between Scarborough Centre Station and Kennedy Station is expected to be 6.7-to-7.5 minutes for both the McCowan option and the Brimley option. Both options would involve a similar distance of travel, with the Brimley option approximately 200m shorter than the McCowan option.

The McCowan option would incent approximately 1,000 more net new riders to the transit system compared with the Brimley option. The McCowan option is expected to result in 500 more boardings in the morning peak hour than the Brimley option, and 3,800 additional riders throughout the day.

Net new riders were calculated in Spring 2016 using Option 1 (3-stop McCowan) as the base case and assuming SmartTrack 'Option C' and assumed a station at Ellesmere. In this update to the Business Case, the SRT is used as a reference case for the purposes of comparing the McCowan option and the Brimley option. Additionally, the network model was updated to reflect more recent assumptions, e.g. removing several Smart Track stations including Ellesmere. As a result, the base network has improved, resulting in fewer net new riders than previously estimated in the analysis reported for the July 12, 2016 Initial Business Case.

With respect to 'Experience', the McCowan option is preferred.

Table 8: Experience Measures

Measure	McCowan Option (Express via McCowan)	Brimley Option (Express via Brimley)
Connections between Scarborough Centre and other UGCs/Mobility Hubs[6]	Approximately 6.5 – 7.5 minutes connection between Scarborough Centre and Kennedy Mobility Hub	Approximately 6.5 – 7.5 minutes connection between Scarborough Centre and Kennedy Mobility Hub
Transit Ridership Change[7]	2,300	1,300

Strengthening Places - Public Health and Environment

Transit has a very positive impact on public health by encouraging a more active lifestyle and reducing air quality impacts through reduction in automobile usage and emissions. However, large infrastructure projects like rapid transit may also have detrimental impacts to natural features, which must be avoided or mitigated.

The Highland Creek system is a significant natural feature of the SSE study area. Both options are underground when crossing the Highland Creek system, they may require mitigation to minimize the impact to the Highland Creek system.

Both options are anticipated to have the same impact on reducing automobile usage.

Table 9: Public Health & Environment Measures

Measure	McCowan option (Express via McCowan)	Brimley option (Express via Brimley)
Significant Environmental Challenges	Mitigation required	Mitigation required
Auto Mode Share (%)[8]	55	55

[6] Reported travel times between Scarborough Centre Station and Kennedy Station represent high-level estimates and should not be considered actual travel time that would be experienced by customers on the subway. Estimates continue to be refined as design of the subway progresses. Reported travel time estimates vary slightly from travel time inputs used by the GTHAv4.0 model to generate ridership projections.

[7] Net new riders were calculated in Spring 2016 using Option 1 (3-stop McCowan) as the base case and assuming SmartTrack 'Option C' and assumed a station at Ellesmere. In this update to the Business Case, the SRT is used as a reference case for the purposes of comparing the McCowan option and the Brimley option. Additionally, the network model was updated to reflect more recent assumptions, e.g. without a Smart Track station at Ellesmere. As a result, the base network has improved, resulting in fewer net new riders than previously estimated in the analysis reported for the July 12, 2016 Initial Business Case.

[8] In the July 12, 2016 IBC reported to Council, auto mode share was erroneously reported as *change in auto mode share: 0.55%.* The report should have read: Auto mode share (%): 55. In other words, there is no change in auto mode share between the July 12, 2016 IBC and the update to the IBC, nor are there any differences in auto mode share between the McCowan and Brimley options.

There are no measurable differences between the options with respect to Public Health & Environment.

Serving People - Social Equity

The impact of a transit investment can be expressed in terms of a change in access to jobs for residents of Neighbourhood Improvement Areas (NIA) and number of NIA residents served by rapid transit.

The McCowan option serves a slightly greater number of social equity seeking individuals than the Brimley option.

Table 10: Social Equity Measures

Measure	McCowan Option (Express via McCowan)	Brimley Option (Express via Brimley)
Change in disadvantaged residents served	1700 people	1500 people

Strengthening Places – 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 SSE study area outside of Scarborough Centre is recognized as stable neighbourhoods, to which adding a subway station could bring unwanted development pressure and change.

Impact to private property is a significant consideration. Table 11 below identifies subsurface property impacts to private properties for each option. In most cases, the partial impact involves narrow strips of property at those locations where a portion of the path of the tunnel-boring machine, together with the three-metre buffer that is maintained on either side, cannot be maintained entirely within the road right-of-way. The Initial Business Case presented to Council on July 12, 2016 examined all property impacts of the tunnel and ancillary structures, such as emergency exit buildings and power substations. This update examines only subsurface property impacts. Since ancillary structures have not been designed for Brimley, to provide an 'apples-to-apples' comparison of the options, surface property impacts have been removed from McCowan.

With respect to subsurface property impacts associated with constructing the new subway tunnel, the Brimley option is preferred as it would impact fewer properties. More detailed planning and design is required to understand the property impacts that would be associated with ancillary structures.

Table 11: Neighbourhood Impact Measures

Measure	McCowan option (Express via McCowan)	Brimley option (Express via Brimley)
Private Property Impacts	Total: 31	Total: 23
Number of Single Family homes impacted:	Partial (subsurface): 19 Complete: 0	Partial (subsurface): 11 Complete: 0
Number of residential multi-unit properties impacted:	Partial (subsurface): 4 Complete: 0	Partial (subsurface): 2 Complete: 0
Number of Commercial properties impacted:	Partial (subsurface): 8 Complete: 0	Partial (subsurface): 10 Complete: 0
Area of land within walking distance of stations designated as Neighbourhoods	0.0 km^2	0.0 km^2
Proportion of land within walking distance of stations designated as Neighbourhoods	0.8%	0.0%

The analysis as it currently stands favours the Brimley option. It is noted that this is an incomplete analysis and additional property impacts are anticipated based on details regarding ancillary structures for both options.

Summary of Strategic Case

	McCowan	Brimley
Serving People		
Choice	*Preferred*	
Experience	*Preferred*	
Social Equity	*Insignificant difference*	*Insignificant difference*
Strengthening Places		
Shaping the City	*Preferred*	
Healthy Neighbourhoods		*Preferred*
Public Health and Environment	*Insignificant difference*	*Insignificant difference*
Supporting Prosperity		
Supports Growth	*Preferred*	
Summary		
	Preferred	

The McCowan option is the preferred alignment for the strategic case.

FINANCIAL CASE: UPDATE

The financial case refers to the capital and operating costs and revenues over the service lifetime of the project, typically 60 years.

Table 12: Capital costs, reported in $Year of Expenditure ($YOE)

	McCowan option (Express via McCowan)	Brimley option (Express via Brimley)
Estimated capital cost ($YOE)	$3.159 B	$2.945 B
Summary		*Preferred*
Notes: • SSE cost estimates prepared by the TTC. Estimates include cost to construct. • Costs do not include costs for project delivery, management reserve or risk allowances. These costs are reflected in the staff report to the Executive Committee. • Costs do not include lifecycle and operations/maintenance. • Costs have been escalated based on the preliminary schedule. The schedule reflects in service by Q2 2026, with construction taking approximately 6 years (2020-2026). Schedule based on March 2017 approval to proceed. • Cost estimates have been developed at approximately 5% design and are a Class 4 cost estimate (per AACE guidelines).		

The capital cost estimate for the McCowan and Brimley options fall within an AACE Class 4 category based on level of design completed, which is typically associated -30% to +50% range of accuracy.

The operating, capital and recapitalization cost estimates for both the McCowan option and the Brimley option are provided in Table 13. These costs are provided in 'present value' dollars (i.e. 2015$). Capital cost estimates in Table 12 were provided in year-of-expenditure (YOE$) costs. The difference in cost between the two options is $0.140 B in present value (2015$) dollars, and $0.214 B in year-of-expenditure dollars. In the financial case evaluation, the Brimley option is preferred as it costs less than the McCowan option. Operational costs are estimated to be approximately the same for both options.

Table 13: Costs (Present Value)

	McCowan option ($, thousand)	**Brimley option ($, thousand)**
Operating Cost	$301,000	$301,000
Capital Costs ($2015)[9]	$2,129,300	$1,996,400
Recapitalization Costs	$742,900	$735,700
Total PV of Costs (PVC)	$3,172,800	$3,032,800

[9] Difference in capital cost reported in Table 12 and
Table **13** reflect difference in the $year. Table 12 is reported in dollars in the year of expenditure ($YOE), while
Table **13** is reported in $2015 Present Value.

ECONOMIC CASE: UPDATE

The economic case quantifies and monetizes the costs and benefits of a proposed project and is developed using the guidance set out in the Draft Metrolinx Business Case Methodology[10]. The economic case is a method for monetizing both the positive and negative impacts of a project for the purposes of evaluating the overall impact of a project, and for the purposes of comparing one option with another.

This economic case evaluation has assessed the benefits and costs of the Brimley option relative to the McCowan option, using a specific set of economic measures. The following measures were considered in comparing the two options:

- User benefits: Travel time savings, travel cost savings, crowding relief.
- Producer benefits: incremental fare savings
- External benefits: Benefits associated with reduction in Vehicle Kilometres Travelled (Vkt)—GHG emissions reduction; road decongestion; accident prevention etc.

It is important to note that not all impacts of a project can be quantified or monetized, and are therefore excluded from the economic case. An example would be the extent to which an option achieves its strategic objectives (see Strategic Case).

The economic case can also include wider economic benefits associated with a project. For example, benefits to commercial businesses as a result of gaining access to a wider labour market. Another example would be the benefits to retail and commercial businesses accrued as a result of being located in closer proximity to other similar type of ventures. These are referred to as economies of agglomeration. These benefits are anticipated for the SSE, but were not analyzed as part of this economic case evaluation[11].

Findings

The Brimley option provides fewer benefits relative to the McCowan option (Table 14) by approximately $9.1 million over a 60-year lifecycle. Relative to the McCowan option, the Brimley option provides less crowding relief and travel

[10] The Metrolinx Business Case Methodology Guidance is currently in draft form. The methodology is based on guidance from the United Kingdom's 'Web-TAG' (Web-Transport Appraisal Guidance) which is applied to any major transportation infrastructure projects for which funding is sought from the UK Government.

[11] Wider Economic Benefits (WEBs) are evaluated in the UK as part of the Web-TAG approach; however, a methodology for evaluating Canadian-based WEBs has not yet been developed.

time-savings but more road decongestion benefits, accident prevention and Greenhouse Gas (GhG) emission benefits. Table 14 provides a summary. The Brimley option is estimated to incur lower costs relative to the McCowan option by approximately $140 million over a 60-year lifecycle (Table15).

Table 14: Economic Benefits (numbers are rounded to nearest '00,000)

	Brimley option, relative to the McCowan Option ($, thousand, rounded to nearest '00,000)
User Benefits	
Travel Time Savings	-$135,500
Fare Savings	-$1,900
Crowding Relief	$64,900
Producer Benefits	
Incremental Fare Revenue	-10,900
External Benefits	
GhG Emissions	$100
CAC Emissions	$0
Accident Prevention	$1,000
Road Decongestion	$58,500
Auto Costs	$14,700
Total Present Value of Benefits (PVB)	**-$9,100**

Table 15: Economic Case Summary

	Brimley option, relative to the McCowan Option ($, thousand, rounded to nearest '00)
Operating Cost	$0
Capital Cost (in $2015)	-$132,900
Recapitalization Cost (in $2015)	-$7,200
Total Present Value of Lifecycle Cost (PVC)	**-$140,100**
Present Value of Benefits (PVB)	-$9,100
Net Present Value (NPV) (PVB-PVC)	**$131,000**

The Net Present Value (NPV) of an option is the difference between benefits and costs (PVB- PVC), and offers insight into the present value of the various options under study[12].

The difference in the NPV between the Brimley option and the McCowan option is approximately $131 million over a 60 year lifecycle. As such, the Brimley option offers a slightly better economic case than the McCowan option taking into consideration the economic measures utilized in this evaluation.

Appendix 1 includes the assumptions used in this economic case evaluation.

[12] Caution should be applied when comparing the BCRs and NPVs of different projects presented in different business cases due to potentially different base assumptions for business cases.

DELIVERABILITY AND OPERATIONS CASE: UPDATE

Operation and Service Planning Considerations

Both options will keep the SRT operational during the construction period. An SRT shutdown would result in additional cost[13] and negative service impacts for passengers.

There may be some impacts to bus operations if the bus terminal is located at Brimley, as approximately half of the bus routes would require travelling a slightly longer distance west to reach the bus terminal. The impacts are not considered significant enough to inform decision-making.

The difference in the impacts to bus operations between the McCowan option and the Brimley option is negligible.

Engineering / Technical Considerations

The construction of a station at Scarborough Centre will impact the mall and road infrastructure. The Brimley option would have fewer impacts, as the bus terminal and station would be built on a vacant property west of the mall. This option would likely involve the tunnel work site being located on the vacant property where the station is constructed, thus minimizing adverse impacts on local businesses and residents. The McCowan option would require the station and bus terminal to be built in a dense area, with greater potential for engineering constraints and costs – which is reflected in the cost estimates.

CONCLUSION

The IBC for the SSE identified a subway connection with a station in the vicinity of Borough Drive and Triton Road (referred to here as McCowan) as being best suited to improve Scarborough Centre's connectivity, and critical to its success as a vibrant urban node and regional gateway. The subway connection is also meant to encourage new development in Scarborough Centre to enable the creation of new walkable complete communities and encourage businesses and institutions to locate there.

Table 16: Summary of Findings

	McCowan option	Brimley option
Strategic Case	*Strongly Preferred*	
Financial Case		*Slightly Preferred*
Economic Case		*Slightly Preferred*
Deliverability & Operations Case	*Insignificant difference*	*Insignificant difference*
SUMMARY	***Preferred***	

[13] Additional costs incurred as a result of shuttering the SRT are included in the cost estimates.

While the Brimley option represents a reduction in costs, the McCowan option is preferred because it is better positioned to meet the objectives of investing in the SSE, to *support the growth and development of Scarborough Centre into a vibrant urban node.* In particular, the McCowan option is preferred because:

1. It is estimated that there will be more boardings (500 more boardings in the AM peak, 1000 more daily net new riders);
2. It better serves existing destinations, population and employment on both sides of McCowan Road and is close to the McCowan Precinct, where development pressure is greatest and future growth is planned;
3. It is consistent with current and future land uses; and more amenable to existing land owners within Scarborough Centre;
4. It supports plans to orient development around the McCowan Road corridor and specifically the Bushby/Town Centre Court gateway, including the expansion of the Scarborough Town Centre to this central area.

In contrast, the area around the Brimley station (the western edge of the Centre) does not have the same number of existing destinations. The area around the Brimley station location does not have the same level of planned growth as the area around McCowan Station. As a result, a station located on the western edge of Scarborough Centre associated with the Brimley option would not meet a key planning objective of the SSE— supporting the development of Scarborough Centre as a vibrant urban node.

A station located in the geographic centre of Scarborough Centre proximal to existing and future development will better support Scarborough Centre as a vibrant urban node.

APPENDIX 1- ECONOMIC CASE ASSUMPTIONS

Table: Economic Case Parameters and Value Assumptions

Parameter	Value	Source / Comments
Discount Year	2015	Business Case Development Handbook (BCDH), Metrolinx
Discount Rate	3.50%	BCDH Tier 2 v0.2, pg44, section 10.3.4
Appraisal period (yrs)	60	BCDH Tier 2 v0.2, pg23, section 6.2.2
Auto operating cost savings ($/veh-km)	$0.63	Metrolinx recommended value
Auto operating cost savings annual growth (%)	0.7%	BCDH Tier 2 v0.2, pg47, section 10.5.1
Accident value ($/veh-km)	$0.07	BCDH Tier 2 v0.2, pg47, section 10.5.1
Accident value annual growth (%)	0.0%	BCDH Tier 2 v0.2, pg47, section 10.5.1
Greenhouse Gas ($/veh-km)	$0.010	BCDH Tier 2 v0.2, pg48, section 10.5.2
Greenhouse Gas annual growth (%)	0.0%	Assumed (Value not specified in BCDH)
Air Quality ($/veh-km)	$0.002	BCDH Tier 2 v0.3, pg42, table 10.1.5 (not specified in v0.2)
Air quality value annual growth (%)	0.0%	Assumed (Value not specified in BCDH)
Annualization factor	300	BCDH Tier 2 v0.2, pg44, section 10.3.3
Value of Time - Non-working (Commuting) $ per hour	$16.13	BCDH Tier 2 v0.2, pg46, section 10.4.2
Value of Time growth (pa)	1.600%	BCDH Tier 2 Draft 0.2, pg46, section 10.4.2
Costs Real or Nominal	Nominal	
Inflation	2.0%	BCDH Tier 2 v0.2, pg22, section 6.2.1

Appraisal Year	Buildup
1	35%
2	70%
3	100%
4	100%
5	100%
6	100%
7	100%
8	100%
9	100%
10	100%

EX23.1

ATTACHMENT 2

City of Toronto & TTC

Draft
Executive Summary:
Scarborough Subway Extension Environmental Project Report

Prepared by:

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Report Number:

60530166

Date:

February, 2017

E.1. Introduction and Background

E.1.1 Summary Recommendation

A number of assessments have been conducted over the past decade of alternative methods to replace or reconstruct/rehabilitate the Toronto Transit Commission's aging Line 3 - the Scarborough Rapid Transit (SRT) facility. Most recently, at its meeting in July, 2016, City Council endorsed the option of replacing it with an extension of the Bloor-Danforth Subway (Line 2) to Scarborough Centre. The subway extension would operate as an 'express' subway service from Kennedy Station, approximately 6.2 kilometres north-east, to its new terminus – Scarborough Centre Station.

As shown in Exhibit E1-1, the recommended alignment for the Scarborough Subway Extension (SSE) is via Eglinton Avenue East, Danforth Road and McCowan Road. The preferred alignment is primarily within the road right-of-way. However, it shifts to west of McCowan Road for a short section north of Lawrence Avenue; it again veers west of McCowan from a point south of Ellesmere Road to allow the subway station to be constructed at the preferred, central location in the area between the two existing SRT stations.

E.1.2 Background

The critical problem affecting the existing SRT line is that the vehicles are over 30 years old and in need of replacement. However, that particular vehicle is obsolete and the newer model that is available is too large for the existing facility and would require physical changes to the infrastructure, for example, the reconstruction of existing structures where there are tight curves.

City Council had confirmed support for the extension of the Bloor-Danforth Subway (Line 2) from Kennedy Station into central Scarborough on October 8, 2013. The initial proposal was for a three stop extension to Sheppard Avenue. However, subsequent to that direction from City Council, City Planning staff re-assessed the transit requirements in this area of Scarborough, taking account of recent changes to the transportation plans in the nearby Stouffville GO corridor - firm funding commitments for the GO Regional Express Rail (RER) program as well as plans for the City's SmartTrack program – as well as the announced delay in the implementation of the previously-approved Sheppard East Light Rail Transit (LRT).

Two refined priorities for the Scarborough transit network were developed and endorsed by the City's Executive Committee on January 28, 2016:

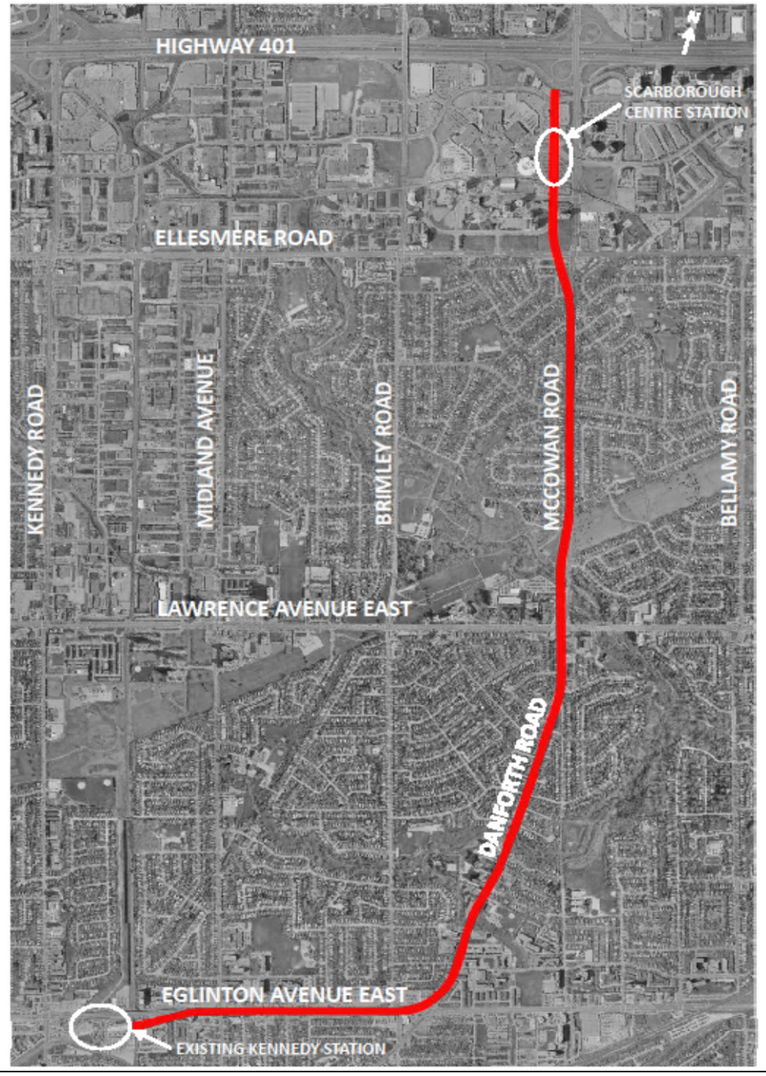
1. Support for the development of Scarborough Centre as a vibrant urban node; and
2. Support for the development of complete communities along the Avenues and improve local accessibility.

The Executive Committee directed staff to proceed with the analysis of an optimized transit network to address these priorities, which included:

- An extension of Line 2 (Bloor-Danforth Subway) express to Scarborough Centre;
- An extension of Line 5 (Eglinton Crosstown LRT) to the University of Toronto, Scarborough Campus;
- SmartTrack stations at Lawrence Avenue East and Finch Avenue East; and
- A rapid transit solution on the Sheppard East corridor.

At its meeting in July, 2016, City Council endorsed the express subway extension of Line 2. This report deals solely with the express subway project.

Exhibit E1-1: Recommended Scarborough Subway Extension Alignment



E.1.3 Study Purpose

This type of transit project must adhere to the requirements of the Ontario *Environmental Assessment Act*. The Ministry of Environment and Climate Change (MOECC) has approved a streamlined Environmental Assessment (EA) process specific to transit projects – The Transit Project Assessment Process (TPAP) and this report provides the required documentation of this process. As with any EA process, the central focus is on ensuring that the impacts associated with the project are clearly identified, and mitigated to the greatest extent practical.

The report describes the conditions in the area in which the project will be implemented, the major elements of the subway extension project, the types of impacts that may be expected from the construction of, and ongoing operation and maintenance related to, this subway extension, and the manner in which those impacts will be mitigated, and monitored.

E.1.4 Study Area

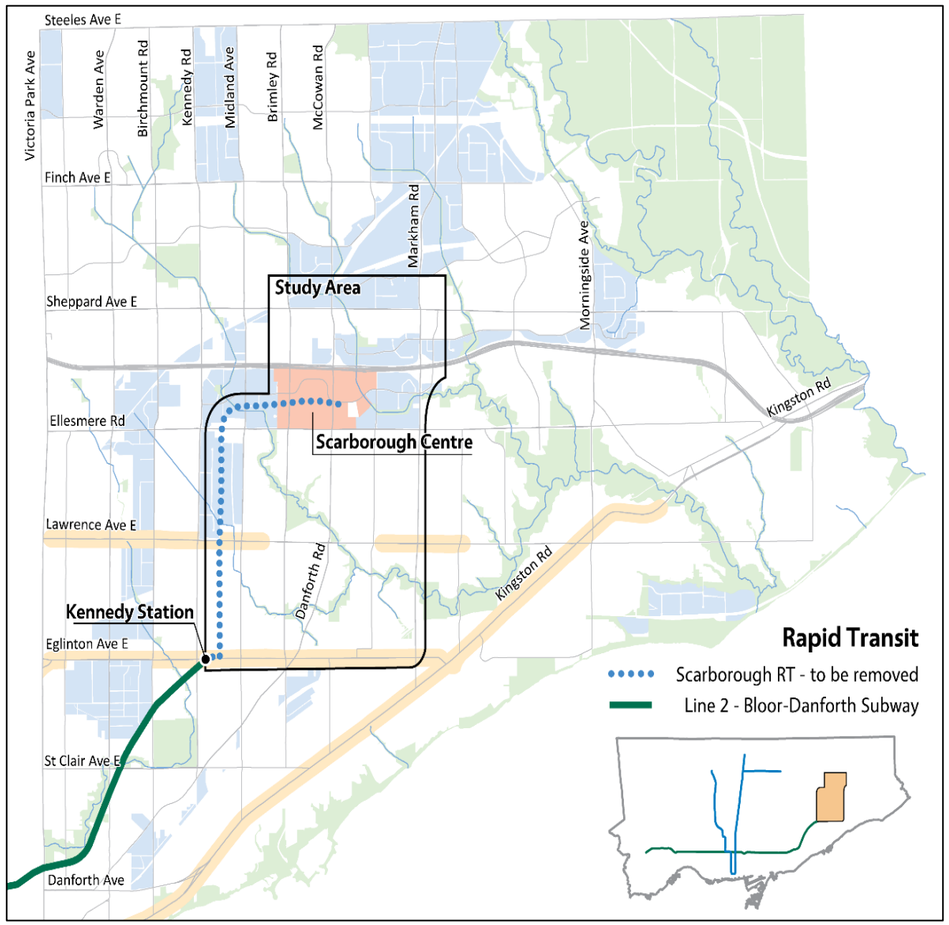
As shown in Exhibit E1-2, the Study Area is roughly bounded on the south by Eglinton Avenue East, Sheppard Avenue East on the north, on the west by the existing SRT line and Brimley Road once north of Ellesmere Avenue, and on the east by Markham Road/Progress Avenue.

E.1.5 Study Process – the Transit Project Assessment Process

The current study adheres to the Transit Project Assessment Process (TPAP), which satisfies Ontario's *Environmental Assessment Act*, Regulation 231/08, the Transit Project Regulation (Transit Projects and Metrolinx Undertakings).

Proponents of a project must follow the prescribed steps in the TPAP within specified time frames, and provide adequate opportunities for review and comment by a broad range of stakeholders, culminating with the Minister of the Environment and Climate Change's decision within six (6) months of the start of the process. Once the TPAP has been completed to the satisfaction of the Minister of the Environment and Climate Change, transit project proponents may file a Statement of Completion and proceed with construction processes.

Exhibit E1-2: Study Area



E.1.6 Relevant Policies

There are a variety of policies that support this Project. The most directly-relevant are described below.

E.1.6.1 Growth Plan for the Greater Golden Horseshoe, 2006

The Growth Plan for the Greater Golden Horseshoe (Growth Plan) was first adopted in 2006 and updated in 2016 after a comprehensive review of the policies. The Growth Plan identified a regional strategy for managing growth to ensure continued economic prosperity and a high quality of life in the Toronto region.

Key policies of the Growth Plan are related to the coordination of land use and transportation infrastructure, including the establishment of Urban Growth Centres (UGCs) to function as mixed-use, high-density downtowns that are well connected to rapid and local transit. Scarborough Centre is one of five UGCs located within the City of Toronto. Its target density is 400 people and jobs/ha. To enable this level of intensification and foster a large and vibrant mixed-use community, this area must be served by very high quality rapid transit.

E.1.6.2 City of Toronto Official Plan

Providing convenient, high speed rapid transit connection to this urban growth centre is a key tenet of the City's Official Plan, to ensure Scarborough has the same degree of mobility opportunities that exist in other urban centres (such as North York and Yonge – Eglinton) and that are otherwise planned (including Six Points in Etobicoke). The key transit planning priority for Scarborough Centre is to better connect the Centre to the rest of the Toronto city region in order to:

- Encourage high-quality employment and residential growth in the Centre; and
- Enhance the accessibility of Scarborough Centre; improving the speed, reliability and convenience of transit service linking Scarborough Centre and key destinations in the Toronto city region.

Better connecting Scarborough Centre to the rest of the City and Region is crucial to its success.

E.1.6.3 Scarborough Centre Secondary Plan

Scarborough Centre Secondary Plan envisions Scarborough Centre as the "urban focal point for eastern Toronto where employment, housing, institutional, cultural, recreational, commercial and community services and transit will be concentrated in a dynamic mixed use location. The Centre is a focal point, at the eastern end of the Scarborough Rapid Transit (SRT) line, of numerous local and interregional surface transit lines. It is adjacent to Highway 401 and at the crossroads of several major arterial roadways. These features create greater opportunities for employment and residences within the Centre. Promoting transit supportive development in the vicinity of rapid transit is an Official Plan strategy. Higher densities of both residential and employment land uses in specific locations within the Centre will increase ridership levels to help sustain the transit services, support future transportation improvements and further the City's goal of accommodating balanced growth at strategic locations within Toronto.

E.2. Existing and Future Environmental Conditions

Existing and future[1] conditions provide a baseline for the generation of alternatives, assessment of impacts and the identification of mitigation measures and monitoring needs. Existing and future conditions for the SSE involved the collection of primary and secondary source data derived from surveys, field investigation, published and unpublished literature, government sources and consultation with agencies and the public. For the purposes of this assessment, data collected were organized into the following key categories:

- Natural Environment;
- Emissions;
- Socio-Economic Environment;
- Cultural Environment; and
- Transportation System.

E.2.1 Natural Environment

The principal features related to the existing natural environment, and some key aspects of each, follow. No major changes to any of these features are expected under future conditions.

E.2.1.1 Physiography, Geology and Soil Conditions

The soil conditions, based on historic and recent borehole investigations, are glacial deposits of gravels, sands, silts and clays.

E.2.1.1.1 Groundwater Conditions

The study area has groundwater at depths of 1 to 10 m below grade; specific locations have a high water table.

E.2.1.1.2 Drainage and Hydrology

The study area is located within the Highland Creek watershed and is approximately 102 km^2 in area, with over 75 km of watercourses. The area is almost completely (85 %) urbanized. A significant portion of the watershed's channel network has been either buried underground or lined with concrete or gabion baskets to reduce erosion and prevent flooding. The majority of the existing stormwater system was built before current MOECC guidelines were in place and there are no quality treatment facilities found within the macro drainage system.

E.2.1.1.3 Fish and Fish Habitat

The resident fish community of Highland Creek is typical of a degraded urban stream and supports a warm water and a migratory cold water fish community. The upper reaches of Highland Creek are generally highly degraded by channelization and enclosure, although the City of Toronto and Toronto Region and Conservation Authority (TRCA) are making extensive efforts to rehabilitate several of these tributaries. Brown Trout and Chinook Salmon are known to use reaches downstream of Morningside Avenue, and it is likely that the barrier (weir) observed upstream of Morningside Avenue, would limit this migratory species from accessing upstream areas.

Lands Information Ontario indicates that West Highland Creek supports a cold water thermal regime (based on water temperature) and East Highland Creek supports a warm water thermal regime (based on fish species present). The Dorset Park Branch, Bendale Branch, Markham Branch and Malvern Branch all support warm water fish communities.

E.2.1.1.4 Terrestrial Ecosystems

The Highland Creek watershed is located in a transition zone between the Carolinian (deciduous forest) and Great Lakes-St. Lawrence (mixed forest) regions, but features species and communities more typical of the latter. The Study Area is highly urbanized with most remaining terrestrial natural heritage features associated with valleylands and hydro corridors. Approximately 11 % of the Highland Creek watershed remains in natural forest cover.

E.2.2 Emissions

E.2.2.1 Air Quality

With the current conditions, the worst-case combined concentration is below the guideline for all contaminants except for benzene and particulate matter ($PM_{2.5}$ and PM_{10}) and total suspended particulates (TSP). This is related to the fact that the study area is in an urban environment. In the future, as the area is further developed, there will be added congestion expected on the roadways, which can affect air quality. However, at this time, for the worst case predicted scenario, the background contribution of contaminants that exists in this area results in a more significant impact on air quality than does the contribution from roadway traffic.

E.2.2.2 Noise and Vibration

The potential for air-borne noise and ground-borne vibration levels is a factor to consider for noise / vibration sensitive land uses located in the proximity of the subway alignment. Depending upon the alignment chosen, these sensitive lands uses include residential dwellings / buildings, institutional facilities including a heritage building, hospitals, group homes, places of worship and commercial / industrial establishments encompassing noise / vibration sensitive operations, equipment or functions.

Existing ambient conditions or background sound / vibration levels due to roads are defined by the volume of traffic, traffic mix (cars, buses and trucks), traffic speed, and proximity to the points of reception of concern. McCowan Road provides the highest ambient sound levels for any nearby receptors. The major arterial roads,

1. *Future conditions, for this purpose, are assumed to be without the implications of the Project*

which also provide relatively high ambient sound/vibration levels, include Eglinton Avenue East, Danforth Road, Lawrence Avenue East and Ellesmere Road. The major collector roads include Brimley Road and Brimorton Drive, which provide lower ambient sound levels.

Both ambient sound and vibration levels may be expected to increase over the years due to natural traffic growth.

E.2.3 Socio-Economic Environment

E.2.3.1 Utilities

Utilities include Bell and Rogers telecommunication lines, Enbridge gas lines, Sanitary Sewers, Storm Sewers, Combined Sewers, Watermains, Toronto Hydro and Hydro One lines.

E.2.3.2 Existing Land Use

Scarborough Centre

Shown in Exhibit E2-1, the Scarborough Centre area has been envisioned to become a vibrant urban area by Toronto's Official Plan since 1968. The Centre (see the figure below) is the most important growth area for both employment and residential growth in eastern Toronto.

The Scarborough Town Centre (a regional mall surrounded by large format retail uses, restaurants and surface parking) dominates the Commercial Precinct in the middle of Scarborough Centre. The Civic Precinct lies to the south of the Commercial Precinct and is comprised of the Scarborough Civic Centre, other government buildings, community services, higher density condominiums and a large woodlot to the south along Ellesmere Road. The Brimley Precinct is characterized by low rise offices, wholesale outlets and warehouses. A number of low rise industrial sites are also located on the western border of the area. The McCowan Precinct includes office towers, low-density employment uses and some residential towers on the south side of Highway 401. There are a number of large vacant sites remaining throughout the Centre.

The Eglinton / Danforth / McCowan Corridor

The corridor, through which the subway will run, south of the centre, is characterized by established low rise residential neighbourhoods, with older employment areas located along Ellesmere Road and the west side of Midland Avenue.

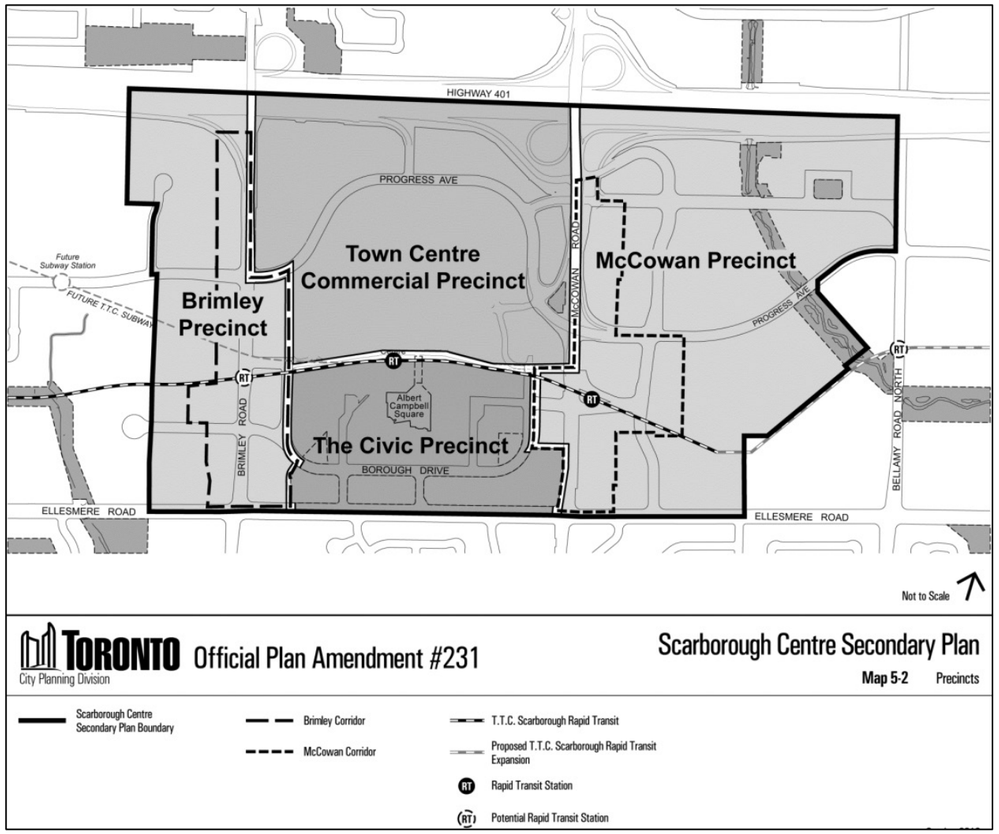
It is expected that the City of Toronto will continue to develop within study area in accordance with the designations within the Toronto Official Plan.

E.2.4 Cultural Environment

The results of the Stage 1 Archaeological Assessment indicate that, while most of the lands within the existing Study Area appear to have been disturbed by past development, some of the study area still retains archaeological potential. Based on available documentation and mapping, there are no designated or listed built heritage resources or cultural heritage landscapes within 100 metres of the recommended station location.

No major changes to the cultural environment are anticipated under future conditions.

Exhibit E2-1: Scarborough Centre – Official Plan



E.2.5 Transportation

A large number of Toronto Transit Commission (TTC) bus routes, the existing SRT, the Bloor-Danforth Subway (Line 2), GO Rail and GO Bus inter-regional services, private intercity bus services and freight rail operations are located within the study area.

In the future, it is expected that an LRT extension from Kennedy Station to the University of Toronto Scarborough Campus, and bus services from Durham Region will also serve the study area. It is also anticipated that the Sheppard East LRT will be built.

E.3. Evaluation Process for Selecting the Preferred Subway Alignment

City staff, together with TTC staff, conducted detailed planning studies to identify the preferred alignment and station location for the extension of the Bloor-Danforth Subway (Line 2) express to Scarborough Centre.

E.3.1 Project Objectives

Specific objectives of the studies were to:

1. Support the City-building principles outlined in the City's Official Plan and Provincial Policy Statement, in particular the development of Scarborough Centre as a vibrant urban node;
2. Make transit as attractive a travel option as practically possible in this area of Scarborough;
3. Minimize Adverse Environmental Impacts associated with the project; and,
4. Achieve Cost-Effectiveness.

E.3.2 Evaluation Approach

The criteria that were found to be the most decision-relevant are: i) the ability to support the existing and planned development within Scarborough Centre, including provisions for future extensions, ii) impacts to existing customers on Line 3 during construction, iii) property impacts and iv) costs

E.3.3 Preferred Subway Extension

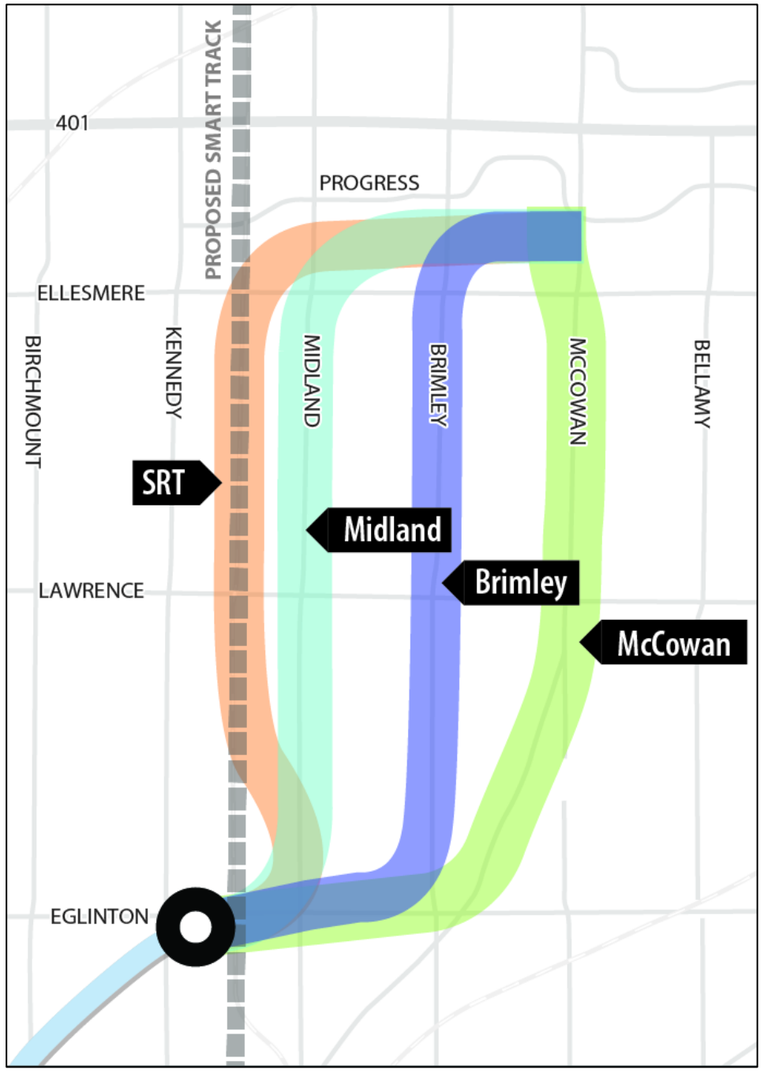
To identify the preferred corridor for the express subway between Kennedy Station and Scarborough Centre Station, the Study Team evaluated the following corridors as per City Council's direction in January 2016 (see Exhibit E3-1):

- SRT – Existing Line 3
- Midland
- Brimley
- McCowan

The evaluation resulted in the identification of the McCowan Corridor as the recommended preferred corridor alternative. The McCowan Corridor option allowed the station to be located in the most central location relative to existing and future developments, offered as fast a travel time as any alternative, permitted the continued operation of the existing SRT line during subway construction, and was the lowest cost of the four alternatives (all options were assumed to have at-grade bus terminals at the time of this assessment).

Subsequent to the initial selection of McCowan as the preferred alignment, staff conducted further assessments to determine if there was a new or modified option that would have a lower capital cost, relative to the McCowan option, but still satisfy the study objectives. One option that was carried forward for more detailed review was a modified alignment via Brimley – with the station located north of the SRT line, on an undeveloped site on the western edge of Scarborough Centre, just on the west side of the mall.. This alternative proved to have a lower capital cost than the McCowan option and, with the station removed from the existing SRT line, it would allow the SRT to remain in operation during subway construction. However, a station on the west side of the mall was found to be significantly less desirable from the perspective of providing the best service to existing customers in this area, and providing a catalyst for future growth. This further process confirmed McCowan as the preferred alignment. Refer to Attachment 1, Initial Business Case for further detail.

Exhibit E3-1: Corridor Alternatives for Express Subway Extension



E.4. Project Description

Since this project is an extension of the existing Bloor-Danforth Subway (Line 2) current technology and operating requirements on the existing line will govern its operation.

The following description of the planned 6.2 km extension of the Bloor-Danforth Subway (Line 2) from Kennedy Station to Scarborough Centre, via Eglinton, Danforth and McCowan, focuses on the following key elements:

1. Alignment – the location and configuration for the running structure.
2. Scarborough Centre Station – the subway station and bus terminal.
3. Ancillary Features – the supporting elements required for the operation of the subway, such as special trackwork, emergency exits, and traction power substations which provide power for operation of the subway trains, as well as the various electrical systems in the subway.
4. Construction Methods – tunnelling versus cut-and-cover techniques.
5. Construction Sequencing – while the construction staging plan that is currently under development.

E.4.1 Alignment

The preferred alignment, shown previously in Exhibit E1-1, travels east along Eglinton Avenue East within the road right-of-way (ROW) from Kennedy Station to Danforth Road. The alignment then travels north along Danforth Road / McCowan Road in the centre of the road ROW until Lawrence Avenue East. North of Lawrence, the alignment runs west of the road ROW to north of the Highland Creek and Hydro Corridor, after which it returns to the centre of the McCowan Road ROW. Beginning a short distance south of Ellesmere Road, the alignment veers to the west, under several private residential properties, a gas station and a woodlot in order to allow the station to be located under the extension of Borough Drive. It then continues underneath Borough Drive / Progress Avenue to the end of the tail tracks immediately south of Highway 401.

E.4.2 Tunnel

A comprehensive assessment of tunneling options resulted in the recommendation for use of a single, large diameter tunnel rather than the twin tunnel construction – two separate 6-metre diameter tunnels - traditionally used by the TTC. This results in reduced cost and reduced construction impacts because the special trackwork – crossovers and tail track - can be constructed within the tunnel as opposed to the cut-and-cover construction that would be required with twin tunnel construction. For more information on tunneling, refer to Section E.4.5.1.

E.4.3 Scarborough Centre Station

Subway Station

The station itself still requires cut-and-cover construction. However, because the tunnel will extend to within a short distance on either side of the subway station box, it is not possible to divert the tracks to either side to create room for a large centre platform as is the case when both the station and special trackwork are constructed using a very long section of cut-and-cover construction. Hence, the tracks must remain at their minimum separation through the station and this requires the use of side platforms.

Bus Terminal

A key component of Scarborough Centre Station is the bus terminal; it provides a key transfer for the many local and regional routes that will serve this new station. It must accommodate a future expanded bus network for TTC, GO Transit, private inter-city carriers, and the introduction of service from Durham Rapid Transit (DRT).

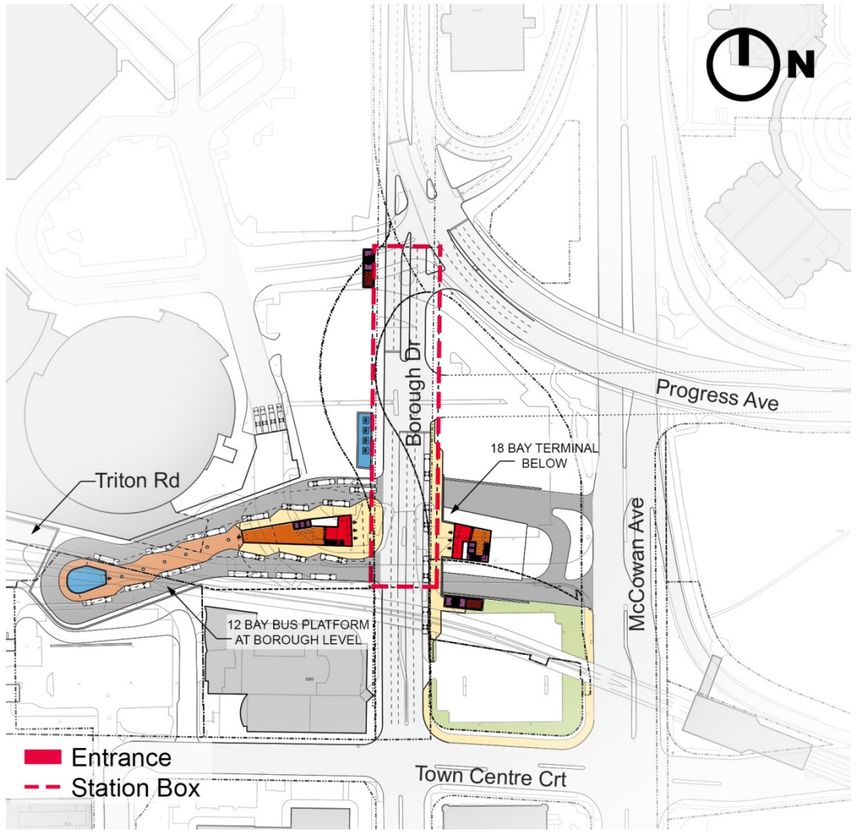
The terminal will require 34 bus bays, 9 of which will accommodate the longer articulated model of buses. This size of terminal provides:

- TTC – 24 bays, with 8 for articulated buses (using TTC Design Manual guidelines)
- GO Transit – 6 bays
- Durham Region Transit – 1 bay, articulated
- Inter-City Private Transit Services – 3 bays

The study of potential locations for this very large terminal concluded that the Triton Road corridor is the preferred location because it would best meet the project objectives related to future development and potential improvements to the road network within Scarborough Centre. The base terminal concept is shown in Exhibit E4-1. The terminal concept shown has two levels. The lower level is in a widened Triton Road and would accommodate 18 bus bays at an elevation similar to McCowan Road. An upper level, at the Borough Drive elevation, would accommodate a further 12 bays and the four remaining bays would be provided on the east side of the new extension of Borough Drive. This road extension, already part of the City's plans for road improvements in this area, is required for this bus terminal and will be constructed as part of this project.

The bus terminal concept presented in this report will continue to be refined through the design process to a) reduce impacts to private property, b) reduce other impacts, and c) reduce costs.
The further development of the bus terminal area will include provision of cycling facilities and consideration of potential opportunities for a taxi stand in the vicinity of a station entrance. However, neither a commuter parking facility nor a Passenger Pick-Up and Drop-Off (PPUDO) facility is included in the project, given that, in keeping with the study objectives, the highest and best use of lands in the vicinity of the new Scarborough Centre Station is transit-supportive development.

Exhibit E4-1: Triton Road Bus Terminal



potential future conditions where the time between trains is scheduled to be much shorter, crossover tracks will also be provided to the north of the station.

3. Tail tracks are to be provided north of the station. These added parallel tracks, together with the north crossover, provide the added length that is required, from a safety perspective, to allow for high operating speed into the station. They also provide for temporary storage of subway trains.

E.4.4 Ancillary Facilities

E.4.4.1 Special Trackwork

'Special trackwork' refers to track, other than standard parallel running tracks that support the operation of the subway. There are three locations where this is necessary:

1. Crossover connections will be provided roughly midway along the length of the subway extension – in the vicinity of Lawrence Avenue East - to allow trains to switch tracks, that is to 'cross over' to the other direction when needed to address service reliability issues on the line or in emergency situations.
2. Crossover tracks are included in front of (ie. just south of) the subway platform at Scarborough Centre Station to enable eastbound trains to terminate and turn back westbound. To allow for

E.4.4.2 Station and Tunnel Ventilation

The SSE project contains a comprehensive fire life safety plan which includes mechanical fire ventilation using fans.

Ventilation shafts are required in the subway station in order to balance air pressure within the tunnels and station and to provide for emergency exhaust and fresh air supply in the event of an underground fire. Ventilation fans can also be used to alleviate high summer temperatures in the underground station.

Initial studies conducted for the SSE have identified a requirement for a mid-tunnel ventilation structure in the vicinity of Lawrence Avenue East. It will be combined with the construction required for an Emergency Exit Building at that location. Based on these initial studies, the at-grade footprint is in the order of 1,000 m^2. The at-grade footprint will be refined during detailed design.

Kennedy Station is slated for fire ventilation upgrades. It has been proposed to perform some or all of this work in concert with SSE project. Fan units will be required at the east end of Kennedy Station in order to provide tunnel ventilation between Kennedy and the fire ventilation to be provided near Lawrence Avenue.

E.4.4.3 Emergency Exit Buildings

Emergency Exit Buildings (EEBs) are the surface element of stairways that extend from the underground tunnel to provide an emergency exit for passengers and an emergency access for firefighting crews. Where feasible, they can also provide for co-location of emergency ventilation and secondary power sources. Each Emergency Exit building requires direct road access to the building by a fire pumper truck and two parking spaces for TTC maintenance purposes. The at-grade footprint of each Emergency Exit Building is approximately 30 m^2.

In accordance with National Fire Protection Agency *(NFPA) 130 and TTC Standards (DM-0102-03/4.2.1)*, emergency egress from the tunnel are provided throughout the underground system so that the distance to an exit is never greater than 381 m. Therefore the distance between emergency exits cannot exceed 762 m.

Eight Emergency Exit Buildings are required for the Scarborough Subway Extension, shown in Exhibit E4-2:

- Emergency Exit 1 – Eglinton Avenue East at Winter Avenue
- Emergency Exit 2 – Danforth Road at Eglinton Avenue East
- Emergency Exit 3 – Danforth Road at Savarin Street
- Emergency Exit 4 – Danforth Road at Barrymore Road
- Emergency Exit 5 – McCowan Road at Lawrence Avenue East

- Emergency Exit 6 – McCowan Road at Meldazy Drive
- Emergency Exit 7– McCowan Road at Hurley Crescent
- Emergency Exit 8 – Corporate Drive at Progress Avenue

The ventilation structure that is required midway along the alignment will be co-located with Emergency Exit Building 5.

Exhibit E4-2: Typical Emergency Exit

E.4.4.4 Traction Power Substations

Electrical power is required to power the trains (referred to as traction power) as well as to operate lights, equipment and safety systems associated with the stations. The connections between TTC's subway and Toronto Hydro's power distribution grid occur in a facility that is referred to as an electrical substation. These substations contain transformers, switches and circuit panels to support the electrical requirements. To meet the traction power requirements for TTC's subway system, substations are typically 2.0-to-2.5 km apart. Since subway stations require power for lights and equipment, TTC usually locates the electrical substations near subway stations. Because the subway extension is 6.2 km long, this extension will require three substations at the following locations:

- Traction Power Substation 1 – Danforth Road at Eglinton Avenue
- Traction Power Substation 2 – Gatineau Hydro Corridor
- Traction Power Substation 3 – located at Scarborough Centre Station.

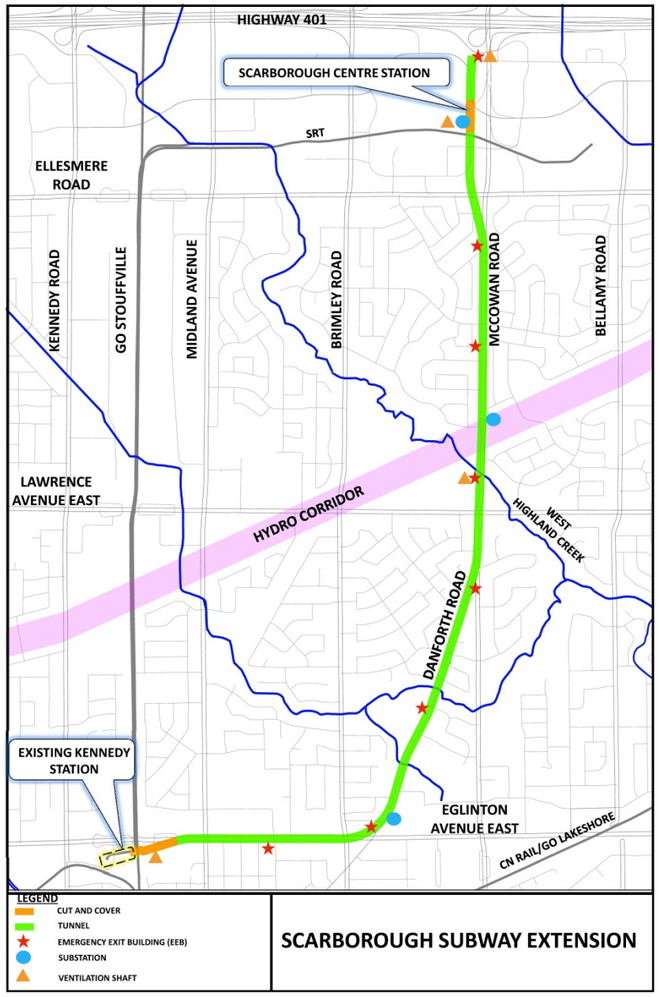
In addition to traction power equipment, the mid-tunnel Traction Power Substations will also house communications and subway signaling equipment rooms.

The order-of-magnitude surface footprint of Traction Power Stations 1 and 2 are 1,000 m^2.

Exhibit E4-3: Traction Power Substation
Don Mills Station

Exhibit E4-4: Traction Power Substation
Aerial View

Exhibit E4-5: Alignment showing locations of Emergency Exits and Ventilation structures



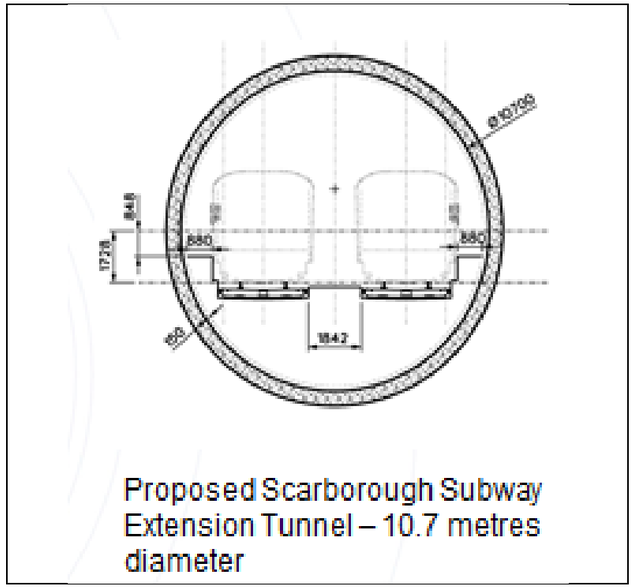
E.4.5 Construction Approach

E.4.5.1 Tunnelled Sections

Tunnelling is the method of construction for the majority of the recommended subway extension. Tunnelling uses a Tunnel Boring Machine (TBM) to excavate a tunnel, handle the excavated material, and place the initial tunnel lining, in a continuous, highly automated process. The front end of the TBM consists of a circular cutting face that excavates the soil and pulls it into its round shell. Traditionally, tunnelling techniques in Toronto have utilized two separate tunnels – one for each direction, otherwise known as twin bores (6 metre diameter per TBM). However, the recommended tunnelling method for this project will utilize a large single bore machine, 10.7 metre diameter, which can accommodate both set of tracks within a single tunnel. This approach also allows the special trackwork to be constructed within the tunnel rather than the requirement for long sections of cut-and-cover as is required with twin bore tunnelling – a significant reduction in construction impact. The single tunnel would also be less costly to construct.

Exhibit E4-6: Single Large Diameter Tunnel

Vancouver Evergreen Line, Tunnel Boring Machine "Alice" – 10 metres diameter



E.4.5.2 Cut-and-Cover Construction

For some site-specific sections of the subway line, excavation by a TBM is not practical or economical and cut-and-cover construction is necessary. The ground surface is opened (cut) a sufficient depth to construct the subway tunnel structure. The sides of the excavation are usually supported by vertical temporary walls to minimize the volume of material excavated and to protect adjacent areas. The walls require cross-bracing or tiebacks for support. Once the construction excavation is complete, the contractor builds the structure from the bottom to the top of the structure. Once the structure construction is complete, the remaining excavation is backfilled and the surface is reinstated. When the construction is taking place within a roadway, decking is normally installed to allow the surface to be used for traffic while the construction activities are taking place below.

With reference to Exhibit E4-5, the conditions where cut-and cover construction is necessary in this project are:

- Station – The large spans (station platform widths), relatively short lengths and complicated spatial arrangements normally preclude economical tunnelling.
- Emergency Exits and vent structures
- The shallow section immediately east of Kennedy Station.

E.4.5.3 Launch/Extraction Shafts and Tunnel Construction Sites

The tunnel construction would begin at the north end of the alignment in order to complete the tunnel excavation to the south side of the station location as quickly as possible. This allows the construction of the station to occur at the same time as the majority of the tunnel construction is taking place.

The tunnel boring machine would be 'launched' in the area shown in Exhibit E4-7. This requires a very large excavation, roughly 90 metres in length and 20 metres in width. The tunnel boring machine would proceed south, past the station location; the primary tunnel work site would be established immediately south of the station box and existing SRT guideway.

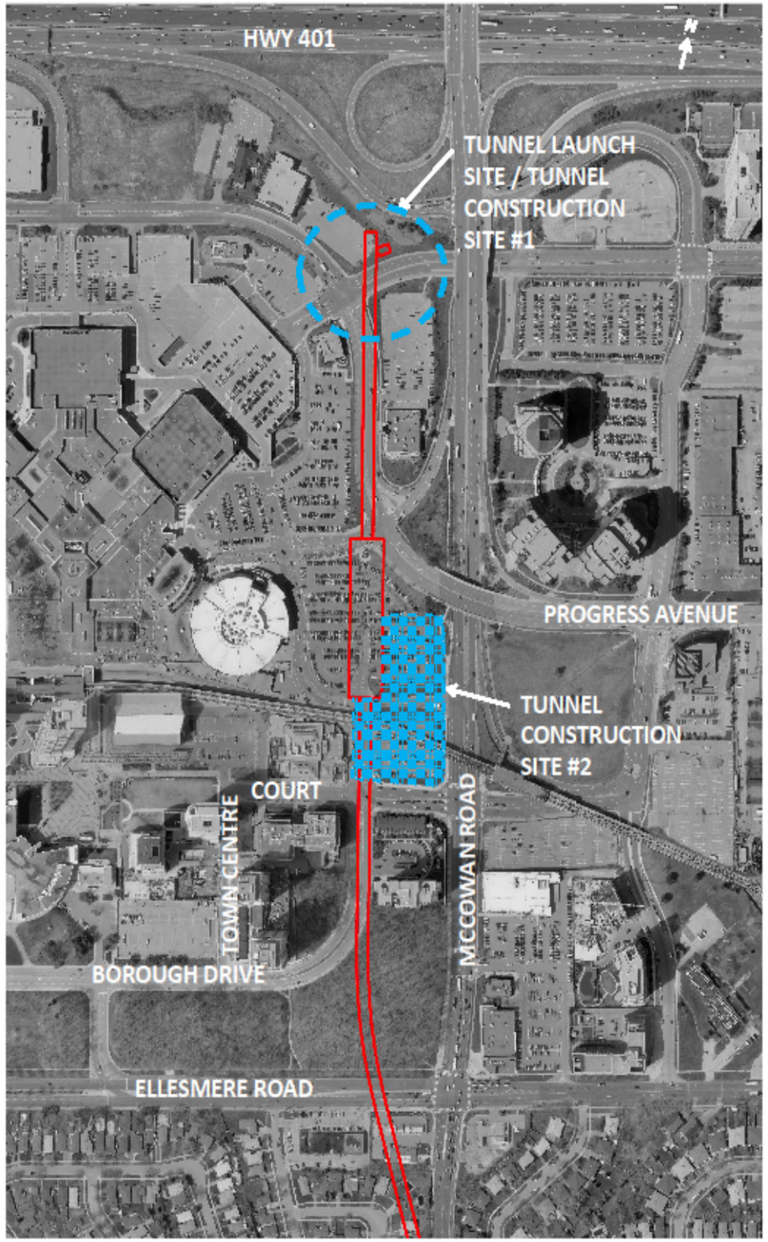
The tunnel work site is a temporary construction site where many key functions of the subway construction takes place, including point of entry for the tunnel liners and tracks, and the excavation of discharged tunnel soil. Trucks bring the tunnel liners to this site and take excavated soil away. This work site requires an area of approximately 10,000 m^2 (1 ha) and will be in operation for the majority of the duration of the construction.

The tunnel boring machine launch site must act as a temporary work site until the tunnel boring machine reaches the primary work site, south of the station.

As a result, this area will be subject to the greatest level of impact during the construction phase.

The current plan is to extract the tunnel boring machine via a shaft on the south side of Eglinton Avenue, in the vicinity of Town Haven Place. The tunnel boring machine is dismantled in the tunnel and taken out in sections, thus requiring a significantly smaller shaft relative to the launch shaft. The staging plans for the cut-and-cover section immediately east of Kennedy Station will incorporate final plans for the extraction shaft.

Exhibit E4-7: Proposed Tunnel Work Sites at Scarborough Town Centre



E.4.5.4 Staged Construction of the Bus Terminal

The existing SRT structure is an impediment to the completion of the new bus terminal. For this reason, the bus terminal must be constructed, and opened, in two separate phases:

Phase 1: ... The portion of the bus terminal that can be constructed with the SRT structure in place will be completed prior to the opening of the subway. Buses will have use of the existing bus terminal during this time. However, as a result of the construction activities around the station area, Triton Road will be closed west of McCowan – potentially for lengthy periods of time – and the majority of buses now using the SRT bus terminal will have to be rerouted to the Triton Road access at the Brimley Road side of the mall.

Phase 2: ... Once the subway is opened, the SRT and existing SRT bus terminal will be closed and buses will be able to use that portion of the new bus terminal that was constructed during Phase 1. An interim plan will be developed for bus service to serve the new subway station. This will involve using the partially-completed bus terminal to the greatest extent possible, supplemented as necessary by temporary bus stops in the southbound bus-only right turn lane on McCowan Road at the station entrance and/or on the newly constructed Borough Drive.

The SRT, including the existing SRT station and bus terminal, will be demolished and the remainder of the bus terminal completed. The preliminary schedule for these activities suggests that the entire new bus terminal will be available 1.5-to-2 years after the subway is operational.

E.5. Environmental Impacts, Mitigation Measures and Monitoring

The environmental impacts for the Scarborough Subway Extension Project are categorized as follows:

- **Displacement of Existing Features** by Project Facilities – Permanent impacts to existing features located within the footprint of the Project that are physically altered to accommodate project facilities.
- **Construction Impacts** – Temporary impacts, occurring only during construction activities.
- **Operations and Maintenance Impacts** – Ongoing and long-term impacts occurring during operations and maintenance activities.

Key impacts and mitigation measures associated with each of these categories are described below.

E.5.1 Displacement of Existing Features

- **Drainage and Hydrology** – The Project will impact existing storm sewers potentially requiring relocation or replacement. The extent of the potential impact and the required relocation / replacement will be identified in the subsequent detailed design phase.
- **Drainage and Hydrology** – The proposed station facilities and bus terminal will be constructed in already built up areas resulting in minor increases in impervious areas. To address impacts to surface water quality, quantity, water balance and erosion control, lot level controls will be implemented for the proposed subway station and its associated facilities.
- **Terrestrial Ecosystems** – Potential impacts on vegetation will be mitigated to the extent possible through avoidance, minimizing the extent of vegetation removals, protecting existing vegetation and restoring vegetation that is removed.
- **Buildings and Property** – Thirty-six private properties are permanently impacted, which includes the full acquisition of one entire commercial property and thirty-five partial private property interests. Six properties in public ownership are also impacted and property interests will be required. In addition, temporary property requirements are necessary to facilitate construction. These requirements will be confirmed during the detail design phase. The City of Toronto will negotiate with the affected property owners for TTC and provide compensation through either a negotiated agreement, or in the event that expropriation is required, in accordance with the *Ontario Expropriations Act*.
- **Aesthetics** – The displacement of existing facilities and the addition of new transit facilities will alter the visual setting in which they are located. Particular attention will be paid to locating and screening of non-public station elements during the detail design phase to minimize impact on residential or commercial areas.

E.5.2 Construction Impacts

The running structure through underground sections will be constructed by tunnelling methods. The Station and special track work areas will be constructed by cut-and-cover method, for example, emergency exit buildings, ventilation shafts, and traction power substations will be constructed following standard at-surface construction methods with excavation activities for connection to the underground sections. In general, mitigation measures will include detailed engineering studies and ongoing management and monitoring of construction activities.

- **Terrain and Soils, Groundwater** – Impacts to groundwater, terrain and soils during construction include ground movement, settlement (and structural stress) due to tunnelling, dewatering and displacement of excavated materials. A soil and groundwater management strategy as well as a monitoring program for dewatering will be developed prior to construction. The tunnel will be constructed using an earth pressure balancing tunnelling boring machine and temporary dewatering will be minimized using water tight continuous support of excavation (e.g., caisson wall, slurry wall) as required. Where necessary, underpinning will be used to minimize the potential for building settlement / structural stress due to excavation, piling and dewatering.
- **Drainage and Hydrology** - Impacts to drainage and hydrology are expected for segments requiring cut and cover construction. The construction of the emergency exit building at the north end of the Scarborough Hospital will likely require the relocation of potential existing storm sewers and retention tanks and may pose temporary impacts to the West Highland Creek. Hydraulic analysis and modelling will be undertaken during detail design to further refine controls. Erosion and sedimentation control measures will be implemented to prevent the potential migration of sediments off-site. Lot level controls will also be implemented for the proposed station, bus terminal and ancillary facilities associated with the tunnel.
- **Terrestrial Ecosystems** – Displacement and disturbance to vegetation may occur during construction. A tree inventory will be undertaken during the detail design phase to document the impacts to trees within the cut and cover construction area. A Tree Preservation Plan will also be developed to determine tree protection and mitigation.
- **Air Quality** – There is potential for temporary dust, Nitrogen Oxides and volatile organic compound emissions during construction affecting local air quality. Best management practices will be implemented to prevent the potential release of dust and other airborne pollutants off-site.
- **Noise and Vibration** - The existing high ambient sound levels are likely to reduce the significance of the noise during construction, although such noise will be clearly audible during peak periods of construction. Noise and vibration measures will be implemented to prevent potential disturbance from construction equipment and activities to nearby receptors.
- **Utilities** – Utilities such as municipal services (watermains, storm and sanitary sewers), Toronto Hydro, Enbridge Gas and telecommunications companies (Bell, Rogers, Zayo, Cogeco and Telus) will likely be impacted by cut and cover construction. Temporary support and protection of utilities will be sought where possible. For large utilities that cannot be temporarily supported, relocation of utilities may be required.
- **Automobile Traffic and Transit Services** – Traffic on Eglinton Avenue, Danforth Avenue and McCowan Road will experience additional delays and queues due to reduced lane availability for

cut and cover construction. TTC bus services may be disrupted due to the reconfiguration of Triton Road access at McCowan Road. A Traffic Impact Study will be conducted to analyze and address issues related to traffic and transit services during construction and operation of the bus terminal. Signage and traffic monitoring programs will be developed and temporary roadside stops will be implemented for affected bus routes.

- **Pedestrians and Cyclists** – Temporary disruptions to sidewalks near construction sites along Eglinton Avenue, Danforth Avenue and McCowan Road are expected. Signage and barriers will be implemented to provide physical separation from construction sites and to ensure pedestrian safety. Alternative routing and/or construction staging options will be employed to maintain pedestrian connections on major roads (Eglinton Avenue, Danforth Avenue, McCowan Road, Progress Avenue).

E.5.3 Operations and Maintenance Impacts

The top of the tunnel structure through underground sections will be about 9 metres below the surface at its more shallow point and 29 metres deep at its deepest point. Given the depth of the tunnel, the operation of the subway is expected to have negligible effect on existing land uses in the study area. Impacts during operation and maintenance are largely related to drainage and hydrology, air quality and noise. For these potential impacts, appropriate measures will be implemented to avoid, minimize or mitigate adverse effects to the extent possible.

- **Drainage and Hydrology** – There is potential for water quality to be impacted due to pollutant loading from the proposed driveways, bus bays and access roads. Lot level controls will be implemented to mitigate these impacts.
- **Air Emissions** – Although no special consideration for air emissions generated by bus terminal operations is required, standard TTC operating policies and procedures with regard to idling buses will be applied to this Project.
- **Noise and Vibration** – Noise and vibrations are expected from subway movement and ancillary facilities such as traction power substations, emergency exit buildings and ventilation shafts. The initial impact assessment concluded that, in applying appropriate mitigation measures at appropriate places, there will be no location predicted where the proposed subway extension would create an unacceptable level of noise or vibration. For the tunnel infrastructure, vibration isolation is achieved with a floating slab track system which mitigates the vibration and subsequent noise levels. Additionally, ancillary facilities will be designed with sound absorbent material to ensure sound emissions are acceptable. During design, further detailed noise and vibration studies will be conducted for the Scarborough and Rouge Hospital and the houses on Stanwell Drive.

E.6. Future Commitments

During pre-planning work, the City of Toronto and TTC have worked closely with key stakeholders to address and resolve any issues or concerns. Not all issues can be addressed within the context of a Transit Project Assessment since the design of the SSE has been prepared to a conceptual level and further details are required to finalize property requirements, planning initiatives, construction issues, and permits and approvals. The following Table E6-1 presents an overview of the proponent's commitments to future studies, permits and approvals during detail design, construction and operations and maintenance. The category column below corresponds with the associated impact that the future commitment was identified under.

Table E6-1: Future Commitments / Permits and Approvals

	Feature	Future Commitments / Permits and Approvals	Category *D – Displacement* *C – Construction* *O – Operations & Maintenance*
1.	**Consultation**	Develop a communications plans and a public consultation plan for the design and construction phases of the project. This will include a community relations program that will provide businesses, residents and commuters with regular project information and respond to enquiries.	**C**
2.	**Consultation**	Create a Construction Liaison Committee made up of community stakeholders in order to respond to, proactively monitor and address construction issues.	**C**
3.	**Consultation**	Provide a Project Information Centre that is open to the public. TTC Community Liaison Officers will be on-hand during the week to speak to visitors and share information about the project. The Project Information Centre will also be used to hold meetings and workshops with stakeholders.	**C**
4.	**Consultation**	Consult with emergency service providers – fire, police and emergency medical services – to develop plans to maintain emergency access during construction.	**C**
5.	**Consultation**	Develop a communications plan/ protocol to address any changes in TTC, GO Transit, Durham Transit and inter-regional bus carriers during construction.	**C**
6.	**Consultation**	Conduct further consultations with emergency service providers on Scarborough Subway Extension facility design details (e.g., Fire routes to stations).	**O**
7.	**Terrain and Soils**	Prepare and implement a Soil and Groundwater Management Strategy, including: –Water treatment methods, which results in discharge water quality complying with prevailing Toronto Regional Conservation Authority (TRCA) and City of Toronto water guidelines and requirements; and, –Procedures for management and disposal of excavated materials, including excess soils and contaminated soils, in accordance with applicable environmental legislation, regulations and guidelines.	**C**
8.	**Terrain and Soils**	Conduct Phase 1 and 2 Environmental Site Assessments, as applicable, prior to property acquisition.	**C**
9.	**Groundwater**	Obtain Permit to Take Water from Ministry of the Environment and Climate Change Ontario, (MOECC) for locations where dewatering exceeds 50,000 litres per day.	**C**
10.	**Groundwater**	Obtain Discharge Permit or Discharge Agreement with the City of Toronto for dewatering during construction.	**C**
11.	**Groundwater**	Execute Industrial Waste Surcharge Agreement with City of Toronto, if water discharge to sanitary sewer exceeds City of Toronto Sanitary and Combined Sewer By-Law.	**C**
12.	**Drainage and Hydrology**	Conduct Hydraulic Analysis and Modelling to define the level of impacts on flow rates, runoff volumes, and water levels and velocities as a result of the above ground structures. Develop and implement a Stormwater Management Strategy based on hydraulic analysis and assessment. The Stormwater Management Strategy will be designed to meet the TRCA Stormwater Management Criteria (2012).	**D**
13.	**Drainage and Hydrology**	Co-ordinate with the City of Toronto for ongoing City Projects within the Bendale Branch of Highland Creek.	**C**
14.	**Drainage and Hydrology**	Obtain permits and approvals in accordance with Ontario Regulation 166/06 (Regulation of Development, Interference with Wetlands and Alterations to Shorelines and Watercourses) within TRCA-regulated areas (Bendale Branch of Highland Creek).	**C**
15.	**Drainage and Hydrology**	Prepare an Environmental Management Plan for the construction of Emergency Exit #5 to assess and address impacts such as nearby terrestrial features from construction, any dewatering concerns that could relate to dewatering impacts to surface features such as fish and fish habitat.	**C**
16.	**Drainage and**	Prepare an Erosion and Sedimentation Control Plan, which	**C**

Table E6-1: Future Commitments / Permits and Approvals

	Feature	Future Commitments / Permits and Approvals	Category *D – Displacement* *C – Construction* *O – Operations & Maintenance*
	Hydrology	complies with prevailing TRCA and City of Toronto guidelines and requirements.	
17.	**Fish and Fish Habitat**	Prepare and submit a Request for Review by Fisheries and Oceans Canada (Note: project is not exempt from review under Fisheries and Oceans Canada self-assessment criteria) for the following locations where the subway alignment crosses below: – Tributary of Dorset Park Branch of West Highland Creek – Dorset Park Branch of West Highland Creek – Bendale Branch of West Highland Creek	**D**
18.	**Terrestrial Ecosystems**	Obtain the following permits from the City of Toronto in accordance with the Tree Protection By-law: – Permit to Remove Healthy City-owned tree – Permit to Injure or Destroy Trees on Private Property	**D**
19.	**Terrestrial Ecosystems**	Determine, in consultation with City of Toronto, whether the Ravine and Natural Feature Protection By-law applies to this project. Obtain a Ravine and Natural Feature Permit, as applicable, from the City of Toronto for the proposed Emergency Exit 5.	**D**
20.	**Terrestrial Ecosystems**	If vegetation clearing is required during the nesting season (as defined under the *Migratory Birds Convention Act*), retain a qualified avian biologist to conduct a nesting survey. If active nests are found, prepare a site-specific mitigation plan in consultation with the Canadian Wildlife Service.	**C**
21.	**Air Quality**	Obtain Certificate of Approval for Air Quality, in accordance with the Environmental Protection Act (through MOECC), as required, for the Scarborough Centre Station bus terminal and ventilation structures.	**O**
22.	**Noise and Vibration**	Obtain Noise By-Law Exemption or Noise By-Law Amendment, if required, in accordance with City of Toronto By-Law requirements, for 24-hour tunnelling and other schedule critical construction activities.	**C**
23.	**Noise and Vibration**	Conduct additional noise and vibration studies for construction sites located adjacent to sensitive uses (residential, Bendale Library and Scarborough and Rouge Hospital).	**C**
24.	**Noise and Vibration**	Obtain MOECC Environmental Compliance Approvals for all relevant stationary noise sources such as HVAC equipment, ventilation shafts and transformers.	**O**
25.	**Noise and Vibration**	Conduct additional detailed noise and vibration studies verifying the impact of the subway, as required, in order to ensure that MOECC/ TTC protocols are achieved. This involves site specific	**O**

Table E6-1: Future Commitments / Permits and Approvals

	Feature	Future Commitments / Permits and Approvals	Category *D – Displacement* *C – Construction* *O – Operations & Maintenance*
		vibration measurements near the Scarborough and Rouge Hospital and Stanwell Drive that will validate analysis assumptions made in the noise and vibration impact assessment.	
26.	**Noise and Vibration**	Undertake additional noise and vibration analysis during detailed design for the traction power substations to determine impacts and the associated mitigation measures, if required.	**O**
27.	**Utilities**	Develop utility and municipal servicing relocation plans with service providers. Contact utility companies (Bell Canada, Rogers Communications Partnership, Cogeco Data Services. Zayo Group (formerly Allstream Inc.), Telus Communications Company, Enbridge Gas, Toronto Hydro Electric System Limited and the City of Toronto (watermains, stormwater and sanitary sewers) early during design to confirm plant location and discuss relocation strategies / cost sharing.	**C**
28.	**Utilities**	Obtain the following permits and approvals from the City of Toronto or MOECC: – Sewage Works Approval (Transfer of Review Program) –Environmental Compliance Approval Application - Sewage Works –Drinking Water Works Permits and Municipal Drinking Water Licenses –Sewer Use Permit for Discharge of Groundwater into Sanitary or Storm or Combined Sewer –Water and sewer connections	**C**
29.	**Buildings and Property**	Conduct further discussions with Hydro One to confirm the technical criteria for locating a traction power substation in the Gatineau Hydro Corridor.	**D**
30.	**Buildings and Property**	Assist in an Infrastructure Ontario Class Environmental Assessment for the Gatineau Hydro Corridor lands.	**D**
31.	**Buildings and Property**	Obtain permits from the Ministry of Transportation (MTO), as applicable, –Encroachment Permit for Subway tailtrack structure (located within 14 metres of Highway 401) –Building and Land Use Permit for all above and below-grade subway structures located within 395 metres of the centreline of Highway 401 Signs Permits for any temporary or permanent signs (including traffic control) within 400 metres of Highway 401.	**D**
32.	**Buildings and**	Obtain Permission to Enter Agreements with private and public	**D**

Table E6-1: Future Commitments / Permits and Approvals

	Feature	Future Commitments / Permits and Approvals	Category *D – Displacement* *C – Construction* *O – Operations & Maintenance*
	Property	property owners for pre-construction investigations, including the following specific permits: – Parks Access Permit from City of Toronto or access to the Frank Faubert woodlot and Hydro One Lands (Gatineau Hydro Corridor) – Notice of Entry Permit for access to Hydro One lands (Gatineau Hydro Corridor) – Encroachment Permit for access to Ministry of Transportation (MTO) lands	
33.	**Buildings and Property**	Obtain demolition permits from the City of Toronto for demolition of buildings and structures.	**D**
34.	**Buildings and Property**	Conduct pre- and post-construction surveys for all utilities, buildings and structures within the zone of influence of subway construction, and monitor as appropriate during construction.	**C**
35.	**Buildings and Property**	Conduct Settlement Impacts Assessment for the tunnelling and Scarborough Centre Station construction based on the results of the geotechnical and geo-environmental investigation program. Specifically, the assessment will address: – Tunnelling in the vicinity of Hydro One Networks Incorporated Tower 41 (Gatineau Hydro Corridor) – Tunnelling under existing buildings and structures – Cut and cover construction for Scarborough Centre Station and the tunnel construction shaft in the vicinity of the Scarborough RT	**C**
36.	**Buildings and Property**	Obtain Building Permits and other related permits (e.g., Designated Structures Permit, Sign Permit/ Sign Variance Permit, Site Services Permit, Heating, Ventilation, Air Conditioning (Mechanical) Permit, Plumbing Permit. Etc.) from the City of Toronto, as required for new structures, including Scarborough Centre Station and stand-alone support structures.	**C**
37.	**Buildings and Property**	Undertake Designated Substances Surveys for any buildings or structures which require demolition.	**C**
38.	**Buildings and Property**	Refine design of Scarborough Centre Station and the associated bus terminal to minimize impact to private property, impact to local streets envisioned by existing planning policies and capital costs.	**C**
39.	**Buildings and Property**	Work with the City of Toronto to ensure that the design and disposition of the various functional elements of the Scarborough Centre Subway Station including, but not limited to, the station	**D**

Table E6-1: Future Commitments / Permits and Approvals

	Feature	Future Commitments / Permits and Approvals	Category *D – Displacement* *C – Construction* *O – Operations & Maintenance*
		entrances, bus terminal, emergency exit buildings, ventilation structures, power substations, and other at-grade building services installations on the station site and/or along the subway alignment comply with current City of Toronto planning and urban design policies and guidelines and the Transportation Services current City standards applicable to streetscape elements within the public right-of-way i.e. pedestrian and cycling facilities and street furniture. A Design Brief outlining the Scarborough Subway Extension alignment and station site context is to be provided to clarify and guide the building and site design and development expectations. A context responsive system-wide building and site design and development approach is to be provided for individual and/or consolidated emergency exit, ventilation and power substation buildings anticipated to be located at intervals along the subway alignment between the Kennedy and Scarborough Centre stations.	
40.	**Buildings and Property**	Comply with and obtain development approvals, permits and/or licenses through the City of Toronto standard Site Plan Application process as applicable for all station sites; to include but not limited to minor variances and zoning by-law amendments as identified through the design development and preliminary and formal Site Plan Application submission.	**D**
41.	**Archaeology**	Conduct Stage II Archaeological Assessment and secure Ministry of Tourism and Culture Sign-off in areas where ground disturbance will occur during construction and which will have archaeological potential.	**D**
42.	**Built Heritage Resources and Cultural Heritage Landscapes**	Conduct a Heritage Impact Assessment for Scott House (520 Progress Avenue) and implement findings and recommendations during construction (in the vicinity of 520 Progress Avenue).	**C**
43.	**Automobile Traffic and Transit Services**	Secure an Official Plan Amendment to modify Map 4 to designate the recommended Scarborough Subway Extension corridor as “Transit Corridor” in the City of Toronto Official Plan.	**D**
44.	**Automobile Traffic and Transit Services**	Obtain Highway Alteration By-Law approval from the City of Toronto, as applicable, for permanent alterations to municipal roads.	**D**
45.	**Automobile Traffic and Transit Services**	Conduct a separate study for the decommissioning of the Scarborough RT – from Kennedy Station to the McCowan	**D**

Table E6-1: Future Commitments / Permits and Approvals

	Feature	Future Commitments / Permits and Approvals	Category *D – Displacement* *C – Construction* *O – Operations & Maintenance*
		Maintenance and Storage Facility, in accordance with the requirements of the Ontario Environmental Assessment Act.	
46.	**Automobile Traffic and Transit Services**	Work with Metrolinx to refine the concept and future alignment of the Eglinton East LRT extension east of Kennedy Station in order to inform the detail design of the SSE tunnel between Kennedy Station and Danforth Road.	**D**
47.	**Automobile Traffic and Transit Services**	Obtain the following permits City of Toronto for construction within the existing City of Toronto road allowances. –Road Cut Permit – Major Construction (Civil Works and Utility Relocations) Street Occupation Permit	**C**
48.	**Automobile Traffic and Transit Services**	Conduct a Traffic Impact Study and develop a Traffic Management Plan for construction to address the following: –Pedestrian, cyclist, and vehicular traffic bypasses around construction sites –On-street and off-street parking Transit service reliability.	**C**
49.	**Automobile Traffic and Transit Services**	Co-ordinate with the Ministry of Transportation (MTO) for any MTO projects on Highway 401 in the vicinity of McCowan Road.	**C**
50.	**Automobile Traffic and Transit Services**	Conduct a traffic, bus operations, and parking impact study for the new Scarborough Centre Station.	**O**
51.	**Rail**	Conduct further discussions with Metrolinx to confirm approvals and monitoring requirement for construction adjacent to the GO Rail Stouffville corridor. Secure Metrolinx approvals (e.g., Metrolinx Work Permit) in accordance with these discussions.	**C**
52.	**Other**	Prepare a monitoring plan in accordance with subsection 9.2.8 of Ontario Regulation 231/08 to verify the effectiveness of mitigation measures.	**D / C / O**

E.6.1 Environmental Project Report Addendum Process:

The TTC will prepare an addendum to the Environmental Project Report if significant changes to the project occur after the Notice of Completion is issued. This will be done in accordance with Section 15 of the Ontario Regulation 231/08. Steps to complete the Addendum will include:

1. Preparation of an Addendum to the Environmental Project Report
2. Preparation of a Notice of Addendum to the Environmental Project Report; and
3. Distribution of the Notice of Addendum to relevant stakeholders, the public and the MOECC.

E.7. Consultation Process

E.7.1 Communication and Consultation Process

An extensive communication and consultation program was undertaken as part of the assessment to inform the community and seek feedback on various aspects of the study. The consultation program was initiated when the studies were based on a three-stop subway extension to Sheppard Avenue East .

In total, the consultation program comprises four formal rounds of communication and consultation - three as part of the preliminary planning and one under the TPAP. Furthermore, there were a number of in-person and online tools and activities to make it easy for the community to get involved and provide feedback.

E.7.2 Consultation during the Preliminary Planning

E.7.2.1 Public Communication and Consultation

Public Meetings during the preliminary planning phase were held between January 2015 and June 2016.

- During the stage when the study was evaluating a three-stop subway extension to Sheppard Avenue East, two meetings were held in January and February of 2015 to introduce the Project and alternative corridor options and receive feedback on the Consultation Plan and Terms of Reference; a further eight public meetings were held in the month of June 2015 to gather feedback on the evaluation of those corridor options
- In February and March of 2016 public meetings were held to provide an update on the changing transit planning landscape in Toronto and to introduce the optimized transit plan for Scarborough, including the express subway extension to Scarborough Centre
- During May and June of 2016 four meetings were held to provide information and gather feedback on the evaluation results of the express subway to Scarborough Centre, including the preferred corridor and alignment

All public meetings allowed the public to ask questions, and offered Discussion Guides for the public to offer their feedback at a time and in a matter most convenient to them.

E.7.2.2 Feedback Received from the General Public on the Proposed Express Subway

During the February/March 2016 consultations the express subway extension approach was introduced and triggered mixed reviews from the public. While some expressed support for the addition of the Eglinton East LRT to the plans, many expressed strong concerns about the removal of the Lawrence Station (and access to Scarborough General Hospital) from the subway extension. These mixed reviews were reiterated during the second round of consultation which occurred in May/June 2016. During this round, the subway alignment was also introduced and potentially impacted properties were identified. Major concerns were expressed by specific property owners and from the Glen Anderson community Association about the recommendation for an alignment that would be under 10 privately owned single family residential properties on Stanwell Drive, immediately south of Ellesmere Road. These concerns led to questions to allow them a better understanding of why the McCowan corridor was chosen as the preferred alignment.

E.7.2.3 Technical Advisory Committee (TAC)

The TAC was established in the early stages of the preliminary planning phase in order to facilitate communication and consult on key recommendations between the Study Team and key stakeholders throughout the study. A total of seven TAC Meetings were held between November 2014 and February 2017. Members of the TAC included representatives from a variety of departments within the City of Toronto, in addition to the TTC, Metrolinx, Toronto Hydro, and the Toronto Region Conservation Authority.

E.7.2.4 Government Review Team (GRT)

Meetings with key agencies were held throughout the preliminary planning phase to provide updates on the project status and to seek advice, comments and questions related to the project. To date a total of two Government Review Team meetings have been held.

E.7.2.5 Indigenous Engagement

Indigenous Communities within in the study area were engaged at key milestones throughout the project. Notifications have been sent via email and registered mail to each community including the following:

- Mississauga's of the New Credit First Nation
- Alderville First Nation
- Curve Lake First Nation
- Hiawatha First Nation.
- Kawartha Nishnawbe First Nation
- Mississauga's of Scugog Island
- Williams Treaties First Nation

No comments or concerns have been received on this matter

E.7.2.6 Stakeholder Advisory Group (SAG)

A SAG was established to provide a forum for identified stakeholders to discuss opportunities, concerns, needs, issues and risks related to the project.

In total, 33 organizations representing a broad range of stakeholder interests (community / neighbourhood, businesses, institutions, professional interests and transit-oriented groups) were invited to take part in the SAG.

There were a total of four SAG meetings and one Interactive Workshop between February 2015 and February 2017. The meetings were used to discuss the costs of construction impacts, development opportunities, concern for existing residents and opportunities to improve connectivity. The SAG meetings also provided insight on preferred corridor options and allowed participants to ask questions and gain a deeper understanding of the decision-making process.

E.7.3 [Placeholder for TPAP Consultation]

[The results of the consultation that will take place during TPAP will be summarised here]

Attachment 3 – Additional Renderings

Aerial view, looking south-west

EX23.1

This graphic is an aerial view of Scarborough Centre, from Consilium Place looking south west towards Scarborough Town Centre.

This aerial vantage point illustrates the different street network and opportunities and opportunity to animate the street frontage of McCowan Road between the two options. It also shows the different development potential opportunities between McCowan Road and Borough Drive, from an eastern vantage point.

Isometric view, looking north-west

This view is from the east side of McCowan Road, just south of Progress Avenue, looking west towards Scarborough Town Centre.

This vantage point hones in on the street network differences, highlighting a normalized intersection at Progress Avenue and McCowan Road for the Triton Terminal option, versus the existing grade-separated conditions we see today in Scarborough Centre for the typical at-grade concept. This graphic also highlights the differences in bus operations, where the Triton concept "tucks" buses away in the vicinity of Triton Road, while the at-grade terminal sits in a prominent space in the Centre.

EX23.1

Scarborough Subway Extension
Toronto Transit Commission
Value Engineering Study

November 17, 2016

BT Eng Project 16-017

November 17, 2016
BTE Project BTE16-017

Mr. Selim Gabra
Senior Project Manager
Scarborough Subway Extension
Toronto Transit Commission
5 Park Home Avenue, 4th Floor
M2N 6L4
Toronto ON

Dear Mr. Gabra:

Re: Scarborough Subway Extension Value Engineering Study

Please find enclosed our draft Value Engineering (VE) Report dated November 4, 2016 for the Scarborough Subway Extension.

The report documents the results of the 5-day workshop held September 12th to September 16th, 2016 in Toronto, Ontario. During the workshop, the team developed a common understanding of the problems and opportunities, and defined the project functions. This report documents the project review and the recommendations of areas for further investigation as the project progresses.

In parallel with the VE study a peer review of the current project risk assessment was carried out, the details of which are included as an appendix to this VE report.

Should you require additional information and/or clarification, please do not hesitate to contact me by telephone at **(416) 488-5353** or by email at **steven.taylor@bteng.ca**.

Very truly yours,
BT Engineering

Steven Taylor, P.Eng., M.Eng., CVS-Life
Value Engineering Team Leader

586 Eglinton Avenue East, Suite 212
Toronto, Ontario M4P 1P2
Phone: 416-488-5353

Table of Contents

Executive Summary

Project Introduction and Scope

This report summarizes the results of the Value Engineering (VE) Study carried out by BT Engineering (BTE) for the Toronto Transit Commission (TTC) for the review of the Scarborough Subway Extension project. The project location is the extension of the existing Bloor-Danforth subway line from the existing Kennedy Station approximately 6.25 km northeasterly to the Scarborough Town Centre, following an alignment along McCowan Road.

The Toronto Transit Commission initiated the Value Engineering (VE) Study to review the early design development of the Scarborough Subway Extension project. At the time of the VE study the TTC had completed an initial cost estimate and risk assessment, and had begun a review of potential delivery models for the project. This review allowed the City of Toronto, TTC, designers and independent team members an opportunity to examine the design at the 5% design milestone. The workshop was a significant project milestone to ensure that the final project is cost effective, constructible and in keeping with the project delivery objectives. The process focussed on identifying creative alternative solutions for the project while meeting the performance needs of the TTC, at the lowest life cycle cost. The review was also to validate the cost estimate and constructability of the design.

The key issues and objectives for the workshop included:

- Direction of senior management to review the project at the 5% design level to focus on cost effective investment while maintaining all performance requirements and considering life cycle costs;
- Review Design and Engineering;
- Validate magnitude of project cost;
- Review and provide input to Risk Register and Project Schedule; and
- Review and comment on the project delivery approach.

The project scope includes the following key elements:

- Extends existing Bloor-Danforth Line 2 from the existing Kennedy Station to a new Scarborough Centre Station (SCS)
- Building a new 6.25 km subway extension
- 10.7 m single bore tunnel (12 m cut diameter)
- New underground subway station
- Single level at-grade 34 bay bus station
- 3 Sub-stations and 8 Emergency Exit Buildings
- Launch and working shafts
- Fan Plants (3) and Ventilation Building
- Existing SRT Service to be maintained during construction

- Meet TTC's level of service standards

The basis of design that was considered at the workshop is the McCowan Alignment Revision J controlled, with an at-grade bus terminal. The baseline design available at the workshop was estimated to be approximately at the 5% design level (September 2016). The associated cost estimate reflects an earlier design development that pre-dates the current 5% design level.

The project contains two major elements including a linear single bore tunnel with associated Emergency Exit Buildings and ventilation shafts, and the future subway and at-grade bus station adjacent to the Scarborough Town Centre.

The construction cost estimate for the concept level baseline design is estimated to be approximately $2.7 billion (escalated to 2021 $) with the SCC Station, Bus Station and Running Structure (tunnel) representing 64% of the total project cost. The construction cost model is illustrated in **Figure E1**.

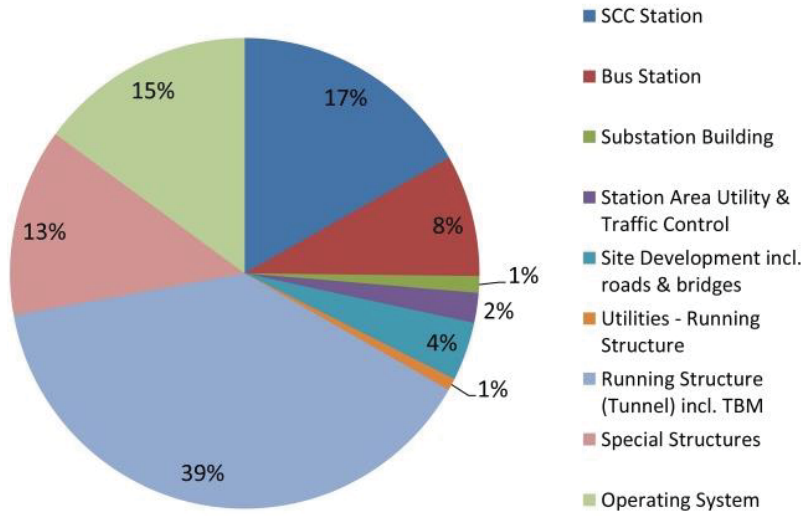


Figure E1: Construction Cost Model

This VE Review represents the consensus of the VE Team, based on the results of the Workshop session. This report is intended to focus the Design Team on select elements of the project which appear to offer the best opportunity to improve value and to ensure constructability of the project.

Value Engineering Review Process

The VE Study included pre-workshop activities reviewing the risk and cost estimating completed to date followed by a 5-day workshop from September 12th to September 16th, 2016. The workshop focus was to validate the current design, cost estimate, and risk assessment and consider the cost effectiveness of the design approach and functional requirements as well as generate, evaluate and develop innovative ideas for alternative value enhancements.

The mixed value engineering team was comprised of Toronto Transit Commission (TTC) management, engineering and operations staff, Design Team mem-

bers from AECOM and Hatch, as well as independent participants from Hanscomb, IBI Group, McNally Construction (tunneling contractor), Stantec, Thurber and Parsons. Toronto Transit Commission Senior Management staffs were present for the opening and closing presentation phases of the workshop.

The goal of the VE Study is to improve value. Value is best defined as the relationship of Function (quality or performance or benefits) versus Cost (monetary, time, environmental impact, etc.). The relationship between Value, Function, and Cost is expressed as: Value = Function (Performance)/Cost.

Value Engineering Workshop Results

The workshop reviewed the project planning and design completed to validate the progress to date. The cost review is described in Section 3.

The initial estimate was reviewed by Hanscomb Cost Consultants, a third party cost consultant, as part of the Value Engineering review, and substantiated as a valid and complete estimate that reflects the level of design.

Risk Review

An independent review of the initial TTC risk assessment was completed in parallel to the pre-workshop activity. This was followed by the VE Team providing input during the workshop to test the probability of occurrence and magnitude of effects of the top 20 schedule and cost risks identified to date. The independent risk review is documented in Appendix D. This review concluded that the approach has followed the best management practices of the industry and the risks identified to date are reasonable.

Schedule Review

The project schedule is based on initiation in 2016 with the initial 3 years allocated for utility relocations, 30% design, and procurement of a design–build contractor. In September 2019 the contract will be awarded. Construction is estimated to take approximately 6 years to complete with an initial 5 month start-up period for the contractor to start construction.

The VE Team validated that the timelines are reasonable forecasts for the construction. Specific ideas that could allow acceleration of the works by de-linking the station and tunnel construction operations are described in the VE proposals.

Project Delivery Model

TTC presented a brief summary of its Draft Contract Packaging Analysis in order to (i) survey the VE Team's experience and (ii) obtain feedback on the analysis process and evaluation criteria.

A brief summary of the presentation and feedback received is documented in the report.

Design Review

The workshop defined a list of candidate value proposals to assist in the delivery of a quality project. The study generated **181** ideas that had the opportunity to improve value (i.e. improve performance or reduce cost while meeting the required performance). From this long list the VE team short-listed **64** ideas which were most likely to be implemented. **Appendix E** presents the entire list of ideas (181) from the creative phase of the workshop and those short listed (64) are presented in Section 7.3, **Table 9** below.

The short listed ideas were carried forward for development into VE Proposals, including analysis and costing.

Summary of Recommended VE Proposals

Based on the creative brainstorming and the subsequent expert specialist review of the 64 short listed ideas, the Team built consensus for the following list of **35** VE Proposals for further investigation by the TTC and design team. (Note: The TTC carried forward 62 items. **See Section 7.3** below for further details).

A summary of the proposals and the magnitudes of the cost avoidance/ or recommended budget increases is presented in **Table E1**:

Table E1: Summary of VE Proposals and Cost Avoidance/Budget Increases

	VE Proposal	Magnitude of Cost Avoidance (excluding mark-up)
	Station	
1	New Bus Plaza – Elimination of Bus Terminal	$50M (TB-01/03/04/07/09/13/18/19/26)
2	Construct bus terminal over shifted subway station	$30M (TB-07)
3	Allow for 2 level bus terminal	$TBD (TB-14)
4	Allow future development opportunities	$TBD (TB-18/19)
5	Alternate bus terminal roof finish	$TBD (TB-29/30)
6	Revisit number of bus bays by reviewing network (routes terminate at SMART TRACK stations)	$TBD (TB-25)
7	Use short section of SRT for monorail and pedestrian link to stations	$TBD (RP-08)
8	Build Centre Platform terminal station	$TBD (BS-03)
9	Reduction in Station Program Space	$TBD (BS-06B)

	Mechanical	
10	Reduce number of fans by 2 in Station	$4.1M (CA-03)
11	Remove centre wall and increase fan size	$3.3M (CT-09)
12	Create service tunnel in invert space	$TBD (CT-13)
13	Provide hoist in Emergency Exit Building (EEB) structures to drop FLS equipment	$400,000+ (LS-01)
14	Investigate if number of substations can be reduced by new technology	TBD (O-01)
15	Eliminate 6 EEB structures except 2 EEB structures with fan plants and add cross passages	Significant savings (CT-21/ SS-01)
16	Use Ontario Building Code (OBC) life safety criteria in lieu of TTC criteria	$TBD (SS-06)
	Tunnel/Structural	
17	Support of excavation as permanent structure	$9M (BS-01)
18	Raise the station	$TBD (BS-02)
19	Allow alternate codes for elements including support of excavation (SOE) and structures	$TBD (BS-06)
20	Tie-back to minimize king piles and struts	$6.5M (BS-10)
21	Pre-cast for stairs and slabs	$2.2M (BS-18)
22	Shift alignment to McCowan and create at-grade Station	$100M - $150M range (CT-01)
23	Change the mass concrete in base slab to granular	$1.6M (CT-10)
24	Reduce track system concrete thickness	$14M (CT-14)
25	Use galvanized steel safety walkway rather than concrete	$TBD (CT-15)
26	Steel fibre reinforcement for tunnel lining	$TBD (CT-16)
27	Reduction in length of launch shaft	$TBD (O-15)
28	Use rubber boots rather than slab over rubber pucks	$TBD (LV-01)
29	Performance specification to achieve TTC requirements (Design Build)	$TBD (CC-02/R-07/R-12)
30	Change Progress Avenue to an at-grade tee intersection	$1.5M to $12M (O-09/A-B)
31	Complete entire tunnel from Kennedy launch and negotiate with Metrolinx	$ Property and Capital Savings TBD (SC-05)
	Other Design Suggestions	
32	GBR and geotechnical risk options	$TBD (R-01, R-02, R-04)
33	Share risk allowance (contingency) that allows contractors to have an interest in achieving an early schedule completion. At the end of the contract the allowance is shared equally	$ TBD (R-19)
34	Allow contract completion flexibility (use escalated penalty clause stepped at end to allow DB price not to be based on a fixed end-date) and bonus clauses	(SC-11)
35	Allow 24 hour work for tunnel (contractor flexibility)	(R-12)

Note: Cost avoidance forecasts are provided as an order of magnitude of potential savings only and the estimates do not include the contingency mark-up.

The most significant proposals include:

- Elevate the subway station to reduce the capital cost of temporary excavations and dewatering. This would allow a future extension of the subway under Highway 401 with shallow cover (it was noted a current project is using 2 m of cover under an MTO freeway)
- In conjunction with an elevated station, introduce a portal south of the station that will allow the tunnel installation to be entirely separated from the station
- Design the new station to support a joint use development with mixed use development over the station (the land will have a higher value after the subway and bus station are constructed)
- More compact bus station and potentially to salvage the existing station as a split bus terminal to minimize the investment in new infrastructure
- Elimination of 1 or 2 of the roadway bridges as both a safety improvement and cost avoidance
- Potentially reducing the number of Emergency Exit buildings by capturing the life safety benefit of constructing a wall between the sides of the tunnels (allows persons to have fire separation by using an exit door immediately through the middle wall)
- The tunnel will become a linear infrastructure corridor and there is a potential to use the space in the bottom of the tunnel for utilities and within the station for mechanical and electrical rooms
- The number of fans may be reduced

Context of the VE Review

It must be recognized that the proposals and recommendations from the VE Team represent the consensus of the team following five days of intensive review of the early concept level design of the McCowan Alignment Revision J. These recommendations will be the subject of more detailed review and analysis.

Conclusions and Recommendations

In conclusion, the VE Team validated the constructability of the 5% design for the project and built consensus for design changes that could allow it to be delivered more cost effectively. The opinion of the VE Team is that the proposed design modifications are viable approaches. These constitute a shopping list for the owner and design team to review at the implementation meeting post workshop. Detail design will refine the conceptual elements as described in this report based on the direction provided following the implementation meeting. A recommendation is that the design development should be reviewed at the 20% level of design to again focus on cost validation, risk assessment and innovation.

1.0 Introduction

1.1 Background

This report summarizes the results of the Value Engineering (VE) Study carried out by BT Engineering (BTE) for the Toronto Transit Commission (TTC). The mixed value engineering team was comprised of TTC management, engineering, and operations staff, AECOM, the City of Toronto, Hanscomb, HATCH, IBI Group, McNally, Stantec, Thurber and Parsons. Members of the TTC Senior Management were present for the opening and closing presentation phases of the workshop.

The project location is illustrated in **Figure 1.**

The elements of the Scarborough Subway Extension project include:

- Extends existing Bloor-Danforth Line 2 from the existing Kennedy Station to a new Scarborough Centre Station (SCS)
- 6.25 km extension of dual running track
- Single Bore 10.7m internal diameter tunnel
- New subway and at-grade bus stations constructed at Scarborough Centre
- Existing SRT Service to be maintained during construction
- Meet TTC's level of service standards

The VE Study included a 5-day workshop from September 12th to September 16th, 2016 to analyze functional requirements of the project, review the preliminary cost estimate and generate, evaluate and develop ideas for alternative value enhancements. The exercise focused on the 5% design drawings.

The purpose of the workshop was to provide an independent review of the project to date including cost estimate and risk analyses and define a list of candidate value proposals to assist in the delivery of a quality project.

The basis of design that was considered at the workshop is the McCowan Alignment Revision J controlled, with an at-grade bus terminal. The baseline design available at the workshop was estimated to be approximately at the 5% design level (September 2016). The associated cost estimate reflects an earlier design development that pre-dates the current 5% design level.

The basis of the 5% design is illustrated in **Figures 2** to **6** illustrating the running tunnel, Scarborough Town Centre subway station and bus station. **Figure 6** illustrates maintaining the existing road network over the new bus station with bridges over the new bus station.

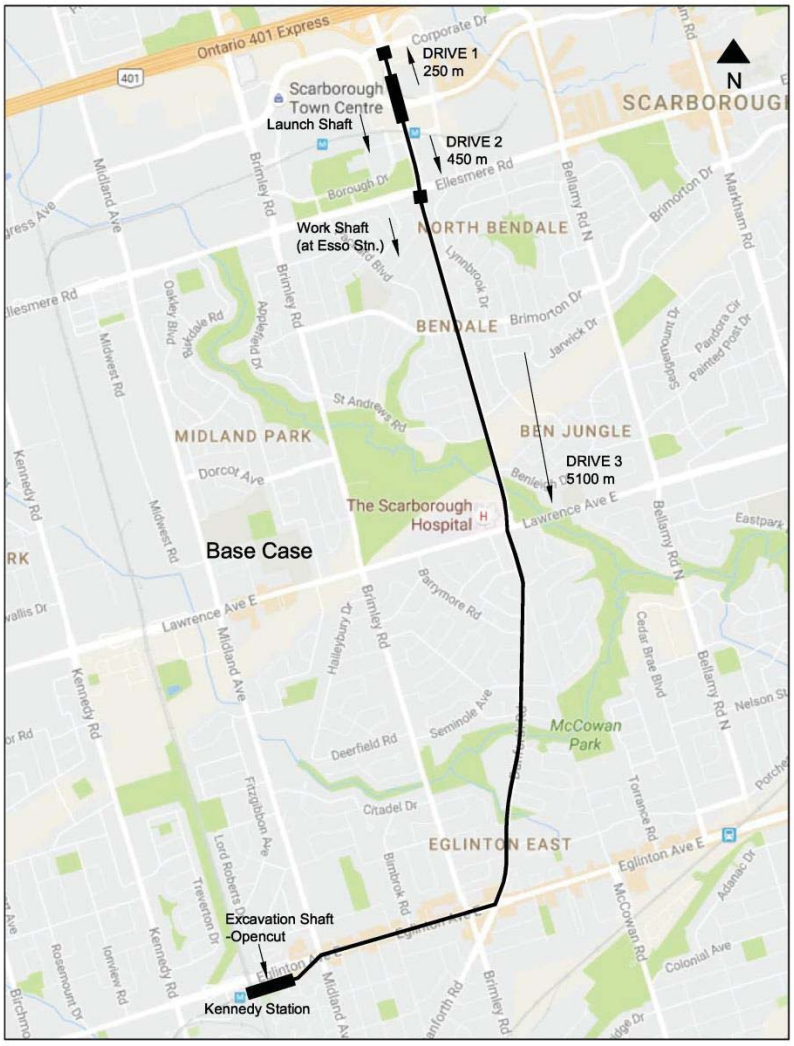


Figure 1: Project Location

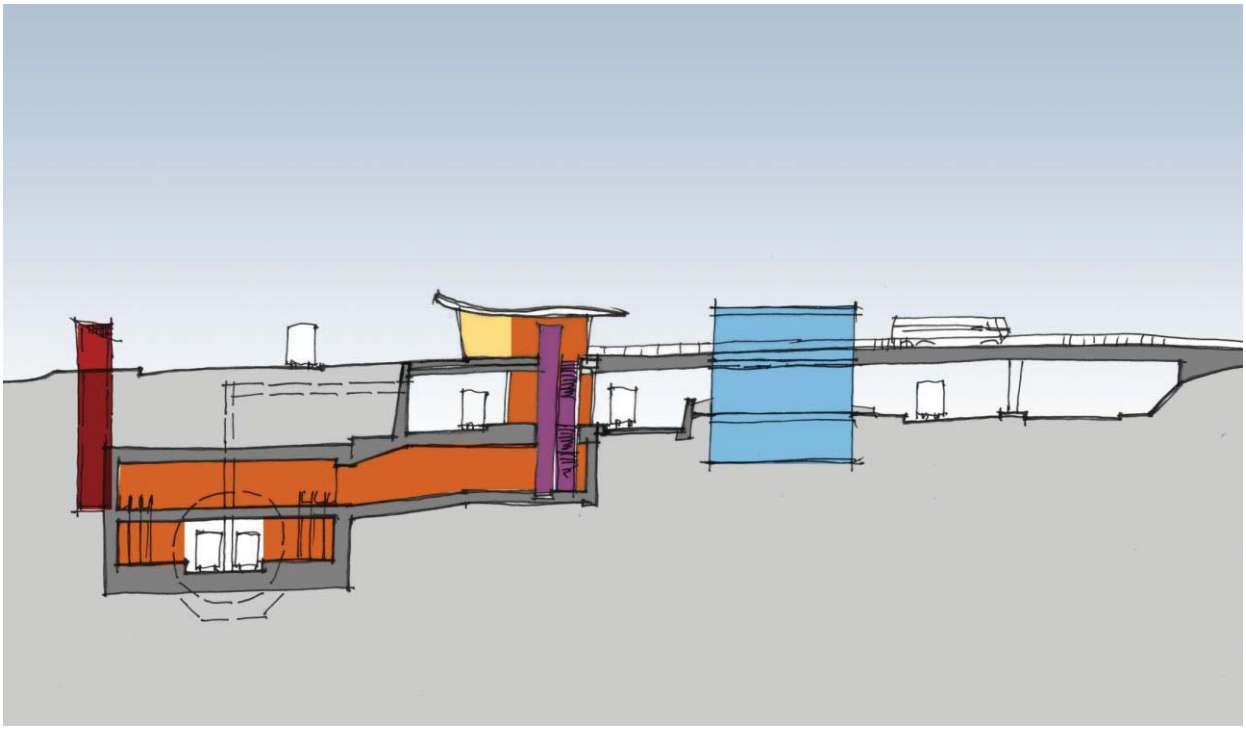


Figure 2: Scarborough Town Centre Station (looking north)

Figure 3: Scarborough Town Centre Station (looking northwest)

Figure 4: Scarborough Town Centre Station Cross Section of Subway and At-grade Bus Station

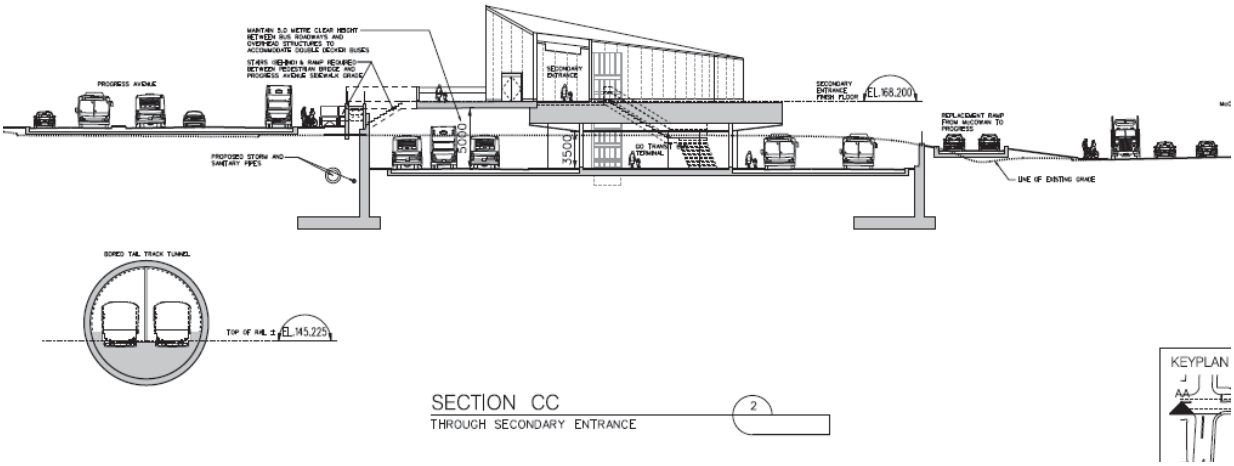


Figure 5: Scarborough Town Centre Station At-grade Bus Station

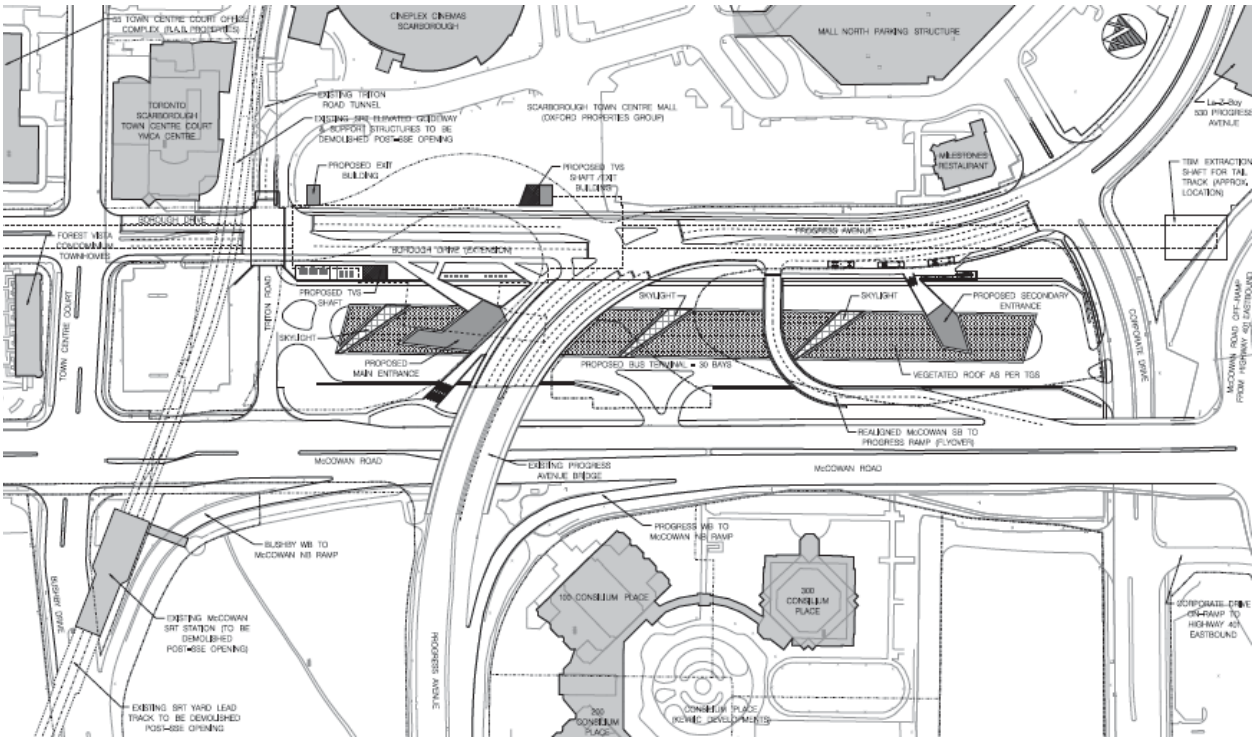


Figure 6: Project – Bus Station

1.2 Purpose of the VE Study

The purpose of the workshop was to provide an independent review of the project to date and define a list of candidate value proposals to assist in the delivery of a quality project more closely aligned with the initial construction budget of $2.7 billion. This considered:

- VE Milestone – 5% Design
- Question all previous decisions
- Focus on value
- Focus on constructability and risks
- Mandate to provide shopping list of ideas back to design team and TTC/City reflecting advice of industry experts
- Ideas present consensus of 5 days of review realizing verification will be required by design team after workshop

The workshop was a significant project milestone to ensure that the final project delivered is cost effective, constructible and in keeping with the project delivery objectives of the Toronto Transit Commission.

1.3 Value Engineering Process

The VE Study included a 5-day workshop on September 12th to September 16th 2016 to analyze functional requirements and generate, evaluate and develop ideas for alternative value enhancements as well as to validate the current design, estimated to be at approximately 5%.

The Value Engineering approach is a powerful decision-making process, which differs from the conventional scientific process by focusing on the project/process functions to allow both convergent and divergent thinking. Alternatives are then generated to appropriately deliver the functions required for the success of the project.

The study utilized the 6-phase job plan of SAVE International to define the necessary project requirements and prioritize elements. This was achieved through the three VE primary stages: pre-workshop, workshop, and post-workshop activities.

The workshop approach was to utilize a joint team comprised of both design team and independent team members. Additional members of the design team also participated in the information and presentation phases of the workshop.

The pre-workshop activities included data collection, analyzing and reviewing study materials supplied by the Design Team, and model development, which established the primary elements of the project design proposal. The pre-workshop tasks also included reviewing the preliminary cost estimate using an independent cost consultant and an independent review of the project's risk assessment using an independent risk consultant.

The workshop focused on reviewing functional requirements of the project and then generated, evaluated and developed ideas of alternative value enhancements (Value Proposals) to move forward with the project. The post-workshop activities involved further refinement of the ideas short-listed by the VE Team and screening by the owner and design team on which ideas to implement, as well as the preparation of the draft and final VE report.

1.4 Governing Principles

Discussions with the Toronto Transit Commission and the design team prior to, during, and following the workshop helped to define the principles that were important, and would contribute to the success of the study. The governing principles of the VE Study were defined to be:

- The VE Team will remain focused on necessary elements defined in the study scope, but will document generated ideas, outside the scope, that may be of benefit to others;
- All suggestions will be accepted by the VE Team and evaluated later for application and development;
- The VE Team will focus on the cost models, risk assessment, functions and value of components to ensure that the most appropriate and cost-effective solutions are selected; and
- The Owner (City of Toronto and Toronto Transit Commission) will continue to have the authority and responsibility to accept, modify, or reject any/all recommendations and estimate corrections made by the VE Team.

1.5 Workshop Agenda

The agenda included all phases of the Value Management Standard – Information, Function Analysis, Creativity, Evaluation, Development, and Presentation.

The full Agenda for the Workshop is presented in **Appendix B** and is summarized in **Table 1: Workshop Agenda.**

Table 1: Workshop Agenda

Activities
Information Phase
• Value Management Overview
• Project Overview Presentations
• Defining Opportunities/Commitments/Constraints
• Quality Modelling
• Team Site Visit
Analysis Phase
• Review of Cost Model
• Review of Top 20 schedule and cost risks
• Identifying Project Functions
• Preparation of FAST diagram
• Cost/Worth Analysis
• Target Costing Analysis
Creativity Phase
• Defining Targets
• Creative Brainstorming
Evaluation Phase
• Screening of ideas to be championed
Development Phase
• Technical write-ups of ideas
Presentation Phase
• Preliminary results presentation of ideas and concepts on final day of workshop
Post-Workshop
• Draft and Final Value Engineering Report
• Final workshop report
• Implementation Meeting

1.6 VE Team

The VE Study Team was comprised of technical specialists and select staff from TTC management, engineering, and operations staff, AECOM, the City of Toronto, Hanscomb, HATCH, IBI Group, McNally, Stantec, Thurber and Parsons.

The Workshop Team is shown in **Photo 1**.

Photo 1: VE Team

During the workshop the members who made up the VE Team were asked to set aside the perspectives of their individual organizations and act solely as knowledgeable experts in their fields of planning, design and operations. The VE Team recommendations/ideas do not reflect the approval of any agency.

The VE Study Team members and their affiliation, expertise, and attendance are listed in **Table 2: VE Team** and the workshop registration sheets are included in **Appendix C**.

The design team presented background information to inform the VE team members and workshop participants of the project scope and objectives on Day 1 of the workshop. The Top 20 schedule and cost risks were reviewed during the workshop. **Appendix G** includes an overview of the risk assessment provided for review by the independent risk consultant.

Steve Taylor, P.Eng., M.Eng., CVS-Life, BT Engineering, served as the VE Team Leader (VETL) for the Workshop session and oversaw the preparation of the VE report. **Table 2: VE Team** provides a listing of the VE Team members.

Table 2: VE Team

Name	Specialty	Representing
Steve Taylor	VE Team Leader	BT Engineering (BTE)
Wayne Hyde	Assistant VE Team Leader/Project Manager	BT Engineering (BTE)
Mary Jane Baron	VE Administration	BT Engineering (BTE)
Abbas Khayyam	Project Manager, Tunnel Ventilation	AECOM
Bryan Shaw	Architecture	AECOM
Dilip Shah	Tunnel Ventilation Systems	AECOM
Howard Jung	DPM/Structural	AECOM
Stuart Lerner	Structural/Stations	Stantec
Bill DeAngelis	Procurement/Constructability	City of Toronto
Mike Logan	Planning/EA	City of Toronto
Molly McCarron	Decision Support	City of Toronto
Dale Panday	Cost	Hanscomb
Nathan Thinagarippilai	Cost Consultant	Hanscomb
Brian Garrod	Tunnels	HATCH
Matthew Geary	Tunnel	HATCH
Nima Eslaminasab	Tunnel Ventilation Systems/Mechanical	Hatch
Tomas Gregor	Project Management, Tunnel Design	HATCH
Richard Stevens	Architect	IBI Group
Steve Skelhorn	Construction	McNally
Veeramany Harharaiyer	Planning/Scheduling	Stantec
Masoud Manzari	Geotechnical Engineer	Thurber
Damien Forbes	Owner	Toronto Transit Commission
Rick Thompson	CPM	Toronto Transit Commission
Selim Gabra	Civil/Structural	Toronto Transit Commission
Desmond Chiu	Cost Estimating	Toronto Transit Commission
Dragomir Jeyremonic	Construction	Toronto Transit Commission
Ed Poon	Civil/Structural	Toronto Transit Commission
Fulvio Fanti	Manager - Estimating	Toronto Transit Commission
Geoffrey Creer	Geotechnical	Toronto Transit Commission
Gordon Torp-Peterson	Director of Design and Engineering	Toronto Transit Commission

Table 2: VE Team

Name	Specialty	Representing
Jey Vellauthapillai	TTC Estimator	Toronto Transit Commission
Jordan Schreiner	Utilities	Toronto Transit Commission
Les MacDermid	Director - Systems	Toronto Transit Commission
Michael Ruel	Civil/Structural	Toronto Transit Commission
Michael Tham	Track Alignment	Toronto Transit Commission
Natasha Jailal	Property	Toronto Transit Commission
Reza Salamat	Senior Scheduler	Toronto Transit Commission
Stephanie Rice	SSE - Third Party Planning and Property	Toronto Transit Commission
Susan Reilly	SSE - Project Administrator	Toronto Transit Commission
Tessa Mackey	Permits and Approvals	Toronto Transit Commission
Troy Cui	Engineering Coordinator	Toronto Transit Commission
Vincent Teng	Stations	Toronto Transit Commission
Yesika Beer	Risk Assessment Office	Toronto Transit Commission
Rene Lipp	Track	Parsons

1.7 VE Job Plan

The Job Plan prepared for the VE Study follows the standard VM methodology (October 1998) of SAVE International (authority to accredit Value Management). The VE Job Plan (refer to **Figure 7**) is conducted in three stages – Pre-Workshop, Workshop, and Post-Workshop.

The Job Plan originally prepared for the VE Study was essentially maintained, although several activities were adjusted in scope to accommodate a greater thrust in some areas. The VE Study results serve as key input into the project.

1.7.1 Pre-Workshop Activities

The pre-workshop activities included data collection, analyzing and reviewing study materials supplied by the Design Team for the McCowan alignment Revision J. The pre-workshop also included an independent review of the cost estimate by Hanscomb cost consultants and a review of the project risk assessment by the independent risk consultant (Gannett Fleming). The planning estimate was prepared by the TTC and established the project 5% design budget. The risk assessment was completed by the TTC and was also used as the basis of the independent review.

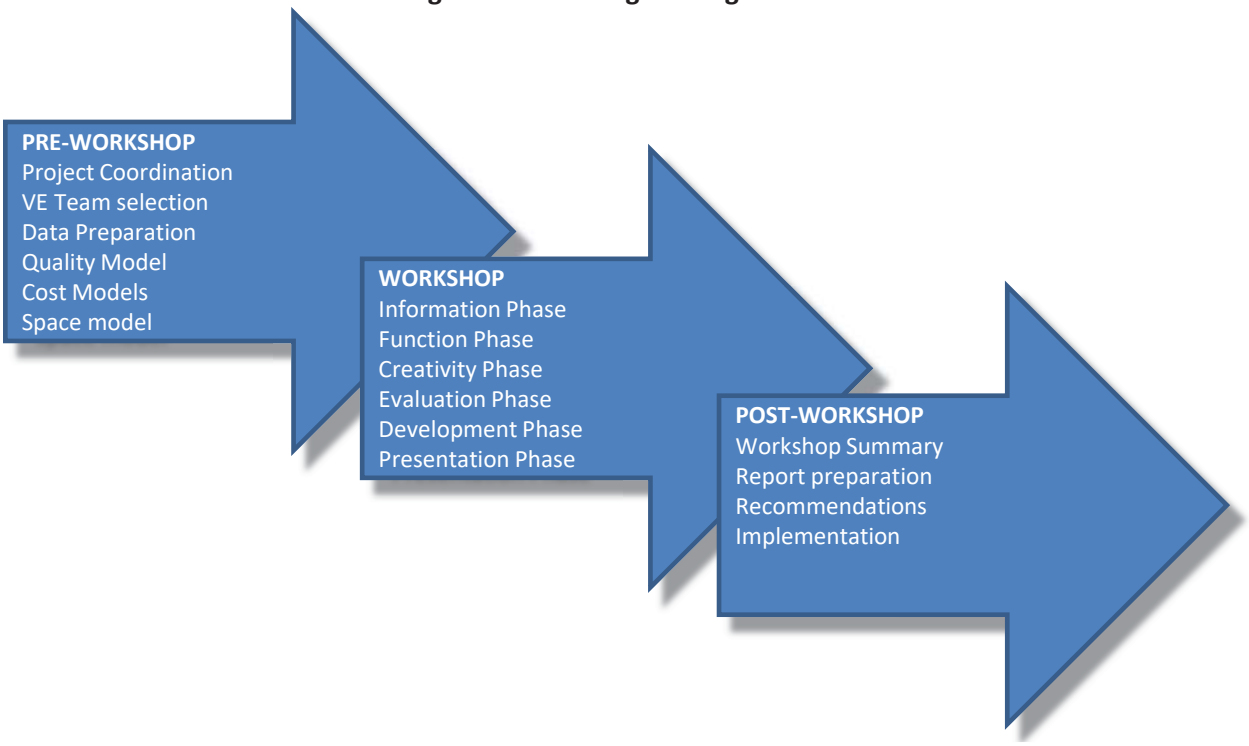
1.7.2 Workshop Activities

The work plan prepared for the VE Workshop followed the VE work plan consisting of the Information, Function Analysis, Creativity, Evaluation, Development, and Presentation phases of the SAVE International value methodology standard. The workshop analyzed functional requirements and generated, evaluated and developed ideas of alternative value enhancements to move forward with the project.

Post-Workshop Activities

The FAST (Function Analysis System Technique) diagram was finalized based on the draft FAST diagram and the functions identified during the Workshop. Each idea was assessed in terms of how it will (or should) be used during the project. The Post-Workshop activities involved the review of the input from the VE Workshop, finalization of the cost estimates for the Value Proposals and the preparation of the VE report.

Figure 7: Value Engineering Job Plan



EX23.1

TORONTO TRANSIT COMMISSION (TTC)
SCARBOROUGH SUBWAY EXTENSION

McCOWAN ALIGNMENT – FOOTLONG STATION DESIGN OPTIONS TTC ESTIMATE PEER REVIEW

Prepared by

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T. 416-487-3811

November 4, 2016

Hanscomb

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Executive Summary

Introduction

Hanscomb Limited has been retained by BT Engineering to provide an Independent Estimate Peer Review of the Toronto Transit Commission (TTC) Order of Magnitude Estimate (OME) for the proposed Scarborough Subway Extension Project. The TTC's OME was prepared based on 2% to 5% complete documentation.

Our Scope of Services is comprised of two phases:

Phase 1: Review all documents provided, specifically:

- Conceptual Design prepared by AECOM for the Subway Station and Bus Terminal
- Meetings with TTC Project Management, TTC Estimating and Hatch
- TTC's Order of Magnitude Estimate for the McCowan Alignment - Footlong Station Option
- Any additional information provided by TTC and Hatch Mott MacDonald

Phase 2: Based on Phase 1, prepare an independent peer review report in both XLS format and written report as requested. Our methodology has been to prepare Order of Magnitude Estimates where we are able to and comment on what we cannot easily estimate, based on our experience as well as access to other available TTC projects cost data.

The key issues arising from Hanscomb's independent peer review of TTC's OME are summarized in XLS format in chart form. It is recommended that our comments be reviewed and resolved by the project team to ensure that the total project budget is complete and a fair representation of the expected project cost.

TTC Estimate

Table 1: TTC's Order of Magnitude Estimate (OME) Main Summary in 2015 dollars:

Item Description	Total 2015 $
SCC Station, Bus Platforms, Site Development & Utilities	$425,829,352
Running Structures & Special Structures	$681,651,075
Utilities - Running Structures	$10,936,687
Operating Systems	$195,897,669
Total Raw Construction Cost in 2015$	**$1,314,314,783**
Engineering & Management	$328,578,696
Contingency Allowance	$492,868,043
Extra-Over Risk - Single Bore Tunnel	$0
Property/Easements - Allowance	$108,242,759
STC Mall Lost Revenue Impact due to Parking / construction distrubance	$1,000,000
Revenue Vehicles & ATC Equipping (TR Cars)	$130,683,021
HST Rebate (11.76%)	($202,855,105)
Total Estimated Cost in 2015 $	**$2,172,832,196**

Executive Summary

Table 2: Hanscomb has summarized TTC's OME in the following categories:

		Scarborough City Centre Subway Station	Scarborough Bus Terminal	Scarborough Centre Site Works Incl. Roads, Bridges & Utilities	Substation	Running Structure	Operating System	Total
SCC Station		$ 228,957,670						$ 228,957,670
Bus Terminal			$ 101,957,873					$ 101,957,873
Site Development inc. roads, bridges & utilities				$ 79,855,436				$ 79,855,436
Substation					$ 15,058,374			$ 15,058,374
Running Structure (Tunnel) inc. Special Structures (EBBs, shafts, etc.) & utilities						$ 692,587,762		$ 692,587,762
Operating System							$ 195,897,669	$ 195,897,669
Total Construction Cost		**$ 228,957,670**	**$ 101,957,873**	**$ 79,855,436**	**$ 15,058,374**	**$ 692,587,762**	**$ 195,897,669**	**$ 1,314,314,783**
Engineering & Management	25%	$ 57,239,417	$ 25,489,468	$ 19,963,859	$ 3,764,594	$ 173,146,941	$ 48,974,417	$ 328,578,696
Contingency Allowance	30%	$ 85,859,126	$ 38,234,202	$ 29,945,789	$ 5,646,890	$ 259,720,411	$ 73,461,626	$ 492,868,044
Property/Easements	Sum							$ 108,242,759
STC Mall lost revenue	Sum							$ 1,000,000
Purchase Vehicles & ATC	Sum							$ 130,683,021
HST Rebate(10.1043%)	Sum							-$ 202,855,105
Total Project Cost		**$ 372,056,213**	**$ 165,681,544**	**$ 129,765,084**	**24,469,858**	**$ 1,125,455,113**	**$ 318,333,712**	**$ 2,172,832,197**

Conclusions

Hanscomb's review of the documentation provided along with the OME prepared by TTC confirms that the scope of work aligns generally with the OME.

Based on our findings, the potential variance equates to an increase of approximately $122 million which is 5.7% higher than TTC's OME. We believe this OME is fair and reasonable for the stage of the project development undertaken at the time of the estimate. Our variance/adjusted amounts incorporate some fluid cost adjustments that may require further discussion with TTC Project Management and Estimating.

Our adjustments are summarized below by general WBS section:

- Subway station and bus terminal adjustments totalling a negligible add;
- No cost adjustment to substation buildings;
- Add for against running structure;
- Add for incomplete tender documentation;
- Add for management reserve; and
- Add for incurred business losses.

Executive Summary

The following are the limitations of our Estimate Peer Review:

- Based on our best judgment, we have reviewed the overall cost of the tunnel on a track metre basis, and we feel that the unit rate is reasonable based on the input from TTC and Hatch.
- For TTC system-wide elements, we again have limited expertise and are relying on the TTC OME and input received from TTC for the TYSSE project as being reasonable and appropriate.

It should be noted that the Toronto York Spadina Subway Extension (TYSSE) project cost data was not made completely available to us for this review as the project is on-going.

In general, the TTC OME is valid and appropriate for this stage of the project development (2% to 5% complete documentation). In our opinion, if the scope does not change, this is a valid estimate in 2015 dollars. Valid order of magnitude estimates (OMEs) typically anticipate a level of accuracy of -20% and +50% (reference AACE 2016 www.aacei.org/toc/toc_18R-97.pdf) assuming that the project scope does not change. However, if the scope changes, as with any and all construction budgets, the ability to fund and absorb the cost of scope changes is often problematic.

1. Overview

1.1 Purpose

This Independent Estimate Peer Review of the TTC OME for the McCowan Alignment - Footlong Option has been prepared by Hanscomb Limited as an independent review in part to ensure that cost projections for this large capital project are fair and reasonable and that the project can be completed on budget. Further, a Value Engineering workshop had been conducted to identify possible cost mitigation items.

To this end, this report provides comment on the following:

- Alignment between project scope and the project estimate;
- TTC OME for the McCowan Alignment - Footlong Station Option;
- Unit prices and alignment with expected market pricing;
- Project engineering and management fee and expenses allowances;
- General Contractor's requirements and fees;
- Project contingency;
- Cursory check of quantities for reasonableness; and
- Escalation contingency.

1.2 Project Description

This project includes construction of a new subway extension from Kennedy Station to Scarborough Town Centre (6.24 km). The TTC have explored a number of alignment corridors, at this juncture the McCowan Alignment Revision J controlled with an at-grade bus terminal is the preferred alignment and was the basis for the TTC budget estimate. Additional alignments may still be under review.

The scope of this project includes the following:

- 10.7m diameter single bore tunnel;
- New 3-storey subway station including six tunnels vent fans;
- Single level 30 bay bus station at a lower level with a green vegetated roof;
- Three substation buildings;
- Eight emergency exit buildings (EEB);
- Launch shaft and working shaft;
- Fan plants (3) beyond the station building;
- Vehicles with running structures; and
- Land purchase.

1. Overview

1.3 Peer Review Methodology

This Independent Peer Review report is intended to provide additional due diligence to confirm the adequacy of the McCowan Alignment - Footlong Station OME prepared by TTC and other documentation prepared by AECOM and Hatch.

The documentation was reviewed by our team to better understand the scope of the project and the basis for the assumptions in the estimates. Our review has been commensurate with the extent of the design work completed to date. TTC has made their best efforts to provide Hanscomb with all of the relevant and key information during our work.

Based on the design information received, we undertook to prepare our own OMEs where we could and comment where we could not easily estimate the scope based on our experiences and access to other TTC project data.

We also reviewed unit rates, general requirement and fees, contingencies, risk, escalation etc.

Under separate cover, we have provided TTC with our 'line by line' review in XLS & PDF format.

1.4 Procurement Model

We understand that the TTC OME assumes a traditional design bid build (DBB) method of procurement which is TTC's standard method for procuring its capital projects. Hanscomb recently participated as a cost estimating subject matter expert at a Value Engineering workshop facilitated by BT Engineering. It was noted at the workshop that the project may be delivered through a design build finance (DBF) model. This contracting strategy is currently under review along with the design bid build finance (DBBF) model to determine which model will fit best with this project. To date the procurement model has yet to be determined.

The implications of a selected procurement model go beyond the cost of the capital work, and may also affect the way the project is presented to market, the amount of design work undertaken before going to market, and the size and makeup of the TTC team managing and controlling the project.

We understand that the extent to which the selected procurement model's tender documentation will be performance based or highly prescriptive is not known at this time, but it is clear that the TTC must understand the selected procurement method's implications for the end product that TTC will operate and maintain for a century to come.

The decision making process regarding possible procurement models may lead to further studies related to value for money analyses and retained risks, etc. From what we understand in Ontario, value for money is often achieved on alternative finance projects (AFP) or public private partnerships (P3) models within the retained project risk cost element, with the construction costs, soft costs and financing costs being comparable between a DBB and a DB or DBF model.

As has been stated by others when describing AFP or P3 projects, the private sector's ability to better manage project risks and leverage design innovation has been widely discussed in the public realm.

2. Peer Review Findings

2.1 General

2.1.1 Estimate Documentation

The TTC's OME was based on drawings prepared by AECOM and Hatch. For system wide elements, land acquisition, engineering and management, etc. the TTC has utilized previous project budget data in order to set these line item budgets.

The documentation listed below was used for the preparation of the TTC Order of Magnitude Estimate:

Title of Documents Received	**Dated** (DD/MM/YYYY)	**Received** (DD/MM/YYYY)
SSE OME Kennedy to Scarborough C.C.	22/07/2016	08/2016
McCowan At-Grade Concept Sketches 1-5	11/08/2016	17/08/2016
McCowan At-Grade Concept Sketches + Renderings 1-8	11/08/2016	17/08/2016
Technical Memo + Sketches 1-22	24/04/2016	17/08/2016
Tunnel Package Diagram	21/07/2016	17/08/2016

We have been careful to ensure that our review has been based on the same documentation used by TTC Estimating in generating the OME. To the best of the project team's ability, we are confident that this has been the case.

2.1.2 Estimate Format

The TTC's OME was prepared in the traditional TTC Estimating cost breakdown structure format with the intention to provide a realistic allocation of costs, consistent with commonly accepted estimating principles for work of this nature and this stage of design progression. The TTC's OME addresses hard construction cost, equipment, land acquisition and soft costs.

The construction cost has separated the following orders:

- Scarborough Centre Subway Station, bus terminal and area facilities;
- Substation building
- Running structure including special structure
- Utilities (excludes stations area)
- System wide elements
- The soft cost has separated the following orders:
    - Project engineering and management allowances
    - Project contingency allowances
    - HST rebate
- Property acquisition, easements, legal fees etc.

2. Peer Review Findings

2.1 General (Continued)

2.1.2 Estimate Format (Continued)

- Scarborough Town Centre (STC) mall lost revenue impact
- Revenue vehicles
- Vehicle automatic train control ATC equipping allowance

This type of cost estimate breakdown is consistent with estimates that are developed at this stage of design and for this type of project.

2.1.3 Project Specifications

We have not received any project specifications for this peer review and would not anticipate this document at this stage of design (2% to 5% complete documents). We understand that the TTC OME assumes strict adherence to the TTC Design Manual.

2.1.4 Costs Provided by Others

The details of TTC's OME indicate that quantities, pricing, allowances etc. prepared by AECOM and Hatch have been validated and adjusted by TTC Estimating and provided to Hanscomb for Peer Review.

2.2 Review of Cost Elements

2.2.1 Review Procedures

As part of our review, the following exercise was undertaken:

- Item description and accompanying unit rate were reviewed for general consistency with current market condition as of 2015;
- OMEs were prepared for the station box, bus terminal and site development including roads, bridges and utilities;
- Tunnel totals in terms of their costs per running metre were reviewed for consistency based on input from TTC Estimating and Hatch. We understand that Hatch has a good track record when comparing their estimates to project award amounts;
- The total cost of special structures such as vent shaft, extraction shaft, launch shaft, working shaft and emergency exit buildings (EEBs) was reviewed for consistency based on our experience with previous similar projects; and
- Substation total costs were reviewed for consistency based on our experience with previous similar projects.

Arithmetic and formulas were checked. Quantity and unit rate extension and page totals were checked and found to be arithmetically accurate.

2. Peer Review Findings

2.2 Review of Cost Elements (Continued)

2.2.2 Scarborough City Centre Subway Station Box

Hanscomb prepared an order of magnitude estimate comparable to TTC's OME using the same design documentation for this project element. Hanscomb's estimate is in the order of 6% lower than TTC's OME. This variance is in order of minus $10 million.

We also carried out 'spot checks' on the major cost items such as on excavation, shoring and concrete and found our quantities to be close to those listed in TTC's OME.

2.2.3 Scarborough City Centre Bus Terminal

Hanscomb prepared an OME comparable to TTC's OME using the same design documentation for this project element. Hanscomb's estimate is in the order 8.5% lower than TTC's OME. The variance is in the order of minus $7.7 million.

This variance is mainly attributable to mechanical and electrical component costs. We have noticed that TTC's OME is carrying high unit rates on a gross floor area (GFA) basis for the outdoor bus platform and driveway for both mechanical and electrical disciplines. We recommend that the unit rates be reviewed. Our perception is that the mechanical and electrical scope of work for the outdoor scope is not as extensive as the unit rates would suggest.

2.2.4 Site Development including Road and Bridge

Hanscomb prepared an OME comparable to TTC's OME using the same design documentation for this project element. Hanscomb's estimate is in the same order of costs as TTC's OME.

2.2.5 Architectural Excellence

The impact of architectural excellence is highly subjective if this project is to include this as a mandated enhancement, and as such this item should be reviewed further. We have seen cost impacts for architectural excellence well in excess of $5 million on station projects. We understand that this budget line item is for the enhancement of architectural finishes only and not for any other kind of design enhancement. For the purposes of this review, we believe that this allowance is reasonable.

2.2.6 Green LEED Sustainability

We understand that the Project is to meet Tier 1 of the Toronto Green Standard and includes a green or cool roof, storm water management, and minor landscaping items. We feel this allowance is reasonable.

2. Peer Review Findings

2.2 Review of Cost Elements (Continued)

2.2.7 Station Artwork

This $0.5 million allowance appears to be the standard for TTC's budget allowance for new station. In our opinion this allowance seems reasonable assuming the status quo and nothing more is required or provided; however, we have carried higher costs for other TTC subway projects that we have worked on. For the purposes of our review, we are adding $0.5 million to this line item.

2.2.8 Station Area Utilities and Traffic Control

Hanscomb prepared an OME comparable to TTC's OME using the same design documentation for this project element. Hanscomb's estimate is in the same order of costs as TTC's OME.

2.2.9 Escalators and Elevators

We have reviewed the AECOM's escalators and elevators quantity table and agreed the quantity of escalators and elevators noted in TTC's OME estimate are correct.

The unit rates appear to be reasonable for both items noted above.

We understand that the elevators are anticipated to be high passenger capacity and may not be required to meet TTC's Design Manual.

2.2.10 Substation Buildings

TTC's OME includes 3 No. substation buildings and we have not received any details of this estimate line item. We have noticed that two substation buildings are standard sized (approximately 600 m^2) and the other is non-standard (much larger GFA and below grade). The budgets carried for these buildings seem reasonable.

Furthermore, the AECOM drawings for the non-standard substation building indicate a larger gross floor area than TTC has estimated. This discrepancy may impact the cost. For the purposes of our review, we have added additional $1 million against this budget line item.

2. Peer Review Findings

2.2 Review of Cost Elements (Continued)

2.2.11 Running Structure Including Tunneling and Special Structure

Table 3: Hanscomb has summarized the TTC's running structure

	TBM Purchase/Sell	Tunnel Structure	Launch Shaft	Extraction Shaft	Working Shaft	EEB	Total
TBM Purchase/Sell	$56,357,365	$0	$0	$0	$0	$0	$56,357,365
Tunnel Structure	$0	$455,117,572	$0	$0	$0	$0	$455,117,572
Launch Shaft	$0	$0	$57,561,982	$0	$0	$0	$57,561,982
Extraction Shaft	$0	$0	$0	$13,308,916	$0	$0	$13,308,916
Working Shaft	$0	$0	$0	$0	$7,463,722	$0	$7,463,722
EEB	$0	$0	$0	$0	$0	$91,841,518	$91,841,518
Total Construction Cost	**$56,357,365**	**$455,117,572**	**$57,561,982**	**$13,308,916**	**$7,463,722**	**$91,841,518**	**$681,651,075**

Based on our best judgment, we have reviewed the overall cost of the tunnel on a track metre basis, and we feel that the unit rate is reasonable based on the input from TTC and Hatch.

The net purchase cost for the TBMs is around $56 million. It is our understanding that this budget is based on a quote from a German vendor sourced by Hatch. Hanscomb has not received this quote for review purposes. We assume that it is reasonable. We recommend that TTC verify this quote.

The special structures include launch shafts, extraction shafts, working shafts and EEBs. Our review indicated that the shafts were in line with what we would expect based on our previous experience for similar projects.

We understand that the Toronto area has lost its local tunnel boring machine (TBM) manufacturer to the vagaries of the market. The loss of this local bidder may affect the overall bidding pool and competitive nature of the purchase line item within the budget. For the purposes of our review, we have not adjusted this line item.

The EEB's, however, tend to have been estimated on the high side. We would normally expect EEBs to be in the region of $3 million each. However, based on our discussions with the TTC Estimating team and our review of the documentation, it was pointed out that the depth of buildings is reaching approximately 40m below grade. This is a consequential depth and will definitely have an impact on the costs of the EEBs. In that respect, we would concur that the rationale of carrying over $7 million for each EEB is reasonable.

EEB #4 is combined with a fire ventilation fan plant and therefore it is larger and more complex than a typical single purpose EEB's. Factoring for the complexity and the combined purpose, we believe that the cost carried appears to be reasonable.

2.2.12 Utilities (along Running Structure)

Hanscomb has not received the estimating details for these line items. This allowance should be reviewed as they seem driven by higher per dual track metre (DTM) cost (and not by scope). For the purpose of this review Hanscomb has doubled the rate of this item. The added cost is plus $10.94 million. .

2. Peer Review Findings

2.2 Review of Cost Elements (Continued)

2.2.13 System Wide Elements

The system wide elements include the track work, power supplies to the tunnels, signals, SCADA, RTU's, subway antenna, NA, Intercom, CCTV, etc.

We feel these allowances are reasonable and have been calculated based available TYSSE rates.

2.3 Review of Soft Costs

2.3.1 Project Engineering and Management

The TTC's OME includes 25% of the hard construction costs for the Project Engineering and Management. This percentage seems to be reasonable based on other large capital projects that we work on regularly assuming a DBB method procurement.

As we noted above, the TTC budget is based on a DBB procurement approach. If the project proceeds through a different procurement model, we suggest that this line item be reviewed and modified as necessary to suit the chosen model. It is possible that the private sector, through a DB or DBF model, may deliver and leverage economies against the scope of this line item

2.3.2 Project Contingency

Hanscomb recommends that this general project contingency be segregated into design and pricing and post-contract contingency (change orders and claims). We understand that TTC is reviewing project risks separately. We understand that the 30% currently being carried is roughly split between the above items in the following way: 25% design evolution and 5% for post-contract changes and claims. The overall percentage of 30% seems reasonable and appropriate for this stage of the project development (2% to 5% complete documents) if 100% complete and coordinated documentation is issued for tender and construction.

Budgets are set assuming that the scope will not change and cannot easily absorb scope creep. TTC may wish to institute a management reserve fund approach where a general project contingency is maintained to cover some scope creep items at the approval of the Executive. For other large capital projects, we have often recommended a reserve of 5 to 7.5% of the bottom line amount. Scope changes beyond 5 to 7.5% should be funded by additional budget injections. For this review purpose, Hanscomb added 7.5% of the construction value for further discussion.

Construction budgets are set assuming that tender documentation will be 100% complete and fully coordinated at the time of tender. If the tender documentation is not as assumed, the value of change orders and claims will likely exceed the 5% allowed as noted above. For this review purpose, Hanscomb has carried an additional 2.5% of the construction value.

2. Peer Review Findings

2.3 Review of Soft Costs (Continued)

2.3.3 Property Acquisition, Easements, Legal Fees, etc.

Property acquisition and easements are calculated based on a percentage of 5.6% on the project costs inclusive of contingencies and engineering and management costs. TTC Estimating has provided some track records costs for other TTC subway extension projects and the carried percentage compares well. For the purposes of our review, we have not made any adjustment to this budget line item.

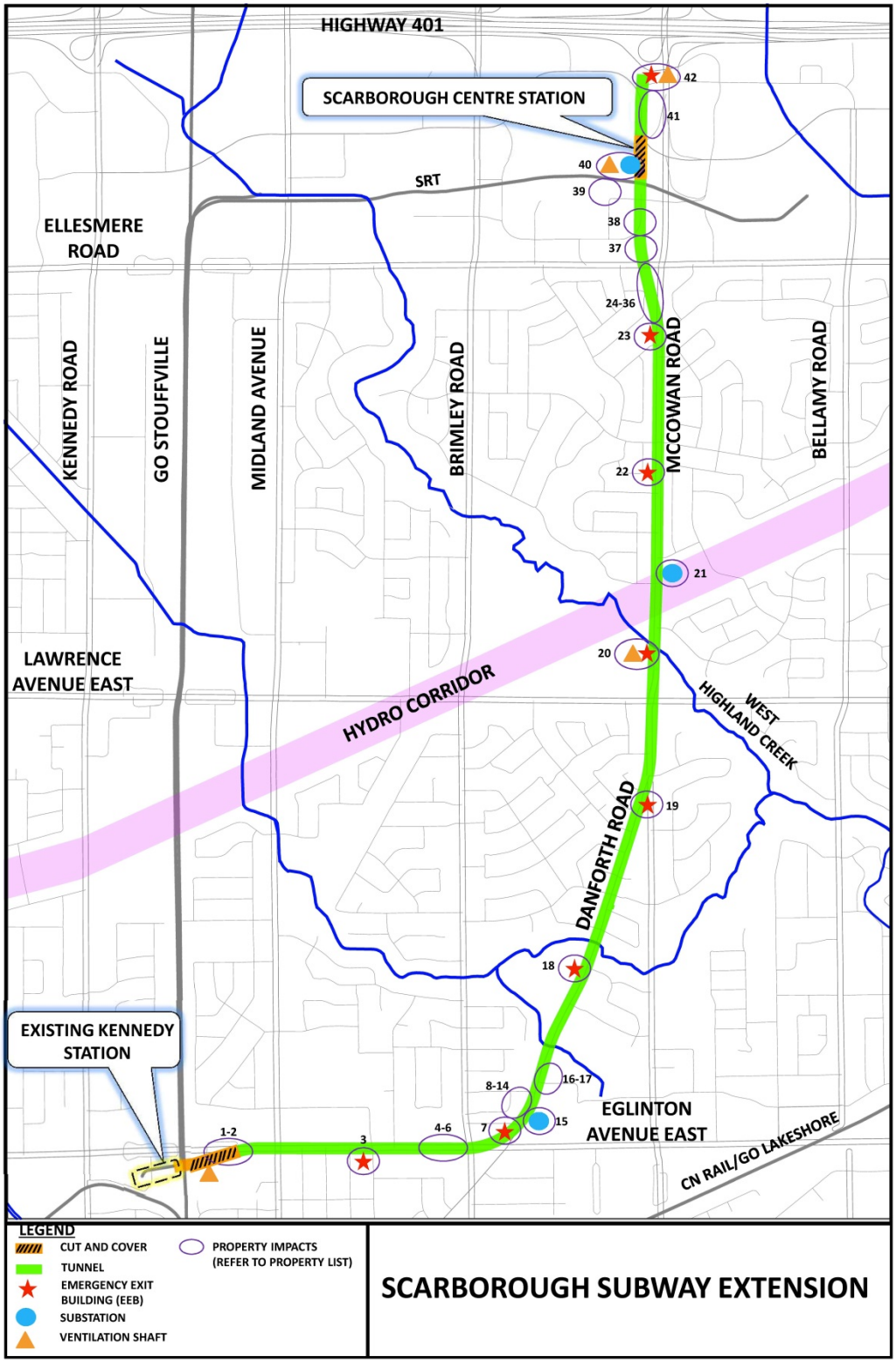
2.3.4 STC Mall Lost Revenue Impact

A lump sum of $1 million has been allocated for Scarborough Town Centre mall's loss of revenue that may potentially arise from construction disturbances. As per the estimate's notes, this appears to be an agreed upon value between all parties concerned. Without further details, we are unable to provide our comments on whether the number is reasonable or not. For the purposes of this review, we have included a variance of plus $4 million against this line item.

2.3.5 Revenue Vehicle and ATC Equipping

This line item appears reasonable based on other TTC projects that we have seen.

APPENDIX B - MOTION – PROPERTY REQUIREMENTS



APPENDIX B - MOTION – PROPERTY REQUIREMENTS

Scarborough Subway Extension
Permanent Property Requirements

#	Address	Property Interest (Full or Partial)	Reason	Ownership
1	2467 Eglinton Avenue East	Partial	Tunnel	City of Toronto
2	110 Town Haven Place	Partial	Tunnel Right-of-Way (No Structure)	Private
3	2583 Eglinton Avenue East	Partial	Emergency Exit 1	Private
4	2693-2697 Eglinton Avenue East	Partial	Tunnel Right-of-Way (No Structure)	Private
5	2699-2703 Eglinton Avenue East	Partial	Tunnel Right-of-Way (No Structure)	Private
6	2705 Eglinton Avenue East	Partial	Tunnel Right-of-Way (No Structure)	Private
7	2730/2742 Eglinton Avenue East	Partial	Emergency Exit 2 and Tunnel	Private
8	1250 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
9	1252 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
10	1254 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
11	1256 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
12	1258 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
13	1260 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
14	1262 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
15	1269 Danforth Road	Full	Traction Power Substation	Private
16	1299 Danforth Road	Partial	Tunnel Right-of-Way (No Structure)	Private
17	10-20 Trudelle Street	Partial	Tunnel	Private
18	1346 (1340, 1350, 1360) Danforth Road	Partial	Emergency Exit 3	Private
19	1515 Danforth Road	Partial	Emergency Exit 4	City of Toronto
20	3030/3040/3050/3060 Lawrence Avenue East	Partial	Emergency Exit 5 and Tunnel	Provincial
21	Gatineau Hydro Corridor Thompson Memorial Park	Partial	Traction Power Substation and Tunnel	Provincial
22	25 Durrington Crescent	Partial	Emergency Exit 6	Private

APPENDIX B - MOTION – PROPERTY REQUIREMENTS

Scarborough Subway Extension
Permanent Property Requirements

#	Address	Property Interest (Full or Partial)	Reason	Ownership
23	1072 McCowan Road	Partial	Emergency Exit 7	Private
24	1082 McCowan Road	Partial	Tunnel Right-of-Way (No Structure)	Private
25	43 Stanwell Drive	Partial	Tunnel Right-of-Way (No Structure)	Private
26	45 Stanwell Drive	Partial	Tunnel	Private
27	47 Stanwell Drive	Partial	Tunnel	Private
28	49 Stanwell Drive	Partial	Tunnel	Private
29	51 Stanwell Drive	Partial	Tunnel	Private
30	53 Stanwell Drive	Partial	Tunnel	Private
31	55 Stanwell Drive	Partial	Tunnel	Private
32	57 Stanwell Drive	Partial	Tunnel	Private
33	59 Stanwell Drive	Partial	Tunnel	Private
34	61 Stanwell Drive	Partial	Tunnel	Private
35	63 Stanwell Drive	Partial	Tunnel	Private
36	1615 Ellesmere Road	Partial	Tunnel	Private
37	185 Borough Drive	Partial	Tunnel	City of Toronto
38	61 Town Centre Court	Partial	Tunnel	Private
39	200 Town Centre Court	Partial	Scarborough Centre Station	Federal
40	300 Borough Drive	Partial	Scarborough Centre Station	Private
41	580 Progress Avenue	Partial	Tunnel	Private
42	530 Progress Avenue	Partial	Emergency Exit 8 and Tunnel	Private

A total of forty-two properties are anticipated to be impacted including: 2

- One full (entire) property (acquisition of a retail plaza), and,
- Forty one partial properties. This occurs where a surface feature, such as an exit building, occupies only a small portion of the overall property, or where an underground corridor through a property is required in order to accommodate the tunnel structure. Property interests include easements or acquisition of the required area.
- Temporary property requirements (i.e. for construction staging, etc.) to be determined.

APPENDIX C – MOTION – BUS ROUTES TO TRITON TERMINAL

TTC Routes connecting to the planned Scarborough Centre Station are shown on the attached map. These are listed below.

Route #	Route Name	Routing
9	Bellamy	Warden Stn – Scarborough Centre Stn
16	McCowan	Warden Stn – Scarborough Centre Stn
21	Brimley	Kennedy Stn – Miliken GO Stn via Scarborough Centre Stn
38	Highland Creek	Scarborough Centre Stn – Rouge Hill GO Stn
43B	Kennedy	Kennedy Stn - Scarborough Centre Stn
93A	Ellesmere East	Scarborough Centre Stn – Kingston Road
93B	Ellesmere East	Scarborough Centre Stn – Conlins
95	York Mills	York Mills Stn – Scarborough Centre Stn
129	McCowan North	Scarborough Centre Stn – Steeles
130A	Middlefield	Scarborough Centre Stn – Steeles
130B	Middlefield	Scarborough Centre Stn – Tapscott
131	Nugget	Scarborough Centre Stn – Old Finch
132	Milner	Scarborough Centre Stn – Hupfield/McLevin
133	Neilson South	Scarborough Centre Stn – Morningside Heights
134A	Progress	Scarborough Centre Stn – Finchdene
134C	Progress	Scarborough Centre Stn – Centennial College
169	Huntingwood	Don Mills Stn – Scarborough Centre Stn
199	Finch Rocket	Finch West Stn - Scarborough Centre Stn
253	Steeles Rocket	Pioneer Village Stn – Scarborough Centre Stn
285	Sheppard East Rocket	Don Mills Stn – Scarborough Centre Stn – U of T Scarborough
295	York Mills Express	York Mills Stn – Scarborough Centre Stn via Scarborough Centre Stn
Wheeltrans		On Demand

Note: Connecting route numbers, names, and routings are preliminary and subject to change.

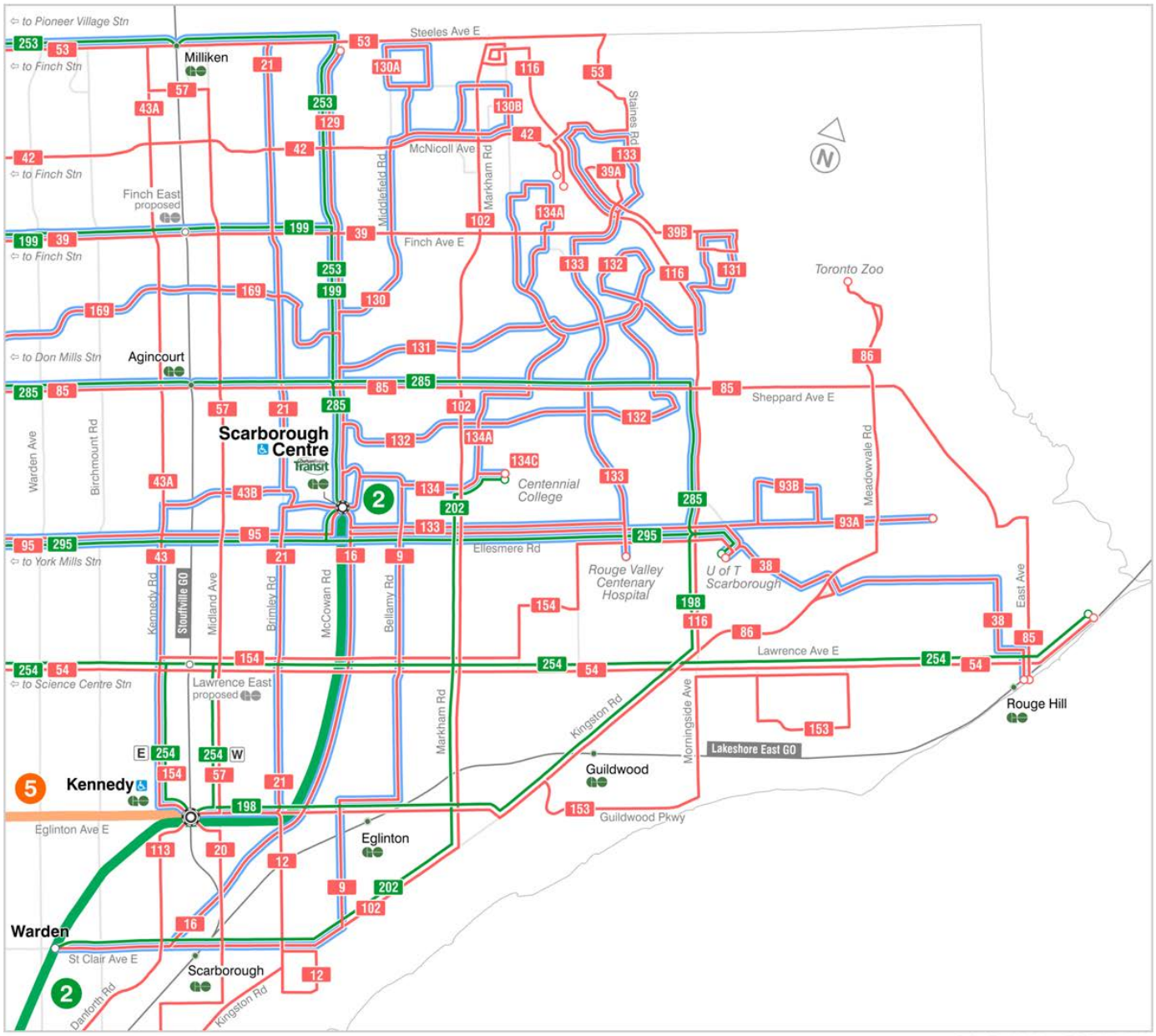
GO Transit – has requested six bus bays to accommodate their routes that now use the SRT bus terminal.
Inter-city private carriers – Greyhound, Canada Coach, and CanAr.
Durham Region Transit – intends to operate their 900 Pulse route into this new terminal.

Total Bus Bays

TTC	24 bus bays (including 4 shared unloading bays)
GO	6
Private inter-city	3
Durham Region Transit	1
Total	**34** Bus Bays

APPENDIX C – MOTION – BUS ROUTES TO TRITON TERMINAL

Scarborough Subway Extension
Conceptual Connecting Bus Network



Legend

- 102 — local route
- 202 — express route
- routes connecting with Scarborough Centre Stn
- 2 Bloor-Danforth Line
- 5 Eglinton Line
- station
- interchange station
- connecting transit agency

Transit Partners

- GO Transit
- Durham Region Transit

APPENDIX D – DECISION HISTORY

At its meeting of June 24, 2014, the Board received a status report on the Scarborough Subway Extension and approved forwarding the report to the City Planning and Growth Management Committee for its information.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2014/June_24/Reports/Scarborough_Subway_Extension_Update.pdf

At its meeting of December 9, 2014, the Board approved the award of Contract FE85-2 for Tunnel Design Services.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2014/December_9/Reports/BR_17122_Procurement_Authorization_Tunnel_Design_Contract_FE.pdf

At its meeting of February 25, 2015, the Board approved the award of Contract FE85-3 for Project Management Services.

ttp://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/February_25/Supplementary_Reports/Procurement_Authorization_Project_Management_Services_Contra.pdf

At its meeting of March 24, 2015, the Board directed the TTC's CEO to provide a report outlining the specific, substantive changes that will be made in the planning and project management for the Scarborough Subway, as compared to the Toronto York Spadina Subway Extension (TYSSE).

This report will be submitted in mid 2017 along with the update to actions arising from the KPMG's review of TTCs Capital Program Delivery.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/April_29/Minutes_other/March_26_2015_minutes.pdf

At its meeting of May 27, 2015, the Board approved the award of Contract FE85-4 for Systems Design and Management Services, as well as Contract FE85-5 for Station Design Services.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/May_27/Reports/Procurement_Authorization_Systems_Design_and_Management_Serv.pdf

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/May_27/Reports/Procurement_Authorization_Station_Design_Services_Contract_F.pdf

At its meeting of June 22, 2015, the Board approved the award of Contract FE85-6 for Geotechnical, Geoenvironmental and Hydrogeological Consulting Services.

https://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2015/July_29/Minutes/Minutes-June_22_2015.pdf

At its meeting of March 23, 2016 and in response to the request from the February 25, 2016 Board Meeting, the Board received a Report noting that staff will include a revised project cost and schedule when the Environmental Assessment Report is submitted for Board approval.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2016/March_23/Reports/Scarborough_Subway_Extension_Update_March_23__2016.pdf

At its meeting of July 11, 2016, the Board received a presentation on Developing Toronto's Transit Network Plan to 2031, from City staff. The change in scope for the SSE from a three stop extension to Sheppard, to a one stop extension to Scarborough Centre, was included in the presentation.

http://www.ttc.ca/About_the_TTC/Commission_reports_and_information/Commission_meetings/2016/July_11/Reports/8_City_of_Toronto_Report_Developing_Toronto%27s_Transit_Networ.pdf