Yonge North Subway Extension
Initial Business Case

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Yonge North Subway Extension Initial Business Case

Contents

Executive Summary

Scope

Metrolinx and Infrastructure Ontario were provided a letter of direction outlining a responsibility for delivering an extension to the Line 1 Yonge-University Subway (Line 1) from Finch Station to a terminus at Richmond Hill Centre. The extension crosses from the City of Toronto into York Region passing along the boundary of Markham and Vaughan before connecting to Richmond Hill. It is a project that will strengthen regional transit systems as it delivers travel time savings for existing and future transit riders.

This Initial Business Case evaluates the performance of different iterations of a YNSE, including the EA-approved version against a Business as Usual (BAU) scenario as the basis for an investment decision. The BAU assumes that "In Delivery" projects from the *2041 Regional Transportation Plan* are in service, as modified by Ontario's Transit Plan[1], and that reasonable improvements to existing surface transit as well as signaling improvements to Line 1 are delivered. The alternatives are meant to be representative and allow for consistent analysis.

For reference, see Figure 1 and Table 1, which provide a summary of the options considered.

[1] Ontario Government, 2019

Figure 1: Options under consideration in the YNSE Initial Business Case

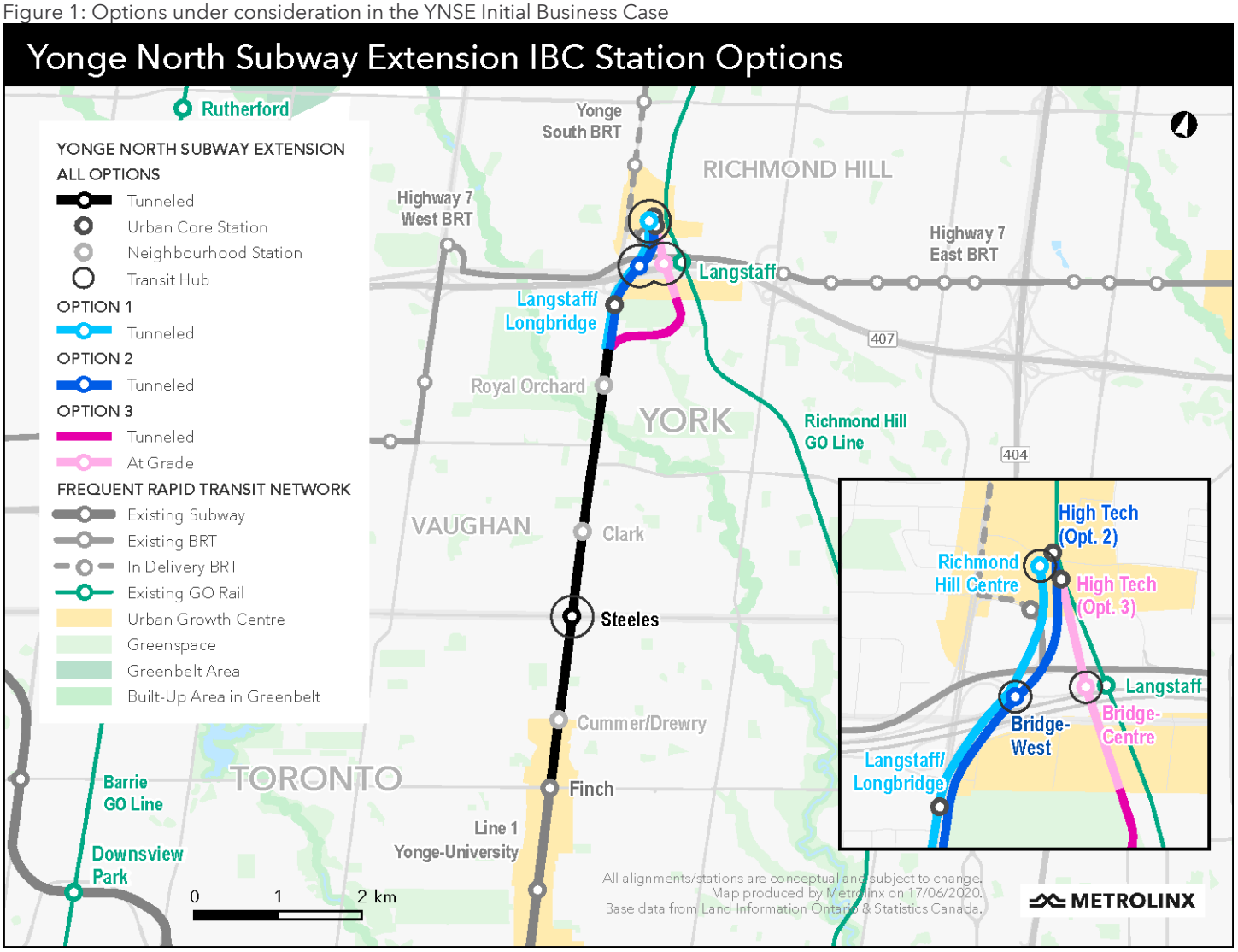

Table 1: Summary of options under consideration in the YNSE Initial Business Case

Option	Length*	Vertical Alignment	Tunneling Method	Primary Stations/Transit Hubs	Complementary Urban Core Station	Neighbourhood Stations	Stations in Model's Representative Alignment **
Option 1	~7.57 km	Tunnel	• Twin bore (large single bore also feasible)	• Steeles • RHC	Langstaff	• Cummer • Clark • Royal Orchard	• Cummer • Steeles • Clark • Langstaff • RHC
Option 2	~7.65 km	Tunnel	• Only large single bore feasible	• Steeles • Bridge-West (underground)	High Tech (underground)	• Cummer • Clark • Royal Orchard	• Cummer • Steeles • Clark • Bridge- West (underground)
Option 3	~8.00 km	Tunnel + At Grade	• Only twin bore feasible	• Steeles • Bridge-Centre (at-grade)	High Tech (at-grade)	• Cummer • Clark • Royal Orchard	• Cummer • Steeles • Clark • Bridge-Centre (at-grade)

* From north of Finch tail track to north end of High Tech Station
** Three Alternative Alignments have been evaluated in this IBC. A representative of each alignment was chosen for the modelling purposes and comparative analysis. These elements identified for these alignments do not represent a chosen scope.

Method of Analysis

A Business Case is a comprehensive collection of evidence and analysis that sets out the rationale for why an investment should be implemented to solve a problem or address an opportunity. Business cases are required by Metrolinx's Capital Projects Approval Policy for all capital infrastructure investments. The Yonge North Subway Extension (YNSE) Initial Business Case (IBC) follows the methodology from the Metrolinx Business Case Guidance[2].

The YNSE IBC falls under the Options Analysis stage of Metrolinx's Project Lifecycle (see page 26), and compares the YNSE against a number of alternative configurations (alignment and station options) as well as a Business as Usual scenario. As with all Metrolinx Business Cases, the YNSE IBC is structured around four cases:

- The Strategic Case, which determines the value of addressing a problem or opportunity based on regional development goals, plans and policies.
- The Economic Case, which uses standard economic analysis to detail benefits and costs of the options to individuals and society as a whole, in economic terms.
- The Financial Case, which assesses the overall financial impact of the options, its funding arrangements and technical accounting issues and financial value for money.
- The Deliverability and Operations Case, which considers procurement strategies, operating plans and the risks associated with deliverability and operations.

[2] http://www.metrolinx.com/en/regionalplanning/projectevaluation/benefitscases/benefits_case_analYNSEs.aspx

Optimizing Benefits

This IBC puts a particular focus on the emerging Richmond Hill Centre and Langstaff communities. While the YNSE has previously been imagined terminating just north of Highway 7, it was identified by Metrolinx as an area where refinement could enhance project benefits and reduce capital costs. The IBC will present some alternative alignment options that specifically address the challenges and opportunities of serving these areas and their future residents and employees.

Managing Costs: Delivering an effective and affordable project

Metrolinx is committed to delivering a YNSE that offers an optimized program within the available funding envelope. To undertake this responsibility Metrolinx has undertaken a comprehensive examination of managing costs on the project.

The YNSE project has been in the planning stage since initiation of the Transit Project Assessment Process in 2007. Through this period the initial infrastructure project scope remained relatively constant while the capital cost estimate grew to more than $9.0 billion at the time of the upload in summer 2019. Through the IBC process Metrolinx completed a comprehensive evaluation worked to optimize project benefits while managing the capital cost downward. Three feasible alignment options were developed that achieve the overall project objectives albeit with varying capital costs, benefits and deliverability considerations.

Each option identified stations at Steeles and Richmond Hill Centre/Bridge as Primary Stations fundamental to achieving project benefits, and Langstaff/High Tech as Complementary Urban Core Station that are likely to be included due to their strong potential to unlock urban growth. Each option accommodates stations at Cummer, Clark and Royal Orchard as Neighbourhood Stations (subject to funding being made available). Careful consideration of the three alignment options is required as none of them are able to deliver the envisioned subway extension with at least five new stations within the announced $5.6 billion infrastructure budget (see Table 37 for infrastructure costs presented in the same format as the budget).

Option 3, although having a more complex deliverability case, does provide significant benefits and the lowest cost for the minimum project scope, including the two Primary Stations at Steeles, and Bridge (at-grade) and likely one Urban Core Station at High Tech (at-grade) with sufficient budget to allow one Neighbourhood Station to be included and maintain a capital cost within the announced $5.6 billion infrastructure budget.

As the project is further developed, work will continue to optimize the project costs and benefits. The preliminary design stage of the project will explore tactics to increase project benefits and enhance value

for money, including development potential. Metrolinx will work with the Province, local municipalities and developers to further evaluate development opportunities enabled by this project and explore innovative funding solutions for potentially including additional neighbourhood stations within the project scope.

Options for Analysis

Three alternative alignments have been evaluated in this IBC. A representative of each alignment was chosen for the modelling purposes and comparative analysis:

- **Option 1** has the same alignment as the approved EA. It is fully underground using a twin tunnel assumption for costing; although a large single bore stacked option would also be possible. For modelling purposes, the representative alignment includes 5 stations at **Cummer, Steeles, Clark, Langstaff, and Richmond Hill Centre (RHC)**;

- **Option 2** also runs fully underground and has a similar alignment to Option 1 to a point north of Longbridge Road. This alignment would turn slightly east to cross on a diagonal under the Highway 407 and Highway 7 corridor. Large single bore stacked tunnel was assumed for costing, as twin bore tunnelling is not possible in this option. For modelling purposes, the representative alignment includes 4 stations at **Cummer, Steeles, Clark, and Bridge- West (underground)**; and

- **Option 3** has a similar alignment to Options 1 and 2, to a point north of Thornhill Avenue. The alignment then turns east and continues under Kirk Drive before turning again to run at-grade and within the CN/GO rail corridor. Twin bore tunnelling has been assumed for costing as a large bore stacked option would not be possible in this option. For modelling purposes, the representative alignment includes 4 stations at **Cummer, Steeles, Clark, and Bridge- Centre (at-grade)**.

In order to investigate and evaluate options that might reduce capital and/or operating costs, with minimal impact on the project outcome, this IBC also evaluates some of the EA approved stations that are not fundamental to the function of the overall projects.

- **Primary Stations**: Steeles, RHC (Option 1), and Bridge stations (Options 2 and 3) are considered "Primary Stations" given their high level of ridership particularly resulting from transfers from buses (over 5,000 average ridership in AM peak hour).

- **Complementary Urban Core Stations**: High Tech and Langstaff stations are considered "Complementary Urban Core Station" as these stations are seen as complementary to primary stations in order to better serve the Richmond Hill Centre and Langstaff Gateway development areas.

  High Tech Station is the name given to a Complementary Urban Core Station located approximately 400 metres north of a proposed Bridge Station. The station takes its name from a proposed location below High Tech Road. In this position, the station would be located in the core of the planned Richmond Hill Centre providing a higher level of access than the Bridge Station alone. It would put platform access for new residents within a highly desirable five-minute walk. In Option 2, the station would be located below grade in a tunnel, while Option 3 would see the station at the same grade as the existing CN/GO rail corridor.

  The advantage over the RHC Station of Option 1 is that the footprint of a High Tech Station could be significantly smaller as there would be no transit facilities at the station since the bus terminal would be located adjacent to a Bridge Station.

- **Neighbourhood Stations**: For the purposes of the IBC the remaining stations under evaluation are been called "Neighbourhood Stations". The neighbourhoods they serve include significant existing or future residential density and a mixed-use element on Yonge Street. These stations are less busy than the Primary Stations with a projected average ridership of less than 3,000 in the AM peak hour.

The benefits and disbenefits associated with the existence or removal of the following stations are evaluated under the Strategic and Economic cases of this IBC:

- High Tech Station at Richmond Hill Centre;
- Royal Orchard Station at Royal Orchard Boulevard;
- Clark Station at Clark Avenue; and
- Cummer Station at Cummer/Drewry Avenue.

Findings

YNSE will increase access to a larger number of residents and jobs in the intensification areas along the corridor while providing a seamless connection between those areas in different municipalities and Toronto midtown and downtown.

All alternative alignments for YNSE offer significant improvements compared to a Business as Usual scenario, generating between $3.7 billion, to $4.0 billion worth of economic benefits. The Benefit-to-Cost Ratio is also between 0.73 and 0.93 when delivered under a Public – Private Partnership (P3) delivery model.

As identified in the Problem Statement, a key goal of the YNSE is saving transit users time by eliminating or shortening their time on buses. YNSE is effective in addressing this problem. It generates relatively strong ridership at each of the stations along the corridor. Ridership is made up of a mix of transit users who will be able to walk into a new subway station, and riders who will access subway by bus.

The alternative alignments are thought to be equally effective at supporting planned development along the corridor. Potential differences in impact on proposed development are addressed in the Station Analysis. Findings are summarized in Table 2 to Table 4.

Table 2: YNSE - High-Level Summary of **Alternative Alignments Analysis**

	Option 1	Option 2	Option 3
Strategic Case			
Strong Connections	• 109,900 daily riders • 29,500 more people within 10 minutes • 1,700 jobs accessible within a 45-minute transit commute to Toronto residents compared to BAU • 25,700 employees within walking distance of subway	• 97,600 daily riders • 26,500 more people within 10 minutes • 1,650 jobs accessible within a 45-minute transit commute to Toronto residents compared to BAU • 22,600 employees within walking distance of subway	• 94,100 daily riders • 26,000 more people within 10 minutes • 1,650 jobs accessible within a 45- minute transit commute to Toronto residents compared to BAU • 22,900 employees within walking distance of subway
Complete Travel Experiences	• 920,000 minutes daily travel time savings compared to BAU • Introduces Transit Hubs and transfer points at RHC, and Steeles stations • 9,400 daily bus transfers to Steeles Station, and 9,300 to RHC Station	• 960,000 minutes daily travel time savings compared to BAU • Introduces Transit Hubs and transfer points at Bridge-West, and Steeles stations • 9,200 daily bus transfers to Steeles Station, and 12,800 to Bridge-West Station	• 860,000 minutes daily travel time savings compared to BAU • Introduces Transit Hubs and transfer points at Bridge-Centre, and Steeles stations • 9,200 daily bus transfers to Steeles Station, and 12,000 to Bridge-Centre Station
Sustainable and Healthy Communities	• 8,500 net new transit users in the weekday AM peak hour compared to BAU • 17,800km decrease in VKT compared to BAU • Reduction in auto related GHG emissions of 11,100 tonnes annually	• 5,200 net new transit users in the weekday AM peak hour compared to BAU • 8,800km decrease in VKT compared to BAU • Reduction in auto related GHG emissions of 4,000 tonnes annually	• 4,900 net new transit users in the weekday AM peak hour compared to BAU • 7,700km decrease in VKT compared to BAU • Reduction in auto related GHG emissions of 4,800 tonnes annually

	Option 1	Option 2	Option 3
Economic Case			
Total Economic Impacts (Benefits) ($2020, Present Value)	$4,058.7 M	$4,072.4 M	$3,735.7 M
Total Costs ($2020, PV)	$4,999.7 M to $5,811.5 M	$4,528.2 M to $5,479.8 M	$4,308.5 M to $5,064.4 M
Net Present Value ($2020, NPV)	$-1,560.6 M to $-748.8 M	$-1,290.3 M to $-338.7 M	$-1,216.8 M to $-460.8 M
Benefit-Cost Ratio	0.73 to 0.85	0.76 to 0.93	0.76 to 0.89
Financial Case ($2020, PV)			
Fare Revenue Adjustment	$196.2 M	$119.6 M	$114.4 M
Capital Costs	$4,944.9 M	$4,471.6 M	$4,572.1 M
Operating and Maintenance Costs	$51.5 M	$-5.2 M	$-52.4 M
Total Costs	$4,996.4 M	$4,466.4 M	$4,381.3 M
Deliverability and Operations			
Procurement and Delivery	• Procurement approach under consideration		
Delivery Timeline	• Target Construction Start late 2023 • Target in-service date of 2029/2030 to follow Ontario Line Entry into Service		
Constructability Matters	• Coordination with the York Durham Sewage System (YDSS) at Steeles • East Don River Crossing • Construction within the busy Yonge Street corridor • Maintaining services on Line 1 during construction • Interface with the Highway 7 and 407 Corridor		
Operations	• Integrated into current Line 1 Operations • Fully automated operation allows for higher service frequencies		

In addition to evaluation of representative alignments, this IBC also undertook analysis of the two **Complementary Urban Core Stations** and the three **Neighbourhood Stations**. The following charts summarize some of the high-level findings with respect to these stations.

Table 3: YNSE - High-Level Summary of High Tech **Station Analysis (Complementary Urban Core Station)**

	HIGH TECH
Strategic Case	
Strong Connections	• This station grants walking access to rapid transit to 5,500 – 7,400 new people and 2,300 - 2,700 new jobs • Supports the vision of the City of Richmond Hill for the Richmond Hill Centre area
Complete Travel Experiences	• Bridge and High Tech stations as a couplet would offer incremental transit and city building benefits (better transit connectivity at Bridge Station in addition to walk-in access for new residents within a highly desirable five-minute walk at High Tech Station). • Nominal impact on travel time of passengers connecting to the subway by bus as they use the transit hub at Bridge Station (only bus riders from Yonge Street would save on their travel time when they stop at the High Tech Station instead of Bridge Station)
Economic Case (Appendix 1)	
	In Option 3 Station has a net benefit when combined with a Bridge-Centre Station compared to Option 2, in a scenario where High Tech is combined with the Bridge-West Station
Financial Case	
	Station adds infrastructure costs to the project impacting total capital cost. Costs are lower when the station is constructed at grade in Option 3
Deliverability and Operations	
	As an at-grade station Option 3, High Tech station should be less complex to construct and have lower operating costs.

Table 4: YNSE - High-Level Summary of **Stations Analysis (Neighbourhood Stations)**

	ROYAL ORCHARD	CLARK	CUMMER
Strategic Case			
Strong Connections	• This station grants walking access to rapid transit to 7,300 new people and 1,300 new jobs • 1,320 ridership in the weekday AM peak hour; 90 alightings • Supports a proposed major development application in the area (currently under review) at the northeast corner of Royal Orchard Boulevard and Yonge Street	• This station grants walking access to rapid transit to 8,100 new people and 1,900 new jobs • 2,370 ridership in the weekday AM peak hour; 810 alighting and 1,560 boarding • Station serves the Promenade Shopping Centre mixed-use area	• This station grants walking access to rapid transit to 5,700 new people and 2,200 new jobs • 2,160 ridership in the weekday AM peak hour; 830 alighting, 1,330 boarding • Yonge Street North Planning Study (currently underway) will allow for the same density as North York Centre Secondary Plan Area for this area • 76% of people and employees in catchment area of Cummer Station could also walk to Finch or Steeles
Complete Travel Experiences	• Some incremental travel time benefits to users who travel to this station compared to a scenario in which this station did not exist • Royal Orchard Station mainly serves walk-in customers accessing the subway during peak hours	• High incremental travel time benefits to users who travel to this station compared to a scenario in which this station did not exist	• High incremental travel time benefits to users who travel to this station compared to a scenario in which this station did not exist
Economic Case (Appendix 1)			
	Analysis suggests the capital costs outweigh the transit users' benefits associated with the station.	Analysis suggests benefits exceed the costs regardless of tunneling technology.	Analysis suggests benefits exceed the costs regardless of tunneling technology.
Financial Case			
	Station contributes to infrastructure costs for the project. The cost could be offset by third party contribution.	Station contributes to infrastructure costs for the project (impact has been included in the representative alignment). The cost could be offset by third party contribution.	Station contributes to infrastructure costs for the project (impact has been included in the representative alignment). The cost could be offset by third party contribution.
Deliverability and Operations Case			
	Station would be deeper due to proximity to East Don River	Typical construction within the Yonge ROW	Typical construction within the Yonge ROW

Recommendation

The YNSE was one of the priority projects announced, along with the Scarborough Subway Extension, the Ontario Line and the Eglinton Crosstown Western Extension. The Ontario Line is expected to provide relief to Line 1 by attracting riders to a new North South corridor. As a result, the Ontario Line will need to open before the YNSE to free up the capacity required to allow the new line to proceed.

This Initial Business Case recommends advancing design of the YNSE and a more detailed analysis of the growth forecasts along the corridor through a Preliminary Design Business Case.

The YNSE will bring rapid transit closer to residents' destinations in the northern portions of Toronto and across York Region. The IBC highlights the need to prioritize access for bus passengers while focusing on walk-in access at each of the contemplated subway areas.

Next steps will include refining the design of the selected alternative engineering to maximize benefits and address risks, developing a Preliminary Design Business Case, seeking required Environmental Assessment Act approvals and proceeding toward delivery.

Next steps will include a detailed assessment of the strongest of the three options and it will include the following:

- confirmation of cost savings when measured against the other options;
- confirmation of funder choice for incremental station locations;
- a business case approach to analysing commuter parking in proximity to the north terminus that balances demand with available capacity;
- comprehensive engineering review of alignment; and
- an updated sensitivity analysis around land use forecasts.

1 Introduction

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Initial Business Case Scope and Objectives

This Initial Business Case has the following objectives:

- Document the YNSE, as currently contemplated at a time the project has been brought under the management of Metrolinx;
- Compare alternative alignments of the YNSE with a BAU scenario;
- Investigate and evaluate options that might have additional transit benefits and/or reduced capital or operating costs; and
- Evaluate stations performance.

Background

The Greater Toronto and Hamilton Area (GTHA) is one of North America's fastest growing regions, projected to grow by over 40% between 2016 and 2041[3]. Most growth in the region is forecasted to take place outside Toronto, resulting in a significant increase in total trips. As directed by the Growth Plan, major office development will be encouraged to locate in urban growth centres, major transit station areas or other strategic growth areas with existing or planned frequent transit service. To address this growth, a number of infrastructure investments will be required to meet different elements of this common need to increase access between key development areas as well as to the core of the region.

To serve longer-distance trips, the Province of Ontario, through Metrolinx, is now investing more than $20 billion in the GO Expansion program to expand the rail system[4], with faster and more frequent trains and the capacity to carry three times as many passengers by 2041. This transit expansion is being developed in existing corridors with all trains running to or from Union Station.

It has been noted that the GO Rail system does not serve all parts of the Greater Toronto Area, nor does it serve many shorter distance trips. The GO Richmond Hill Corridor currently provides service to central York Region, but is not part of the GO Expansion program that is being implemented on some other GO Rail corridors. As a result, Metrolinx is also working to implement other rapid transit investments to address the needs of the Greater Toronto Region. The YNSE project extends rapid transit service to other municipalities in the Region and provides a connection between destinations in these municipalities with destinations in Toronto.

[3] Statistics Canada 2016 Census; Growth Plan for the Greater Golden Horseshoe, 2019
[4] http://www.metrolinx.com/en/greaterregion/projects/go-expansion.aspx

A particular need that has been identified is that the existing Line 1 Yonge-University Subway attracts riders from points north of the existing terminus at Finch Station. As a result, these transit users must access the subway via surface bus routes that can be lengthy and subject to delay as they compete for space on crowded roads. This means that transit users in this area experience longer journey times and less reliability. It also impacts the attractiveness of transit in this part of the Region. The YNSE is one of four priority transit projects announced by the Province in 2019 for the Greater Toronto and Hamilton Area with a preliminary funding announcement of $5.6 billion.

Several intensification areas have also been envisioned along the future Yonge Subway corridor: Yonge Street North (City of Toronto), Yonge-Steeles Corridor (City of Vaughan), Richmond Hill Centre (City of Richmond Hill), Langstaff Gateway Community (City of Markham), and Thornhill Yonge Street (City of Vaughan and City of Markham). North York Centre Urban Growth Centre in City of Toronto and Richmond Hill Centre/Langstaff Gateway Urban Growth Centre in City of Richmond Hill and City of Markham are also parts of the YNSE Corridor which provides a greater opportunity to create unique communities focused on access to transit.

Richmond Hill Centre/Langstaff Gateway Urban Growth Centre provides a tremendous opportunity to create these unique communities that feature an unmatched access to transit. The subway is an enabler of achieving provincial direction for the UGC. The Provincial Growth Plan recognizes the UGCs as regional focal points for accommodating population and employment growth. The subway also supports the municipal visions for their future communities. The Richmond Hill Centre/Langstaff Gateway UGC is more than an area of intensification, it is a carefully considered as part of the Regional fabric, position to link the employment centres of York Region with Yonge Street, the spine of Toronto.

An extension of the Line 1 Subway into York Region has been recognized as a priority "In Development" Project under the *2041 Regional Transportation Plan*. It has been a priority by Metrolinx, York Region, and City of Toronto as a local and regional transit authority. Given the significance of the project, the Province, City of Toronto, Region of York, and the TTC have dedicated resources to YNSE planning work. In the 2019 Ontario Budget, the Province announced its plan to build four subway projects, with a total preliminary cost estimate of $28.5 billion. The YNSE was one of the priority projects announced, along with the Scarborough Subway Extension, the Ontario Line and the Eglinton Crosstown West Extension.

On May 28, 2020 the province and York Region signed the historic "Ontario-York Region Transit Partnership Preliminary Agreement" in order to support the timely delivery of the YNSE. The Preliminary Agreement forms the foundation of the continued partnership between the province and York Region and represents an important step forward to implementing an integrated and expanded transit system.

The Preliminary Agreement supports a collaborative relationship between the province, TTC and York Region providing, among other things, a framework of the roles, responsibilities and potential funding mechanisms for the delivery of the YNSE.

Extending the Reach of Line 1

Toronto's original subway investment was a subway under Yonge Street from Union Station to Eglinton Avenue which was completed in 1954. This subway was designed to satisfy the demand of commuters that were taxing the ability of surface routes. The Yonge line was expanded to York Mills in 1973 and to Finch Avenue in 1974, partly in response to levels of demand from points north.

As noted in Figure 2, planning work on the Yonge North Subway dates to 2007. When the Yonge North Subway Extension is completed in 2029/2030 it will represent a further investment in extending Toronto's subway network.

Figure 2: Chronology of YNSE Planning

2007

'Move Ontario 2020'

Yonge North Subway Extension was part of the Province's 52 rapid transit projects identified in its Move Ontario 2020 Plan

2008

'The Big Move 2008'

The proposed Yonge North Subway Extension was identified as a top 15 priority project and one of the prioritized transit projects in the GTHA in the Regional Transportation Plan (RTP) approved by the Metrolinx Board in November 2008.

2009

Yonge Subway Extension EA Approval

TPAP was completed for 7.4 km extension to Richmond Hill with 6 new stations

'Yonge North Subway Extension Benefits Case'

Metrolinx completed and released the the first Benefits Case Analysis in June 2009 including an evaluation of three options: a full subway extension with 6 stations; a full subway extension with 5 stations; and a Bus Rapid Transit extension with Richmond Hill GO Line service improvements.

Metrolinx BCA concludes subway has positive environmental, economic, land development and community benefits with Royal Orchard Station providing limited incremental benefits

2012

'Conceptual Design Report' endorsed by TTC and YRRTC Boards, including removal of Royal Orchard Station

2013

'Yonge North Subway Extension Benefits Case Analysis Update'

This analysis is a continuation of the study done in the Yonge North Subway Extension Benefits Case 2009. This Analysis included an evaluation of three options: a full subway extension to Richmond Hill Centre; a phased subway to Steeles Avenue with Bus Rapid Transit service to Richmond Hill Centre; and a phased subway extension with increased parallel GO Rail service frequencies

2014

Addendum to EA Approval

An addendum to the Environmental Assessment was approved to include an underground train storage facility and surface facilities.

2016

Government Funding for Detailed Plan

The provincial government announced support of $55 million to Metrolinx in order to work with the TTC and the York Region on a detailed plan for the subway extension

2018

MOU established to guide Preliminary Design and Engineering (PDE)

PDE funding ($91.3M) provided by Province and York Region (Public Transit Infrastructure Fund Phase 1)

TTC led and project managed all aspects of PDE work

2019

Government Investment in Building the Project over the Next 10 Years

The provincial government announced support of funding towards the project.

TTC and YRRTC presented significant increase in capital cost

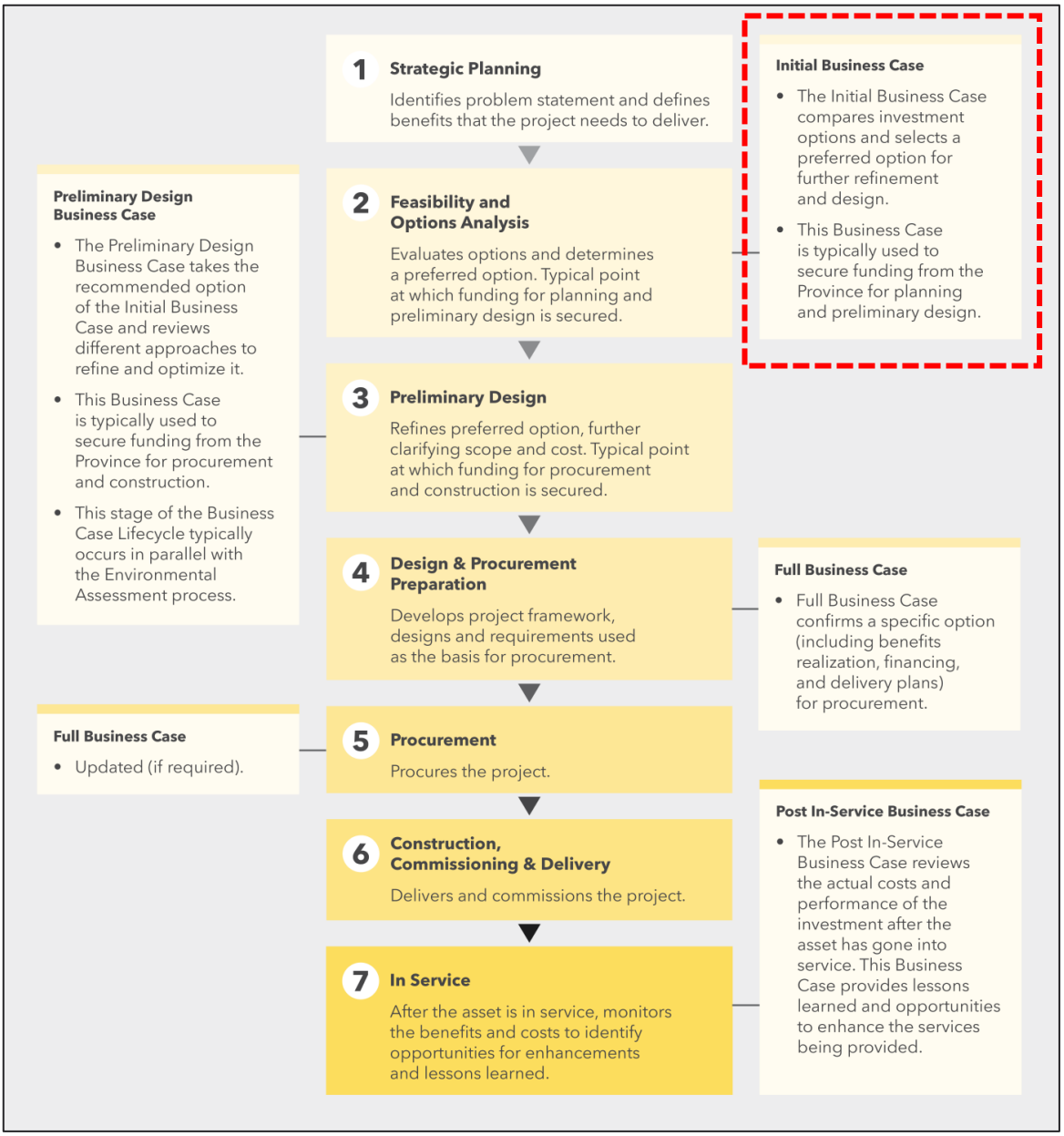
Project delivery uploaded to Province (Metrolinx/IO)

Metrolinx initiated Value Engineering and Initial Business Case using extensive work already completed

Business Case Overview

Business Case analyses are mandated by Metrolinx for all capital projects. As projects develop in scope and construction, business cases are completed to define the rationale and requirements for delivering said investment. As shown in Figure 3, the Initial Business Case is the first of four business cases completed in an investment's lifecycle. The IBC reviews potential investments at a high-level that respond to a problem and/or opportunity. It conducts a detailed analysis of each option using quantified information and detailed rubrics for qualitative indicators. An IBC provides recommendations for next steps in the Metrolinx Business Case process.

Figure 3: Metrolinx Business Case Development Process



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Problem Statement

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Introduction

This chapter defines the case for change, which is used to guide the evaluation of investment options considered within this business case.

Case for Change

Problem and Opportunity Statement

The existing Line 1 Yonge-University Subway (Line 1) terminates at Finch Station. In the peak hour about 10,000 transit users access the subway at this station, over 70% of the customers reach the station after traveling significant distances by bus. Extending the subway north provides accessibility to rapid transit by bringing stations closer to existing transit users and, providing them with seamless transit service to/from downtown Toronto and all points in between. An extension would also improve the customer experience on Line 1 by reducing those journey times.

The GTHA is experiencing unprecedented growth, which calls for corresponding expansion of its transportation network. Yonge Street remains a corridor for growth in the Region and is expected to continue to urbanize with greater densities. Population and employment growth both on and off the Yonge Street corridor in North York Centre, Markham, Richmond Hill and Vaughan will increase demand on the existing bus-based transit network. The Provincial Growth Plan, Regional Official Plan and municipal planning documents have outlined the urban vision for the Richmond Hill Centre and Langstaff Gateway development areas. Expanding the transit system through an extension of Line 1 is essential to not only respond to this growth but to also address the larger strategy to connect people to schools, jobs and their communities.

Residents of the central portion of York Region and the northern boundary of Toronto are already experiencing challenges accessing downtown Toronto and/or major employment hubs and destinations served by the subway network. Road traffic congestion is expected to worsen, and commute times are expected to become longer, with negative impacts to Ontario's quality of life, environment and economy. The YNSE will attract new transit riders to transit by providing the capacity necessary to offer safe, frequent, fast, and reliable service that is competitive with private automobile journeys. There is an opportunity to shift the transit mode share to match levels found in more urban areas of the Region.

Project outcomes and how they will be measured, are summarized in Table below.

Table 5: Problem or Opportunity Drivers

	Driver	How does this Driver influence the problem/opportunity?	What is the impact of not addressing the problem/opportunity?
Internal to the Transport Network	Travel experience	• Expand the existing subway network to where residents live to shorten their journey times.	• Failure to increase rapid transit coverage results in longer journey times for those living in more distant portions of the region and worsens transit user experience due to long congested bus rides.
	Travel Behavior	• A mode shift of North York/Toronto and York Region residents away from automobile to transit	• Long journey times or unreliable service will not promote a mode shift away from auto and further road congestion, resulting in longer commute times, loss of productivity, and a decrease in air quality.
	Regional Rapid Transit Network	• Strengthen the Region's rapid transit network by enhancing the connection between the key corridors of the VIVA Bus Rapid Transit (vivaNext), 407 Transitway, GO Highway 7 Bus, Go Richmond Hill Line, YRT bus routes, the TTC Steeles bus routes, and Line 1 Yonge-University Subway	• A rapid transit system that is not effectively linked limits the system's ability to provide higher convenience, flexibility and higher levels of service to its riders.
External to the Transport Network	Transit Supportive Communities	• Serve emerging Richmond Hill Centre/Langstaff and Yonge Street corridor with quality rapid transit to support future residents who seek a transit focused lifestyle	• Without connection of emerging urban growth centres with rapid transit, these communities will be limited in their development as successful urban centres that contribute to overall Regional land use goals.
	Economic Activity across the Region	• Supporting counter-peak trips to expand access to jobs along the Yonge Street corridor and in York Region.	• Lack of access to rapid transit will impact current employees and future economic development in York Region and the north of Toronto.

Business as Usual

A Business as Usual (BAU) scenario is used as a base case in this IBC to give us a comparator for the options under consideration. In the BAU the Line 1 Yonge-University Subway continues to terminate at Finch Station.

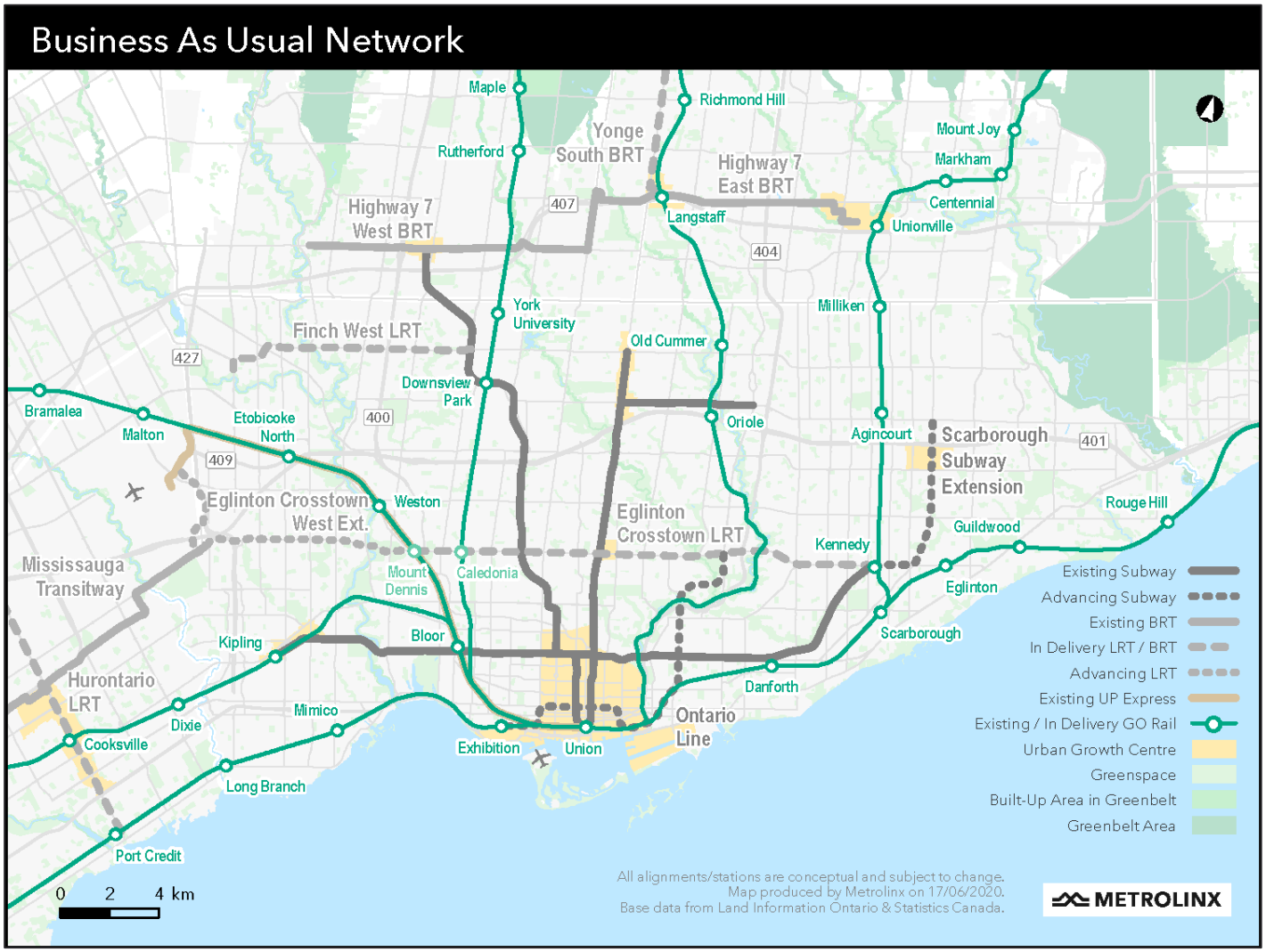
The *2041 Regional Transportation Plan*, adopted by the Metrolinx Board of Directors in 2018, identifies as Priority Action 1.1 the delivery of 14 transit projects by 2025. These projects are known as "In Delivery," meaning they are currently in advanced stages of design or under construction, and include the GO Expansion Program, Eglinton Crosstown LRT, Finch West LRT, Scarborough Subway Extension, Highway 7 BRT and Yonge BRT.

The 2041 "In Delivery Network" is included in the BAU scenario, with a few modifications reflecting recent decisions:

- The Scarborough Subway Extension is included in the BAU with three stops rather than one, in accordance with commitments from the current provincial government and in accordance with the approved PDBC;
- The Eglinton Crosstown West Extension is included as an underground extension of the Eglinton Crosstown (the extension to the airport has been included for modeling purposes, but it is not a funded project); and
- The Ontario Line is included in the BAU as an optimized alternative for the formerly proposed Relief Line (north and south) subway

The BAU scenario also assumes reasonable improvements to existing surface transit, as well as the capacity improvements currently underway on Line 1 Yonge-University Subway.

Figure 4: Business as Usual Network



Strategic Value

The Metrolinx *2041 Regional Transportation Plan* (RTP) presents a common vision for the region:

"The GTHA will have a sustainable transportation system that is aligned with land use and supports healthy and complete communities. The system will provide safe, convenient and reliable connections, and support a high quality of life, a prosperous and competitive economy, and a protected environment."

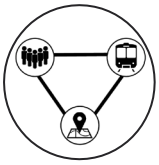
The YNSE is identified as a priority "In Development" Project under the *2041 Regional Transportation Plan*. The project is a high priority for the Region of York. Advancing "In Development" projects is a priority action in the 2041 RTP, captured in Strategy 1: Complete the Delivery of Current Regional Transit Projects, and Strategy 2: Connect More of the Region with Frequent Rapid Transit through the Frequent Rapid Transit Network.

The goals of the 2041 RTP are to achieve:

- *Strong Connections* – this IBC will evaluate options leading to an option that will connect more people to more places and opportunities;
- *Complete Travel Experiences* – this IBC will evaluate options leading to a solution to improve reliability, comfort and safety; and
- *Sustainable and Healthy Communities* – this IBC will evaluate transit investments to provide more environmentally friendly travel options.

Strategic Outcomes

The Strategic Case summarizes the performance of each investment option against the following strategic objectives to indicate if the investment supports addressing the problem or opportunity and the goals of the 2041 RTP:



Strong Connections

The preferred investment should improve transit coverage by rapid transit access closer to where people live and serving key destinations, increase access to economic opportunities for people in the region by better connecting them to jobs and support transit-oriented development, thus creating a synergy between transit and places.

Complete Travel Experiences

The preferred investment will improve travel time and reliability for riders whose journeys include time on surface bus routes on congested streets, leading to crowding and delays. It will eliminate transfers for riders who live and work along the YNSE Corridor north of the current Finch terminus of Line 1 Yonge-University Subway. It will also improve their comfort by integrating into the future transit network to allow for convenient and seamless trips across the Region.

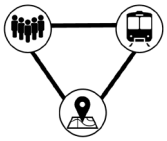
Sustainable and Healthy Communities

The recommended investment will move more people more quickly using less energy by shifting trips to more sustainable modes and reducing auto congestion. Specifically, the investment will reduce the lengths of bus routes required to serve transit users in York Region and the north of Toronto. The recommended investment will also strive to reduce the overall negative impact of travel on the natural environment and quality of life. This will be realized through the reduction of greenhouse gas emissions, the preservation of green spaces and limited noise and vibration impacts.

Strategic Objectives

To support the strategic outcomes, the recommended investment should achieve the objectives listed in Table 6. These objectives were developed to support the realization of the three Strategic Outcomes and tailored to the Problem and Opportunity Statement (see page 29).

Table 6: Strategic Objectives

Goals	Objectives
 **Strong Connections**	Improve access to transit
	Increase access to existing economic opportunities in Toronto and York Region, and support emerging employment centres along the YNSE Corridor and the Richmond Hill Centre/Langstaff area.
	Support planned development along the YNSE
 **Complete Travel Experiences**	Improve travel time
	Improve reliability
	Build an integrated transportation network
 **Sustainable and Healthy Communities**	Move people with less energy and pollution
	Improve quality of life and public health

3

Investment Options

METROLINX

Introduction

This chapter introduces the options to be evaluated and compared against the BAU Scenario (which includes projects "In Delivery" and assumes reasonable improvements to existing surface transit) through the four cases that constitute the Initial Business Case. Three options will be considered here, within a similar north-south corridor, connecting the existing Line 1 Yonge-University Subway terminus at Finch Station to Richmond Hill.

Options Development

The Environmental Assessment completed in 2009 approved a six-station underground extension of the Line 1 Yonge-University Subway from its terminus at Finch Station in the City of Toronto to a proposed terminus at the Richmond Hill Centre in the City of Richmond Hill. Stations were proposed at Cummer Avenue/Drewry Avenue, Steeles Avenue, Clark Avenue, Royal Orchard Boulevard, Langstaff Road/Longbridge Road, and Richmond Hill Centre (RHC). Intermodal bus terminals were proposed for Steeles Station and Richmond Hill Centre Station.

The former Benefit Case Analysis by Metrolinx completed in 2013 also evaluated the subway extension from existing Finch station to RHC serving all the six new stations mentioned above.

In April 2019, the Province of Ontario announced an $11.2 billion commitment to support capital construction for four major rapid transit projects, including the YNSE.

Metrolinx is committed to delivering a YNSE that offers an optimized program within the available funding envelop. To undertake this responsibility Metrolinx has taken a comprehensive examination of managing costs on the project to close the gap between that funding envelope of $5.6 billion and a recent cost estimate of $9.3 billion provided in 2019 by the TTC. Since the full scope of the EA-approved alignment exceeded the announced project budget by the Province of Ontario, Metrolinx initiated analysis of alternative options that would achieve the highest possible benefits for the approved budget. Metrolinx was also tasked with finding ways to increase benefits of the project.

Creating a Bridge: Better Serving Richmond Hill Centre and Langstaff Gateway through Station Placement

The future communities of Richmond Hill Centre and Langstaff Gateway are favoured by their location in York Region and benefit from outstanding highway access from both Highway 407 and Highway 7 and VIVA rapidways to the north, east, and west. But while these highways serve to connect the communities of York Region, they also serve to divide the two halves of this burgeoning hub. Further complicating the urban geography is a significant hydro distribution corridor that limits development and places restriction on building structures to improve access.

Forecasts envision that these communities might grow to provide homes for more than 64,000 residents and might offer employment to more than 36,000 employees. As important as these raw numbers are, equally important is the shared vision for new urbanized core in the centre of the Greater Toronto Area. Each of the communities is planned to be a self-contained opportunity to live, work and play all within one dynamic environment. The plan also calls for these places to act as a center not only to the municipalities in which they are located, but to the larger region. These aspirations are seen to be possible only by building the transit infrastructure needed to empower this evolution.

Through the conceptual design development process, an opportunity to "bridge" the two communities with transit was contemplated. A common subway station facility could stitch together Richmond Hill Centre and Langstaff Gateway and optimizes transit service to these important destinations.

Bridge Station is the name given to this concept in the IBC. It would be an integrated transit facility located under the Highway 7 and 407 corridors. This location allows it to be accessed from both the Richmond Hill Centre and Langstaff Gateway development area. While the design has not been finalized the station has an opportunity to serve as link between adjacent urbanizing communities.

Perhaps most importantly, the Bridge Station has the potential to optimize and centralize subway access for the Langstaff Community. While previous concepts have included a subway entrance south of Highway 407 at Yonge St., this access has been challenged by being located on the western periphery of the Langstaff Gateway development area. The Bridge concept in Option 2 pulls the station entrance further east, while in Option 3 the station is in an even more central location adjacent to the rail corridor. As will be demonstrated in this IBC, in either of the options the western half the Langstaff site is more effectively served, while bringing far more of the developable area to the east within walking distance of the subway.

The station will feature significant bus facilities to serve Regional GO Bus Routes, and local York Region Transit routes. An advantage of the Bridge station location is the opportunity to integrate the frequent VIVA BRT routes into the terminal design, optimizing the connection between higher order transit modes. The Bridge concept puts not only the subway at the connection point of the two development areas, but it puts the full transit hub at the same location. Residents on both sides of the highway corridor have access to local and regional buses serving York Region and the wider Greater Toronto Area.

The Bridge station is also well positioned to provide a seamless connection with the Langstaff GO Station. This connection is valuable for not only transit users transferring between the Subway and Richmond Hill GO Corridor but will also allow GO rail customer to access the station with a common conveniently located bus facility.

The other strength of the Bridge station is that it seeks to take advantage of lands that are constrained for other uses. The Bridge Station and its associated transportation infrastructure are appropriately contained within the existing Highway 7 and 407 corridors, leaving as much of the adjacent development areas as possible free for placemaking development.

High Tech Station is the name given to a complementary station located approximately 400m north of a proposed Bridge Station. The station takes its name from a proposed location below High Tech Road. In this position, the station would be in the core of the planned Richmond Hill Centre providing a higher level of access than the Bridge Station alone. A second station would recognize the vision of the provincially designated Urban Growth Centre as having a truly regional impact on the Greater Toronto Area. It would put platform access for new residents in Richmond Hill Centre within a highly desirable 5-minute walk. For employers and their employees, it would replicate similar transit supportive conditions seen in Downtown, Midtown and North York Centre where office complexes have a quick direct connection with the subway. Municipal planning staff have highlighted that this type of access is attractive to developers, employers and future employees.

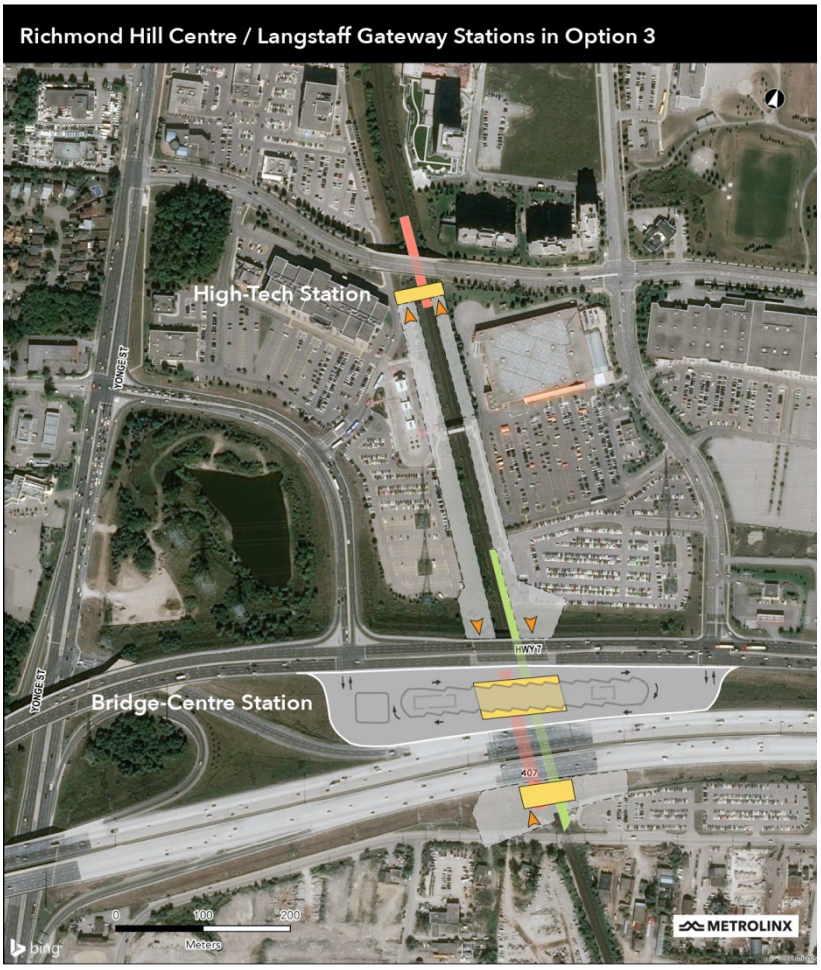


Figure 5: Bridge and High Tech stations in Option 3

In Option 2 the station would be located below grade in a tunnel, while Option 3 would see the station at the same grade as the existing CN/GO rail corridor. The footprint of a High Tech Station could be significantly smaller in Options 2 and 3 than a RHC Station in Option 1 as there would be no bus terminal facilities at the station. This modest scale would not only reduce the costs but would likely facilitate integration with adjacent development. In Option 3 the need for further station facilities would be further reduced with less vertical circulation required and ventilation requirements eliminated since the station would be at the surface.

Options Overview

Introduction

This chapter provides a short list of defined, well-scoped and defensible investment options for consideration and evaluation in the Strategic, Economic, Financial, and Deliverability and Operations Cases.

The IBC analysis was conducted with a two-fold approach. Metrolinx undertook an exercise to review possible alternative alignments and approaches that would deliver the YNSE at a lower capital cost or provide for new station locations. A key element of this work was to look at the tunneling options and approaches. Much of the Toronto subway has been built using twin bore tunnels, with stations platforms built separately. The Metrolinx analysis looked at single large bore approaches where station platforms are built within the diameter of the tunnel reducing the surface impact of station construction and associated costs.

1. Alternatives Alignment Analysis

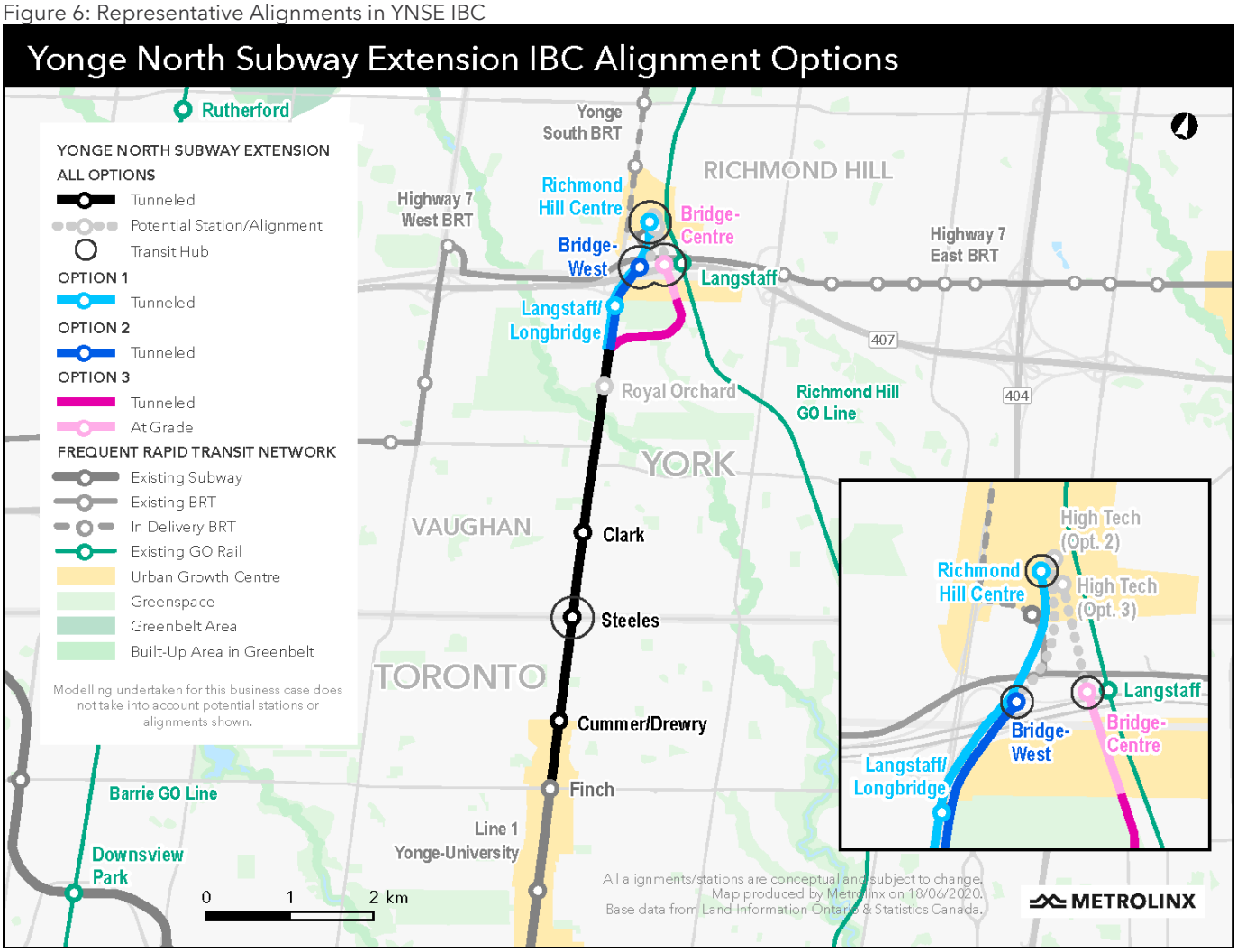
Three alignment options, including the EA approved project, are evaluated in this IBC against the BAU. Given the fact that there are a multitude of scenarios (stations and alignments combinations), a representative of each alignment was chosen for the modelling purposes and comparative analysis, using the stations (or equivalent) that was part of the project at the time delivery was assumed by the Province:

- **Option 1** has the same alignment as the approved EA. It is fully underground and assumed to be constructed with a twin bore approach as outlined in the EA. (however it could feasibly be constructed using a single large bore approach) For modelling purposes, the representative alignment includes 5 stations at **Cummer, Steeles, Clark, Langstaff, and RHC**;

- **Option 2** has a similar alignment to Option 1 to a point north of Longbridge Road. The alignment would turn slightly east to cross under the Highway 407 and Highway 7 corridor on a diagonal. This alignment is also fully underground and assumed to be constructed in a single large bore tunnel For modelling purposes, the representative alignment includes 4 stations at **Cummer, Steeles, Clark, and Bridge- West**; and

- **Option 3** has a similar alignment to Options 1 and 2 to a point north of Thornhill Avenue. The alignment then turns east continues under Kirk Drive before turning again to run at-grade and within the CN/GO rail corridor. This alignment would be built using twin bore tunnels because the alignment must be relatively shallow to be able to transition to an at-grade alignment. The alignment would portal to the surface just north of the Holy Cross Cemetery. For modelling purposes, the representative alignment includes 4 stations a **Cummer, Steeles, Clark, and Bridge- Centre (at-grade).**

Figure 6: Representative Alignments in YNSE IBC



2. Stations Analysis

In order to investigate and evaluate options that would keep the project with capital budget constraints and/or operating costs, with minimal impact on the project outcome, this IBC evaluates some of the EA approved stations that have smaller contribution to the ridership of the YNSE. Steeles, RHC, and Bridge stations were considered as "**Primary Stations**" given the high level of ridership from these stations particularly resulting from transfers from buses (over 5,000 average ridership in AM peak hour).

High Tech Station (in Alignment Options 2 and 3) and Langstaff Station (in Alignment Option 1) are considered as "**Complementary Urban Core Station**", as these stations are complementary to primary stations in order to better serve the Richmond Hill Centre/Langstaff Gateway Urban Growth Centre. The vision for these areas is to leverage the presence of the subway and other infrastructure to promote the creation and strengthening of an important regional centre.

For the purposes of the IBC, the remaining stations under evaluation have been called "**Neighbourhood Stations**". Those stations, listed below, would serve and can support existing and emerging Yonge Street communities along the corridor. These stations are less busy and have average ridership of less than 3,000 in AM peak hour:

- Royal Orchard Station at Royal Orchard Boulevard;
- Clark Station at Clark Avenue; and
- Cummer Station at Cummer/Drewry Avenue.

The benefits and disbenefits associated with the existence or removal of these stations are evaluated under the Strategic Case as well as the Economic case in Appendix 1, based on a comparative desktop analysis.

Business as Usual

The Business as Usual for the horizon year 2041 assumes the delivery of fifteen transit projects identified as "In Delivery" in the *2041 Regional Transportation Plan* with modifications from Ontario's Transit Plan, announced in April 2019. The BAU scenario also assumes reasonable improvements to existing surface transit, as well as capacity improvements currently underway on Line 1 Yonge-University Subway.

Elements Common to All Options

The elements of each option are noted in the individual descriptions below.

It is important to recognize that the YNSE will include a number of common elements. These include required modifications to the existing Finch Station, special track work along the corridor and emergency exit buildings.

Each of the options includes an at-grade Train Storage and Maintenance Facility just north of High Tech Road within the CN/GO Rail Corridor and on adjacent municipally owned lands. This facility would provide storage for an estimated 12 train sets and include provision for cleaning and light maintenance.

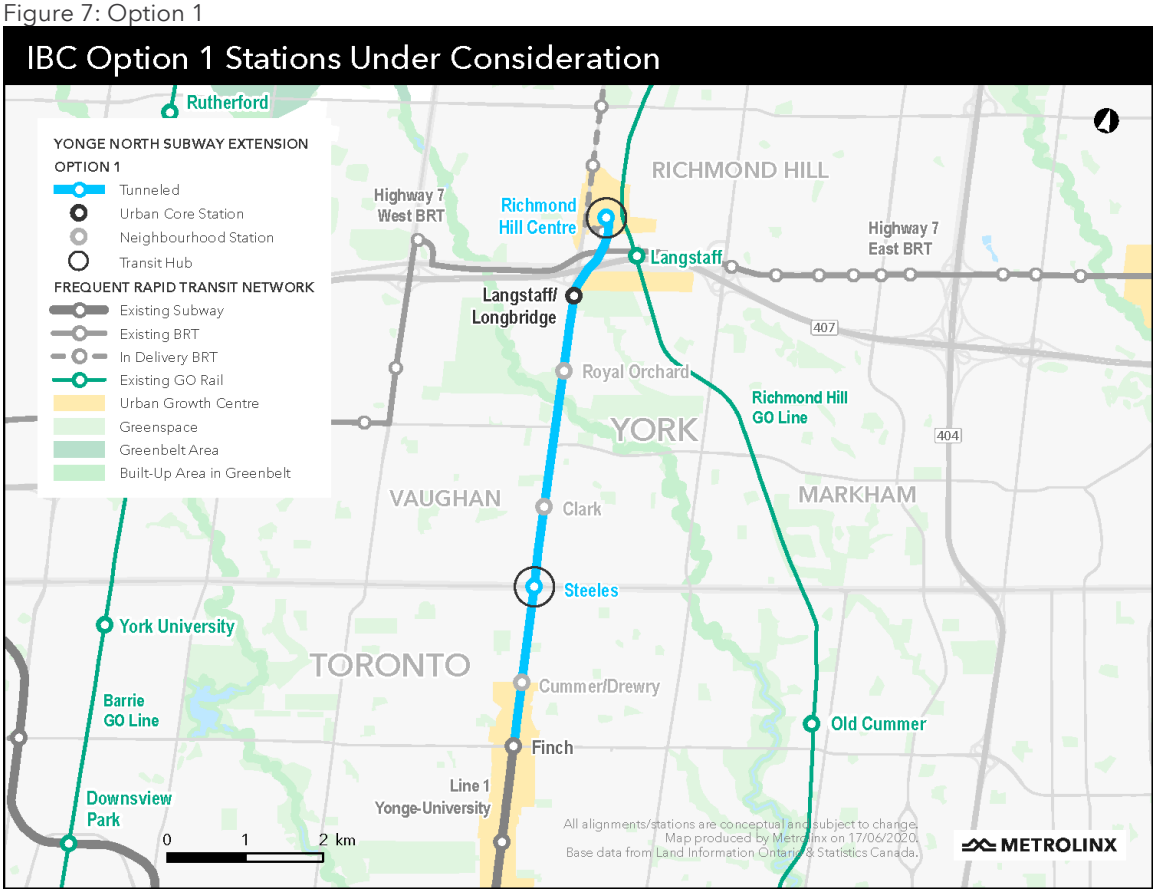
Each option includes two proposed large bus terminals/transit hubs at Steeles and RHC/Bridge stations in addition to a smaller bus facility at Clark Station and the off-site bus loop serving bus routes as Cummer Station.

Option 1

Option 1 accords to the approved EA. In this option, two stations have been identified in proximity of Highway 7 and Yonge Street. The RHC Station is located north of Highway 7, while the Langstaff station was located south of Highway 407 on the west periphery of the Langstaff Gateway Community on Yonge Street and includes commuter parking. This alignment could include the following stations:

- **Primary Stations**: Steeles, and RHC
- **Complementary Urban Core Station**: Langstaff
- **Neighbourhood Stations**: Cummer, Clark, and Royal Orchard
- Assumed stations in the **alignment representative**/modelling scenario: Cummer, Steeles, Clark, Langstaff, and RHC

Figure 7: Option 1

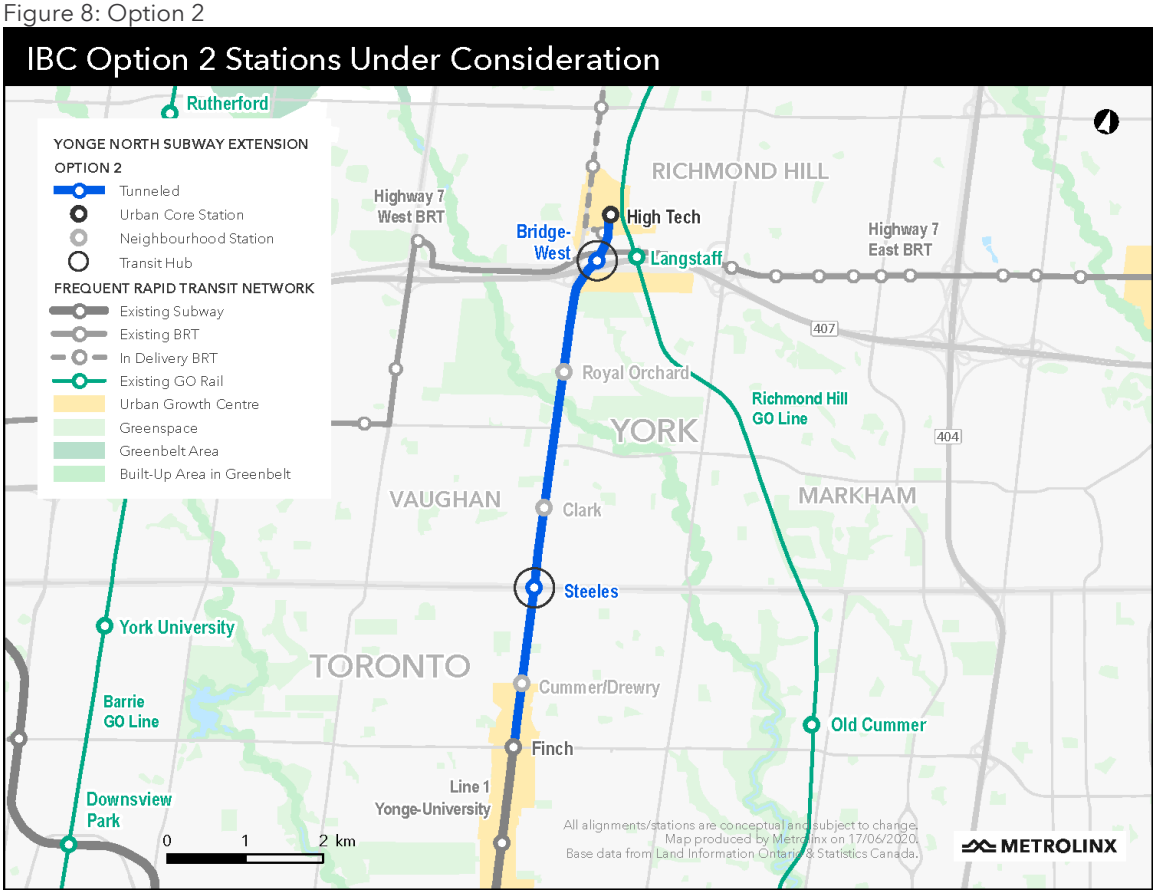


Option 2

Option 2 has the same alignment as Option 1 to a point north of Longbridge Road. From there the alignment would turn slightly east to cross under the Highway 407 and Highway 7 corridor on a diagonal. This option provides an opportunity for a station north of Langstaff Gateway Community between Highway 407 and Highway 7 (Bridge-West Station). This station would be below grade with station entrances north of Highway 7 and South of Highway 407 and could serve both Richmond Hill Centre and Langstaff Gateway communities. These areas are two parts of the Richmond Hill Centre/Langstaff Gateway Urban Growth Centre that are separated by Highway 407 and Highway 7 by about 250m. This alignment could include the following stations:

- **Primary Stations**: Steeles, and Bridge-West (underground)
- **Complementary Urban Core Station**: High Tech (underground)
- **Neighbourhood Stations**: Cummer, Clark, Royal Orchard
- Assumed stations in the **alignment representative**/modelling scenario: Cummer, Steeles, Clark, Bridge- West (underground)

Figure 8: Option 2



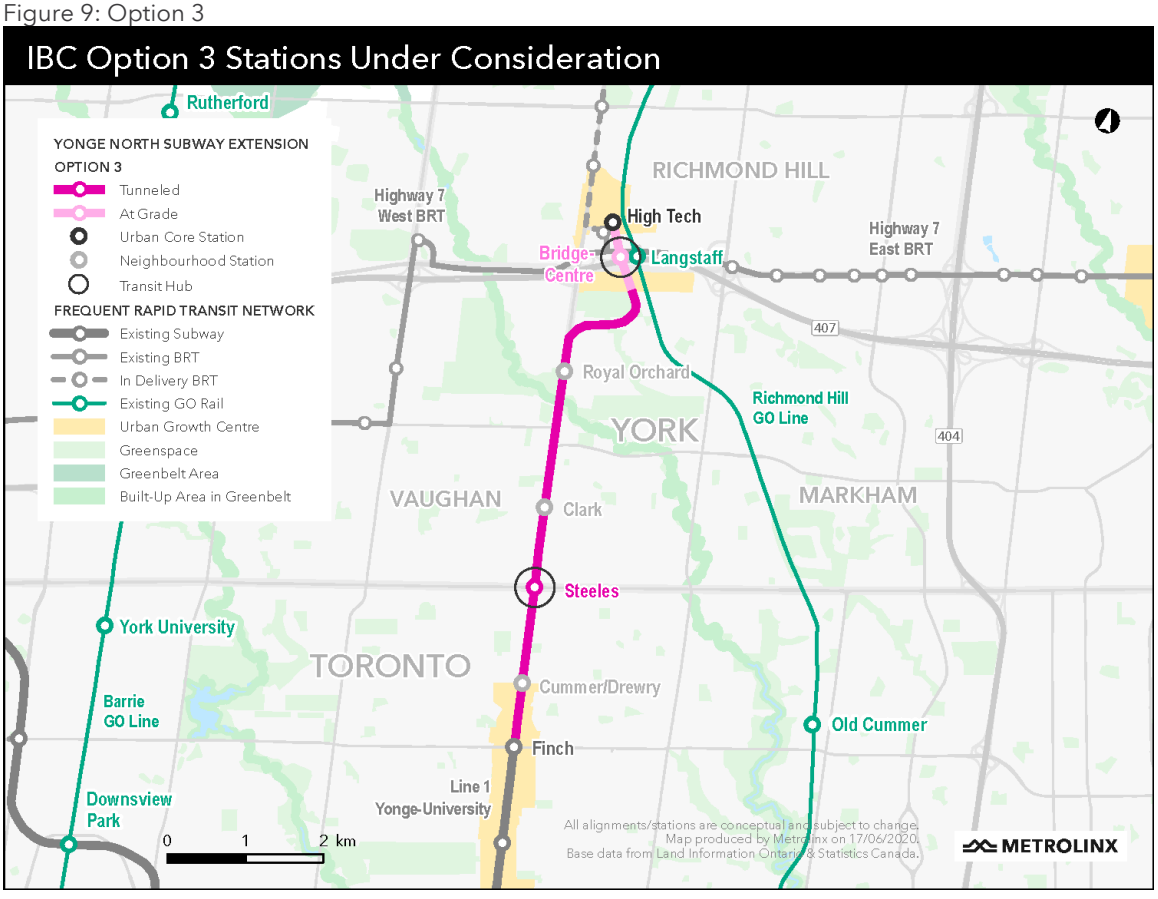
Option 3

Option 3 has the same alignment to Options 1 and 2 to a point north of Thornhill Avenue. From there the alignment then turns east to continue under Kirk Drive before turning again to run at-grade and alongside the CN/GO rail corridor. The at-grade portion of the alignment provides for cost savings over the fully tunneled approaches of the other options. The cost savings associated with Option 3 made it an important alternative for evaluation.

Like Option 2, this alignment offers a more centralized station within Langstaff Gateway Community, between Highway 407 and Highway 7, instead of the Langstaff Station. However, in this option, the Bridge Station is at-grade and further to the east, next to the CN/GO rail corridor (Bridge-Centre Station). This alignment could include the following stations:

- Primary Stations: Steeles, and Bridge-Centre (at-grade)
- Complementary Urban Core Station: High Tech (at-grade)
- Neighbourhood Stations: Cummer, Clark, and Royal Orchard,
- Assumed stations in the alignment representative/modelling scenario: Cummer, Steeles, Clark, Bridge- Centre (at-grade)

Figure 9: Option 3



Technology

Conceptual designs to date have assumed the use of existing TTC subway technology (see

Table 7). Any introduction of new technology is assumed to be technical compatible with what is currently operated on Line 1 Yonge-University (Toronto Rocket trains and Automatic Train Control and one-person train operation).

Table 7: Yonge Street Extension Technology and Rolling Stock

Vehicle	Track Gauge	Train Length	Train Capacity (Crowding Standards)	Max. Axle Load	Train Control system	Operation
Toronto Rocket	1,495 mm (Almost Standard)	138m	1,100 passengers	15 tonnes	Communications-Based Train Control	Semi-Automatic

Summary of Assumptions Used for Analysis and Travel Demand Modelling

In order to develop the business case evaluation and undertake the modelling and analysis that support it, a number of assumptions were made with respect to future conditions (see Table 8). These are consistent with the standard assumptions generally applied to Metrolinx studies and are inferred from both policy and observed trends.

Metrolinx uses the Greater Golden Horseshoe Model Version 4 (GGHMv4) as a core network modelling tool when developing Business Cases, conforming to Metrolinx' Business Case Guidance. The GGHMv4 is a large-scale regional model, calibrated/validated at a regional level to forecast ridership growth.

GGHMv4 was released in 2015 and used to undertake the technical analysis for the 2041RTP, as well as several business cases and planning studies by both Metrolinx and MTO. The version 4 model served as a significant update to the previous version of the model, moving towards state-of-the-art activity-based travel demand forecasting. GGHMv4was developed for the MTO using 2011data from the Transportation Tomorrow Survey, with the forecast horizon typically being 2041. The model considers changes in land use patterns and the transportation network to more accurately estimate ridership over a longer horizon.

Metrolinx is aware of differences in other modeling approaches but see the modeling inputs used in the GGHMv4 as appropriately conservative yet standardized across project evaluation work.

Land use forecast input to the GGHMv4 align with regional land use planning and do not necessarily reflect draft municipal policy that was referenced above.

Table 8: Summary of Assumptions

	2041 Assumption (Source)
City of Toronto Urban Structure	• City of Toronto Official Plan, Maps 2,13-20
Population and Employment	• Expanded Market Land Use based on 2011 Census (Statistics Canada) and existing development applications
Base Rapid Transit Network	• *2041 Regional Transportation Plan* "In-Delivery Network" with updates from Ontario's Transit Plan (Ontario Government, 2019)
Fare Structure	• 2018 TTC-level fare at all GO stations within City of Toronto Boundaries • 2018 TTC fare on all TTC routes (including the projects herein evaluated) • 2018 Distance-Based GO fare structure, except within City of Toronto • 2018 Ride to GO fare discount YRT/GO
GO Network	• GO Expansion Full Business Case, 2019
Surface Transit Network	• Surface transit network assumptions were provided by TTC • Bus Plan for YNSE provided by York Region Transit
Travel Behavior Model	• Greater Golden Horseshoe Model v4 (GGHMv4)*
Line 1 hourly capacity	• 36,000 (provided by TTC)
In-effect planning policies	• Places to Grow: Growth Plan for the Greater Golden Horseshoe (2019) • The Regional Municipality of York Official Plan (2010) • City of Toronto Official Plan (2006) • City of Vaughan Official Plan (2010) • City of Markham Official Plan (2014) • Langstaff Gateway Secondary Plan (OPA 183) • Richmond Hill Official Plan (2010) • Yonge-Steeles Area Regional Transportation Study (2015)
Draft planning policies	• Yonge Street North Planning Study • Yonge Steeles Corridor Secondary Plan • Promenade Centre Secondary Plan • Richmond Hill Centre Secondary Plan

* The Greater Golden Horseshoe Model Version 4 (GGHMv4) is the latest version of the GGHM family of models and was released in 2015. It was developed for the MTO using 2011 Transportation Tomorrow Survey (TTS) data, with the forecast horizon typically being 2041.

4

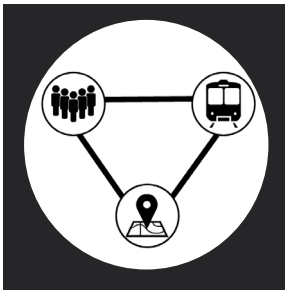
Strategic Case

METROLINX

Introduction

The Strategic Case summarizes the performance of the options against the identified strategic objectives to indicate if the investment addresses the Problem Statement and the goals of the *2041 Regional Transportation Plan*. Criteria were developed and selected to evaluate each option's ability to meet the objectives and support the realization of the strategic outcomes.

This chapter will be structured around the 3 outcomes defined in the Problem Statement chapter, as follows:



STRONG CONNECTIONS

Assessment of how the options would improve people's mobility and access to opportunities and destinations.

COMPLETE TRAVEL EXPERIENCES

Review of how the options would allow people to travel faster, more comfortably, more conveniently and more reliably.

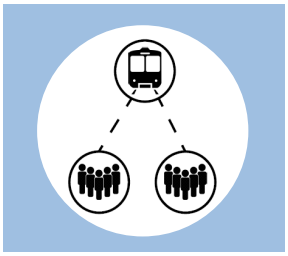
SUSTAINABLE AND HEALTHY COMMUNITIES

Examination of how the options would support sustainable travel patterns and public health.

OUTCOME 1: STRONG CONNECTIONS

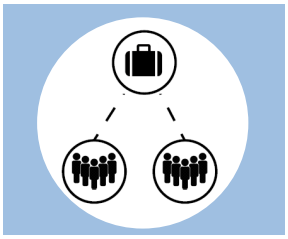
Adding a new rapid transit line will improve the connections between people and the places where they live, work and play. The service will improve access to jobs and other services by transit, and, strengthen connections between people and jobs within Toronto and the surrounding region. Improving the quality of, and access to, transit services is essential to support the continued economic development of the Greater Toronto and Hamilton Area.

This section will compare the options' ability to deliver three benefits that support the realization of Outcome 1 "Strong Connections".



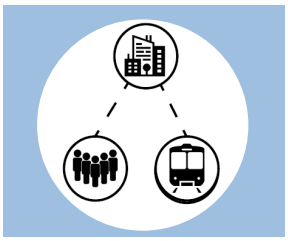
Improve Access to Transit

Do the options go where people are and where they go?



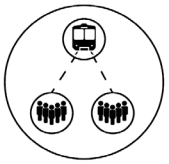
Increase Access to Economic Opportunities

Do the options connect more people to more jobs?



Support Planned Development along the YNSE Corridor

Do the options support planned growth and development opportunities?



OUTCOME 1: STRONG CONNECTIONS

BENEFIT 1: Improve Access to Transit

The YNSE extends the Line 1 Yonge-University Subway (Line 1) approximately up to 8.0 km north of the existing terminus at Finch Station, thus providing additional subway access for residents in both Toronto and York Region.

The YNSE will serve communities along the Yonge Street corridor that include both existing residents and emerging dense residential/mixed-use areas. Significant development has been supported by planning policy frameworks in proximity to each of the YNSE stations.

For some, improving access to transit means locating a subway station closer to where they live. Toronto has many examples of communities where residents can walk a relatively short distance to a subway station. Where this happens, it is a tremendous opportunity for those individuals as it brings the region closer to them.

However, improving access to transit is also about putting stations in locations that shorten the journey time for transit users. For a vast portion of Toronto's transit users, their journey begins on a surface bus or streetcar route. This is certainly the case for the YNSE, where over half the user will transfer to/from buses. This IBC looks at the benefits of the YNSE for both of these users groups. While some of the early discussion focuses on what is happening now and in the future on the Yonge Street Corridor, the benefits of the YNSE extend well beyond an 800m distance.

Alternative Alignment Analysis

The analysis below illustrates that there will be moderate differences in the forecasted number of people living within 800m of each of the alignments. It is important to remember that these forecasts are just estimates of what will happen in the future.

- **Option 1**: Approximately 56,700 people are projected to live within 800 metres (approximately a 10-minute walk)[5] of the new stations in 2041. The extension brings approximately 29,500 more residents within a 10-minute walk of rapid transit, compared to BAU. This number is the greatest amongst all the alternative options. This option also attracts 109,900 daily riders[6] along the extension from Finch Station. It is worthwhile to note that the parking lot at Langstaff impacts the magnitude of new riders; as such riders already have access to a car and are willing to make the switch to transit if convenient commuter parking is available.

[5] All metrics related to walking distance access were calclulated using an 800m radius buffer (as the crow flies distance) around stations, where an 800m walk is considered to take approximately 10-minutes at the standard average walking speed (5 km/hour).
[6] Projected 2041 daily boardings at Finch and the new stations

- **Option 2**: Approximately 48,000 people are projected to live within 10-minute walk of the new stations in 2041. This option brings approximately 26,500 more residents within a 10-minute walk of rapid transit compared to BAU. This option attracts 97,600 daily riders along the extension from Finch Station.

- **Option 3**: This alignment has similar coverage as Option 2. Approximately 48,800 people are projected to live within a 10-minute walk of the new stations in this option in 2041. This extension brings approximately 26,000 more residents within a 10-minute walk of rapid transit compared to BAU. This option attracts 94,100 daily riders along the extension from Finch Station.

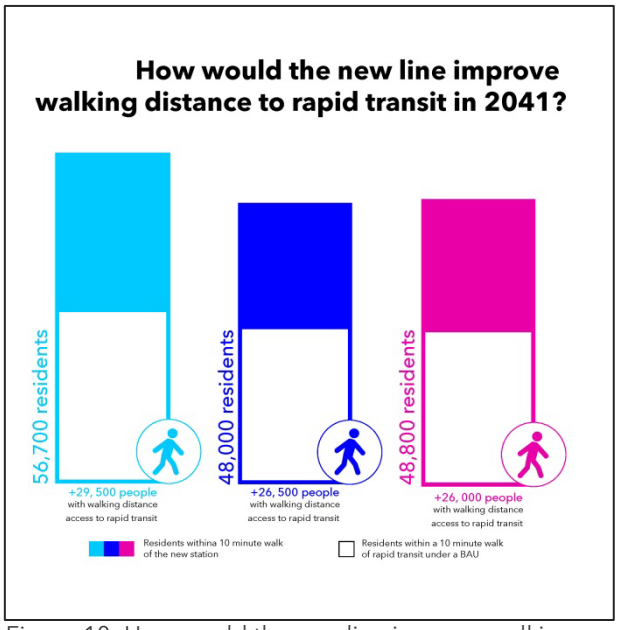


Figure 10: How would the new line improve walking distance to rapid transit in 2041?
Source: GGHMv4

Table 9: 2041 Ridership by Station in AM Peak Hour

Station	Option 1	Option 2	Option 3
Cummer	2,000	2,000	2,000
Steeles	5,400	5,200	5,100
Clark	2,200	2,300	2,300
Langstaff	3,300*		
RHC	8,000		
Bridge-West		8,000	
Bridge-Centre			7,400

* In the ridership model, it is assumed that there is a new parking lot in proximity of the Langstaff Station.

Much of the difference in future population in the estimates is related to the approach to providing a YNSE station at Richmond Hill Centre and Langstaff Gateway. Option 1 includes an additional station in the Richmond Hill Centre area. Through additional analysis this IBC takes a deeper look in the strengths and weakness to alternative approaches to this question.

Shorter, more reliable journey times have the potential to attract riders to transit. Ridership modeling suggests that a shift toward transit will occur. The model looked at three scenarios involving the YNSE corridor that will be serviced by the extension. Trips to the corridor from other destinations have the greatest mode share (around 23%). Trips within the corridor have the smallest mode share (around 15%).

Within the ridership model, previous analysis has suggested that removing or adding Neighbourhood Stations on the alignment does not have a significant impact on overall ridership for the YNSE. Most riders continue to use transit but would experience longer journey times if a particular station was removed, or short travel times if a particular station was added.

The station analysis attempts to capture the travel time savings and other benefits associated with these stations as a control for comparison. It should be noted that removing or adding a station may impact some potential riders to the point they might choose to use or not use transit, depending on the availability to of a station. It should also be noted that there may be other factors that are not captured in these results such as potential impact on the scale of future development goals along the specific portion of the corridor.

Note: *Ridership modeling does not take into account any potential impact of changes to demand resulting from the Covid-19 outbreak.*

Table 10: Transit Mode Share for Corridor Trips

Nature of Trip (AM Peak Hour)	Share of Transit Trips			
	BAU	Option 1	Option 2	Option 3
Trips to the Corridor	22.25%	23.36%	23.17%	23.05%
Trips from the Corridor	19.52%	20.74%	20.28%	20.24%
Trips within the Corridor	14.08%	15.56%	15.31%	15.29%

Table 11: "Improve Access to Transit" Summary

Criteria	Option 1	Option 2	Option 3
How many people would have walking distance access to the **YNSE stations** in 2041?* *Projected 2041 residents within a 10-minute walk of the new stations	56,700 people	48,000 people	48,800 people
How many people would gain walking distance access to **rapid transit** in 2041?* * Projected 2041 residents within a 10-minute walk of the line who wouldn't have walking distance access to rapid transit (i.e. Line 1 Yonge-University, Highway 7 East BRT, Highway 7 West BRT, Richmond Hill GO Line, Yonge South BRT) in the BAU scenario	29,500 people	26,500 people	26,000 people
How many people will use the new transit line?* * Projected 2041 daily boardings at Finch and new stations *2041 GGHMv4 outputs	109,900 daily boardings (compared to 59,300 daily boardings in BAU at Finch Station)	97,600 daily boardings (compared to 59,300 daily boardings in BAU at Finch Station)	94,100 daily boardings (compared to 59,300 daily boardings in BAU at Finch Station)

Stations Analysis

This section details forecasted performance of the Complementary Urban Core Stations and the Neighbourhood Stations. The stations analysis was undertaken utilizing a desktop methodology, focusing specifically on the stations relative and comparative performance. This analysis is distinct from the travel demand modelling undertaken for the alignments analysis and economic analysis in this IBC.

Further analysis was not undertaken for the Primary Stations as they stand apart in terms of ridership generally and particularly transfers from buses.

High Tech Station in Alignment Options 2 and 3

High Tech Station in both alignments will improve access to transit through the provision of new rapid transit infrastructure, compared to the BAU scenario.

Adding a High Tech Station to Alignment Options 2 and 3 would provide walking-distance access (800 metres or 10- minute walk) for approximately 5,500 to 7,400 new people in 2041 at Richmond Hill Centre (with no overlap with catchment area of the Bridge Station), compared to a scenario where the line would terminate at a Bridge Station.

The following figures illustrate the pedestrian catchment area of proposed station entrances in Options 1 to 3. Catchment areas shown on these figures are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

Figure 11: Walk Time to Station Entrances – Northern Stations in **Option 1**

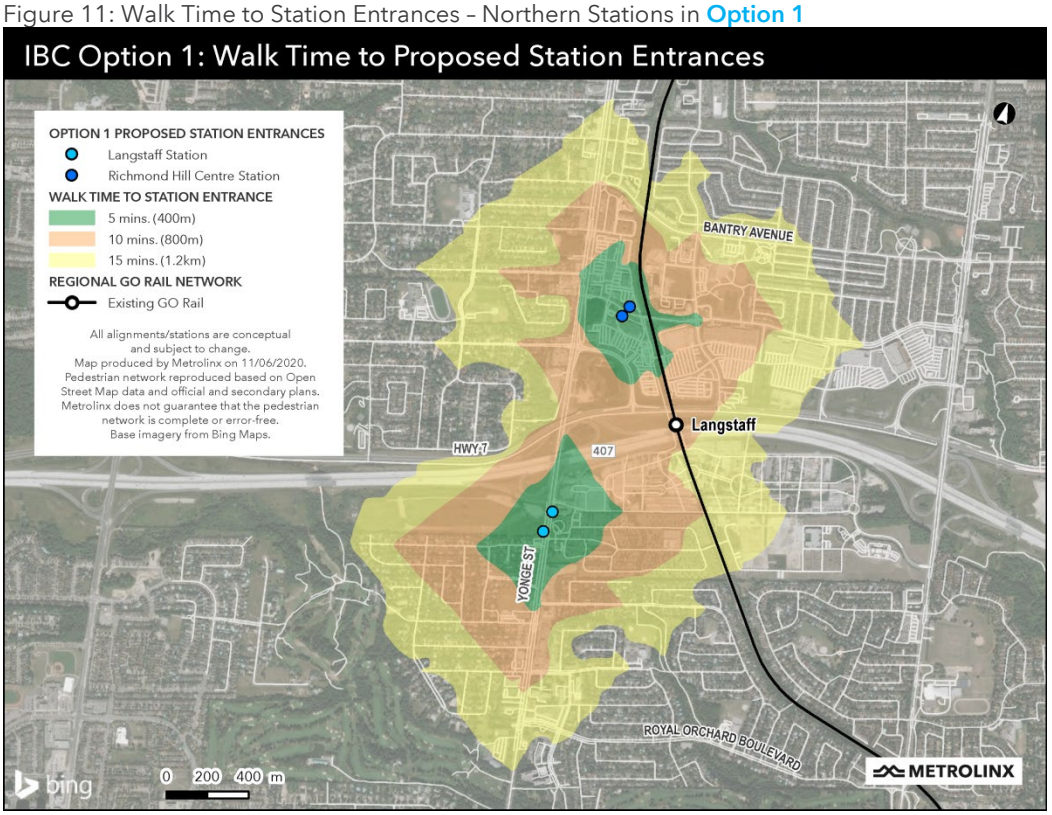


Figure 12: Walk Time to Station Entrances – Northern Stations in **Option 2**

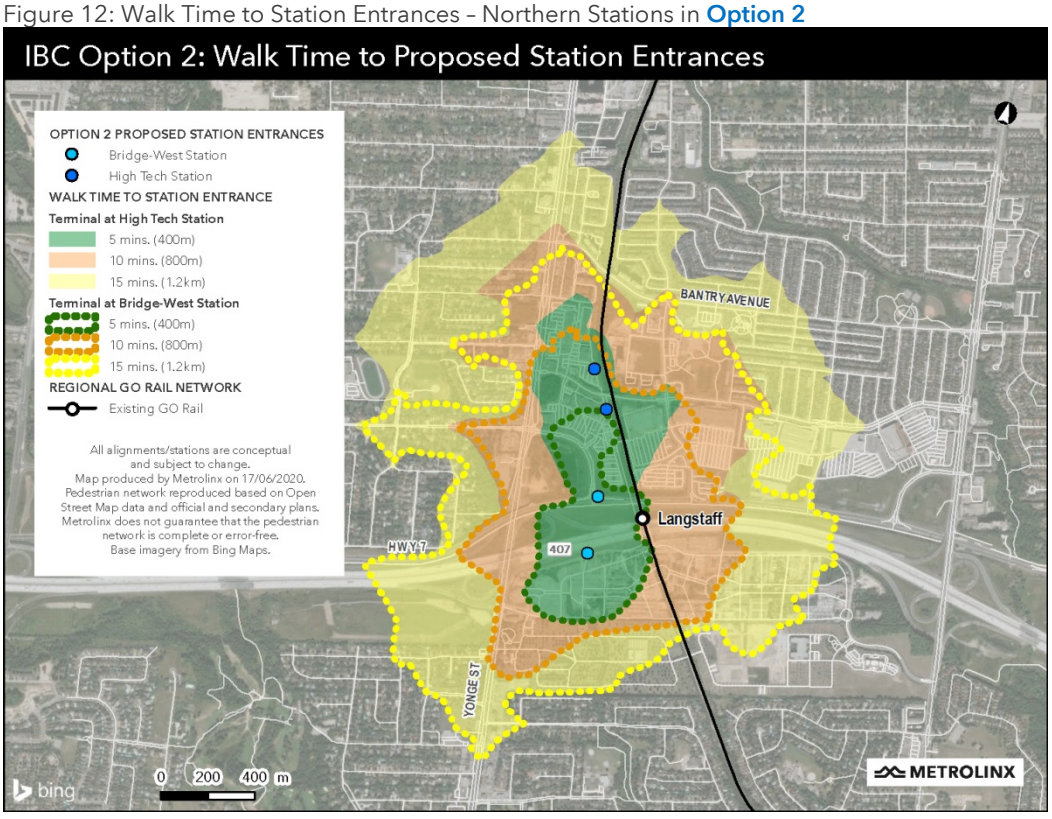
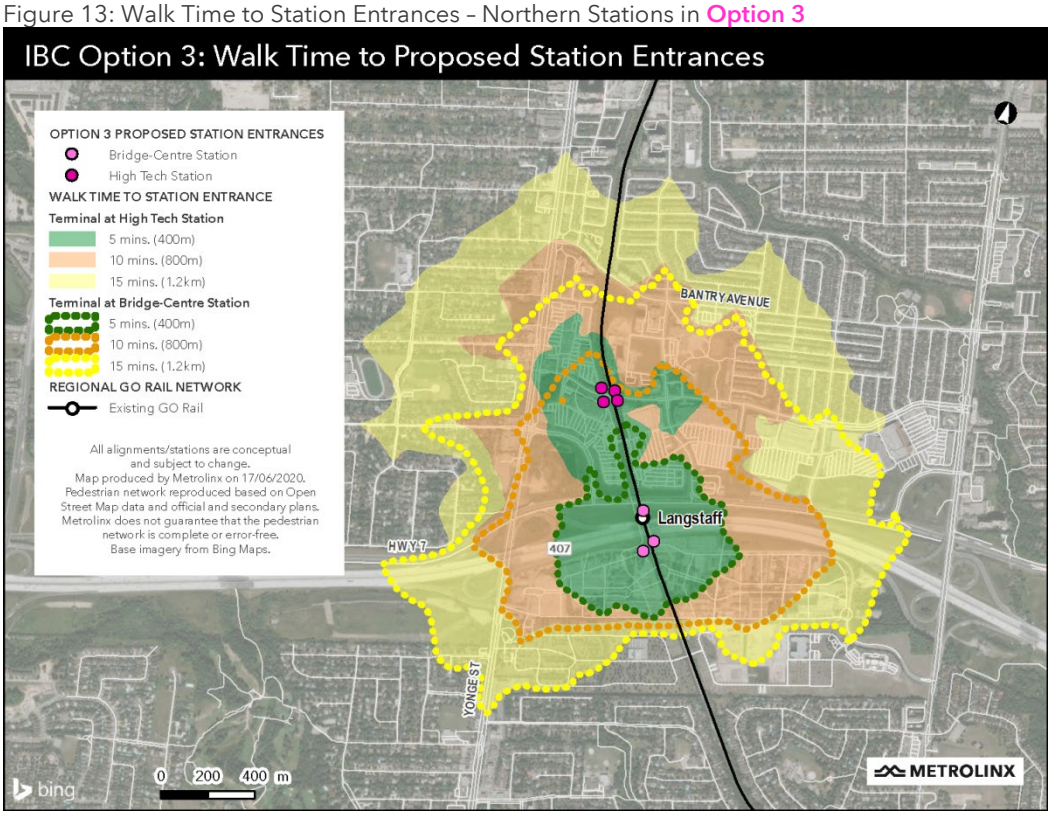


Figure 13: Walk Time to Station Entrances – Northern Stations in **Option 3**

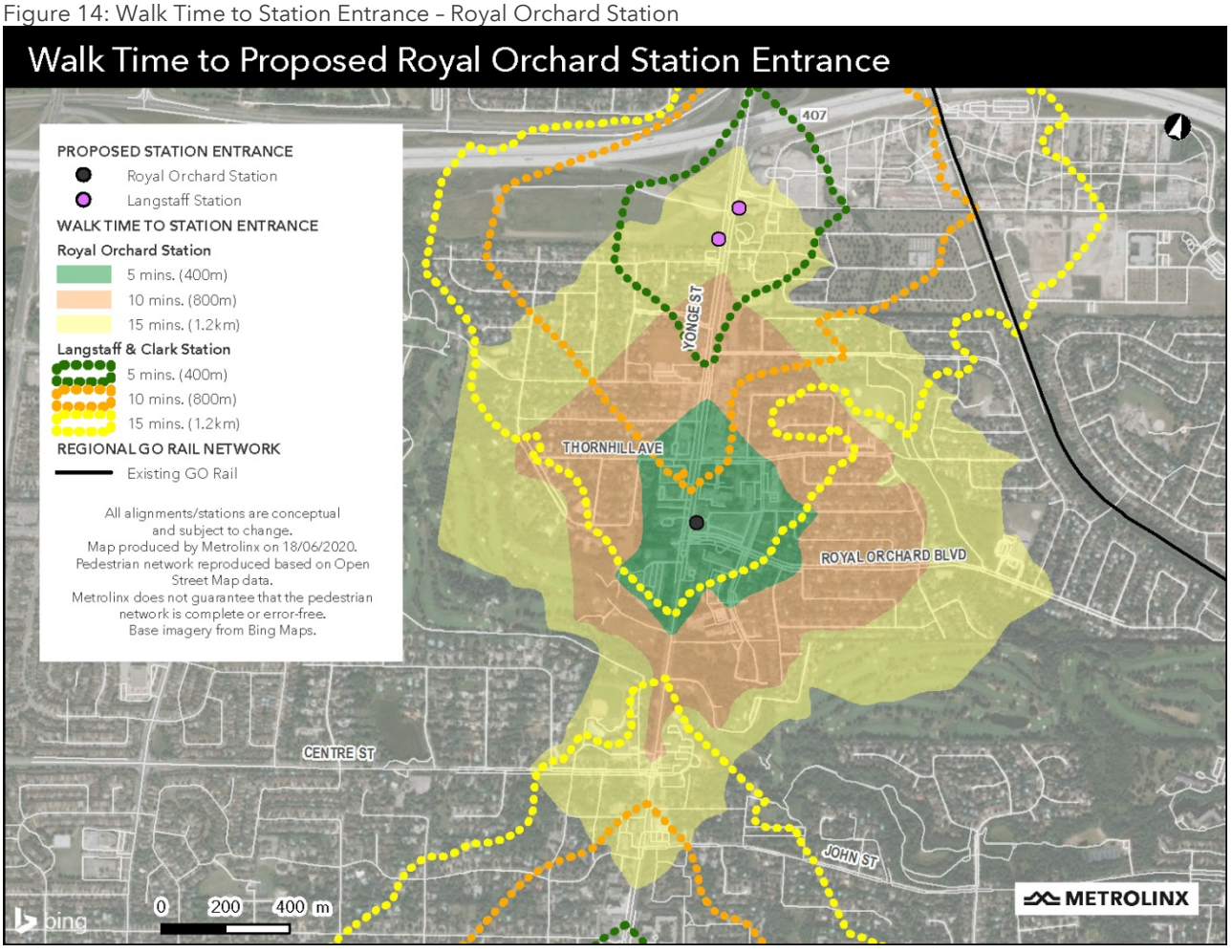


Royal Orchard Station

Royal Orchard Station would provide walking-distance access (800 metres or 10- minute walk) for approximately 7,300 people in 2041 in Alignment Options 2 and 3.

This number will be reduced in Option 1 where a Langstaff Station also exists, and the catchment areas overlap. In that case, 5,200 people would live in 10- minute walk of Royal Orchard Station with no overlap with Langstaff Station's catchment area. Catchment areas shown on these figures are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations. Figure 14 illustrates the pedestrian catchment area of propose station entrance for the Royal Orchard Station. Catchment areas shown on this figure are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

Figure 14: Walk Time to Station Entrance – Royal Orchard Station

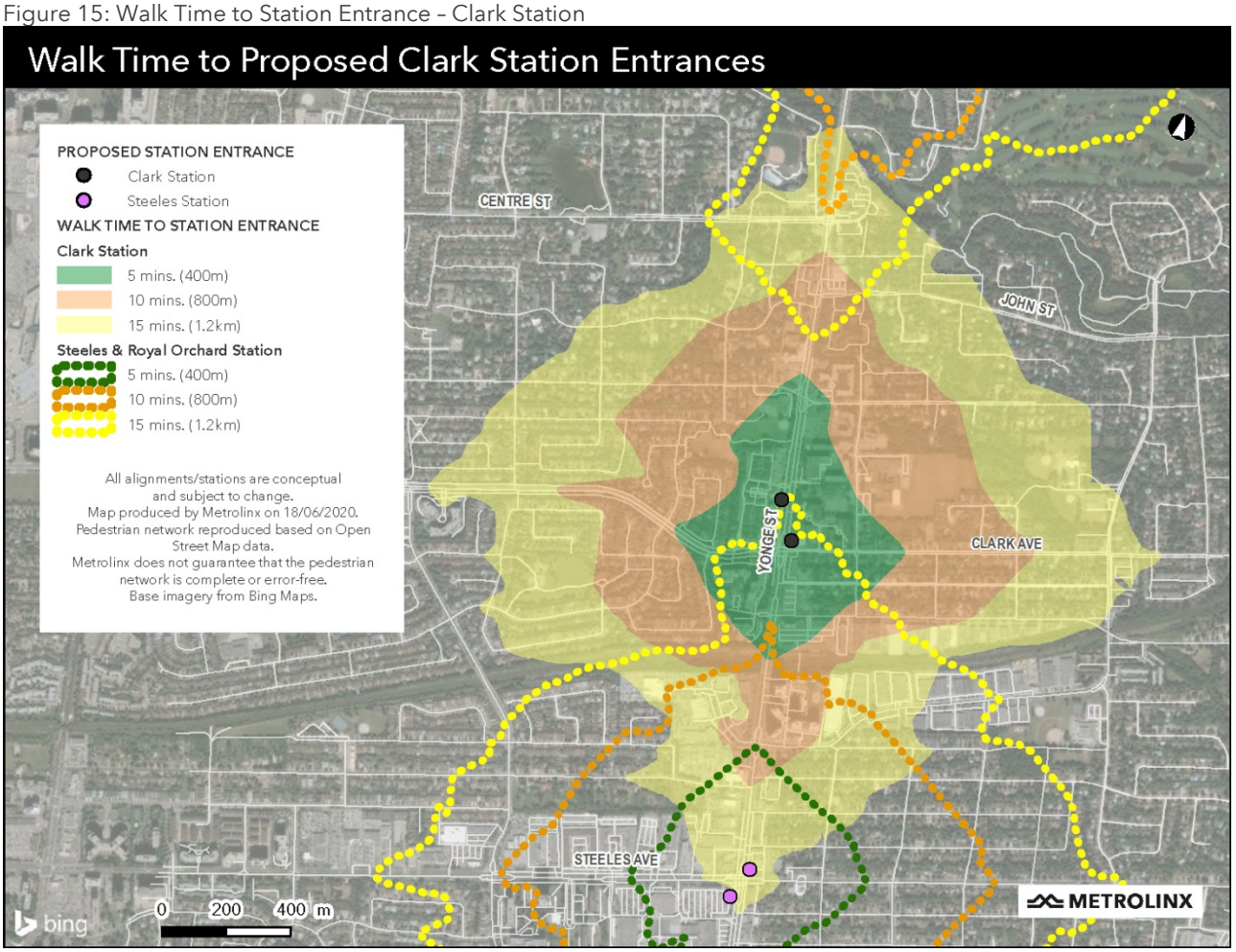


Clark Station

A Clark Station would serve a portion the existing population between Steeles and Langstaff Stations. Approximately 8,100 people would live in 800 metres or 10-minute walk of Clark Station with no overlap with Steeles Station (about 20% of the catchment area of this station is within 800m of Steeles Station).

Figure 15 illustrates the pedestrian catchment area of propose station entrance for the Clark Station. Catchment areas shown on this figure are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

Figure 15: Walk Time to Station Entrance – Clark Station

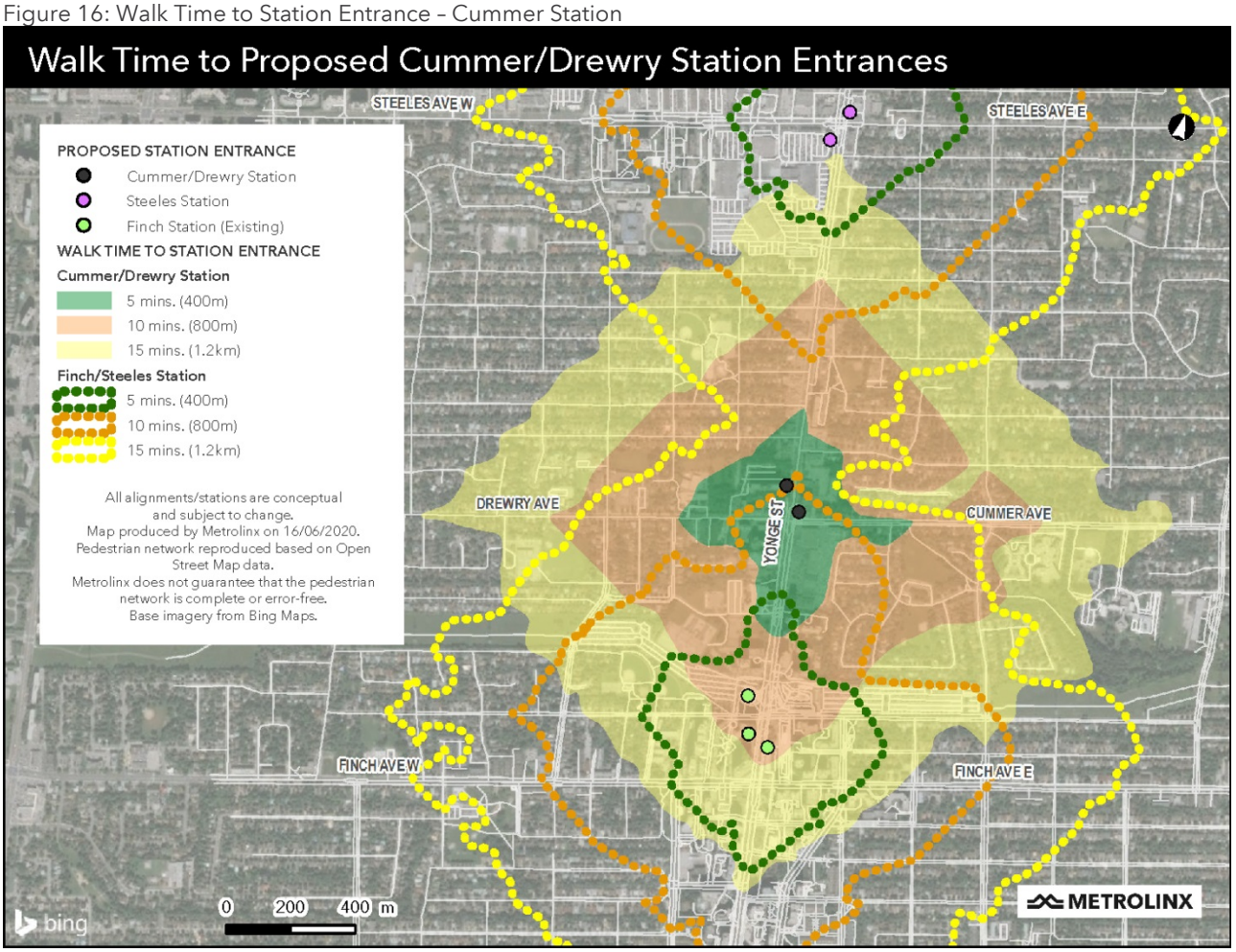


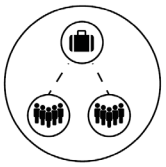
Cummer Station

The 800m catchment area of Cummer Station has overlaps with the catchment areas of both Finch and Steeles Stations. The number of people that would live within 10-minute walk of Cummer Station with no overlap would be around 5,700.

Figure 16 shows the pedestrian catchment area of propose station entrance for the Cummer Station. Catchment areas shown on this figure are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

Figure 16: Walk Time to Station Entrance – Cummer Station





OUTCOME 1: STRONG CONNECTIONS

BENEFIT 2: Increase Access to Economic Opportunities

The YNSE as an extension of Line 1 Yonge-University Subway will increase access to Downtown Toronto and all points along the Yonge Street corridor compared to BAU. The YNSE will also serve significant employment in York Region, putting more jobs within walking distance, or shortening the time on buses for those accessing employment areas somewhat removed from the Yonge Street corridor.

Note: *Metrolinx undertakes travel demand modelling based on future land use forecasts developed by the Province of Ontario, for the 2041 horizon. For the purposes of the IBC, Metrolinx has taken a standardized approach to forecasting population and employment growth, applying market-trend based future land use projections which conform to the Growth Plan region level targets, while allocating growth based on several factors including observed trends, development potential, and designated growth areas. This Market land use forecasts is consistent with ridership forecasting on other projects.*

Through our consultations with our municipal partners we recognize that there are other forecasts for the corridor based on potential future development scenarios. In particular, the Region of York has forecasted additional employment growth in the Richmond Hill Centre and Langstaff areas. Additional growth in these areas would be well served by the subway project and result in additional northbound trips in the AM peak hour.

We recognize that the growth assumptions applied in the modelling for this IBC may be conservative along the YNSE corridor, as the corridor specific growth forecasts noted above are not captured. Land Use sensitivity analysis has been undertaken to understand the impact of said alternative growth scenarios along the YNSE station areas, detailed in the BENEFIT 3 section. Additionally, results will continue to be refined post-IBC based on sensitivity analyses and additional work going into the PDBC.

Alternative Alignment Analysis

There will be moderate differences in the number of jobs within 800m of the alignments:

- **Option 1**: Approximately 25,700 jobs are projected to be located within a 10-minute walk[7] from the YNSE stations in 2041. This is the greatest number compared to the other two alignments.
- **Option 2**: Approximately 22,600 jobs are projected to be located within a 10-minute walk from the YNSE stations in 2041.
- **Option 3**: This alignment is similar to Option 2. Approximately 22,900 jobs are projected to be located within a 10-minute walk from the YNSE stations in 2041.

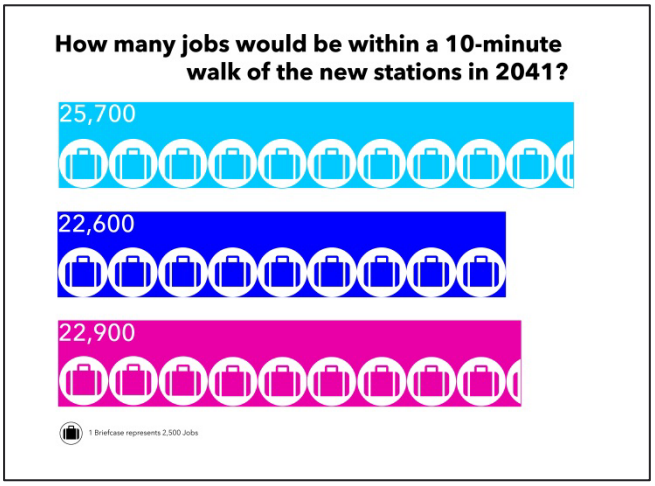


Figure 17: How many jobs would be within a 10-minute walk of the new stations in 2041?
Source GGHMv4 outputs

The above calculations are particularly sensitive to projections for employment at Richmond Hill Centre and Langstaff Gateway. As noted above municipal visions for these communities would result in significantly more employment in the Urban Growth Centre.

The YNSE increases the number of additional jobs within a 45-minute transit commute by between 1,650 jobs (Options 2 and 3) and 1,700 jobs (Option 1), compared to BAU.

Compared to BAU, the YNSE also provides employers an advantage by increasing the number of people, and therefore potential employees, within a 45-minute transit trip of jobs along the corridor by between 3,500 employees (Options 2 and 3) to 3,600 employees (Option 1).

Projections for employment density in the area served by the YNSE are illustrated in Figure 18 below. High levels of employment density are shown along Yonge Street within the North York Centre Urban Growth Centre. Mid-range levels of employment density extend into York Region. Richmond Hill Centre shows high levels of employment density. It should be noted that this figure is based on available information from the modelling data and updated analysis for the Yonge Street corridor and is provided for illustrative purposes only. Mapping such as this is only one tool in understanding how the Yonge Street corridor and York Region generally will evolve from a land use perspective.

[7] All metrics related to walking distance access were calclulated using an 800m radius buffer (as the crow flies distance) around stations, where an 800m walk is considered to take approximately 10-minutes at the standard average walking speed (5 km/hour).

The vision for the Richmond Hill/Langstaff Gateway Urban Growth Centre is that these two parts of the UGC will become vibrant mixed-use communities with significant employment opportunities. This IBC acknowledges the importance of supporting this vision and ensuring that it is supported by the transit investment.

Areas with high levels of employment density near the YNSE are also highlighted on the map. Employment centres at Leslie and Highway 7 and Highway 404 and Steeles are evident on the map and are located just 4km and 6km east of new YNSE subway stations. The Promenade Mall located just 2km west of the Yonge Street corridor also shows higher employment densities.

New employment along and in proximity to the corridor has the potential to take advantage of the capacity that is available on the non-peak direction.

Figure 18: 2041 Employment Density

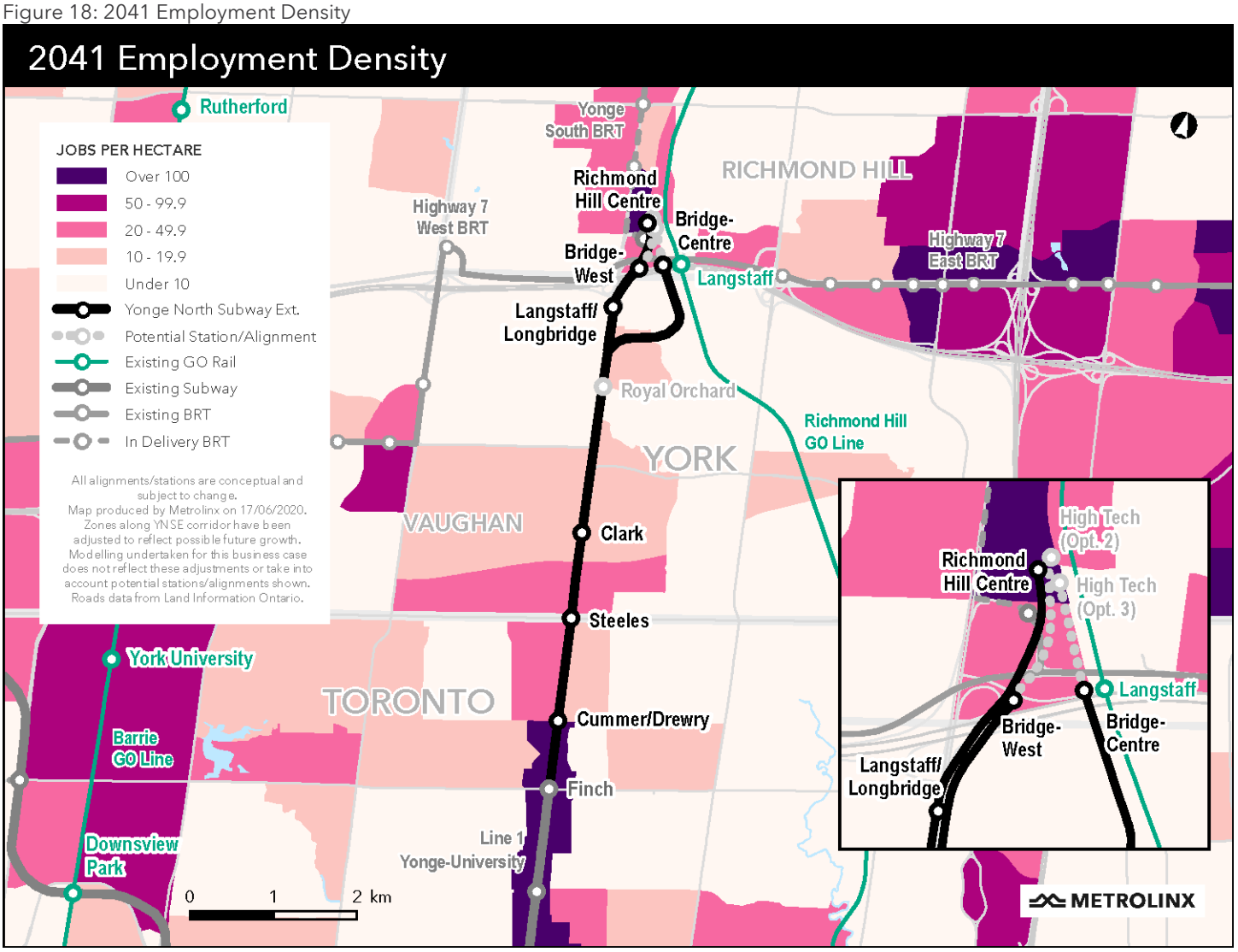


Table 12: "Increase access to economic opportunities" Summary

Criteria	Option 1	Option 2	Option 3
How will the option serve areas of existing and planned employment growth?* * projected 2041 jobs within a 10-minute walk of the YNSE stations * Source GGHMv4 outputs	25,700 jobs	22,600 jobs	22,900 jobs
How many more employment opportunities will people have access to within a 45-minute transit commute compared to BAU?* * projected 2041 new jobs within a 45-minute of the YNSE * Source GGHMv4 outputs	1,700 jobs	1,650 jobs	1,650 jobs
How many more employees will have access to employment within a 45-minute commute?* * Source: GGHMv4 outputs	3,600 employees	3,500 employees	3,500 employees

Stations Analysis

High Tech Station in Alignment Options 2 and 3

Including a High Tech Station would provide walking-distance access (800 metres or 10-minute walk) for approximately 2,300 and 2,700 new jobs by 2041 at Richmond Hill Centre/Langstaff Gateway area when compared with a scenario where Bridge station is the terminal.

High Tech Station in Alignment Option 3 has better coverage than the High Tech Station in Alignment Option 2. Operating as a couplet with Bridge Station, approximately 4,400 and 4,800 jobs would be within a 10-minute walk of these two stations in Alignment Options 2 and 3, respectively. To compare, this number is around 4,500 jobs in Alignment Option 1 with Langstaff and Richmond Hill Centre stations. For the catchment area maps, refer to The following figures illustrate the pedestrian catchment area of proposed station entrances in Options 1 to 3. Catchment areas shown on these figures are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations. Figure 11- Figure 13. These figures illustrate the pedestrian catchment area of proposed station entrances in Options 1 to 3. Catchment areas shown on these figures are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10 minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

Royal Orchard Station

The Royal Orchard community has a primarily residential character with some retail focused employment. Royal Orchard Station would provide walking-distance access (800 metres or 10-minute walk) for approximately 1,300 jobs in 2041 in Alignment Options 2 and 3. This number will be reduced in Option 1 where a Langstaff Station also exists, and the catchment areas overlap. In that case, 900 jobs would be within 10-minute walk of Royal Orchard Station with no overlap with Langstaff Station's catchment area. Refer to Catchment areas shown on this figures are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations. Figure 14 for the pedestrian catchment area of propose station entrance for the Royal Orchard Station. Catchment areas shown on this figure are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

Employment projections for the corridor suggest that Royal Orchard station area will continue to have a residential focus through 2041. This is also supported by York Region given their latest land use forecasts (April 2020). Overall, the analysis[8] suggests that only about 7% of the ridership is associated with passenger alighting during weekday AM peak hour 90 alighting out of 1,320 total ridership in the morning peak hour) and this is due to the fact that there is little existing or forecast employment growth adjacent or in proximity of the station. The attractiveness of Royal Orchard as a transfer point to employment is determined by the bus network that connects it to the larger region. The Royal Orchard area is subject of future planning studies which may impact the composition of future development in the area.

Clark Station

Approximately 3,400 jobs are forecasted within 800 metres or a 10-minute walk of Clark Station. However, since the catchment area of this station has overlap with Steeles Station, this number reduces to 1,900 jobs with no overlap. Refer to Figure 15 for the pedestrian catchment area of propose station entrance for the Clark Station. Catchment areas shown on this figure are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

The analysis[9] shows a good level of ridership at Clark Station. It suggests that in the weekday AM peak hour, out of 2,370 total station users, 810 alight and 1,560 board at the station. AM peak hour boardings are generally associated with employees along the Yonge Street corridor and in Downtown Toronto. The alightings are associated with passengers accessing employment destinations around Clark Station, either walking or via a bus connection.

Cummer Station

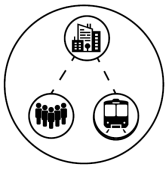
The 800m catchment area of Cummer Station has overlaps with the catchment areas of both Finch and Steeles Stations. The number of jobs within 800 metres or a 10-minute walk of this Station with no overlap is approximately 2,200. Refer to Figure 16 for the pedestrian catchment area of propose station entrance for the Cummer Station. Catchment areas shown on this figure are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. Catchment areas shown on this figure are based on an assumed 2041 pedestrian network, where an 800m walk is considered to take on average ten minutes. For clarity, the population with a 10-minute distance were calculated using a more simplified approach of applying an 800 metres radius buffer (as the crow flies distance) around stations.

[8] The stations analysis was undertaken utilizing a desktop methodology, focusing specifically on the stations relative and comparative performance. This analysis is distinct from the travel demand modelling undertaken for the alignment's analysis and economic analysis in this IBC.
[9] Same as above

Calculations are based on population projections for Traffic Analysis Zones (TAZ), as a result it may underestimate the population in proximity to the station in case like Cummer Station area where growth is planned to have higher density in proximity to the station.

The analysis[10] suggests that like Clark Station, there is a good level of ridership at this station (slightly fewer than the Clark Station). Out of 2,160 total station users in the weekday AM peak hour, about 830 alight and 1,330 board at this station. As previously noted, alighting in the mornings generally suggest transit users accessing employment or educational destinations in the Cummer Station area on in the surrounding area and accessed by bus. The east end of the TTC Route 42 is associated with low density employment. AM peak hour boarding are also associated with employees along the Yonge Street corridor and in Downtown Toronto.

[10] Same as above



OUTCOME 1: STRONG CONNECTIONS

BENEFIT 3: Support Planned Development along the YNSE

For the extension to attract ridership, it needs to be built where people reside and jobs are located today, and where there is potential for growth in the future. Transit infrastructure has been found to encourage development activities in all categories of use, generating further wider economic benefits for communities and the region. This growth and development, in turn, generates more transit ridership.

Alternative Alignment Analysis

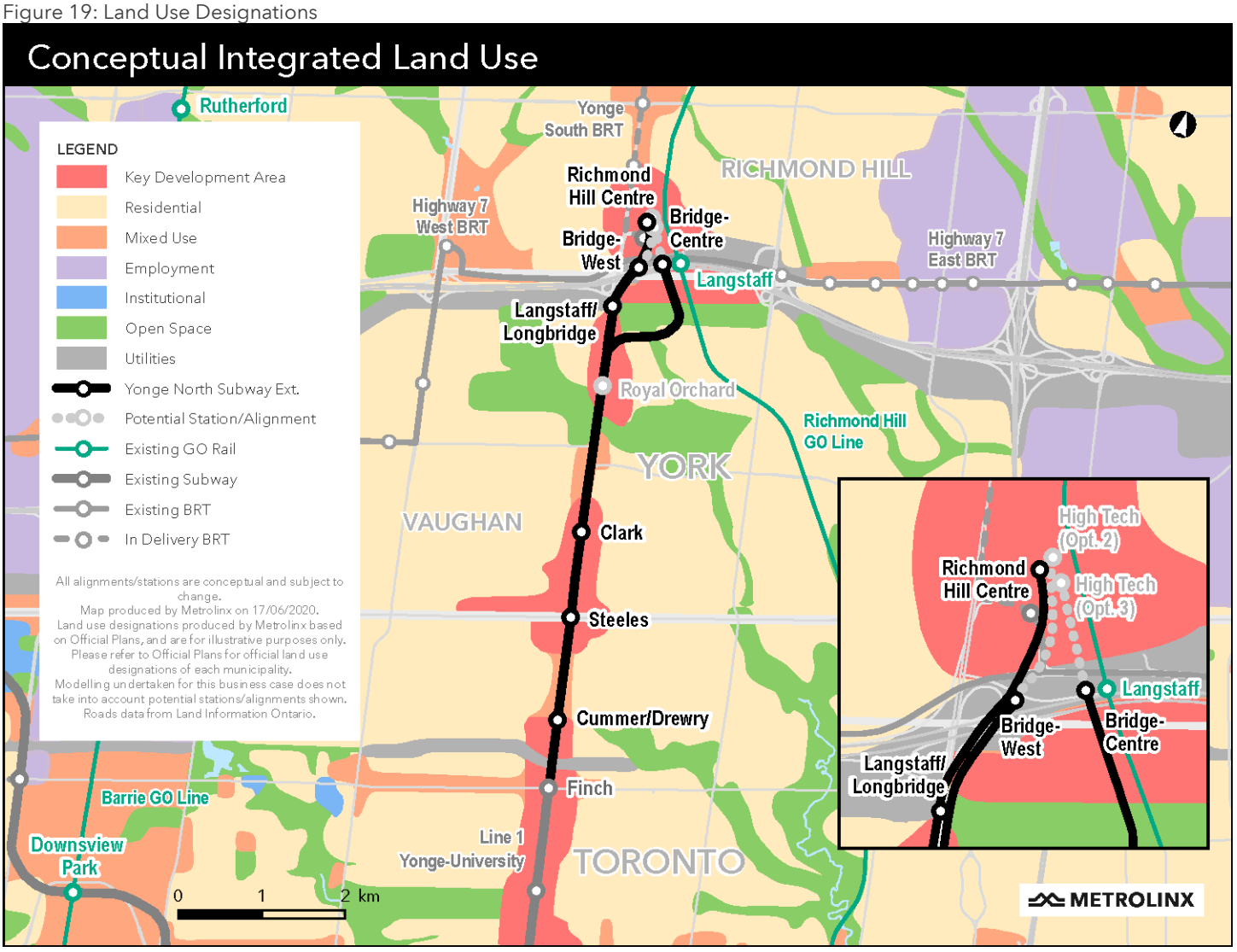
The alternative alignments are thought to be equally effective at supporting planned development along the corridor. Potential usage differences are addressed in the Station Analysis.

The YNSE passes through the City of Toronto, and Region of York municipalities of City of Vaughan, City of Markham and City of Richmond Hill. Each of these municipalities designates the YNSE Corridor with designations that are supportive of growth. Figure 19 summarizes the land use designations along the corridor. This map has been prepared to provide a high-level indication of planning policies along the corridor. While the map attempts to illustrate policy across four municipalities it is not meant to be a reference for land use planning information. For a complete understanding of Municipal planning policy reference should be made to the Official Plan documents of each municipality.

The following discussion provides an outline of the planned developments, along the corridor. The IBC looks at future development in several ways to provide a comprehensive understanding of the emerging context for the corridor:

- Current and upcoming planning policy exercises along the corridor have been highlighted
- Land use forecasts developed by the relevant municipalities

Figure 19: Land Use Designations



Places to Grow: Growth Plan for the Greater Golden Horseshoe (2019)

The Growth Plan under the Places to Grow Act is a framework for implementing the Government of Ontario's vision for better managing growth in this region. The YNSE connects two areas that have been identified as "Urban Growth Centres" (UGC) in the Growth Plan, specifically North York Centre and Richmond Hill/Langstaff Gateway. As extension, the Line 1 continues to interface with "Yonge - Eglinton Centre", and "Downtown Toronto" as well.

The Regional Municipality of York Official Plan (2010)

York Region's Official Plan identifies the Richmond Hill/Langstaff Gateway area as "Regional Centre" at the intersection of two "Regional Corridors": Yonge Street and Highway 7. The Regional Centres are planned as the most important and intense concentrations of development within the Region. They are intended to be vibrant urban places for living, working, shopping, entertainment, cultural identity and human services. The Regional Centres will mature throughout and beyond the period of this Plan to become exciting "downtowns," containing the highest concentration and greatest mix of uses in the Region, including a range of employment and housing opportunities oriented to rapid transit hubs.

Active Planning Policies

York Region is now reviewing and updating its Official Plan. The Growth Plan 2019 requires the Region to plan for an intensification target of 50 percent of growth within the delineated built-up area. Staff are undertaking an analysis of lands best suited for intensification and will recommend to Council how population should be distributed among the nine local municipalities in order to meet the Growth Plan intensification target.

As part of consultation with the stakeholders, York Region provided their latest 2041 and full build-out population and employment forecasts along the YNSE corridor in the region, noting that these forecasts are a work in progress and will be finalized in the updated official plan. Table 13 below is the vision of the Region for the stations area.

Table 13: Land Use forecast by York Region (data received April 2020)

Stations Area	Traffic Analysis Zones	2041		2061	
		Population	Employment	Population	Employment
RHC/High Tech	3134, 3140, 3146, 3157, 3167, 3168	20,371	9,625	37,716	23,025
Langstaff/Bridge	3136, 3139	8,834	4,600	31,930	13,700
Royal Orchard	3091, 3101, 3109, 3112	13,160	2,381	20,818	2,831
Clark	3063, 3066, 3076, 3083	35,810	9,765	41,604	11,065

City of Toronto Official Plan (2006)

City of Toronto Official Plan policies direct growth in areas that have been identified as "Avenues", and "Centres". Lands between Finch Avenue and Cummer/Drewry Avenue are part of the North York Centre and the rest of the corridor to the north is identified as Avenues.

Centres are places with excellent transit accessibility where jobs, housing and services will be concentrated in dynamic mixed-use settings with different levels of activity and intensity. These Centres are focal points for surface transit routes drawing people from across the City and from outlying suburbs to either jobs within the Centres or to a rapid transit connection.

The Avenues are important corridors along major streets where reurbanization is anticipated and encouraged to create new housing and job opportunities while improving the pedestrian environment, the look of the street, shopping opportunities and transit service for community residents.

As per the policies of the City of Toronto, a dedicated "Transit Corridor" should be established on Yonge Street north of Finch Station to facilitate the development of Yonge Street as an Avenue and to improve transit service for residents of York Region.

The lands along the Yonge Street corridor are also designated as "Mixed Use Areas". Mixed Use Areas will absorb most of the anticipated increase in retail, office and service employment in Toronto in the coming decades, as well as much of the new housing.

Active Planning Policies

City of Toronto has initiated a planning study to develop a vision for the future of the Yonge Street corridor between Finch Avenue and Steeles Avenue, knows as "Yonge Street North Planning Study", in response to existing and anticipated development pressures in the area. The Study will determine the level of development that can be supported by the existing and improved transportation network and planned higher order transit system. The primary objective of the Study is to provide a comprehensive set of planning tools to realize the vision for the area and respond to increasing development pressures.

Lands along the Yonge Street corridor are identified as "Node", "Node Transition", and "Avenue" in the draft Policies made public in 2014 and are currently under review:

- **Drewry/Cummer Node**: The south half of the node is located within the North York Centre Secondary Plan Area. The Drewry/Cummer Node includes lands between Finch Avenue and Wedgewood Drive/Connaught Avenue; around the proposed Cummer Station area. Draft policies would allow greater heights and densities on the south side than what is in the current policy and would create height and density permissions on the north side.

- **Steeles Node**: At the Steeles Node (lands between Athabaska Avenue and Steeles Avenue) the same maximum density (5 times including incentives) and height (40 storeys) as the Drewry/Cummer Node is envisioned.
- **Transition Area** (lands off Yonge Street between Madawska Avenue/Moore Park Avenue and Athabaska Avenue) flanks the Node and provides a transition from the stable low-density neighbourhood to the higher density and heights on Yonge Street.
- **Avenue Area** (lands between Wedgewood Drive/Connaught Avenue and Madawska Avenue/Moore Park Avenue) represents a parcel depth east and west of Yonge Street that would achieve a mid-rise built environment.

The City of Toronto has highlighted that development around Cummer Station might be higher than has been previously anticipated. Based on the recent communications with the City of Toronto, below is their 2041 growth projection for the Traffic Analysis Zones around Cummer Station noting that there are currently development applications filed with the City that would push the population numbers higher than the forecast provided. For clarity, the IBC analysis reported for the Cummer Station does not include these projections.

Table 14: Land Use projections by City of Toronto for Cummer Station area (data received June 2020)

Stations Area	Traffic Analysis Zones (TAZ)*	2041	
		Population	Employment
Cummer	1542, 1546, 1548, 1564, 1574	25,220	13,570

* Note TAZs 1564, and 1574 are also within Steeles Station area. Similarly, TAZs 1548, 1546, 1542 are also within Finch Station area.

Forthcoming Planning Policies

- Amendment to North York Centre Secondary Plan "in proximity to the planned Cummer subway station"[11]:
  - increasing permitted densities
  - increasing permitted heights
  - adding transit and transit-supportive infrastructure to the list of available density incentives/community benefits
  - revising transportation improvements

[11] Yonge Street North Planning Study, May 2013

City of Vaughan Official Plan (2010)

The lands long the Yonge Street corridor and to the west, are within "Intensification Areas" as per the City of Vaughan Official Plan. Intensification Areas will be the primary locations for the accommodation of growth and the greatest mix of uses, heights and densities in accordance with the prescribed hierarchy established in the Official Plan. Intensification Areas are divided into five areas: "Vaughan Metropolitan Centre", "Primary Centres", "Local Centres", "Regional Intensification Corridors" and "Primary Intensification Corridors":

- **Primary Centres** will be locations for intensification accommodated in the form of predominantly mixed-use high- and mid-rise buildings, developed at intensity supportive of transit. Lands between Steeles and the CN Railway are identified as Primary Centres.
- **Regional Intensification Corridors** will be a major focus for intensification on the lands adjacent to major transit routes, at densities and in a form supportive of the adjacent higher-order transit. The Regional Intensification Corridors link the Vaughan Metropolitan Centre with other Intensification Areas in Vaughan and across York Region. Lands between the railways up to Thornhill Public School; as well as lands between Royal Orchard Boulevard and the Hydro Lands below Highway 407 are identified as Regional Intensification Corridors.
- **Local Centres** will provide the mixed-use focus for their respective communities, in a manner that is compatible with the local context. Lands between Thornhill Public School and the Thornhill Golf Club are identified as Local Centres.

Active Planning Policies

- **Yonge Steeles Corridor Secondary Plan**: City of Vaughan began the "Yonge Street Area Study" in 2008 to determine an urban design and land use framework for the lands on the west side of Yonge Street, from Steeles Avenue to Highway 407 (excluding the Thornhill Heritage Conservation District), and on the north side of Steeles Avenue, from Yonge Street to west of Hilda Avenue. On September 7, 2010 Council adopted the Yonge Steeles Corridor Secondary Plan that proposes the land use policies and urban design guidelines for future development in the area along Yonge Street and Steeles Avenue. The Secondary Plan was subsequently forwarded to York Region for approval. A number of appeals were filed due to the York Region Council not making a decision within the time frame prescribed by the Planning Act. The Local Planning Appeal Tribunal (LPAT) hearing on the Yonge-Steeles Corridor Secondary Plan has been organized into phases. The first phase of the hearing is intended to deal solely with the population permitted prior to and after construction of the YNSE.

  In September 2015, York Region in partnership with the Cities of Vaughan, Markham and Toronto completed the Yonge-Steeles Area Regional Transportation Study (YSRTS). The purpose of the study was to provide guidance on how to manage population, employment and travel demand growth in

the study area and include the proposed residential development phasing for the pre-subway and post-subway scenarios in the Cities of Markham and Vaughan secondary plans for the Yonge and Steeles Study Area.

- **Promenade Centre Secondary Plan**: The City has started developing a secondary plan study for the Promenade Mall and surrounding area – known as the Promenade Centre. The study will establish a vision, key principles and a complete land-use plan to guide the future evolution and development. The Promenade Centre study area is situated within Centre Street, Bathurst Street, Clark Avenue West and Pierre Elliott Trudeau Park. Although this area is located 2km away from the YNSE Corridor, the modelling results show that this area will have considerable impact on the ridership of the YNSE. Based on the draft Population and Employment Estimates dated October 25, 2019, it is anticipated that this area would accommodate between 6,520 – 11,470 people and 4,580 – 5,850 jobs by 2041.

City of Markham Official Plan (2014)

The lands along the YNSE Corridor and within the City of Markham are identified as "Intensification Area", "Regional Corridor/Key Development Area", "Regional Centre", "Gateway Hub", "Gateway Anchor Hub", and "Heritage Centre".

- **Intensification Areas**: A primary focus of growth in Markham is for new development and redevelopment to be directed to centres and corridors. The Regional Centres and Regional Corridors/key development areas will be the prime locations for infill and intensification. The most intensive of intensification is being directed to Yonge Street and Highway 7 Regional Corridors where rapid transit services intersect with major nodes of retail and commercial development. These areas along the YNSE are as follows:
    - **Yonge Steeles Regional Corridor**: The Yonge Steeles Corridor comprises the lands east of Yonge Street between Steeles Avenue East and one block south of Elgin Street and the Thornhill Village Heritage District. These lands are designated as "mixed-use". It is the policy of the City that a new secondary plan be established for the Yonge Steeles Corridor.
    - **Yonge North Regional Corridor**: The Yonge North corridor comprises the "Mixed Use High Rise", "Mixed Use Mid Rise", "Residential High Rise" and "Residential Mid Rise" lands along the east side of Yonge Street north and south of Royal Orchard.
    - **Langstaff Gateway Regional Centre**: The Regional Centre of the Langstaff Gateway comprises the lands bounded by Yonge Street on the west, Highway 407 on the north, Bayview Avenue on the east and the Holy Cross Cemetery on the south. These lands provide for a mixed-use Regional Centre. The current secondary plan document for the Langstaff Gateway lands (2010) shall be revised to conform to the land use designations and policies identified in the Official Plan.
- **Langstaff Gateway Anchor Hub**: The Official Plan identifies Markham Centre and the Langstaff Gateway as Anchor Mobility Hubs with significant levels of planned transit service and development potential.
- **Holy Cross Planning Area**: The planning area is bounded by the Langstaff Gateway Planning Area to the north, Yonge Street to the west and Bayview Avenue to the east. The Holy Cross Planning Area along the YNSE comprises the "Private Open Space", and "Greenway".
- **Thornhill Heritage Centre:** The Thornhill Heritage Centre comprises the "Mixed Use Heritage Main Street", "Residential Low Rise" and "Greenway" lands east of Yonge Street and north and south of John Street located within the Thornhill Heritage Conservation District. A new secondary plan shall be approved for the Thornhill Heritage Centre**.**

- **Yonge/Elgin Corridor:** The Yonge/Elgin Corridor comprises the "Residential Mid Rise" and "Mixed Use Mid Rise" lands on the east side of Yonge Street south of John Street to just south of Elgin Street**.**

Forthcoming Planning Policies

- New Yonge Steeles Corridor secondary plan
- New Langstaff Gateway Secondary Plan
- New secondary plan for the Thornhill Heritage Centre

The current Langstaff Gateway Secondary Plan (OPA 183) has estimated to accommodate up to 15,000 residential units or a population of approximately 32,000 and 15,000 jobs at build-out.

City of Markham has retained planning consultants to assist the City in preparing an analysis of development potential, population and employment forecasts, and densities along the York Region portion of the corridor to provide input to Metrolinx's IBC. The results of planning consultant's analysis will also provide input to City-wide long-term forecasting for future planning purposes including a potential Secondary Plan exercise for the Yonge Street corridor in Markham.

An analysis was undertaken to identify development potential for the Yonge Street corridor between Steeles and Richmond Hill Centre and specifically for the proposed stations at Steeles, Clark, Royal Orchard, and Langstaff within a 500 metre and 800 metre radius which represents about a seven to 10-minute walk. While the study was undertaken by the City of Markham, the land use forecasts include population estimates for lands in the adjacent municipalities at each of the stations. Markham staff took this report to the City's Development Services Committee on Monday May 25, 2020 on "Yonge North Subway Extension Intensification Analysis". [12]

[12] https://pub-markham.escribemeetings.com/Meeting.aspx?Id=7784795c-99cb-43e1-bdb0-43e4f2ab16f0&Agenda=Agenda&lang=English&Item=50

Richmond Hill Official Plan (2010)

Most of the lands along the YNSE corridor are designated as "Regional Centre", and "Utility Corridor". The Richmond Hill Centre is part of the Richmond Hill/Langstaff Gateway Urban Growth Centre shared with the City of Markham. It is the policy of the City of Richmond Hill to develop the Richmond Hill Centre into a compact, mixed-use urban centre supported by a high-quality public realm, walkable streets and transit-oriented development. Richmond Hill Centre will be a major residential and employment destination, a meeting place, and the primary location for cultural facilities, public institutions and major services. The Centre will be prominent, major transit node in Richmond Hill and in York Region. The City has initiated preparation of a Secondary Plan for the Richmond Hill Centre in accordance with policies of its Official Plan.

Active Planning Policies

- **Richmond Hill Centre Secondary Plan:** Richmond Hill Centre will be built around the intersection of five modes of public transit, including the YNSE, the Richmond Hill GO line, the Highway 407 Transitway, VIVA bus rapid transit, and GO and YRT buses. The Secondary Plan will shape the vision for the urban centre with a balance of residential and commercial uses where people can live, work, and play. It will also support the creation of public spaces, walkable streets, and transit-oriented development. Based on the information received from the City on May 25, 2020; it is estimated that approximately 32,000 people and 21,000 jobs will be accommodated in the Centre at the build out. The Centre incorporates six "Character Areas": The Inner Transit Core, Outer Transit Core, Bantry, South of High Tech, Red Maple, and West of Yonge. The Inner Transit Core, located in the centre of the secondary plan area, allows for the highest density (40-70 storeys and 8-20 FSI). Density decreases with distance from the Inner Transit Core.

Population and Ridership Forecast

Metrolinx undertakes travel demand modelling based on future land use forecasts developed by the Province of Ontario, for the 2041 horizon. For the purposes of the IBC, Metrolinx has taken a standardized approach to forecasting population and employment growth, applying market-trend based future land use projections which conform to the Growth Plan region level targets, while allocating growth based on several factors including observed trends, development potential, and designated growth areas. This Market land use forecasts is consistent with ridership forecasting on other projects. Figure 20 illustrates 2041 Population Density based on the **Market-trend based land use projections** that Metrolinx employees for for ridership modeling estimates. This figure confirms that that the YNSE is proposed to serve an area of the with prominent population density. Population projections for the corridor, suggest that there will be significant growth resulting in higher residential densities along Yonge Street corridor. In North York north of Finch Avenue, we see densities above 200 persons per hectare continuing up to Cummer/Drewry Avenue. Toronto expects over 200 jobs and people per hectare along the entire Yonge corridor (per the Growth Plan requirement for a major transit station area).

A significant pocket of development is seen at Steeles Avenue, and then higher densities stretch into York Region. The Richmond Hill Centre and Langstaff Gateway lands are also seen to have higher densities in the 2041 timeline.

Figure 20: Projected Population Density in 2041

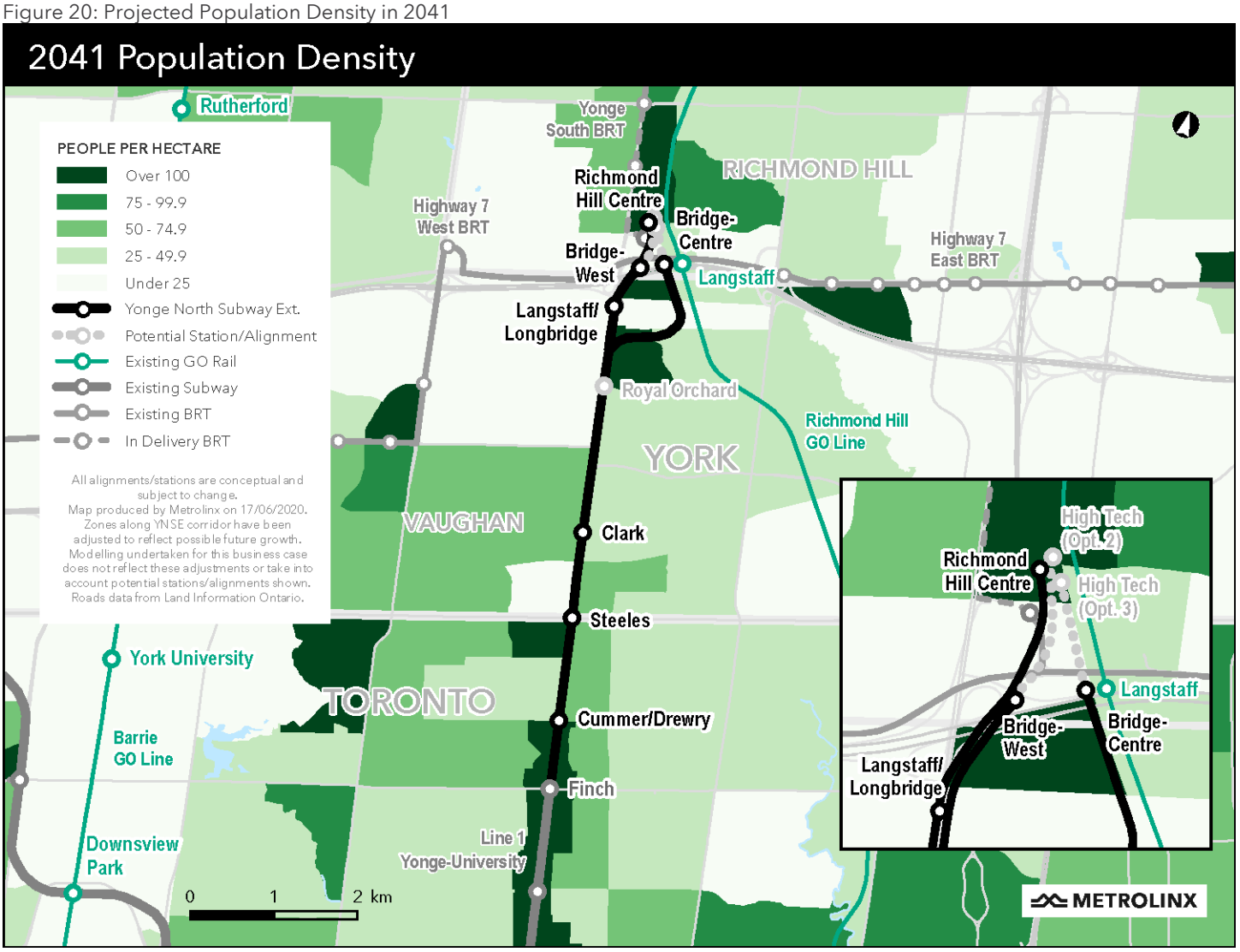


Table 15: "Support Planned Development along the YNSE" Summary

Criteria	Option 1	Option 2	Option 3
How does the option align with planned/future development?	The line serves proposed development along the YNSE Corridor in Toronto, Vaughan, Markham as well as specifically serving the Langstaff Gateway and Richmond Hill Centre developments.	The Bridge Station is located between Highway 407 and Highway 7 and more centralized within Langstaff Gateway and therefore, it better serves the Urban Growth Centre. A High Tech station – which is not shown in the representative alignment, could complement the Bridge Station to serve additional areas of the Richmond Hill Centre development and support city building goals.	
Does the option improve the connectivity of Urban Growth Centres (UGC)?	Yes, this alignment provides a new connection to Richmond Hill/Langstaff Gateway, and improved connection to the northern portion of North York Centre UGC, while connecting to other UGCs on Line 1 Yonge-University Subway.	Yes, like Option 1 these alignments also provide connection to UGCs on Line 1. The Bridge Station in these options also connects two parts of the Richmond Hill Centre/Langstaff Gateway UGC that are separated by Highway 407 and Highway 7 by about 250m.	
Does the option support areas with land uses compatible with rapid transit as identified in Official Plans of the City of Toronto, Region of York, City of Vaughan, City of Markham and City of Richmond Hill.	Yes, generally, stations are in areas designated for mixed-use, employment, and higher-density residential use. In York Region these areas have been identified by local municipalities as Regional or Local Centres.	Yes, like Option 1, stations are generally located in areas supported for higher density. However, the northern areas of the Richmond Hill Centre could disbenefit as a result of a consolidated station serving both Richmond Hill Centre and Langstaff Gateway areas.	

Stations Analysis

High Tech Station in Alignment Options 2 and 3

This station would bring subway closer to the core of the Richmond Hill Centre area which supports the vision of the City of Richmond Hill for this area. People who live and work in the area would benefit from the direct walk-in access to the subway.

Since in options 2 and 3, a future bus terminal would be still proposed at the Bridge Station, more lands would become available (or unencumbered) in the Richmond Hill Centre area for new developments.

Royal Orchard Station

The Royal Orchard Station area has some development constraints, but strong support at the municipal and property owner level to see this portion of Yonge Street evolve with additional growth.

On the west side of Yonge Street (City of Vaughan) much of the lands are part of the Thornhill Village Heritage District. The heritage elements of Thornhill Village contribute to the unique character of the area. The charming mix of new and old buildings may contribute to the attractiveness of future development in the area.

In the City of Markham, there is a significant multi-building, mixed-use high-rise project proposed at the northeast corner of Royal Orchard Boulevard and Yonge Street. It includes four Residential towers ranging in height between 25 and 59 stories, with two four-storey podium buildings, and overall 1,560 residential units as per the City of Markham. Staff are targeting a preliminary report for the Council in Q2 2020. This development introduces a transit supportive development replacing a car-oriented strip style plaza.

Surface transit connections are impacted by the absence of east-west routes and by the heritage and environmental features on the west side of Yonge Street.

There are also limited existing and future employment land uses on the east side of Yonge Street a stretch of roughly four kilometres of Yonge Street, so the station will appeal largely to walk-in customers accessing the subway during peak hours. It is understood that the area is the subject of upcoming planning studies and the character of the area may evolve in terms of population and land use.

Clark Station

Vaughan's Yonge-Steeles secondary plan anticipates significant development along Yonge Street especially in the southern portion.

Moreover, not all the projected riders in this area are from the pedestrian catchment area of the stations. Our analysis shows that the Promenade Centre, located 2 kilometres away from the YNSE Corridor, will also have considerable impact on the ridership of the YNSE, especially at the Clark Station. The City has started developing a secondary plan study for this area, known as the Promenade Centre.

Overall, the recent planning trends in the area demonstrate strong and early growth (within YNSE planning horizon/2041) for Clark Station.

Cummer Station

There are projects under construction at Drewry/Cummer Avenue and Yonge Street area.

Cummer Station is within North York Centre Urban Growth Centre and is in the Drewry/Cummer Node in the Yonge Street North Planning Study (currently underway), located north of the North York Centre Secondary Plan Area. The Yonge Street North Planning Study will allow for the same density as North York Centre Secondary Plan Area for this area.

However, the pedestrian catchment area of the Cummer Station partially overlaps with the catchment area of two other subway stations (Steeles and Finch). It is noted that municipal policies focus density in proximity to Drewry/Cummer/Yonge Intersection. Some existing and future residents and employees in the larger Cummer Station catchment area would have closer walk-in access to the subway either at Finch or Steeles stations.

The Drewry/Cummer shows evidence of transition to the significant density areas associated with the southern portion of North York Centre. Sites in the area are generally well advanced in the intensification process, with some under construction, others late in the approval process, and several large properties in the ownership of development interests.

Land Use Sensitivity Analysis

As noted earlier, land use projections/population and employment growth along the corridor have the potential to impact projected ridership at the YNSE stations. While the technical analysis/modelling undertaken to support the Strategic and Economic Cases of this IBC was based on the **2041 Market-trend based land use projections**, Metrolinx relies on for planning and business case studies and recognizes that a significant amount of land use planning has been undertaken by the local municipalities with the involvement of staff and members of the community. This work has developed a clear vision for the amount and type of development they have in mind.

In order to understand the impact this targeted land use planning along the YNSE corridor would have on the projected YNSE station ridership, a land use sensitivity analysis was undertaken. This desktop analysis leveraged the ridership forecasts and travel patterns simulated by the GGHMv4 and applied alternative land use growth scenario adjacent to the YNSE station areas to estimate impacts to station ridership. For this analysis, it is assumed that trip making patterns across the alternative land use scenarios would be consistent with the Market land use based modelling. It is recognized that certain high growth areas may encourage shifts in travel patterns and thus more pronounced changes in ridership. This will be further assessed in the PDBC phase.

Metrolinx retained an experienced demographics and forecasting consultant (Consultant) familiar with the Growth Plan forecasts for the Greater Golden Horseshoe to assist reviewing land use in proximity to the YNSE corridor. This consultant developed updated projections based on an analysis of market-trend based development potential, population and employment forecasts/projections prepared by other parties.

For this sensitivity analysis, three alternative YNSE corridor land use scenarios were assessed, and compared against the 2041 Market land use applied in the modelling:

1. **2041 Consultant Projections** – Updated 2041 Market population and employment growth, with greater focus on lands within 800m of potential YNSE station areas
2. **2041 York Region Projections** – Latest 2041 population and employment forecasts provided by York Region
3. **2041 City of Toronto Projections** – Updated 2041 population and employment forecasts for the area adjacent to Cummer Station, provided by the City of Toronto

The YNSE station ridership impacts associated with these alternative growth scenarios is detailed below. It should be noted that the ridership comparisons for Cummer, Steeles, Clark, and Bridge are based on the Option 2 and 3 ridership forecasts (outlined in Table 9 on page 54). Since Langstaff and RHC are not part of Options 2 and 3, the ridership comparisons are based on Option 1 (also outlined in Table 1 on page 10).

Cummer Station

According to data provided by the City of Toronto in June 2020 (provided in Table 14 on page 73), population projections in the Traffic Analysis Zones (TAZ) around Cummer Station are 21% higher than the 2041 Market projections, and employment projections are 4% higher. Trips originating from/destined to these zones account for 16% of Cummer Station boardings and 33% of Cummer Station alightings.

Based on the land use analysis, the estimated ridership impacts for Cummer Station are:

- 35 additional AM peak hour boardings and 10 additional AM peak hour alightings, under the City of Toronto projections
- 200 additional daily riders at Cummer Station, under the City of Toronto projections

Steeles Station/Clark Station

The York Region forecasts estimate significant additional population growth in the Clark and Steeles Station areas, as well as higher anticipated employment than assumed in the 2041 Market forecasts (provided in Table 13 on page 71). Population projections from York Region in the TAZs around Steeles Station/Clark Station are 90% higher than the 2041 Market projections, and employment projections are 40% higher. Trips originating from/destined to these zones account for 8% of boardings and 1% of alightings at Steeles Station, and 34% of boardings and 28% of alightings at Clark Station.

The 2041 Consultant projections for the Steeles/Clark area are consistent with the Market forecasts, and as such no ridership changes are estimated at Steeles and Clark under this scenario.

Based on the land use analysis, the estimated ridership impacts for Steeles Station are:

- 500 additional AM peak hour boardings, under the York Region projections
- 1,800 additional daily riders at Steeles Station, under the York Region projections

The estimated ridership impacts for Clark Station are:

- 200 additional AM peak hour boardings and 60 additional AM peak hour alightings, under the York Region projections
- 800 additional daily riders at Clark Station, under the York Region projections

Bridge Station

According to the 2041 Consultant forecasts, population projections in the TAZs around Bridge Station (covering the RHC and Langstaff station areas) are 38% higher than the 2041 Market projections, and employment projections are consistent with the Market projections. The York Region forecasts project further increases to land use around Bridge Station, with population and employment being 54% and 92% higher than the Market projections, respectively. Trips originating from/destined to these zones account for 12% of boardings and 6% of alightings at Bridge Station.

Based on the land use analysis, the estimated ridership impacts for Bridge Station are:

- 200 additional AM peak hour boardings, under the Consultant's projections
- 900 additional daily riders, under the Consultant's projections
- 400 additional AM peak hour boardings and 100 additional AM peak hour alightings, under the York Region projections
- 1,600 additional daily riders, under the York Region projections

Langstaff Station

Per the 2041 Consultant forecasts, population projections in the TAZs around Langstaff are 65% higher than the 2041 Market projections, and employment projections are consistent with the Market projections. The York Region forecasts estimate significant growth around Langstaff Station, with population and employment being 90% and 800% higher than the Market projections, respectively. Trips originating from/destined to these zones account for 12% of boardings and 17% of alightings at Langstaff Station.

Based on the land use analysis, the estimated ridership impacts for Langstaff Station are:

- 200 additional AM peak hour boardings, under the Consultant's projections
- 800 additional daily riders, under the Consultant's projections
- 300 additional AM peak hour boardings and 300 additional AM peak hour alightings, under the York Region projections
- 2,200 additional daily riders, under the York Region projections

Richmond Hill Centre Station

2041 Consultant forecasts project 29% higher population than the Market forecasts in the Richmond Hill Centre area, and employment projections are consistent with the Market projections. For the York Region forecasts, population and employment are projected to be 43% and 39% higher than the Market forecasts, respectively. Trips originating from/destined to these zones account for 9% of boardings and 7% of alightings at RHC Station.

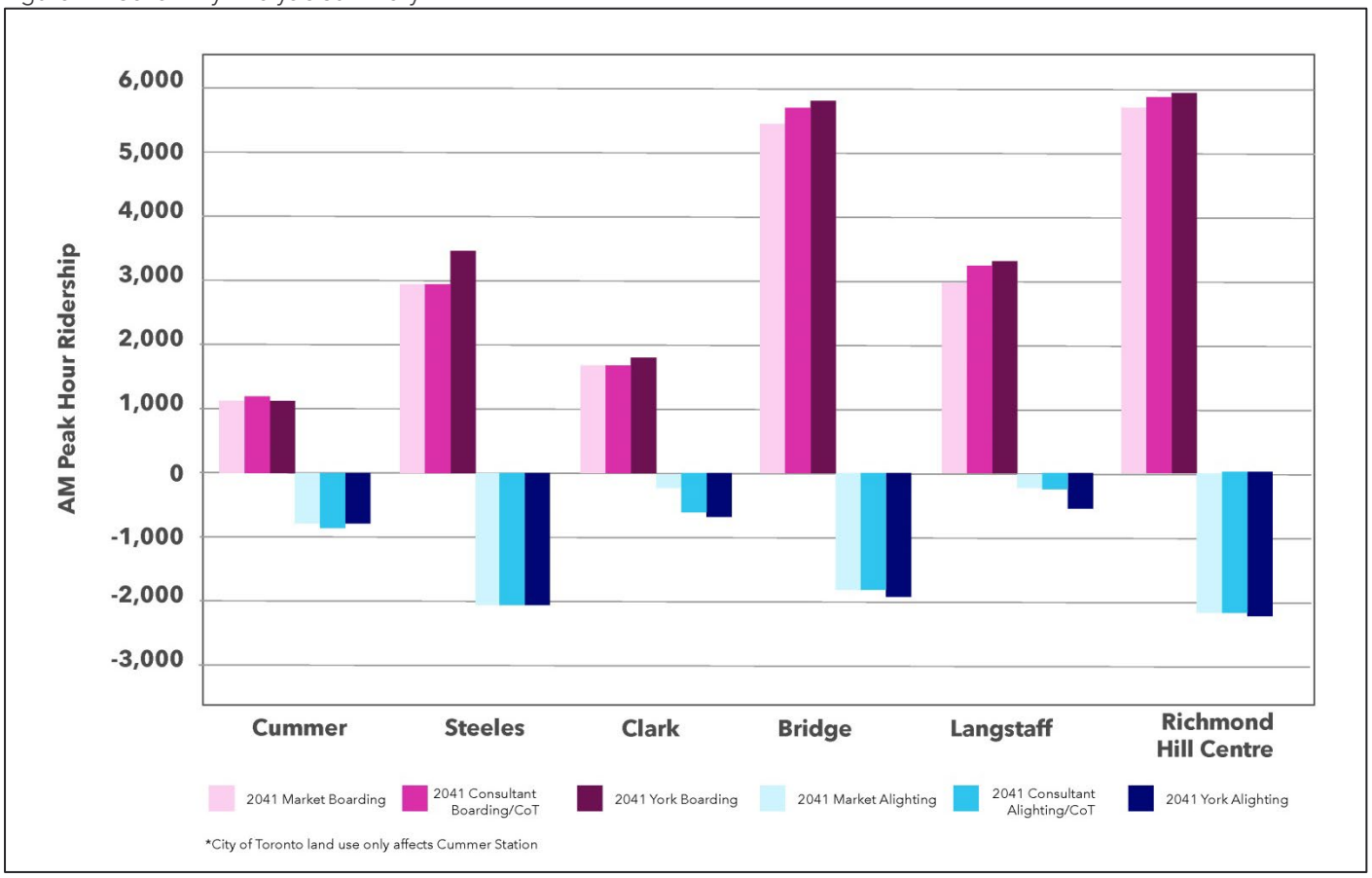
Based on the land use analysis, the estimated ridership impacts for RHC Station are:

- 200 additional AM peak hour boardings, under the Consultant's projections
- 500 additional daily riders, under the Consultant's projections
- 200 additional AM peak hour boardings and 60 additional AM peak hour alightings, under the York Region projections
- 600 additional daily riders, under the York Region projections

Sensitivity Analysis Summary

Figure below summarizes the land use sensitivity analysis.

Figure 21: Sensitivity Analysis Summary



Overall, the alternative land use scenarios impact boardings at Steeles, Clark and the Northern Stations (Bridge, Langstaff, and RHC), and alightings at Clark, Bridge, and Langstaff most significantly. However, since the corridor zones account was only a portion of overall ridership at the YNSE stations, line level ridership impacts are moderate. The Consultant's forecasts increase YNSE ridership by 2,200 daily riders, while the York Region forecasts increase YNSE ridership by 7,400 daily riders. The impact of the City of Toronto's projections is minimal, as only Cummer Station is affected.

As noted, land use sensitivities will be further explored in the PDBC phase.

OUTCOME 2: COMPLETE TRAVEL EXPERIENCES

The extension of a rapid transit line will improve the speed, frequency and reliability of transit service in the study area. Combined, these will enhance the overall travel experience for customers and make transit a more attractive travel mode.

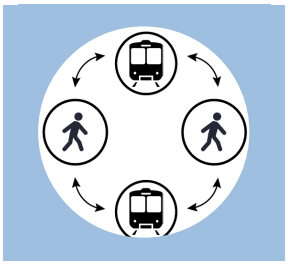
This section will compare the options' performance on three objectives that support the realization of Outcome 2 "Complete Travel Experiences":

Improve Travel Time

Do the options make transit travel faster?

Improve Reliability

Do the options make transit trips more dependable?



Build an Integrated Transit Network

Do the options provide a seamless travel experience?

OUTCOME 2: COMPLETE TRAVEL EXPERIENCES

BENEFIT 4: Improve Travel Time

Moving people quicker and offering reliable travel is at the heart of the *2041 Regional Transportation Plan*. The new rapid transit line should reduce travel times for people travelling in Toronto, not only for those located near the new stations, and create favourable conditions for a smooth-running transit network. The YNSE brings rapid transit closer to where transit users live and work. This means they spend less time on buses and more time on subways.

Alternative Alignment Analysis

The travel time savings can be calculated for the region, but it is valuable to see benefits as experienced by transit users. A couple of examples illustrate the time savings that will be experienced by two users groups:

- passengers accessing the subway by bus at a new station; and
- passengers with walk-in distance from a new station.

Travel time savings are expected to be very comparable the alternative alignments options, with very minor deference for those traveling from the northern terminus of the YNSE. As noted later, the Station Analysis will focus on the travel time savings associated with individual stations.

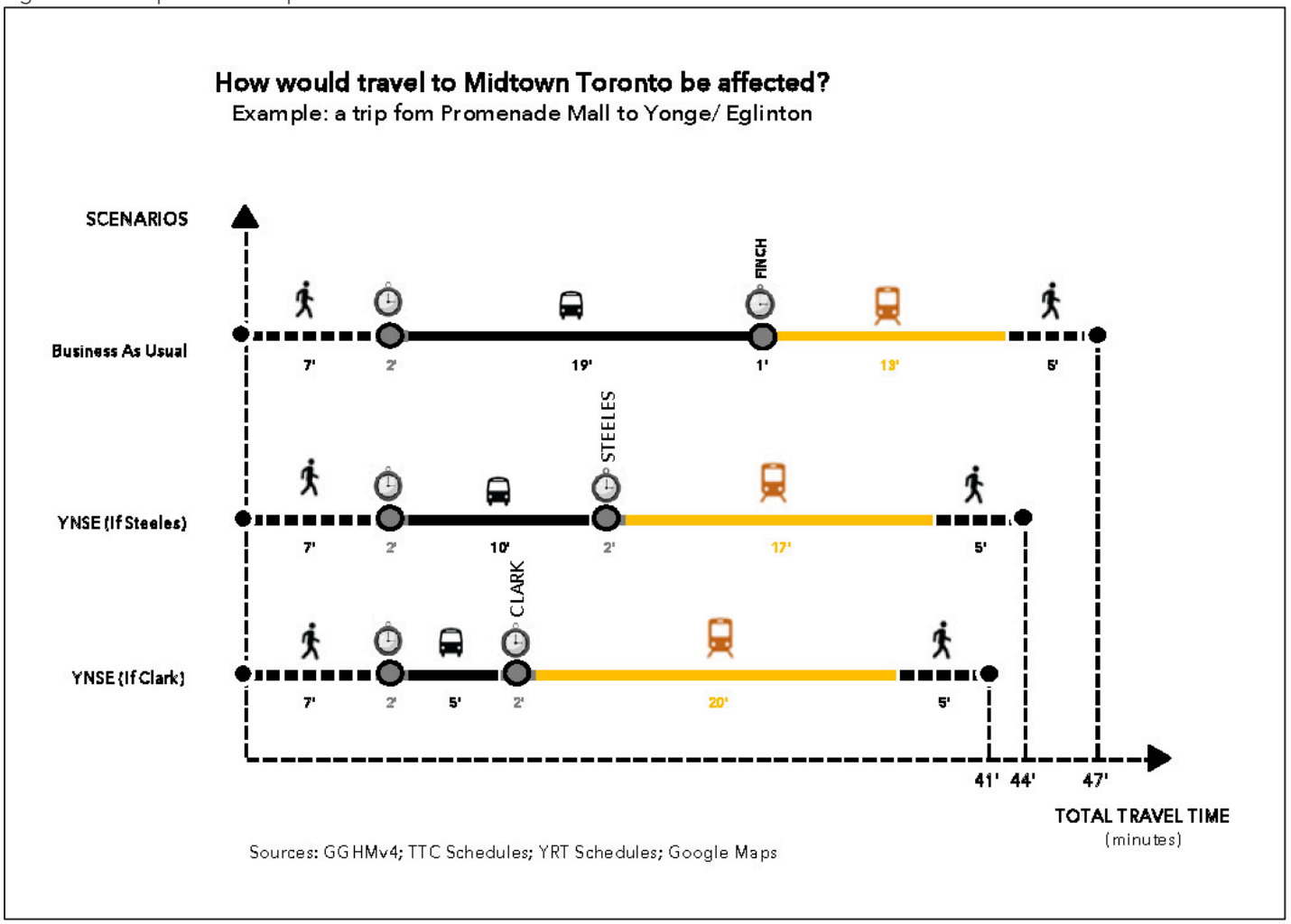
For the purpose of this discussion, we have simplified the assessment by focusing on examples based on Option 1. The results would generally be similar for the other options.

Passengers Accessing the Subway by Bus at a New Station

The area around Promenade Mall is a mixed-use community. A community resident who travels to Yonge and Eglinton will experience travel time savings on their journey. In the example, their time on the bus is almost halved, taking just 5 to 10 minutes to a Clark or Steeles Station with the YNSE in place, compared with the 19 minute journey to Finch Station (Figure 22).

For transit riders living in proximity to a new station, the YNSE would provide one-seat rides to numerous origin and destination pairs and open up additional trips possible with a single transfer.

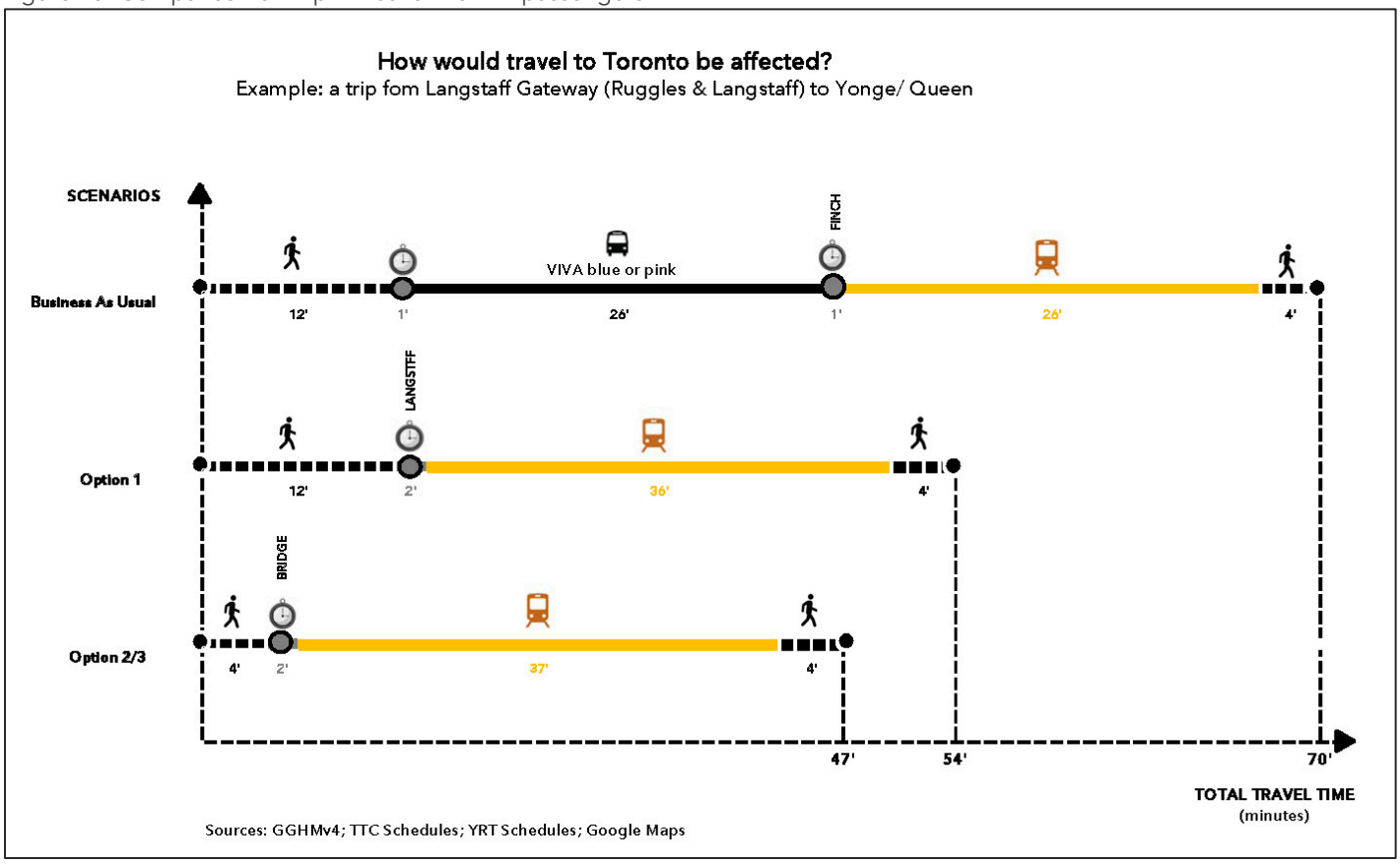
Figure 22: Comparison of Trip Times for Bus Riders



Passengers with Walk-in Distance from a New Station

In a second example, a resident in the Langstaff Gateway Community within walking distance of the Langstaff/Bridge Station traveling to downtown Toronto would experience the full benefit of living near the station. Rather than taking a 26-minute bus ride to connect at Finch Station, they would be able to access the station directly (a 12-minute walk in Option 1 and 4-minute walk in Options 2 and 3), saving time not only on the bus, but also the time and effort associated with transferring between modes. Including 10 additional minutes on the subway, they will still experience between 20% to 30% time saving with the YNSE in place.

Figure 23: Comparison of Trip Times for walk-in passengers



These examples could be reversed to highlight the benefits of the YNSE to transit users accessing employment opportunities in York Region. A Toronto resident living at Yonge and Eglinton will experience a similar three to six-minute saving for their journey to Promenade Mall. Similarly, an individual living in downtown Toronto could save 16 to 23 minutes on a journey to work at Richmond Hill Centre.

The net impact of these travel time savings are a savings of 860,000 to 960,000 minutes on transit trips compared to BAU in the AM and PM peak periods (see Table 16 on page 94). Option 3 has the lowest travel

time saving because of the lower average train speed in this option due to longer curves. When modeled, the lower speed makes transit slightly less attractive for new users and makes trips longer for people getting on the subway at Bridge Station. While the time differences will be imperceivable for individual users, the travel time savings number is compounded by the number of riders in the system.

Crowding relief on buses accessing Finch station will be realized as the bus network is adjusted to better distribute routes to closer subway stations. This benefit will be realized not only by the passengers on buses that are accessing a closer terminal, but passengers on buses that continue to access Finch Station should experience fewer delays getting in and out of the terminal.

Crowding on Line 1 Yonge-University Subway

It should be noted that the Line 1 Yonge University subway experiences crowding during peak periods. For the transit user there are several ways that crowding impacts their experience, from the minor inconvenience of not having a seat, to traveling in a very crowded car, to having to wait at a station for a train with available capacity to allow boarding. The more extreme impact of crowding would be transit users that ordinarily use Line 1 changing their travel patterns or avoiding a congested route or time of day. These congestion and crowding impacts have been captured and monetized in the Economic Case.

There are a number of measures underway to add capacity to the line. These include infrastructure upgrades like signal improvements that will allow for automatic train control as well as downstream station infrastructure improvements to maintain safe and comfortable conditions at interchange points. The TTC's Line 1 Capacity Enhancements study is currently underway which will be determining what additional infrastructure, beyond the new signaling system, is required to increase capacity to the assumed figure of 36,000 people per direction per hour.

Through ridership analysis, it has been determined that new ridership associated with the extension would have a small impact on Line 1 crowding, partly because the line is close to capacity. Preliminary analysis suggests that the extension is expected to increase crowding south of Bloor station by around 1% (assuming Ontario Line will also have been in service by 2041). Many of these impacts would not be felt on the YNSE but would impact downstream passengers north of Bloor-Yonge who would experience more crowded trains and delays in boarding than would occur without the extension.

As noted, the Ontario Line is assumed to be in place in the modeling that supports this business case. The Ontario Line will provide relief to Line 1 by attracting riders to a new North South corridor. As a result, the Ontario Line will need to open before the YNSE to free up the capacity required to allow the new line to proceed. Regular analysis on Line 1 ridership and crowding should continue as the TTC advances their Capacity Enhancement Work, Ontario Line infrastructure is fully defined, and the PDBC for the YNSE is completed.

Table 16: "Improve Travel Time" Summary

Criteria	BAU	Option 1	Option 2	Option 3
How will the option affect travel time to midtown Toronto for an example trip from Promenade Centre?	47 minutes	41 minutes	41 minutes	41 minutes
How will the option affect travel time to Downtown Toronto *Yonge/Queen) for an example trip from Langstaff Gateway Community (Langstaff/Ruggles)?	70 minutes	54 minutes	47 minutes	48 minutes
How will the option affect travel time to Downtown Toronto *Yonge/Queen) for an example trip from Thornhill (Longbridge/Yonge)?	64 minutes	48 minutes	60 minutes	61 minutes
What are the resulting total daily travel time savings?*				
* total travel time savings for all transit trips in Toronto, weekday AM and PM peak periods (perceived time) * Source: GGHMv4 outputs	n/a	920,000 minutes	960,000 minutes	860,000 minutes

Stations Analysis

High Tech Station in Alignment Options 2 and 3

The analysis shows that compared to Option1 where there are two stations at Langstaff and RHC, the couplet of Bridge and High Tech Stations would impose incremental disbenefit on the users who connect to the subway at these two stations instead. This benefit appears to derive from modeling assumptions around the distribution of growth south of Highway 407. With alternative distribution this disbenefit might be eliminated.

By adding a High Tech Station to Options 2 and 3, around 55% of people living and working in the Richmond Hill Centre area would gain walk-in access to the subway and therefore experience the full benefit of living near the station and saving time on their trips to/from Toronto. However, this station would have nominal impact on those passengers connecting to the subway by bus, as they would be able to get on the subway at the transit hub next to the Bridge Station.

Royal Orchard Station

The analysis suggests that adding a Royal Orchard Station would offer incremental travel time benefits to users who travel to this station compared to a scenario this station did not exist and those users had to use bus, or other nearby stations. However, this incremental benefit is not as great as other Neighbourhood Stations.

Royal Orchard station is positioned to break up what would be a significant gap of between 2.5 and 3.5km between Clark Station and Langstaff/Bridge Station. The analysis indicate that Royal Orchard Station will serve walk-in customers accessing the subway during peak hours. Passengers accessing the subway by bus will have the option to get on the subway at other stations. The 800m catchment area of this station would only have a minimal overlap with the Langstaff Station in Option 1. If a Royal Orchard Station was added, almost all the people and jobs in this area would be able to walk to the subway at an earlier station; and therefore, they would save time on their trips to Toronto. In Option 1, this station would benefit about 70% of people and jobs that are outside of the overlap with the catchment area of Langstaff Station.

An additional stop at a Royal Orchard Station would introduce small delay to the upstream riders who board at Langstaff/Richmond Hill Centre Stations in Option 1 or Bridge/High Tech Station in Option 2 and 3.

Clark Station

According to the analysis, Clark Station would have great travel time benefits to users who travel to this station compared to a scenario in which this station did not exist, and those users had to use bus, or other nearby stations.

The analysis also shows that the Promenade Centre has considerable impact on the ridership of the YNSE, especially at the Clark Station, meaning it would result in travel time saving for riders coming from the Promenade Centre area by bus. Without a Clark Station, those riders would have a longer trip on bus connecting at Steeles Station.

However, like Royal Orchard Station, an additional stop at a Clark Station would introduce a small delay to the upstream riders in all the alternatives.

Cummer Station

According to the analysis, Cummer Station shows great travel time benefits to users who travel to this station compared to a scenario in which this station did not exist, and those users had to use bus, or other nearby stations.

A Cummer Station would save travel time for around 24% of the residents and jobs within its 800 metres. The other 76% would have walk-in access to either Finch or Steeles stations within 10 minutes. Some of these passengers would still experience travel time savings if they were located within a walk-in distance to the new Steeles station. Passengers accessing the subway by bus will also have the option to connect to the subway at other stations which would serve them better.

However, a Cummer Station would cause a small delay to upstream riders, the impact would increase given the higher loads on the subway as it approaches Finch Station.

OUTCOME 2: COMPLETE TRAVEL EXPERIENCES

BENEFIT 5: Improve Reliability

The extension of a rapid transit line will improve the speed, frequency and reliability of transit service in the study area. Combined, these will enhance the overall travel experience for customers and make transit a more attractive travel mode.

No significant differences should be experienced between the options with respect to reliability. The YNSE would have a positive impact on surface route crowding across the local transit network, reducing the time that passengers spend in congested conditions. In the BAU the volume of buses on Yonge Street is significant and competes for space with other vehicular traffic on the corridor. These buses are prone to delays from weather, construction, accidents as well as general traffic volume.

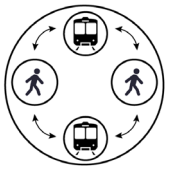
In Table 17 "Reliability" is converted to a time-savings equivalent. It is calculated in the ridership model by adding up perceive travel time associated with waiting for reliability factors such delays or crowding. Subway is more reliable than bus, in terms of keeping a schedule and in terms of travelling at consistent speeds without impact from other vehicles on the road. The reduction of time on buses leads to an additional daily perceived travel time savings of 480,000 to 520,000 person-minutes. Crowding relief on buses accessing Finch station will be reduced as the bus network is adjusted to better distribute routes to closer subway stations. This benefit will be realized not only by the passengers on buses that are accessing a closer terminal, but passengers on buses that continue to access Finch Station should also experience fewer delays getting in and out of the terminal.

It is worth noting that the YNSE project has the potential to improve service reliability on the subway network by improving the end of line facilities at the new northern terminus of Line 1 Yonge-University Subway. While this has not been included in the modeling, enhanced infrastructure is critical to achieving the required headways that are planned.

Table 17:" Improve Reliability" Summary

Criteria	Option 1	Option 2	Option 3
What is the impact in perceived person minutes of improving reliability by replacing busses north of Finch with Subways?*	480,000 person-minutes	520,000 person-minutes	500,000 person-minutes

* 7 hour AM and PM Period
* Source: GGHm v4



OUTCOME 2: COMPLETE TRAVEL EXPERIENCES

BENEFIT 6: Build an Integrated Transportation Network

The YNSE is designed to run as part of the existing transit network with a TTC fare, regardless of final ownership, operation, or maintenance arrangements. Connection with existing Line 1 Yonge-University Subway will be seamless with trains running from the extension directly onto the existing subway line.

Alternative Alignment Analysis

There are few differences between the alignment options with respect to building an integrated transportation network. As noted below in the Station analysis there will be some impacts on the surface integration associated with the stations that are included in the network.

The subway extension will create or upgrade connections with the transit network. In Option 1, a multi-modal hub will be established at Richmond Hill Centre. This hub will be located at the Bridge Station area in Options 2 and 3. This hub will include access to the GO Bus Network, in particular the cross regional 407 Express Services. Richmond Hill Centre which currently acts a GO Transit Hub, can be expected to expand its role and offer an important connection point to east-west regional transit. The ridership model suggests that in Option 1, approximately 9,300 daily riders transfer from busses to RHC station. The number is around 12,800 and 12,000 in Options 2 and 3, respectively.

This will also be the interchange point between the VIVA BRT services operating east and west on Highway 7, and north along Yonge Street to Newmarket.

With a transit hub either at RHC in Option 1 or at Bridge Station in Options 2 and 3, rapid transit connections to other hubs at Vaughan Metropolitan Centre and Unionville GO will be improved. It will improve access to reliable and frequent rapid transit and will make travel more affordable by reducing the need to own a car.

In addition, the RHC Station/Bridge Station will provide for an efficient connection with GO train service on the Richmond Hill Line.

At Steeles Station, the YNSE will provide a connection with several bus services operated by the Toronto Transit Commission (TTC) and York Region Transit (YRT). Steeles Station will be the new connection point for the TTC's Steeles Express services and about 9,400 daily riders will transfer from buses to this station.

Langstaff Station is proposed to include a commuter parking lot facility. This lot is located on the Hydro lands to the southwest quadrant of Yonge Street and Highway 407. Options 2 and 3 assume that there would be no commuter lot for the northern stations in the ridership model. The modelling results suggest that there is a demand for park-and-ride access. The difference in transfers for the northern stations noted above is partially attributable to this availability of parking, resulting in less need for bus transfers when compared to Option 2 and Option 3. The impact of parking will be reviewed in more depth through the Preliminary Design Business Case.

In total 32,600, 35,600, and 33,300 daily transfers are forecasted from bus to subway in Options 1, 2, and 3 (including to Finch Station) respectively.

Operating Reliability and Savings on the Surface Bus Network

The introduction of the YNSE will reduce the costs of operating a supporting bus network.

There are six TTC bus routes that terminate at Finch Station that will no longer terminate at that location, eliminating one to two kilometres of route distance in each direction. YRT operates two VIVA routes and 14 regular and express buses. These buses routes will be shortened by up to seven kilometres for buses that previously terminated at Finch and will now terminate at Richmond Hill Centre terminal.

An example of the saving is for the VIVA Blue route which currently connects Newmarket to Finch Station through Richmond Hill Centre.

Table 18: "Build an Integrated Transportation Network" Summary

Criteria	Transportation Network	Option 1	Option 2	Option 3
How well does the option connect with rapid transit?	Line 1	Seamless through connection		
	Line 4	at Sheppard-Yonge via existing Line 1		
	Line 5 (Eglinton Crosstown LRT)	at Eglinton via existing Line 1		
	Line 2	at Bloor-Yonge via existing Line 1		
	Ontario Line	at Queen via existing Line 1		
	Richmond Hill GO	at RHC Station	at Bridge-West Station	at Bridge-Centre Station
	Lakeshore West/East GO	at Union Station via existing Line 1		
	VIVA BRT (north, west and east routes)	at RHC Station	at Bridge-West Station	at Bridge-Centre Station

Surface Integration

Integration with the surface route network is essential to ensure convenience for passengers and to avoid shifts to less sustainable travel modes. The YNSE replaces all existing bus connections with new connections at the newly constructed station.

The most significant transfer stations are Steeles and RHC in Option 1, and Steeles and Bridge Station in Options 2 and 3. These stations would also have a bus terminal. Transfers at Langstaff Station are limited to the on-street Yonge bus route.

Table 19: 2041 Weekday Daily Bus Transfers to YNSE Stations

Station	Option 1	Option 2	Option 3
Finch	7,900 (28,500 in BAU)	8,400 (28,500 in BAU)	6,800 (28,500 in BAU)
Cummer	2,500	2,300	2,700
Steeles*	9,400	9,200	9,200
Clark	2,600	2,900	2,600
Langstaff	900		
Richmond Hill Centre*	9,300		
Bridge-West*		12,800	
Bridge-Centre*			12,000
Total	**32,600**	**35,600**	**33,300**

* Transit hubs

Table 20: 2041 Weekday Daily Transfers from Kiss-and-Ride and Drop-Off (PPUDO)*

Station	Option 1	Option 2	Option 3
Finch	900 (1,800 in BAU)	900 (1,800 in BAU)	900 (1,800 in BAU)
Cummer	300	400	400
Steeles	300	400	400
Clark	400	500	600
Langstaff	700		
Richmond Hill Centre	1,200		
Bridge-West		2,200	
Bridge-Centre			1,900
Total	**3,800**	**4,400**	**4,200**

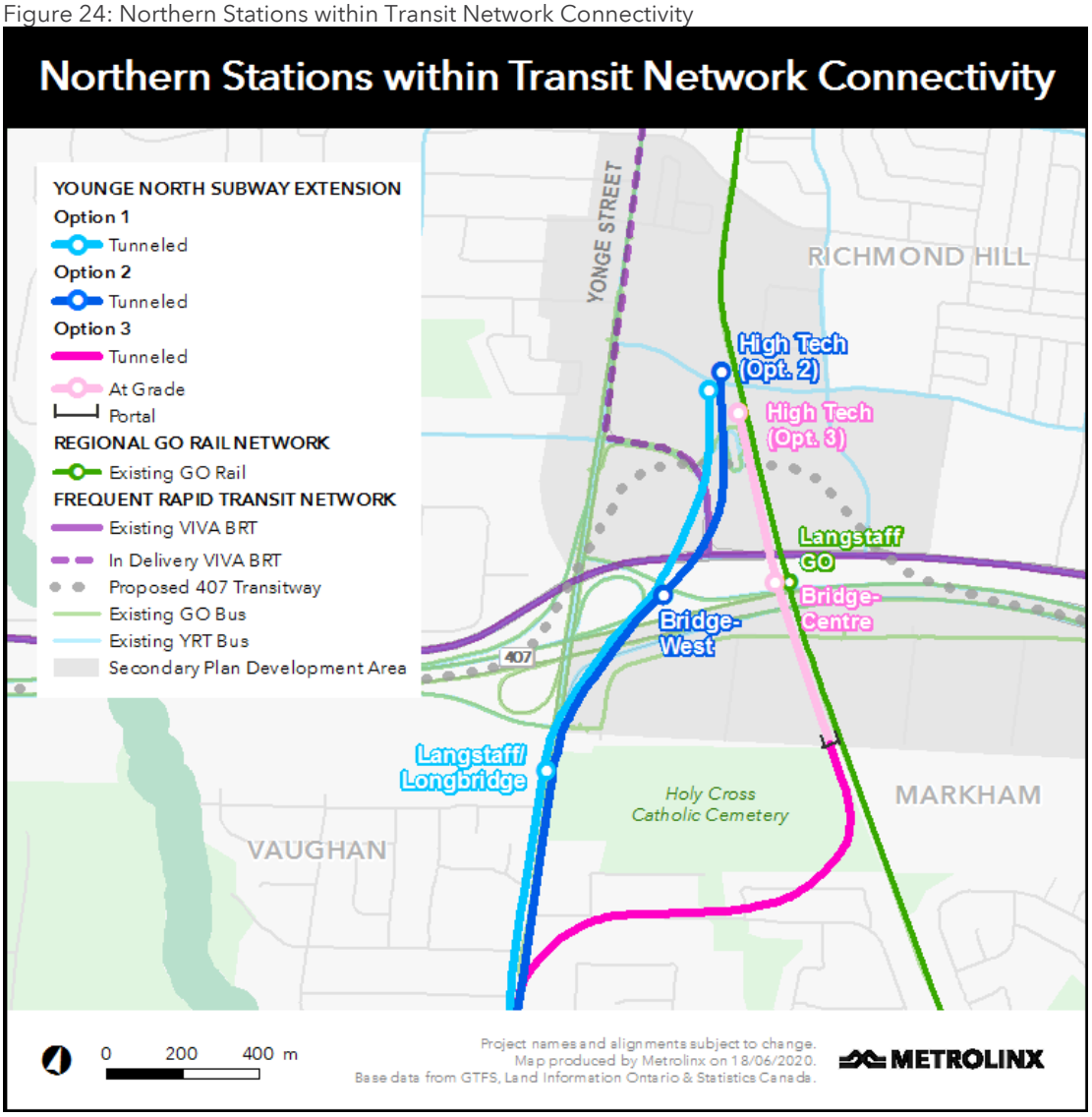
* Includes both formal (dedicated facility) and informal (generally on-street) PPUDO activity at stations.

Stations Analysis

High Tech Station in Alignment Options 2 and 3

High Tech Station would bring subway access to the Richmond Hill Centre area, but it does not include the large transit hub that was contemplated for the Richmond Hill Centre station. Bridge and High Tech stations as a couplet would offer additional transit and economic benefits compared to the northern stations in Option 1. The proposed location for a Bridge Station would provide better opportunity for transit integration as it is at the intersection of major transit routes including but not limited to VIVA Bus Rapid Transit (vivaNext), Highway 7 GO bus service, and the Go Richmond Hill Line. The alignment of the 407 Transitway could be refined through amendment to the EA, once the YNSE's preferred option is selected.

Figure 24: Northern Stations within Transit Network Connectivity



Royal Orchard Station

There are limited surface transit connections at Royal Orchard Station given the absence of east-west routes, constrained by the heritage and environmental features on the west side of Yonge Street. This station would serve YRT route 3 which provides an east west connection across York Region from the Pioneer Village Station at York University in the west to Don Mills and Sheppard in the east. Transfer activity at Royal Orchard station is quite modest in the AM peak hour. Very few of these see passengers boarding a bus at Royal Orchard in the AM peak hour.

Clark Station

Clark Station would serve YRT bus routes 2 and 5, as well as a planned branch of the VIVA BRT Orange. A small off-street terminal would serve the terminating routes at this location. This station would connect a considerable portion of the City of Vaughan to Line 1 subway service. The VIVA BRT connection has significant potential to improve the customer experience for transit users destined to and from east Vaughan development and the employment areas of Concord. This improvement in transit journey would also extend to the Promenade Mall area closer to Yonge Street.

The analysis suggests that there is significant transfer activity at Clark Station in the weekday AM peak hour. Notably, almost half of these transfers involve passengers boarding a bus at Clark Station.

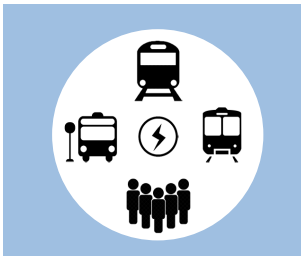
Cummer Station

This station would serve TTC bus routes 125 and 42. The east end of route 42 is a low-density employment area. Ridership to this area likely contributes to the relatively high number of alightings in the AM peak hour. Cummer station would serve transit users from the higher density West Minster - Branson neighbourhood who currently take route 125. The analysis shows that there is a good level of transfer activity at Cummer Station (less than Clark Station) at the weekday AM peak hour. Less than a third of these transfers are subway passengers boarding a bus at Cummer Station.

OUTCOME 3: SUSTAINABLE AND HEALTHY COMMUNITIES

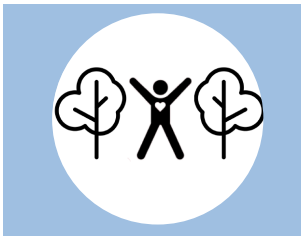
The addition of a new rapid transit service will support the development of sustainable communities and travel patterns along the corridor.

This section will compare the options' performance on three objectives that support the realization of Outcome 3 "Sustainable and Healthy Communities":



Move People with Less Energy and Pollution

Do the options lead to a reduction in energy use for transportation?



Improve Quality of Life and Public Health

Do the options create conditions for healthy lifestyles and communities?

OUTCOME 3: SUSTAINABLE AND HEALTHY COMMUNITIES

BENEFIT 7: Move People with Less Energy and Pollution

Transit moves people more efficiently and sustainably than individual motorized vehicles, meaning it reduces the space and cost of getting people to their destinations. That is why a key objective of the new rapid transit line is to shift as many bus and auto trips as possible to subway, to relieve road congestion and to minimize energy consumption in the process. Subways make use of use of automatic operation and electric rail technologies, which will greatly reduce the amount of energy spent per trip and per passenger compared to automobile and bus modes.

Travel demand forecasting shows that building the YNSE could result in 4,900 (in Option 3) to 8,500 (in Option 1) net new transit riders during the weekday AM peak hour, compared to the BAU scenario. The assumed parking lot at Langstaff Station impacts the magnitude of new riders in Option 1. Higher ridership would result in more reduction in total number of Vehicle Kilometres Travelled and thus more reduced Greenhouse Gas emissions. The Preliminary Design Business Case will recalculate the VKT and related benefits based on the final infrastructure investment.

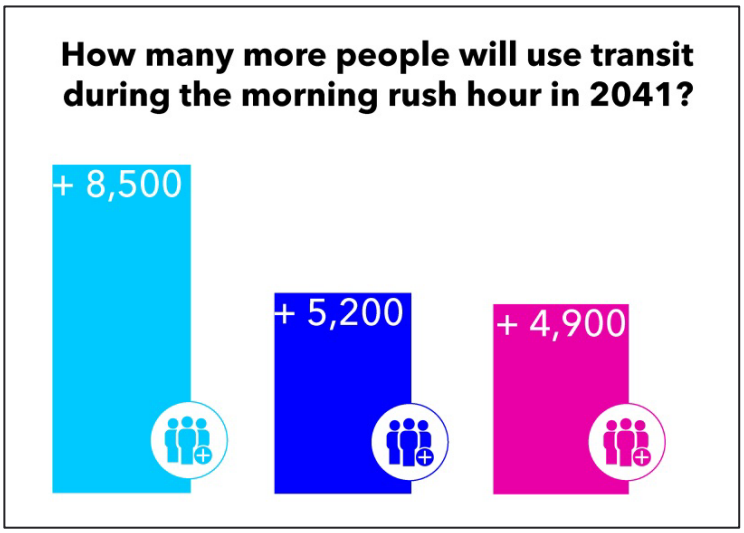


Figure 25: How many more people will use transit during the morning rush hour in 2041?
Source: GGHMv4 outputs

Vehicle Kilometres Travelled (VKT) measure the total distance travelled by cars, capturing traffic volumes as well as length of trips. A decrease in VKT in the Toronto Region gives an indication of congestion and greenhouse gas emissions reductions.

Option 1 of the YNSE is estimated to reduce Toronto's total number of VKT during the weekday AM peak hour by 17,800, compared to BAU. This number is about 8,800 and 7,700 for Options 2 and 3 respectively (Table 21).

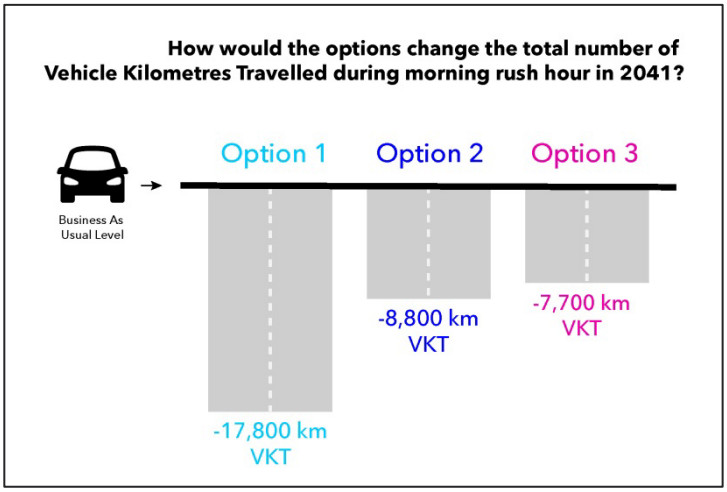


Figure 26: How would the options change the total nmber of Vehicle Kilometres Travelled during morning rush hour in 2041?

Table 21: "Move People with Less Energy and Pollution" Summary

Criteria	Option 1	Option 2	Option 3
What impact will the option have on taking cars off the road in 2041?* *reduction in total Vehicle Kilometres Travelled during morning peak hour * Source: GGHMv4 outputs	- 17,800 km	- 8,800 km	- 7,700 km
What will the energy impacts of the new line be?	Electrical Rail will serve customer currently on diesel buses		
How many more people will use transit during morning peak hour in 2041compared to BAU?* * Source: GGHMv4 outputs	8,500 net new transit riders	5,200 net new transit riders	4,900 net new transit riders

OUTCOME 3: SUSTAINABLE AND HEALTHY COMMUNITIES

BENEFIT 8: Improve Quality of Life and Public Health

The new investment should reduce negative impacts to health and create appropriate conditions for healthy habits as compared to BAU. Building transit close to people and jobs encourages transit usage, as well as walking as an access mode, rather than driving. A shift in travel mode to active transportation or transit reduces the amount of transportation-related greenhouse gases (GHG) emissions that have a detrimental impact to public health. Such a shift has the added social benefit of increasing physical activity among the population with a positive effect on general health. Travel demand projections show that building the YNSE could result in an annual reduction of between 4,000 tonnes (Option 2) and 11,100 tonnes (Option 1) in auto generated GHG emissions, compared to BAU.

Beyond healthy commuting practices, new rapid transit can be leveraged to encourage the development of more active and healthy commuting options. Walking and cycling activity is highly dependent on convenience, density, built form and supportive infrastructure.

The YNSE brings higher quality transit service to the development areas of Richmond Hill Centre and Langstaff Gateway. These areas have the potential to intensify in a manner that is supportive of transit use and encourage walking and cycling.

The introduction of rapid transit provides the opportunity to develop active transportation infrastructure for access in areas that are currently auto centered. YNSE travels through areas served by high volumes of buses, meaning they already benefit from infrastructure that supports active transportation. The addition of a subway line in these areas could reinforce the use of active modes for access.

Where impacts to the natural and built environment are concerned, a tunneled alignment, such as that proposed by YNSE, avoids major impacts to communities, fauna and flora.

Table 22: "Improve Quality of Life and Public Health" Summary

Criteria	Option 1	Option 2	Option 3
What is the option's impact on air quality and auto-related emissions? * Annual Emissions in Tonnes	- 11,100 tonnes	-4,000 tonnes	-4,800 tonnes
How does the option impact the public realm?	Tunnelled alignment along 7.57 kilometres in built-up presents minimal challenges and impacts to public realm	Tunnelled alignment along 7.65 kilometres in built-up presents minimal challenges and impacts to public realm	• Tunnelled alignment along six kilometres in built-up presents minimal challenges and impacts to public realm • At-Grade alignment along 2 kilometres has a higher potential for disruption to the natural environment and quality of life (noise, vibration, visual impact). Impacts and opportunities to mitigate to be further understood during design development.
How do the options support the development of walkable communities?	YNSE brings rapid transit to dense and/or intensifying auto-centered areas, thus encouraging active modes for access.		

Strategic Case Summary

Table 23: Summarizing the Strategic Case – Alternative Alignment Analysis

OUTCOME	OBJECTIVE	Option 1	Option 2	Option 3
Strong Connections	Improve access to transit	The extension in this option attracts 109,900 daily riders and grants walking access to rapid transit to + 29,500 people compared to BAU	The extension in this option attracts 97,600 daily riders and grants walking access to rapid transit to + 26,500 people compared to BAU	The extension in this option attracts 94,100 daily riders and grants walking access to rapid transit to + 26,000 people compared to BAU
	Increase access to economic opportunities	• The extension in this option grants access to 1,700 more employment opportunities within a 45-minute transit trip compared to BAU • 25,700 employees will also be within a 10-minute walking distance of subway	• The extension in this option grants access to 1,650 more employment opportunities within a 45-minute transit trip compared to BAU • 22,600 employees will also be within a 10-minute walking distance of subway	• The extension in this option grants access to 1,650 more employment opportunities within a 45-minute transit trip compared to BAU • 22,900 employees will also be within a 10-minute walking distance of subway
	Support Planned Development along the YNSE	The alternative alignments are thought to be equally effective at supporting planned development along the corridor. Potential differences are addressed in the Station Analysis.		
Complete Travel Experiences	Improve travel time	• The line in this option generates 920,000 minutes daily travel time savings compared to BAU. • This option brings subway closer to residents and employees of RHC and Langstaff Gateway and saves 16 minutes on a trip from this area to Downtown Toronto compared to BAU.	• The line in this option generates 960,000 minutes daily travel time savings compared to BAU. • This option brings subway closer to residents and employees of RHC and Langstaff Gateway and saves 23 minutes on a trip from this area to Downtown Toronto compared to BAU.	• The line in this option generates 860,000 minutes daily travel time savings compared to BAU. • This option brings subway closer to residents and employees of RHC and Langstaff Gateway and saves 23 minutes on a trip from this area to Downtown Toronto compared to BAU.
	Improve reliability	Daily perceived travel time savings of 480,000 person-minutes, due to reduction of time on buses as a result of no or short trips to access the YNSE.	Daily perceived travel time savings of 520,000 person-minutes, due to reduction of time on buses as a result of no or short trips to access the YNSE.	Daily perceived travel time savings of 500,000 person-minutes, due to reduction of time on buses as a result of no or short trips to access the YNSE.
	Build an integrated transportation network	• The YNSE represents a seamless extension of Line 1 which provides access to the existing and future connections with Toronto's other rapid transit lines. It	• This option introduces a new connection between the subway network and GO train service at Bridge-West Station and integrates	• This option introduces a new connection between the subway network and GO train service at Bridge-Centre Station and

OUTCOME	OBJECTIVE	Option 1	Option 2	Option 3
		introduces a new connection between the subway network and GO train service at Richmond Hill Centre Station and integrates with express bus routes along the corridor. • 9,400 daily bus transfers to Steeles Station, and 9,300 to RHC Station	with express bus routes along the corridor. • 9,200 daily bus transfers to Steeles Station, and 12,800 to Bridge-West Station	integrates with express bus routes • 9,200 daily bus transfers to Steeles Station, and 12,000 to Bridge-Centre Station
Sustainable and Healthy Communities	Move people with less energy	The option provides an alternative to more, longer auto trips, generating 17,800km decrease in AM peak hour VKT in Toronto and York Region, and attracting 8,500 net new riders to transit, compared to BAU.	The option provides an alternative to more, longer auto trips, generating 8,800km decrease in AM peak hour VKT in Toronto and York Region, and attracting 5,200 net new riders to transit, compared to BAU.	The option provides an alternative to more, longer auto trips, generating 7,700km decrease in AM peak hour VKT in Toronto and York Region, and attracting 4,900 net new riders to transit, compared to BAU.
	Improve quality of life and public health	The option delivers 11,100 tonne reduction in yearly auto generated GHG emissions yearly	The option delivers 4,000 tonne reduction in yearly auto generated GHG emissions yearly	• The option delivers 4,800 tonne reduction in yearly auto generated GHG emissions yearly. • Its ~1.4km at-grade alignment has a potential for disruption, which will require mitigation through design.

Table 24: Summarizing the Strategic Case – Stations Analysis (High Tech)

OUTCOME	OBJECTIVE	HIGH TECH
Strong Connections	Improve access to transit	• This station grants walking access to rapid transit to 5,500 – 7,400 people compared to a scenario that this station does not exist • High Tech Station in Alignment Option 3 has better coverage than the High Tech Station in Alignment Option 2
	Increase access to economic opportunities	• This station grants walking access to rapid transit to 2,300 - 2,700 new jobs compared to a scenario that this station does not exist
	Support Planned Development along the YNSE	• More conformity with the vision of the City of Richmond Hill for the Richmond Hill Centre area • No bus terminal at High Tech Station so, more lands for new developments in Richmond Hill Centre's core area
Complete Travel Experiences	Improve travel time	• Analysis shows incremental travel time disbenefit when users use Bridge + High Tech stations instead of Langstaff + RHC Stations in Option 1 • Around 55% of people living and working in the Richmond Hill Centre area would gain walk-in access to the subway and save time on their trips to/from Toronto • This station would have nominal impact on travel time of those passengers connecting to the subway by bus
	Build an integrated transportation network	• High Tech Station would bring subway access to the Richmond Hill Centre area but not the transit hub • Travel time savings for bus riders from Yonge Street to stop at the High Tech Station instead of Bridge Station • Bridge and High Tech stations as a couplet would offer additional transit benefits compared to the northern stations in Option 1 • Bridge Station in a better location for transit integration as it is at the intersection of major transit routes i.e. VIVA Bus Rapid Transit (vivaNext), Highway 7 GO bus service, Go Richmond Hill Line, etc.

Table 25: Summarizing the Strategic Case – Stations Analysis (Royal Orchard)

OUTCOME	OBJECTIVE	ROYAL ORCHARD
Strong Connections	Improve access to transit	• Option 1: About 20% of the catchment area of this station is within 800m of Langstaff Station; 5,200 people would live within a 10-minute walk of Royal Orchard Station with no overlap • Options 2 and 3: No overlap with any other stations; 7,300 people would live merely within a 10-minute walk of Royal Orchard Station
	Increase access to economic opportunities	• Option 1: 900 jobs would be within 10-minute walk of Royal Orchard Station with no overlap with Langstaff Station • Options 2 and 3: 1,300 jobs would be merely within a 10-minute walk of Royal Orchard • 1,320 ridership in the weekday AM peak hour: 7% alighting due to little existing or forecast employment growth adjacent or in proximity of the station
	Support Planned Development along the YNSE	• Development constraints due to Thornhill Village Heritage District, limited surface transit connections, absence of East-West routes constrained by the heritage and environmental features • Municipal support for growth in the station area; i.e. major development application in the area currently under review is at the northeast corner of Royal Orchard Boulevard and Yonge Street underway: 4 residential towers up to 59 storeys and 1,560 units • Limited existing and future employment land uses on the east side of Yonge Street within roughly 4 kilometres of Yonge Street
Complete Travel Experiences	Improve travel time	• Analysis demonstrates incremental travel time benefits to users who travel to this station compared to a scenario this station did not exist, but not as well as other Neighbourhood Stations • Royal Orchard Station will serve mainly walk-in customers accessing the subway during peak hours • Small overlap with the Langstaff Station in Option 1, meaning people and jobs in this area would be able to walk to the subway at an earlier station and therefore save travel time. There would no overlap with Option 2 and 3 • This station would introduce small delay to the upstream riders who alight at northern station(s)
	Build an integrated transportation network	• Limited surface transit connections at Royal Orchard Station • It serves YRT route 3

Table 26: Summarizing the Strategic Case – Stations Analysis (Clark)

OUTCOME	OBJECTIVE	CLARK
Strong Connections	Improve access to transit	• Clark Station would bridge the gap between Steeles and Langstaff Stations • About 20% of the catchment area of this station is within 800 metres of Steeles Station • 8,100 people would live within a 10-minute walk of Clark Station with no overlap with Steeles Station
	Increase access to economic opportunities	• 1,900 jobs would be within a 10-minute walk of Clark Station with no overlap with Steeles Station • Good level of ridership in the weekday AM peak hour: 2,370 ridership, 35% alighting and 65% boarding
	Support Planned Development along the YNSE	• Analysis demonstrates strong and early growth for Clark Station • Significant developments upcoming at Yonge-Steeles area • Promenade Centre, located 2 kilometres away, has considerable impact on the ridership of the YNSE especially at the Clark Station
Complete Travel Experiences	Improve travel time	• Analysis demonstrates great incremental travel time benefits to users who travel to this station compared to a scenario in which this station did not exist • Travel time saving for riders from Promenade Centre area • This station would introduce small delay to the upstream riders who alight at northern station(s)
	Build an integrated transportation network	• This station serves YRT bus routes 2 and 5 as well as planned branch of the VIVA BRT Orange • It would connect a considerable portion of the City of Vaughan to Line 1

Table 27: Summarizing the Strategic Case – Stations Analysis (Cummer)

OUTCOME	OBJECTIVE	CUMMER
Strong Connections	Improve access to transit	• About 50% of the catchment area of this station is within 800 metres of Finch and Steeles Station • 5,700 people would live within a 10-minute walk of Cummer Station with no overlap with Finch and Steeles Stations
	Increase access to economic opportunities	• 2,200 jobs would be within a 10-minute walk of Cummer Station with no overlap with Finch and Steeles Stations • Good level of ridership in the AM peak hour: 2,160 ridership, 40% alighting, 60% boarding
	Support Planned Development along the YNSE	• Projects under construction at Drewry/Cummer Avenue and Yonge Street area • Yonge Street North Planning Study (currently underway) will allow for the same density as North York Centre Secondary Plan Area for this area
Complete Travel Experiences	Improve travel time	• Model demonstrates great incremental travel time benefits to users who travel to this station compared to a scenario in which this station did not exist • It would save travel time for about 24% of the residents and jobs within its 800 metres • Other 76% could walk to Finch or Steeles Stations within 10 minutes • It would cause delay to more passengers on board that alight at Steeles and other northern stations
	Build an integrated transportation network	• This station serves TTC bus routes 125 and 42

5

Economic Case

METROLINX

Introduction and Assumptions

The Economic Case is one of two chapters focused on the rationale for pursuing an investment (the other being the Strategic Case). While the Strategic Case evaluates options based on a project specific policy/plan-oriented evaluation framework, the Economic Case determines if the expected benefits of this investment exceed the costs required to deliver it, and articulates the overall benefit to society of pursuing each investment option. This analysis considers the magnitude of costs and benefits for a 60-year lifecycle (the evaluation period) as well as:

- Benefit Cost Ratio (BCR) – the net benefits divided by the net costs, which is used to indicate benefits that are realized per dollar spent
- Net Present Value (NPV) – the net benefits minus net costs, which is used to indicate total net benefits to the region.

Assumptions set out in Table 28 are provided by the Metrolinx Business Case Guidance (2019). The values presented in the economic case are the total lifecycle costs and benefits of the project in economic terms. Therefore the costs shown are different from the Province's expected investment to construct the project and the project's budget. See Table 37 for these specific financial costs.

This economic case focuses on comparing the three alignment representative/modelling scenario options that were introduced in Chapter 3 the IBC. It was recognized that because representative scenarios were used in the Economic Case they do not necessarily represent optimized investment alternatives for the YNSE, the PDBC will explore how to further optimize the investment. In an attempt to build on the results provided, further economic case analysis was conducted to understand the costs and benefits of adding or removing stations from the program. This analysis is included in Appendix 1.

Table 28: List of Economic Assumptions

Input	Impact Type
Analysis Approach	• All benefits/costs are expressed in real terms in 2020$. • Appraisal begins in 2020. • Construction period from 2024 to 2030, with an opening year of 2030 and 60 years of operation (2030 to 2089) evaluated.
Evaluation Period	70 years (2020-2089)
Economic Discount Rate	3.5%
Value of Time (VoT) (2020$)	$18.42/hour
VoT Growth Rate	0%
Ridership Growth Rate	1.3%, capped after 30 years from year of evaluation (2020-2049).
Auto Occupancy	1.077
Auto Operating Cost Savings (2018$)	• Marginal operating cost: $0.09/km • Total operating cost: $0.66 km
Decongestion Benefit	• 0.01 hours/vehicle-km (peak period) • 0.00125 hours/vehicle-km (off-peak)
Safety Improvements (Accident Mitigation/Relief) (2018$)	$0.10/km
GHG Emissions (2019$)	$54.5/Tonne

Modelling Assumptions

The GGHMv4 model considers changes in land use patterns and the transportation network to estimate ridership with a forecast horizon of 2041. The following assumptions were applied:

- Extension Train Headway: 3.5 minutes (or 210 seconds) per direction
- Seated Capacity per Train: 400 people
- Total Capacity per Train: 1,100 people
- Extension Capacity: 18,000 passengers per hour per direction
- Speeds varied: by segment for each alignment ranging from 25km/hr to 50km/hr
- Stations: Further to the Investment Options chapter, the modelled options for Options 1, 2 and 3, includes primary stations and a combination of Complementary Urban Core Stations and Neighbourhood Stations. The combination of stations for each alignment was based on early indicators. For more information, please see Appendix 1.

Costs

The costs or 'required investment' to deliver the YNSE are divided into the following categories:

- **Capital Costs**: fixed one-time costs incurred during the implementation of the investment. The capital costs include the labour and materials required for construction; as well as contingency. Property acquisition costs are excluded from the economic analysis.
    - **Fleet:**
        - Fleet cost growth per year is assumed as 0%
        - It is assumed 12 train sets will be purchased at a cost of $3,794,000 per car (6 cars per trainset) (2020$) or $272,880,000 Total (2020$), with a 30-year lifecycle

    Tunneling: For the Options 1 and 3, twin bore tunneling was assumed, whilst in Option 2, costs reflect large single bore (stacked) tunneling. Tunneling technology will be confirmed in the Preliminary Design Business Case.

- **Rehabilitation Costs:** Complete major rehabilitations to restore infrastructure to ensure operational conditionals throughout the project's lifecycle. Rehabilitation and refurbishment are assumed to continue for the 60-year operation period, and a terminal value, equal to the last 20 years of rehabilitation cost is assumed.

- **Operating and Maintenance Costs:** ongoing costs required to operate the service and provide day to day maintenance.
    - **Fleet:** a minimum of 6 additional trains will be required for operations, assumed to be a 1-person train operation.
    - **Bus Operating Impacts:** impacts to the bus network generated by the extension. In this case, savings as bus requirements are reduced.

The capital, operating, maintenance and rehabilitation costs for the entire lifecycle of the YNSE investment are listed in Table 29. These costs are incremental to the BAU scenario and have been discounted based on the approach defined earlier in this chapter.

Metrolinx has applied at standardized approach to account for uncertainty in project costing. This approach applied to all projects with adjustment to recognize the nature of the project and where it stands in the design development process. In accordance with IBC methodology all cost estimates, excluding fleet, include contingency of 30% to cover unknown risk events. An uplift to individual cost items of 26% was applied to balance optimism bias, with a standard deviation of 22.45%. Optimism bias is the tendency of individuals to expect better than average outcomes. In the context of infrastructure projects, optimism bias can lead to underestimation of costs and project duration. For fleet, neither contingency nor optimism bias was applied.

Exclusions from the analysis:

- Property costs are excluded from the economic analysis, and as such, do not require rehabilitation
- Transit-Oriented Communities are not reflected outside the growth assumptions in the land use model in the costs or benefits.

Table 29: Summarizing Economic Costs

	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Capital Costs	**$4,965.0 M to $5,776.8 M**	**$4,549.3 M to $5,500.8 M**	**$4,387 M to $5,142.5 M**
Infrastructure	$4,400.1 M to $5,146.3 M	$4,020.3 M to $4,895.3 M	$3,870.8 M to $4,565.5 M
Fleet	$262.4 M to $262.4 M	$262.4 M to $262.4 M	$262.4 M to $262.4 M
Rehabilitation	$453.4 M to $530.5 M	$412.9 M to $502.8 M	$397.9 M to $469.4 M
Terminal Value	$-78.2 M to $-66.9 M	$-74.2 M to $-60.9 M	$-69.2 M to $-58.7 M
Bus and Streetcar Fleet	$-84 M	$-85.4 M	$-85.4 M
Operating Costs	**$34.7 M**	**$-21.1 M**	**$-67.1 M**
Operating & Maintenance Costs	$816 M	$769.8 M	$714.3 M
Bus Impacts (Savings)	$-781.3 M	$-790.9 M	$-781.4 M
Total Present Value of Costs	**$4,999.7 M to $5,811.5 M**	**$4,528.2 M to $5,479.8 M**	**$4,308.5 M to $5,064.4 M**

* Cost estimates reflect a range representing low to high forecasts to account for optimism bias at the early stages of project design. The values presented are in economic terms. Therefore, the costs shown are different from the Province's expected investment to construct the project and the project's budget. See Table 37 for these financial costs.

User Impacts

User Impacts are a key area of analysis for transport investments. They capture how the investment will improve the welfare of transport network users or travelers. This includes both YNSE riders and all other transportation network users since both groups benefit from travelers switching to transit from other modes.

The YNSE investment will impact the following groups:

- **Existing Subway Passengers**: The investment will reduce the generalized cost of travel below the current cost of travel by expanding the subway network across Toronto. This investment will provide a direct benefit to existing users, specifically bus users who have new opportunities to shift their journeys from buses to the subway.
- **New Subway Passengers:** The investment will reduce the generalized cost of travel on transit. This will attract new users to transit that used to travel via other modes. These new users will receive a benefit equal to the difference in what they were willing to pay and the new generalized cost of travel on transit.
    - **Auto Users:** The investment will attract some auto users off local roads; this will generate congestion reduction benefits when compared to the Business as Usual for the remaining auto users.

All user impacts included in this analysis, which is summarized in Table 30, are "net impacts" across the investment, that is, the a sum of benefits and disbenefits to users.

Table 30: Summarizing User Benefits

User Type	Impact Type	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Transit	Travel Time Benefits	$2,702.3 M	$2,814.1 M	$2,529.0 M
	Crowding & Reliability	$1,172.6 M	$1,169.6 M	$1,128.0 M
Automobile	Congestion Reduction	$95.1 M	$46.6 M	$40.7 M
	Auto Operating Costs	$59.9 M	$29.4 M	$25.7 M

External Impacts

The YNSE would also generate external (also known as 'societal') impacts based on well-being and environmental impacts. The benefit categories are health, safety (accident reductions on the road network) and environmental GHG emission reductions.

External impacts are estimated through the mode changes generated by the proposed investment. If travelers move from a less efficient mode to subway then there is an impact equivalent to the externalities per trip on the new subway, minus the externalities on their previously used mode.

Health and safety benefits are calculated based on the change in automobile Vehicle Kilometres Travelled (VKT). The GHG reductions impacts are estimated in tonnes through GGHmV4.

Table 31: Communicating Present Value of External Impacts

Impact Type	Impact	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Health & Safety	Accident Reduction	$17.5 M	$8.6 M	$7.5 M
Environment	Greenhouse Gas reductions	$11.3 M	$4.1 M	$4.9 M

Economic Case Summary

The following table summarizes the option's costs and benefits and their overall performance through the Benefit Cost Ratio (BCR) and the Net Present Value calculation.

The Expected BCR is the mean of the continuous distribution of benefit cost ratios obtained by varying the capital cost input.

Table 32: Summarizing Economic Case

Impact Type	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Total Costs ($2020, PV)	**$4,999.7 M to $5,811.5 M**	**$4,528.2 M to $5,479.8 M**	**$4,308.5 M to $5,064.4 M**
Capital Costs	$4,511.6 M to $5,246.4 M	$4,136.4 M to $4,998.0 M	$3,959.9 M to $4,662.20 M
Rehabilitation Costs	$453.4 M to $530.4 M	$412.9 M to $502.8 M	$397.7 M to $469.4 M
Operating and Maintenance Costs	$34.7 M	-$21.1 M	-$67.1 M
Total Impacts	**$4,058.7 M**	**$4,072.4 M**	**$3,735.7 M**
User Impacts	$4,029.9 M	$4,059.7 M	$3,723.3M
External Impacts	$28.8	$12.7 M	$12.4 M
Fare Revenue Adjustment	**$192.2 M**	**$117.1 M**	**$112.0 M**
Benefit-Cost Ratio (BCR)	**0.73 to 0.85**	**0.76 to 0.93**	**0.76 to 0.89**
Expected BCR	**0.79**	**0.84**	**0.82**
Net Present Value ($2020, NPV)	**$-1,560.6 M to $-748.8 M**	**$-1,290.3 M to $-338.7 M**	**$-1,216.8 M to $-460.8 M**
Expected NPV	**$-1,154.3 M**	**$-813.5 M**	**$-837.6 M**

Jobs Supported and GDP Impacts

The capital investment into transit is expected to support direct and indirect person years of employment, in the construction and supply chain industries leading to increased GDP to the GTHA region. Table 33 sets out the impacts during the construction phase of the project and is closely linked to capital spend. All monetary values are in 2020 prices. It should be noted that these results are high level estimates based on Statistics Canada and adjusted by the Ontario Ministry of Finance to estimate the direct and indirect employment impacts of the capital investment.

Table 33: Jobs Supported and GDP Impacts During the construction Phase

Line Item	Option 1	Option 2	Option 3
Direct and Indirect Employment (Jobs Supported per Year)	4,900	4,500	4,300
GDP Impact Per Year ($M/yr)	$500 M	$460 M	$441 M

Economic Parameters Sensitivity Tests

The sensitivity tests were undertaken to account for on uncertainty in input variables that have a substantial impact on the business case.

The values of key economic parameters were varied to determine how the options would perform under different circumstances to reflect these uncertainties.

The tests noted the following conclusions:

- Operating Cost growth rate tests had minimal impacts on the BCR.
- Where the Economic Discount rate is tested at 2.5% over the investment lifecycle, the BCRs increase for all options. For example in the Dark Blue Alignment (Option 2), the BCR increased from 0.76 to 0.93, to 0.96 to 1.16 which represents the highest performing test.
- If the Ridership Growth Rate is lower than assumed in the IBC and tested at 0%, the BCR decreases for all options. For example in the Classic Blue Alignment (Option 1), the BCR decreased from 0.73 to 0.85, to 0.71 to 0.82 which represents the lowest performing test. This test illustrates what happens if the ridership in the model cannot be realized, for example, if passengers choose other modes.

Table 34: Sensitivity Analysis

Parameter	MX Assumption*	Tested Value	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Using Standard Metrolinx Assumptions			**0.73 to 0.85 (EV: 0.79)**	**0.76 to 0.93 (EV: 0.84)**	**0.76 to 0.89 (EV: 0.82)**
Value of Time Growth Rate A parameter used to escalate the Value of Time across the investment lifecycle. Value of Time is a factor used to monetize changes in generalized time to determine the overall welfare benefit to transport network users.	0.0%	0.7%	0.86 to 1.00 (EV: 0.93)	0.95 to 1.14 (EV: 1.04)	0.93 to 1.10 (EV: 1.02)
Economic Discount Rate The economic discount rate reflects society's time preference for money, that is, present consumption versus future consumption.	3.5%	2.5%	0.92 to 1.07 (EV: 0.99)	0.96 to 1.16 (EV: 1.06)	0.95 to 1.12 (EV: 1.04)
Ridership Growth Rate A parameter used to escalate ridership throughout the investment lifecycle.	1.3%	0%	0.71 to 0.82 (EV: 0.77)	0.75 to 0.90 (EV: 0.82)	0.74 to 0.86 (EV: 0.80)
		2%	0.74 to 0.87 (EV: 0.80)	0.78 to 0.94 (EV: 0.86)	0.77 to 0.91 (EV: 0.84)
Operating Cost Growth Rate A parameter used to escalate operating costs throughout the investment lifecycle.	1%	0%	0.73 to 0.85 (EV: 0.79)	0.77 to 0.92 (EV: 0.84)	0.75 to 0.89 (EV:0.82)
		3%	0.73 to 0.85 (EV: 0.79)	0.77 to 0.93 (EV: 0.84)	0.77 to 0.9 (EV: 0.83)

* Expected Value (EV) is the expected BCR.

6

Financial Case

METROLINX

Introduction

The Financial Case assesses the overall financial impact of proposed investment options. While the Strategic Case and Economic Case outline how an investment achieves organizational goals and social value, the Financial Case is one of two cases (the other being the Deliverability and Operations Case) that focuses on the requirements to successfully deliver an investment. This includes a review of total revenue (fares) gained and expenditures (capital, operating and maintenance) required over the lifecycle of the investment incremental to the base case scenario. The Financial Case is agnostic with regard to procurement and delivery method, but cost estimates are prepared based on a traditional design-bid-build approach.

As previously noted, the Financial Case analysis was conducted based on the alignment representative/modelling scenarios outline in Chapter 3 and reviewed in the Strategic and Economic Cases. It is recognized that the financial case for an optimized YNSE infrastructure investment that included or excluded additional stations would differ from the options presented below.

Table 35 sets out the assumptions used in this Financial Case.

Table 35: Assumptions used in this Financial Case

Parameter	Value	Parameter
Discount Rate	5.5% (nominal)	Discount Rate
Inflation Rate	2%	Inflation Rate

Capital Costs

The capital cost of building and delivering the proposed investment options forms the largest component of overall project costs. Estimates of probable capital costs were estimated in 2020$ (see Table 36). They include an allowance for property acquisition, as well as a professional services allowance to account for the completion of designs, procurement activities and support activities during construction.

Cost estimates should be considered Class 5 estimates.

All cost estimates, except for fleet, reflect 30% contingency to cover unknown risk events.

Indirect costs include Professional Services, Taxes, and Insurance.

Prior to the upload of delivery responsibility from TTC to Metrolinx in Summer 2019, the estimated infrastructure project cost for Option 1, including Cummer, Steeles, Clark, Langstaff and Richmond Hill Centre stations and related subway infrastructure, was more than $9.3 billion. At this project price the business case and affordability was significantly challenged given the announced $5.6B budget.

To manage the significant cost estimate overage, Metrolinx initiated, through the IBC process, benefits optimization, value engineering and optimization of Option 1, which identified Options 2 and 3 as both being technically feasible and potentially able to increase benefits and/or be delivered for a lower capital cost. Although none of the options can deliver the full initial scope of the project, including a minimum of five new stations within the announced $5.6 billion budget.

Options 1 and 2 can be delivered within the $5.6 billion budget, including stations at Steeles, Richmond Hill Centre/Bridge and Langstaff/High Tech. To add additional stations into the project scope will require an increase in the project budget beyond $5.6 billion, with each Neighbourhood Station estimated to cost between $400 and $500 million.

Option 3, although having a more complex deliverability case, can be delivered for approximately $5.2 billion, and includes the two Primary Stations at Steeles, and Bridge (at-grade) and one Complementary Urban Core Station at High Tech (at-grade). At this cost, Option 3 does also provide the opportunity for one Neighbourhood Station to be included in the project scope and maintain costs within the $5.6 billion infrastructure budget.

Table 36: Capital Costs in Financial Terms, Discounted

Line Item	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Infrastructure	**$4,364.3 M**	**$3,933.2 M**	**$3,900.2 M**
Stations, Bus Terminals/Entrances	1,258.74 M	793.36 M	929.41 M
Tunnel & Ancillary Structures	559.38 M	913.75 M	546.97 M
TSMF & Portal	222.91 M	108.97 M	258.18 M
System Wide Elements	307.54 M	347.49 M	334.24 M
Indirect	1,548.89 M	1,430.11 M	1,364.63 M
Property Acquisition	466.80 M	339.48 M	466.80 M
Subway Fleet	**$265.5 M**	**$265.5 M**	**$262.4 M**
Rehabilitation	**$458.2 M**	**$411.7 M**	**$409.5 M**
Terminal Value	**$-57.4 M**	**$-51.6 M**	**$-51.3 M**
Bus and Streetcar Fleet	**$-85.7 M**	**$-87.2 M**	**$-87.2 M**
Total Capital Costs	**$4,996.4 M**	**$4,466.4 M**	**$4,381.3 M**

Table 37: Capital Costs in Financial Terms, Undiscounted

Line Item	Option 1	Option 2	Option 3
Infrastructure	$6,266.9 M	$5,587.1 M	$5,600.5 M
Subway Fleet	$935.2 M	$935.2 M	$935.2 M
Rehabilitation	$4,171.0 M	$3,747.2 M	$3,727.5 M
Terminal Value	$-2,307.8 M	$-2,073.3 M	$-2,062.5 M
Bus and Streetcar Fleet	$-658.6 M	$-670.0 M	$-670.0 M
Total Capital Costs	**$8,406.6 M**	**$7,359.5 M**	**$7,000.1 M**

Operating and Maintenance Costs

The operation and maintenance of a subway extension will bring additional project costs, over the entire operational lifecycle of the investment. Operating and maintenance costs cover all aspects of operating the subway extension including staffing, vehicle, track and station maintenance, and power.

There are also operating costs impacts due to changes in the bus requirements generated by the YNSE. It is important to remember that these impacts are associated with bus network that was identified to for the YNSE when competed with the Business as Usual scenario. Generally, there are less bus routes having to access stations, with a terminus at a new subway station closer to their origin resulting in shorter routes and/or requiring fewer buses.

Table 38: Operating and Maintenance Costs in Financial Terms, Discounted

Line Item	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Project Operating and Maintenance Costs	$832.8 M	$785.7 M	$729.0 M
Bus Operating Impacts	$-781.3 M	$-790.9 M	$-781.4 M
Total Operating Costs	**$51.5 M**	**$-5.2 M**	**$-52.4 M**

Table 39: Operating and Maintenance Costs in Financial Terms, Undiscounted

Line Item	Option 1	Option 2	Option 3
Project Operating and Maintenance Costs	$6,452.7 M	$6,087.7 M	$5,648.6 M
Bus Operating Impacts	$-6,452.7 M	$-6,087.7 M	$-6,179.2 M
Total Operating Costs	**$274.1 M**	**$-166.6 M**	**$-530.6 M**

Revenue Impacts

Revenue impacts are quantified in Table 40 and have been derived from the transportation demand model used to estimate ridership. Revenue impacts include revenue resulting from changes in fare paid and number of trips taken.

Table 40: Revenue Impacts in Financial Terms

Line Item	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Incremental Fare revenue	$196.2 M	$119.6 M	$114.4 M

Funding Sources

Capital Costs

The provincial government expects the YNSE to cost an estimated $5.6 billion in capital expenditure. The province is committed to ensuring all three parties (i.e. federal government, the province and municipalities) contribute to the funding of this essential transit infrastructure projects as well as seeking other third party funding for stations.

Through the Preliminary Agreement, the province and York Region will work closely and collaboratively to develop an approach to funding measures that works for all parties. Part of this work includes a comprehensive financial review and due diligence exercise to explore potential revenue raising measures, which will be subject to future decision-making. Such an exercise will be narrowly scoped, focusing specifically on the YNSE and the future benefits that the project is expected to generate.

Not all the IBC options' projected capital expenditure will fall within the current funding bracket identified by the province. Metrolinx is continuing to explore opportunities to optimize project scope to reduce capital costs through the preliminary design phase and future collaboration with partner municipalities and transit agencies.

Operating Costs

The TTC will be the operator of the YNSE and will incur the operating costs. The fare revenue identified can offset the operating costs, alongside York Region providing an operating contribution. Details of these arrangements remain to be resolved. This important piece of work will be facilitated by the impacted stakeholders.

As the owner of the assets, the Province/Metrolinx will be responsible for all lifecycle maintenance costs.

Financial Case Summary

The following is a summary of the overall financial impact of the investment.

Table 41: Financial Case Summary

Financial Case Metric	Option 1 ($2020 PV)	Option 2 ($2020 PV)	Option 3 ($2020 PV)
Total Revenue Impacts	$196.2 M	$119.6 M	$114.4 M
Total Capital Costs	$4,944.9 M	$4,471.6 M	$4,572.1 M
Total Operating and Maintenance Costs	$51.5 M	$-5.2 M	$-52.4 M
Total Costs	**$4,996.4 M**	**$4,466.4 M**	**$4,381.3 M**
Net Present Value (NPV)	**$-4,800.2 M**	**$-4,346.8 M**	**$-4,266.9 M**
Total Cost Recovery Ratio	**0.04**	**0.03**	**0.03**
Operating Cost Recovery Ratio (R/C Ratio)	**3.81**	**All Gain**	**All Gain**

7

Deliverability and Operations Case

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Introduction

The Deliverability and Operations Case is an analysis of investment delivery, operations and maintenance, service plans and any other issues that may prevent the realization of an option. This includes delivering the project from original concept through to planning, design, environmental assessment, stakeholder engagement, procurement, construction and operations. The Deliverability and Operations Case is one of two cases (the other being the Financial Case) focused on requirements for delivering the investment.

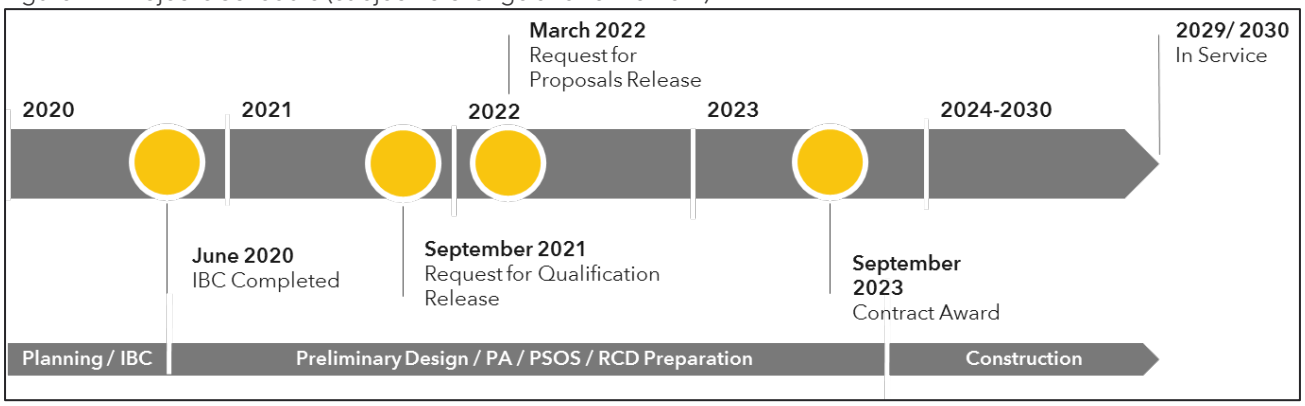
Where appropriate the Deliverability and Operations Case will highlight the similarities and differences of the alternative Options identified in Chapter 2 and of the individual stations that might make up the YNSE.

The Deliverability and Operation Case will continue to evolve as Metrolinx continue to advance the management of the project. The following outlines some key aspects of the project based on available information.

Project Schedule

The following is an indicative schedule for the project.

Figure 27: Project's Schedule (subject to change and refinement)



Post IBC analysis would be completed in the summer of 2020. Project requirements would be completed in 2022. The procurement process would be completed in late 2023 with the contract awarded to the successful team. Following design development by the successful team, construction would proceed. The project is scheduled to open for revenue service in 2029/2030 following completion and opening of Ontario line.

At this time and for the purpose of the deliverability analysis, it is assumed that each of the Options under development to have the same Project Schedule including construction period.

Operating Concept

For the purpose of this IBC an indicative operating concept was assumed for the YNSE. During the peak period, it is assumed that every other Line 1 subway train will continue north from Finch Station to the YNSE terminus with an average headway of 3.5 minutes (210 seconds). Outside of the peak period when headways on Line 1 are reduced it is likely that all trains would operate to the YNSE terminus.

Ridership in this IBC has been calculated at these service levels. It is recognized that turn back train operations are possible when ridership beyond Finch does not exceed a reasonable percentage of the available capacity of the vehicles. If trains arrived at Finch unevenly loaded it could potentially impact operations over the entirety of Line 1. Therefore, it is anticipated that at some point over the service life of the YNSE turn back operations would no longer be feasible, and all service would run to the terminus station.

Terminal Operations

Options 1 and 3 have been assumed to have centre platforms for the northern terminus station. A centre platform allows for typical end of line operations including efficient train-turnaround and management of disabled trains. From a passenger perspective, information about departing trains can be effectively provided should departure platforms change for operational reasons.

Option 2 is assumed to have a stacked platform configuration for the northern terminus station. This means that platforms at the station are located on two different levels. End-terminal operations with stacked platforms have operational challenges. A stacked configuration is not as versatile in its management of disabled trains and can affect train-turnaround times. Effective terminal management is critical for reliable service. From a passenger perspective, signage must direct passengers to the correct platform particularly if service patterns have been disrupted.

Detailed concepts for the terminal station will be developed post IBC with the aim of developing a design that provides for reliable operations and a comfortable transit user experience.

Project Delivery

Status of Design

The YNSE builds on initial work undertaken in 2008 and work currently underway to advance the project towards execution readiness.

The 2009 Environmental Project Report (EPR) for the YNSE Transit Project Assessment Process (TPAP) was prepared jointly by the Regional Municipality of York (York Region), York Region Rapid Transit Corporation (YRRTC), the Toronto Transit Commission (TTC), and the City of Toronto.

In keeping with typical practice for transit projects of this nature, the project was screened through the TPAP at a very early level of preliminary design, which was shared with the public at a series of public open houses.

Subsequent to the TPAP Notice of Completion, the TTC, in partnership with the City of Toronto, York Region, YRRTC and Metrolinx, procured design consultants to iterate the design work. The 15% design submission introduced adjustments to the EA scope to improve constructability. Some design changes were identified as necessitating an Addendum to the existing approved Environmental Project Report (EPR).

Over the past year following the transfer of project leadership to meet budgetary targets, Metrolinx has undertaken an options analysis exercise to develop alignment and station alternatives. Sufficient design was completed to allow for Class 5 costs estimates development for each of the options.

The Option 1 alignment has undergone a higher level of design than the others as it was the previously defined scope for the Transit Project Assessment Process and a Conceptual Design Report completed by the TTC. Options 2 and 3 have lower levels of conceptual design particularly were they vary from the Option 1 alignment. However, engineering work has been undertaken to understand the feasibility of all of the options.

Project and Program Dependencies

As an extension of Line 1, there are several interdependencies with the existing Line 1 infrastructure. Of note are capacity issues that have been identified with respect to Line 1 and station capacity at key interchange points.

The Ontario Line project has been identified as relieving downstream demand from Line 1. Previous analysis has indicated that a new subway line, such as the Ontario Line would have to be complete and open prior to the opening of an YNSE.

These project and program dependencies are common to each of the options under development.

Other Project Interfaces

The Highway 407 Transitway is a proposed rapid bus corridor running adjacent to Highway 407 from Brant Street in Burlington to Brock Road in Pickering. The infrastructure would provide for a grade separated busway alignment and a series of stations across the Region. Approval for the EA for the section through Richmond Hill Centre was received from the Ontario Minister of the Environment in February 2011.

The Environmental Assessment Report for the 407 Transitway included a conceptual design for a station that would allow for passenger interchange with the YNSE at Richmond Hill Centre. The design for a Richmond Hill Centre Station in Option 1 or a Bridge station in Option 2 or 3 would have to include provision for a future seamless connection with a Highway 407 Transitway. An interface with the Bridge Station might require minor modifications to the planned alignment to facilitate a connection with the YNSE bus facilities being in closer proximity to the Highway 407 Corridor.

GO Rail Richmond Hill Corridor

As previously noted, each of the Options has the potential to interface with the CN Rail corridor on which GO Transit's Richmond Hill service operates. It is anticipated that construction and operation of the YNSE would not have significant impact on the GO Rail operations.

A connection between the YNSE service and GO Rail's Langstaff Station would be established at the Richmond Hill Station in Option 1 and Bridge Station in Options 2 and 3. The level of any construction impact on Langstaff GO station to facilitate this connection would be determined during the detailed design phased.

Existing and Future Bus Operations at Richmond Hill Centre

As previously noted, Richmond Hill Centre is and will continue to be an important hub for bus operations. Notably, it will be the terminus and interface point for the Orange, Blue and Purple VIVA busways on Highway 7 and Yonge Street. The planned bus terminal to be located at Richmond Hill Centre Station (Option 1) or Bridge Station (Options 2 or 3) will have to accommodate the high volumes of buses and passengers that use these routes.

Richmond Hill Centre (or Bridge) Station will act as an important hub for VIVA/York Region Transit and GO Bus operations. The bus facilities must be designed to facilitate transfers between all services and provide the required facilities to support bus operations.

These requirements have been contemplated in the conceptual designs used for the IBC. Additional refinement of requirements will be advanced during the design development process.

TTC Maintenance and Storage Facility (MSF)

The TTC has identified the requirements for a large-scale MSF. This facility would be located on the east portion of the Line 1 Yonge –University Subway. This facility would balance maintenance and storage facilities across the line. It would improve operations, reduce non-revenue train movements and increase the overnight maintenance period.

Environmental Assessment

As noted previously the Transit Project Assessment Process (TPAP) for the YNSE was completed in in 2009. With the passage of time it is likely that an appropriate update to the TPAP would be undertaken to update key information.

The Environmental Project Report noted the presence of two designated heritage conservation districts along the corridor; specifically, the Vaughan Thornhill Heritage Conservation District and the Markham Thornhill Conservation District. There are additional listed properties along the corridor, with information available in the Environmental Assessment Report. Build Heritage and Cultural Heritage Locations will be considered during an update and through the design development and construction phases of the project.

Option 1 is consistent with the TPAP that was completed and would likely require the least amount of changes to update. Updates to account for any significant modifications to the project would be required and might include the East Don Crossing and any stations that were removed from the original approval. It would also require updated field studies to confirm existing conditions and potential impacts.

Options 2 and 3 would require more significant updates under the TPAP process as the approved alignment is being altered and the stations and their locations would be similarly changed. It is anticipated that the Option 3 would require the most significant Environmental Assessment work given that the proposed alignment has the potential to impact lands that were not included in previous evaluations.

Procurement and Delivery

The Yonge North Subway Extension project is an extension of the existing Line 1 subway, which TTC operates and maintains, and will therefore need to be fully compatible with the existing subway infrastructure. A Procurement Options Analysis will be undertaken to determine the optimal delivery option for the project, including consideration of public-private partnership (P3) models.

The P3 delivery model is a long-term contract between a private party and a government entity, for providing a public asset and service, in which the private party bears significant risk and management responsibility with remuneration linked to availability and performance-based incentives. There are five major mechanisms that drive the P3 value proposition:

1. Fixed Price, Performance-Based Contracts seek to protect the public from construction cost overruns and ensure that private partners execute on their contractual obligations; poor asset/service performance results in monetary deductions to the private partners.

2. Optimal Risk Allocation allocates risk based on the premise that the party which is best able to manage a given risk most efficiently, should assume that risk.

3. Integration of design, construction, and maintenance to enhance performance and residual asset value and performance resulting in savings associated with increased levels of competition and other efficiencies afforded through the private sector.

4. Private Financing provides access to capital and financing and imposes the discipline of the market and an additional layer of oversight on the project.

5. Innovation, the P3 model promotes private sector design innovation. The technical specifications are written as performance based, focused on customer experiences and technical outcomes. By relaxing specific constraints, the private sector can optimize its solution from a cost and deliverability perspective.

Through these mechanisms, the public sector can realize the benefits of the private partnership while retaining public control and ownership of the infrastructure being built and the functions it provides.

Constructability

This section highlights some of the unique characteristics of the options and stations under review. It provides a high level description of the different alignments between Royal Orchard Boulevard and High Tech Road as illustrated in Figure 1on page 9.

Alignment Option 1

This alignment runs under Yonge Street north of Royal Orchard Boulevard until veering east north of the contemplated Langstaff Station before terminating at RHC Station. It runs under Highway 407 and Highway 7 as well as the Hydro One corridor. After terminating at RHC, the alignment will portal from underground to surface to the CN/GO corridor. A portion of the required land for the High Tech Station is located within the CN Rail corridor and may require adjustment to the existing rail track alignment. It is possible to complete this section of the tunnel with a twin bore or single large bore tunnel approach.

Alignment Option 2

This alignment runs under Yonge Street north of Royal Orchard Boulevard until veering east north of the contemplated Langstaff Station. It varies slightly from Option 1 by creating a enough straight tangent section to allow for a station platform between Highways 7 and 407. The key consideration of this alignment is ensuring that the tunnel avoids structural elements of Highways 7 and 407. To achieve appropriate separation the tunnel must be sufficiently deep under the highway corridors. Additionally, consideration needs to be given to how to connect the station between the highways to the surrounding development. Pending further design, this may be achieved via underground pedestrian connections. This option is seen to carry increased cost and risk.

Alignment Option 3

This alignment notably deviates from Yonge Street north of the contemplated Royal Orchard station. The alignment passes under Kirk Drive and several low-density residential properties. To minimize the amount of construction under residential properties, the alignment will travel under Kirk Drive for as long as possible. The alignment will then veer north under a small section of the Holy Cross Cemetery as it passes to run on/adjacent to the CN/GO Rail Corridor. The alignment will portal from underground to surface through this section. The contemplated Bridge Station and any alignment/stations north of it would operate on the surface in the CN Rail Corridor. A portion of the required land for the alignment and Bridge and High Tech stations is located within the CN/GO Rail Corridor and may require adjustment to existing rail tracks.

The design of the tunnels will be such that it will mitigate any direct impact on the property or infrastructure above. Potential impacts and mitigations will be identified through the Transit Project Assessment Process and detailed design phases. The impacts that would have to be addressed would include noise and vibration during construction and operations.

Table 42: Constructability Overview for Potential New Stations

New Station	Construction Complexity	Rationale
Cummer	Medium Complexity	• bus facilities to a turning loop/driver facility located away from station • platforms to be located within Yonge Street ROW • adjacent area of transitioning street retail and higher density development.
Steeles	High Complexity	• station scope includes a significant off-street bus facility to be located within an emerging urban node • YNSE alignment and station are located above the York Durham Sanitary Sewer
Clark	Medium Complexity	• platforms to be located within Yonge Street ROW • three bay off street bus terminal station • Adjacent area of transitioning street retail and higher density development.
Royal Orchard	High Complexity	• platforms to be located within Yonge Street ROW • station located at significant depth due to proximity to East Don River Tributary, may warrant a mined approach to station construction
Langstaff (Option 1)	Medium Complexity	• platforms to be located within Yonge Street ROW • station site located adjacent and under Hydro One transmission corridor careful coordination required • scope includes commuter parking and off-street PPUDO • bus connections occur on-street minimizing bus facility requirements
Bridge- West (Option 2)	High Complexity	• platforms to be located in tunnel under the Highways 7 and 407. • station entrances would be built outside the highway corridors with below grade connections to the station platform level • significant bus terminal facility would be located spanning above the CN/GO Rail corridor
Bridge- Centre (Option 3)	Medium complexity	• platforms to be located at the grade of the CN/GO Rail corridor under the Highways 7 and 407. • station entrances would be built outside the corridor with connections to the station platform level • significant bus terminal facility would be located spanning above the CN/GO Rail corridor
Richmond Hill Centre Station (Option 1)	Medium Complexity	• significant bus terminal would be located above/adjacent subway alignment.
High Tech Station (Option 2)	Medium to High Complexity	• below grade station in tunnel • walk-in station – very limited or no bus facilities
High Tech station (Option 3)	Medium Complexity	• at-grade station adjacent to rail corridor • walk-in station – very limited or no bus facilities

Other YNSE Project Elements

Finch Station Modifications

A new underground triple box structure below Yonge Street (approximately 190m long x 20m wide, to be confirmed based on the Tunnel Design), and tying into the end of the existing tail track to form a double ended pocket track; is required to effectively link the existing subway to the proposed extension. This will allow for north bound trains to travel north into the extended alignment.

The modifications at Finch Station are expected to be limited to track areas and back of house areas. The integration of the extension will require careful coordination to ensure impacts on existing operations are minimized.

East Don River Crossings

Each of the concepts will require a crossing of the East Don River just north of Centre Street on Yonge Street. The Environmental Project Report and Conceptual Design Report contemplated the alignment coming out of a portal to cross tributary enclosed in a bridge structure. The roadway of Yonge Street would occur on a second level of the same structure.

The current design conceives lowering the depth of the tunnel to pass under the East Don River, leaving the existing culvert in place. The alignment of the tunnel(s) would briefly leave the alignment of Yonge Street in order to avoid interfering with the structural integrity of the existing culvert.

With a twin tunnel configuration as possible in Option 1 or required by Option 3 the tunnel alignments might go either side of the Yonge Street corridor. With the stacked tunnel configuration, possible in Option 1 and 2, the tunnel would divert to either the east or west of the corridor to achieve the crossing of the East Don River.

Highway 407

Coordination with the 407 ETR will be required for all Options to ensure that highway infrastructure is protected, and those operations are maintained. Options 2 and 3 will require additional coordination with respect to locating of a Bridge Station.

Train Storage and Maintenance and Facility (TSMF)

For the purpose of the Initial Business Case, a common approach to the TSMF facility has been included in all the options. An at-grade train storage facility would be established between High Tech Road and 16th Avenue on the CN rail corridor. Train storage for 12 train sets would occur at this location, with provision for two additional trains to be stored at northern terminus platform.

It is anticipated that the TSMF would include provision for light routine maintenance of trains being stored at the facility overnight. While the requirements have not been finalized, it is not anticipated that any heavy maintenance would occur at this location. Support buildings including driver facility have been identified as elements of the TSMF. Conceptual design has indicated the potential for the existing two tracks in this location to be maintained, plus provision for a possible additional future track. As design progresses, adjustment to the alignment of CN Rail tracks may be required. CN will be included in the consultation required for design development.

Detailed design will be required to finalize the concept for the TSMF and to identify potential environmental impacts (including noise and vibration) that will need to be mitigated.

Working with stakeholders, additional work will be undertaken to confirm TSMF requirements from a Line 1 perspective.

Protection for Future Extension of the Line

The alignment options have been conceptually developed to allow for a future extension to Line 1 to the north of the Richmond Hill Centre area terminus for revenue or non-revenue purposes. Further work on the requirements will be completed through the design development process.

Appendix 1

Preliminary Stations Analysis

METROLINX

Background

The Pre- Benefits Cost Ratio (Pre-BCR) and Pre-Net Present Value (Pre-NPV) provide an early opportunity to compare forecasted lifecycle project (and its components, in this case a station) benefits against costs, in advance of the more detailed cost-benefit analysis that supports an initial business case (IBC). The Pre-BCR and Pre-NPV is fully rooted in the Metrolinx's Business Case Guidance but focuses on a subset of the benefits that would be included in a benefit cost ratio (BCR) that is generated as part of a business case. As shown in the table below, the Pre-BCR and Pre-NPV are focused on the core travel time savings associated with each station.

Based on a 2020 review of approximately 70 business case options, it is estimated that travel time savings captures approximately 60 percent of overall benefits. As such, a multiplier was applied to determine an approximation of all other benefits, including external benefits from reductions in automobile use.

In terms of costs, the Pre-BCR and Pre-NPV consider only station-level estimates of capital costs, including construction, rehabilitation, and operations and maintenance costs over the project's lifecycle. Recognizing there are limitations to reviewing station-only costs (for example, crew and administration, power, vehicle and track costs are not included), the Pre-BCR and Pre-NPV's primary purpose as early indicators is to compare stations relative to each other and their performance.

The travel time savings, and transfer savings are derived from Greater Golden Horseshoe Model (GGHM) outputs jurisdictions. Further detail on the analysis assumptions can be found in Table 1.

Table 1: Stations Analysis - Preliminary Benefit Cost Ratio (Pre-BCR) vs. Benefit Cost Ratio (BCR)

	Preliminary Analysis (Pre-BCR and Pre-NPV)	**Initial Business Case (BCR and NPV)**
BENEFITS		
Travel Time Savings (In-Vehicle, Wait, Access/Egress Time)	✓	✓
Reduction in Transfers	✓	✓
Reliability	*Proxy Applied*	✓
Road Safety*		✓
Decongestion*		✓
Auto Operating Cost Savings*		✓
GHG Emission*		✓
COSTS		
Lifecycle Capex (Rehab, Rolling Stock)	*Station-Only*	✓
Operating & Maintenance	*Station-Only*	✓
Capital	*Station-Only*	✓
RESOURCE COST ADJUSTMENTS		
Incremental Fare Revenue Adjustment	*Included in Proxy*	✓

Further considerations

It is important to note the following:

- The modelling work to inform the preliminary analysis are based on modelling work that predates the IBC model runs mentioned in the business case. Headways and speeds were refined for the IBC.
- The analysis does not consider impacts along the entire line.
- Estimates of new user related benefits in this station analysis are based on a global-adjustment, and not necessarily reflective of station-specific behaviours with regards to new users.
- Assumes Kiss-and-Ride and Park-and-Ride users have net 0 travel time impacts.
- Construction period from 2024 to 2030, with an opening year of 2030.

Neighbourhood Stations Analysis

For Clark, Cummer and Royal Orchard Stations, the evaluation examined how each station would perform if implemented in the network (that is, in) relative to the Business as Usual if the station did not exist (that is, out). The following was considered:

- **Travel Time Benefits:** are the incremental travel time impacts to users who travel to the proposed station (Wait, In vehicle, Transfer) relative to the BAU, if the station did not exist, and users would have to use bus, other nearby stations, etc. Also considered are the upstream travel time disbenefits for existing users who wait at the proposed station, relative to the BAU where if it did not exist, the subway would not be required to stop. This considers all Boardings and alightings.

- **Other Benefits:** Applying the multiplier, accounts for all other benefits, including those from potential new users.

- **Costs:** are the incremental capital costs for the construction period, and the operating & maintenance for station components only. This includes bus loops, terminals etc. where identified. Please note, costs vary based on tunnelling technology, and both are represented in the tables below.

Table 2: Summarizing the South Stations Analysis: **Twin Bore Technology Assumed**

Impact Type	Cummer	Clark	Royal Orchard
Total Benefits ($2020, PV)	**$329.8 M**	**$396.4 M**	**$186.6 M**
Travel Time Benefits	$197.5 M	$237.4 M	$111.7 M
All Other Benefits	$132.3 M	$159.0 M	$74.8 M
Total Station Costs ($2020, PV)	**$188.3 M to $444.8 M**	**$179 M to $418 M**	**$233.5 M to $524.2 M**
Capital Costs	$166.8 M to $423.3 M	$156.3 M to $395.2 M	$191.9 M to $482.6 M
Operating Costs	$21.5 M	$22.8 M	$41.6 M
Pre- Net Present Value ($2020, NPV)	$-115.1 M to $141.4 M	$-21.6 M to $217.4 M	$-337.8 M to $-47.2 M
Pre- Benefit-Cost Ratio (BCR)	**0.74 to 1.74**	**0.95 to 2.21**	**0.36 to 0.8**
Expected Pre-BCR	**1.04**	**1.33**	**0.49**

Table 3: Summarizing the South Stations Analysis: **Large Single Bore Technology Assumed**

Impact Type	Cummer	Clark	Royal Orchard
Total Benefits ($2020, PV)	**$329.8 M**	**$396.4 M**	**$186.6 M**
Travel Time Benefits	$197.5 M	$237.4 M	$111.7 M
All Other Benefits	$132.3 M	$159.0 M	$74.8 M
Total Station Costs ($2020, PV)	**$157.5 M to $364.5 M**	**$163.4 M to $380.3 M**	**$217 M to $484.6 M**
Capital Costs	$136 M to $343 M	$140.6 M to $357.6 M	$175.4 M to $443 M
Operating Costs	$21.5 M	$22.8 M	$41.6 M
Pre- Net Present Value ($2020, NPV)	**$-34.7 M to $172.3 M**	**$16.1 M to $233.1 M**	**$-298.2 M to $-30.6 M**
Pre- Benefit-Cost Ratio (BCR)	**0.9 to 2.09**	**1.04 to 2.42**	**0.38 to 0.86**
Expected Pre-BCR	**1.26**	**1.46**	**0.53**

Richmond Hill Centre/Langstaff Gateway Stations Analysis

For Bridge and High Tech stations, both stations were incremental to a BAU, representative of Option 1 in the IBC. The analysis examined two options:

- **Option 1:** How would Bridge perform if it replaces the BAU that is, Langstaff and Richmond Hill Stations?
- **Option 2:** How would Bridge and High Tech perform if it replaces the Business as Usual, that is, Langstaff and Richmond Hill Stations?

The following was considered:

- **Travel Time Benefits:** Are the incremental travel time impacts to users who travel to the proposed station(s) (Wait, In vehicle, Transfer) relative to the BAU with Langstaff and Richmond Hill stations instead? This considers all boardings and alightings.
- **Other Benefits:** Applying the multiplier, accounts for all other benefits, including those from potential new users.
- **Costs:** Are the incremental capital costs for the construction period and the operations and maintenance for station components only? This includes bus loops, terminals etc., where identified. Please note, costs vary based on tunnelling technology, and whether the stations are above- versus below- ground; both are represented in the tables below.

Table 4: Summarizing the North Stations Analysis: **Underground Stations, Large Single Bore Technology Assumed**

Impact Type	Bridge	Bridge & High Tech
Total Benefits ($2020, PV)	**$-243.0 M**	**$-127.5 M**
Travel Time Benefits	$-145.5 M	$-76.3 M
All Other Benefits	$-97.5 M	$-51.1 M
Total Station Costs ($2020, PV)	**$-218.9 M**	**$69.2 M**
Capital Costs	$-160.0 M	$76.3 M
Operating Costs	$-58.9 M	$-7.0 M
Pre- Net Present Value ($2020, NPV)	**$-24.1 M**	**$-196.7 M**

Table 5: Summarizing the North Stations Analysis: **Aboveground Stations, Twin Bore Technology Assumed**

Impact Type	Bridge	Bridge & High Tech
Total Benefits ($2020, PV)	**$-243.0 M**	**$-127.5 M**
Travel Time Benefits	$-145.5 M	$-76.3 M
All Other Benefits	$-97.5 M	$-51.1 M
Total Station Costs ($2020, PV)	**$-684.1 M**	**$-479.2 M**
Capital Costs	$-590.7 M	$-385.8 M
Operating Costs	$-93.5 M	$-93.5 M
Pre- Net Present Value ($2020, NPV)	**$441.2 M**	**$351.8 M**

Preliminary Findings

Neighbourhood Stations Analysis

- **Clark Station** performs the best relative to Cummer and Royal Orchard station, where the expected Pre-BCRs indicate benefits exceeds the costs regardless of tunneling methods.
- **Cummer Station** performs well also**,** where the expected Pre-BCRs indicate benefits exceed the costs regardless of tunneling technology.
- **Royal Orchard Station** does not perform as well as the other stations, and in all circumstances, the costs far outweigh the benefits to the station.

Richmond Hill Centre/Langstaff Gateway Stations Analysis

- **Bridge Station** the cost savings to build and operate this one station, (versus Langstaff and Richmond Hill Stations) outweighs the disbenefits to the users who would travel to the station, under the twin bore option. The disbenefits to the users marginally outweigh the savings under large single bore method.
- **Bridge and High Tech stations:** With the introduction of High Tech station to this option in addition to Bridge, users are disbenefited less than the Bridge only option. There are incremental costs under the large single bore option (versus Langstaff and Richmond Hill Stations), whilst there are incremental savings under the twin bore method.