VAUGHAN

memorandum

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Item # 28
Report No. 27 (CW)
Council - June 28, 2016

DATE: JUNE 27, 2016

TO: HONOURABLE MAYOR & MEMBERS OF COUNCIL

FROM: JOHN MACKENZIE, DEPUTY CITY MANAGER PLANNING & GROWTH MANAGEMENT

RE: COMMUNICATION – COUNCIL MEETING, JUNE 28, 2016

ITEM NO. 28, REPORT NO. 27, COMMITTEE OF THE WHOLE – JUNE 21, 2016
METROLINX REGIONAL EXPRESS RAIL – BARRIE RAIL CORRIDOR EXPANSION UPDATE CITY-WIDE

Recommendation

The Deputy City Manager, Planning & Growth Management recommends:

1. THAT Council formally requests that Metrolinx and the Region of York support efforts to improve the strategic, economic, financial and operations case for the Highway 7 – Concord station through the Concord GO Centre Mobility Hub and Transportation studies, in support of the later inclusion of the Highway 7 – Concord station in the GO RER 10 Year program or in a subsequent implementation phase;

2. THAT Council formally requests that Metrolinx and the Region of York support efforts to advance the implementation of Kirby station;

3. THAT Metrolinx be requested to implement a comprehensive communication plan for RER Implementation in consultation with City staff which may include public meetings;

4. THAT Council formally request that Metrolinx and the Region of York work with City Staff to identify immediate short term Station Parking and Access solutions at the Rutherford and Maple GO stations to address current parking and station access pressure; and

5. THAT Metrolinx and the Region be requested to include consideration for additional grade separation crossings on Vaughan roads, specifically, McNaughton, Rivermede and Kirby Road, as part of RER implementation.

Background and Analysis

Metrolinx staff released a series of documents on June 21, 2016, regarding the GO Regional Express Rail Update. The Metrolinx Board will consider the recommendations contained in these reports on June 28, 2016.

The recommendations are beneficial and of significant interest to the City of Vaughan because they will influence growth, land use and transportation decisions for the next ten years and beyond. The recommendations have implications for the planning of the New Communities areas and the City of Vaughan Municipal Comprehensive Review (MCR).

The Metrolinx reports provided an update on the progress made toward meeting the ten year GO Regional Express Rail commitment to system improvement in terms of the advancement of infrastructure planning, public engagement and station access; and they make multiple recommendations on new stations and the integration of the City of Toronto SmartTrack concept into the GO RER program.

Also included in the RER Planning Update package are:
Appendix 1: Station Access
Appendix 2: New Stations Analysis
Appendix 3: Regional Express Rail – Smart Track Business Case
Appendix 4: Enhanced Eglinton West Rapid Transit Initial Business Case

In the reports, Metrolinx acknowledges the significant role it has in addressing future regional transportation needs. Since the reports were issued, a number of new stations in the City of Toronto, the Region of York, Durham and County of Simcoe have been formally announced.

Metrolinx endorses a new station at Kirby Road and at Mulock Drive

Metrolinx staff have completed the New Stations Analysis study and have recommended two stations in York Region, both of which are on the Barrie GO Corridor. The new stations are Kirby (Vaughan - near the intersection of Kirby Road and Keele Street) and Mulock (Newmarket – near the intersection of Mulock Drive and Bayview Avenue).

These stations have been previously identified in the York Region 2016 Transportation Master Plan (TMP) update. The Kirby Station is also a focus for the Block 27 New Community Secondary Plan Study, the North Vaughan Transportation Master Plan and the City's Kirby GO Station Sub-Study.

Staff acknowledges Metrolinx's efforts to address the City of Vaughan and York Region requests and its recognition of previous planning work undertaken by the City to identify the land use/transit potential of the Kirby and Concord sites along with the need to enhance connections to the GO rail network. Staff is in support of the recommended new station at Kirby Road. In 2015 the City entered into a Memorandum of Cooperation with Metrolinx and the Block 27 Landowners Group Inc. (Block 27 LG) to advance the station. The City will now begin more detailed discussions with the Block 27 LG and Metrolinx and is encouraging the Region to be a Party to this effort.

Proposed Concord GO station requires further review

Notwithstanding Metrolinx's consultation to date with York Region and local municipal staff, some of the needed stations in York Region on the Barrie and Stouffville corridors did not achieve a positive result through the Refining of the List of potential station locations or in the Initial Business Case analysis. These locations include:

- Concord – Vaughan, Highway 7 east of Keele Street
- Denison/14th Avenue – Markham, Denison Street/14th Avenue east of Kennedy Road
- Major Mackenzie – Markham, Major Mackenzie Drive east of Markham Road

While the Concord GO Station in Vaughan did not achieve as positive a result as Kirby, Staff are encouraged by Metrolinx's recommendation 1.3, which advises they will continue to collaborate to improve the Initial Business Cases for stations, including the proposed Concord station, and bring them forward to the Metrolinx Board for future consideration. Staff look forward to these discussions with Metrolinx and the opportunity to inform the New Station Analysis. A Project Manager in Policy Planning has been assigned to this project to support the preparation of a more detailed Concord GO Centre Mobility Hub Study, which will result in an amendment to the current Secondary Plan. However, additional City staff resources in other departments may be required for work in support of the overall RER initiative including planning around stations.

The case for the Highway 7 – Concord Station will be further developed and refined through the Mobility Hub study. As it currently stands, the planning approvals around the Highway 7 – Concord Station can support a population of up to 8,000 people and approximately 10,000 jobs at build-out. Another feature of

this potential station is its outstanding connectivity. It will be directly linked to the Viva Bus Rapid Transit System on Highway 7 and to the future Highway 407 Transitway. It also has excellent connections that will allow persons boarding at this station to connect to the Spadina Subway Line at Downsview Park and depending on the Barrie line links approved to the south, to the Eglinton Crosstown LRT and the Bloor Danforth Subway Line. This connectivity provides local commuters with an excellent range of transit options, thereby enhancing its attractiveness both as a place of residence and as a place of business. It also supports our Economic Development Strategy by providing an alternative transit route into the nearby (3.5 km) Vaughan Metropolitan Centre from the north and the south, by way of the Viva BRT. The Mobility Hub Study will build on this foundation.

The GO Rail Parking and Station Access Plan is under development and is scheduled for final adoption by Metrolinx Board in December 2016

Metrolinx is underway on a study of existing GO Rail station parking facilities and requirements and station access. The recommendations of this study are critical to the success of Regional Express Rail and directly affect the capacity and operations of the Regional transit and road systems.

The study is considering a range of station access options, including improvements to active transportation, local transit, pick up and drop off (including on-demand services), parking and customer information.

The results of this study will directly benefit and impact Vaughan residents and inform land use around GO stations. Station access and parking concerns were a focus for discussion at the recent Committee of the Whole meeting, from the perspective of various departments, and staff will continue to monitor and provide input on these reports as they come forward. Staff is facilitating remote parking at Maple station and will be working with the Region to improve infrastructure around stations including grade separations and upgrades for Rutherford Road and Major Mackenzie Drive.

In addition, staff have reviewed early Metrolinx work on proposed grade separations including those near existing and planned stations and are of the view that additional separations may need to be considered by Metrolinx as part of RER initiative particularly at McNaughton, Rivermede and Kirby, in Concord near Oster Lane and in Block 27. Staff will continue to work with the Region to communicate these concerns to Metrolinx.

A Draft Discussion Paper for the Next Regional Transportation Plan Has Been Released

A Draft Discussion of the next Regional Transportation Plan has been released for stakeholder input. The Discussion Paper for the next Regional Transportation Plan describes Metrolinx's review of The Big Move Regional Transportation Plan, including extensive technical analysis and background research, as well as consideration of lessons learned and stakeholder feedback.

The intent of the Discussion Paper is to spark a dialogue with stakeholders and the public on the future of mobility in the region over the long-term (to 2041). The City of Vaughan previously provided a report and several recommendations to the Province in January of 2013. In addition, City staff have met with Metrolinx staff including recently at the City of Vaughan offices on June 9, 2016 to provide input to inform the Metrolinx staff report and draft document. Comments are due in October 2016 and staff will review the report and provide advice and recommendations for consideration at a future Committee meeting.

Concerns with Planned Works Around Maple and Rutherford GO Stations and Communications with Residents

During the discussion at the Committee of the Whole meeting, concerns were expressed over the nature and extent of the planned works within and around the Maple and Rutherford GO stations. Councillors requested more details on planned communications with stakeholders including nearby residents.

Particular interest was expressed regarding noise mitigation and the potential for impacts to vegetation on the west side of the Barrie GO Rail Corridor near residential streets north of Major Mackenzie Drive.

Station work at the Maple GO station is critical to Metrolinx's ability to offer the interim increased levels of service at the Maple station that have been committed to, while the infrastructure to support 15 minute, two-way electrified service is built. The City has provided permits for permission to enter at both Maple and Rutherford stations so that staging and works can begin at the earliest opportunity as the works are foundational to being able to offer this increased service.

Through discussions with Metrolinx staff, since the Committee meeting, City staff have been able to confirm that the tunneling work and the equipment to support that work will only disrupt the side of the berm that faces the rail corridor. The work zone will not disrupt the fence that currently separates the existing residential development from the rail corridor or the trees/greenery between the fence and Lindenshire Avenue.

Understanding residents' concerns about the impact on the green space in the midst of the development and construction in the area, Metrolinx has committed to working with the City of Vaughan to see how trees and greenery can be protected and enhanced. This may include engaging a landscape architect and providing for an examination of the potential for transplanting mature trees along the Lindenshire Avenue side of the berm as part of the project. For any trees that are impacted, Metrolinx is committing to replanting at a 3 to 1 ratio outside the clearance that is needed along the rail corridor. Noting the concerns and interest of Council members, more detailed discussion on this matter will be required.

The City has received numerous concerns from residents regarding the current shortage of parking at the Rutherford GO station and extensive delay going to and from the station. While the City realizes plans are underway to expand the station and parking, there is a need to address the immediate concerns; especially when tunneling and station work begin this summer and more parking spaces are displaced. Joint efforts from Metrolinx, York Region and the City will be needed to find immediate and/or temporary solutions. Similar concerns exist for Maple station and a remote parking lot is currently being reviewed by staff to the north and east of the Maple station.

Conclusion

As a result of new information emerging from the Metrolinx RER process, it is recommended that, in addition to the recommendations of Item No. 28, Report 27 of Committee of the Whole – June 21, 2016, "Metrolinx Regional Express Rail – Barrie Corridor Expansion Update City-Wide", the recommendations set out in this memorandum also be approved.

Attachments

Metrolinx Appendix 1: Station Access
Metrolinx Appendix 2: New Stations Analysis
Metrolinx Appendix 3: Regional Express Rail – Smart Track Business Case
Metrolinx Appendix 4: Enhanced Eglinton West Rapid Transit Initial Business Case

Respectfully submitted,

JOHN MACKENZIE
Deputy City Manager,
Planning and Growth Management

Appendix 1: GO Rail Parking and Station Access Plan Update

Executive Summary

Metrolinx is currently updating its 2013 GO Rail Parking and Station Access Plan, as station access is critical to the success of Regional Express Rail (RER). Increased GO service needs to be supported by easy and convenient station access solutions in order to be successful. Sufficient and more sustainable station access and egress along with a reduced reliance on parking is critical to meeting GO RER ridership forecasts and provincial, Metrolinx, and municipal policies.

A Business Case Assessment (BCA) is being used to evaluate the impact of station access interventions at the network, corridor, and station-specific level in three scenarios: Business-As-Usual, Incremental Change, and Big Changes and Partnerships. This will help determine the preferred approach to meet the needs of current and future GO riders. A range of station access interventions are being evaluated, including improvements to active transportation, local transit, pick up and drop off (including on-demand services[1]), parking, and customer information.

Timelines and Next Steps

This appendix provides an update on the progress to date and the scenarios being evaluated as part of the RER update. The assessment of benefits and impacts of each station access scenario is being finalized and a preferred scenario will be optimized. The optimized scenario should provide direction on the priority station access capital investments to the Capital Projects Group in the short and medium term to inform their procurement and station design work and meet current demands without precluding the success of long term station access interventions.

A draft of the updated Plan document will be shared with internal and external stakeholders for review. A revised draft plan will be presented the Board of Directors in September and following their feedback and further refinement and stakeholder review, the final plan will be presented to the Board in December for adoption.

[1] On-demand services refers to range of current (e.g. taxi) and emerging ride-haul (e.g. Uber), dynamic carpooling, micro-transit services and technologies (e.g. autonomous vehicles).

1.0 Updating the 2013 GO Rail Parking and Station Access Plan

In 2013, Metrolinx released a GO Rail Parking and Station Access Plan, which included a vision and guiding principles for parking and station access, a policy statement and decision-making framework, strategies for new parking at a corridor-wide and station level and high level implementation plan. To date, it has been used to guide parking expansion and, to a more limited extent, other station access improvements at GO stations. The Plan gives station programmatic direction for each station, such parking expansion numbers, whether it is surface or structure, timeframe for implementation, etc.

Metrolinx is currently updating the Plan to:

- Assess impacts of GO Regional Express Rail (RER) on station access.
- Analyse station access mode use and potential.
- Identify station access investments to support GO RER.
- Develop strategies to operationalize station access policies.

2.0 The Importance of Station Access to RER Success

The "first mile" and "last mile" is how riders connect to and from GO, using a wide range of travel modes.

Walking
Includes walking & personal accessibility devises

Cycling
Includes cycling & bike-share

Transit
Includes municipal transit, para-transit, micro-transit and GO Bus

Pick-up & Drop-off
Private and autonomous vehicles and on-demand services such as taxis, ride-share, ride-haul services

Parking
Includes carpooling, car-sharing, EV parking, reserved parking & two-wheeler parking

Figure 1: Station access modes being considered in the Station Access Plan Update.

How we design stations should be guided by both the way riders travel today and our goals for growing use of more sustainable modes in the future. The Big Move provides the following direction on this:

- ***Goal A.*** Transportation Choices (Objective 1) Increased transportation options for accessing a range of destinations.
- ***Goal B.*** Comfort and Convenience (Objective 6) Improved information, including real-time information, available to people to plan their trips.
- ***Goal C.*** Active and Healthy Lifestyles (Objective 8) Increased share of trips by walking and cycling.
- ***Goal G.*** Reduced Dependence on Non-Renewable Resources (Objective 16) Increased proportion of trips taken by transit, walking and cycling.
- ***Goal L.*** Efficiency and Effectiveness (Objective 31) Increased productivity of the transportation system.
- ***Goal M.*** Fiscal Sustainability (Objective 36) Fair and effective fiscal treatment of various modes that better reflects the cost of transportation services in the prices paid by users.

While we need to invest to support all travel modes, we should prioritize those needed to serve the most riders while shifting towards more sustainable modes. Growing GO ridership by providing free parking is in conflict with the direction provided by The Big Move and the Growth Plan for the Greater Golden Horseshoe and is not financially or environmentally sustainable:

- Subsidizing and not managing parking demand makes other modes uncompetitive with driving.
- Local transit cannot compete without improving transit priority on station sites and surrounding municipal roads, addressing discrepancies in service frequency, and aligning schedules.
- Existing traffic congestion around stations makes growing the use of auto-oriented modes challenging and further highlights the need for transit priority measures.
- Expanding parking at GO stations at current rates is not in alignment with Provincial and municipal intensification policies around transit.
- Walking and cycling facilities and connections around stations need to be improved to address comfort and safety concerns.
- Increasing parking does not provide an effective solution for many off-peak riders.

Increased GO service does not help riders if they cannot connect to the service. Sufficient station access and egress is critical to meeting RER ridership forecasts, as the forecasts assume unrestricted access, that is, customers could get to the station by their preferred travel mode (e.g. unhampered by limited parking). We need to rapidly grow use of other travel modes to serve the forecasted GO ridership, if planned parking expansion remains at levels set by the 2013 GO Rail Parking and Station Access Plan.

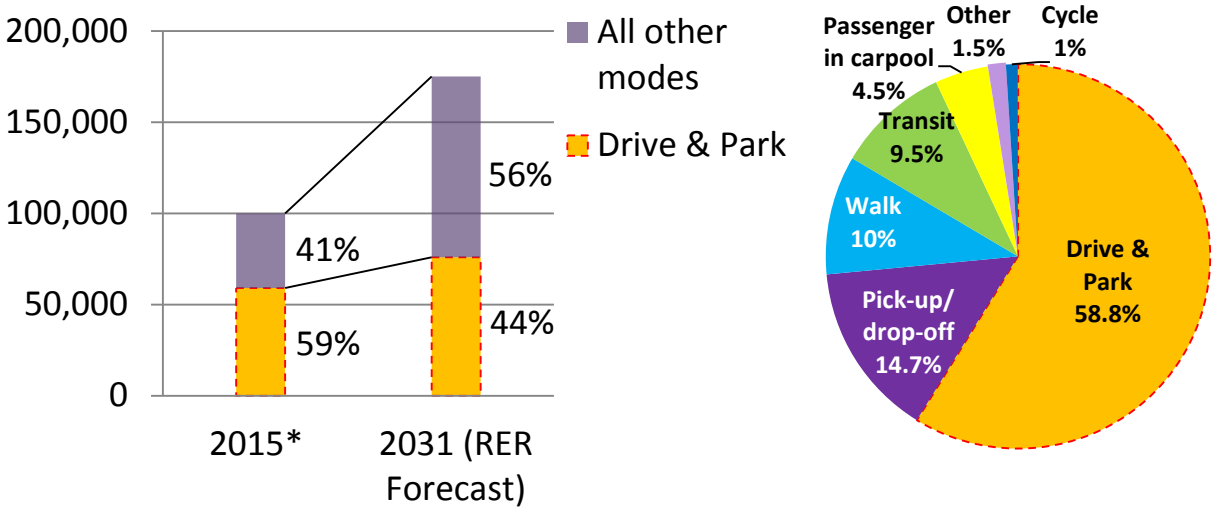


Figure 2: LEFT - Average weekday peak direction boardings (excluding Union) showing how other travel mode use will need to grow to meet ridership forecasts, if planned parking expansion remains at levels set by the 2013 GO Rail Parking and Station Access Plan. RIGHT - Riders travelling to GO stations by mode
* Source: 2015 Cordon Count & 2015 GO Rail Passenger Survey

2.0 Station Access Scenarios

Following a background review period, where we engaged internal and municipal stakeholders and conducted research on various travel modes, we initiated a Business Case Assessment (BCA). The BCA is evaluating the impact of station access interventions at the network, corridor, and station-specific level in three scenarios to determine the preferred approach to meet the needs of current and future GO riders.

1. Business-As-Usual
2. Incremental Change
3. Big Changes and Partnerships

The BCA will identify which scenarios maximize ridership and it is yet to be determined if any scenario can meet unhindered ridership forecasts. The BCA is taking a conservative, realistic approach for each scenario.

2.1 Business-As-Usual - *Prioritize long term parking expansion while nominally supporting other modes.*

This scenario is intended to evaluate the impact of significant parking growth (approximately 25-30k more spaces across the network) mostly through structures (in particular, along the Barrie and Stouffville corridors) with some improvements for walking, cycling, transit, etc. (e.g. pedestrian routes and plazas in key locations, bike parking and routes, bus loops/terminals on GO sites, etc.). The impact of station access trips on the surrounding road networks and

communities would be significantly greater than it is today and the operating costs of maintaining stations would grow significantly with the addition of large parking facilities (e.g. $150-200 per space per year, not including preventative maintenance). Metrolinx is encountering increasing resistance from municipalities to new parking structures, and there are diminishing mitigation options.

This scenario is somewhat easy to deliver, however, because:

- the GO RER budget provides access to capital investment dollars
- Metrolinx staff are well equipped to deliver and maintain more parking, and
- most of the station access interventions are with Metrolinx lands and control
- it meets existing GO customer expectations of free parking supply

As well, by concentrating parking in structures there would be more opportunities to redevelop, lease, or sell surplus station lands.

2.2 Incremental Change - *Limit parking expansion and incrementally shift focus to growing other modes.*

This scenario is intended to evaluate the impact of modest parking growth (approximately 12-15k more spaces across the network) mostly through surface and leased options, and substantial improvements to facilities for walking, cycling, and transit (e.g. comfortable, attractive pedestrian routes and new bridges, transit priority lanes, secure bike parking, etc.) It aggressively grows carpool and reserve parking and expands the co-fare subsidy to all GO stations in the absence of fare integration and subsidize micro transit and other ride-haul services. The impact of station access trips on the surrounding road network and community would remain high. The costs of maintaining GO stations would grow at a lower rate than Business-As-Usual and could be offset by increase in reserved parking revenues. This scenario would require cooperation and consensus building across a wide range of public and private stakeholders to make the improvements to facilities and services that are not completely within Metrolinx control and would increase operating costs associated with these new facilities and services.

2.3 Big Changes and Partnerships - *Restrict parking expansion and aggressively shift the focus to growing other modes.*

This scenario was intended to evaluate the impact of limited parking growth (approximately 5-7k more spaces across the network) mostly through leased options and assumes new parking management measures across the network to incent use of other modes, which are given priority. The impact of station access trips on the surrounding road network and community would be curtailed. The costs of maintaining GO stations will grow at a significantly lower rate than the other two scenarios.

Similar to the Incremental Change scenario, this scenario would also require increased allocation of operating resources and alignment across all levels of government and high degree of coordination across wide range of public and private stakeholders, given its reliance on

potential new funding models that may be required to direct investment in municipal infrastructure and to improve local transit service.

2.4 Scenarios Summary

The three distinct scenarios have been chosen for comparison purposes. Each scenario represents a position on a continuum of the pace of change, the amount and type of interventions, how much it will cost to build and maintain, how easy it is to deliver, and how it strategically meets Provincial, Metrolinx, and municipal policy. However, each scenario addresses the individual station context; so for example, the Business-As-Usual Scenario does not propose a blanket expansion of parking across the network, such as at urban stations where there is no existing parking. The scenarios evaluation helps define which broad direction Metrolinx should choose, but the preferred one needs to be optimized and refined by station to address the local context and any gaps. While the scenarios are still being evaluated using the Business Case Assessment tool, the following is a preliminary qualitative evaluation to identify key risks and rewards associated with each scenario.

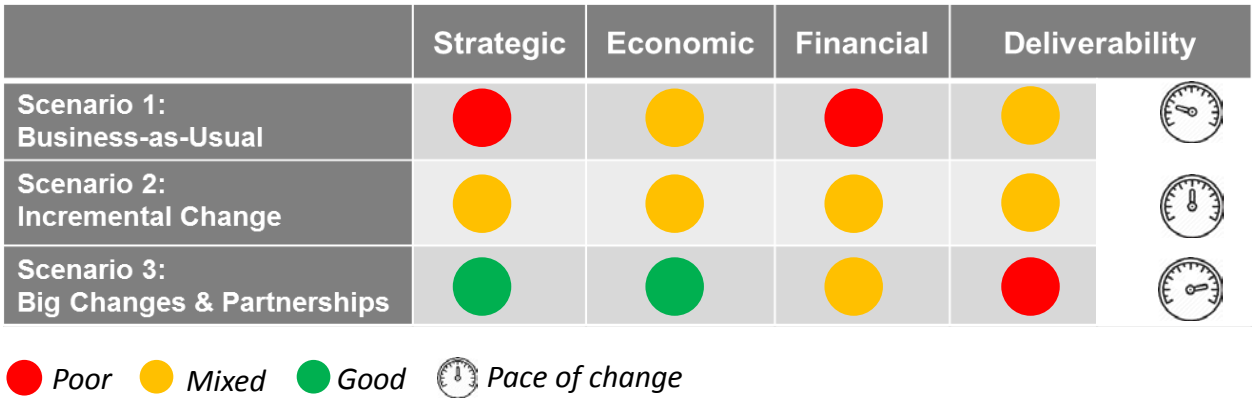


Figure 3: Preliminary summary Business Case Assessment of the three scenarios being evaluated

3.0 Station Access Interventions

The station access interventions being evaluated in the three business case scenarios are described below.

3.1 Active Transportation Interventions

Adding multi-use paths, sidewalks, pedestrian bridges and tunnels on the station site and/or on adjacent municipal lands improves and increase access to the station by foot or bike. For example, in strategic locations at some stations, a bridge or tunnel across rail corridors, at grade separations along the rail corridors or other major barriers (e.g. highway corridors) significantly expand the walkshed (the area within approximately 800m or a 10 minute walk to the station). Continuing to provide sheltered bike racks and adding secure bike parking and repair rooms makes it more attractive to ride a personal bike to the station. Providing bike

share bikes in and around GO stations encourages more customers ride to and from GO without having to use their own bike and offers the flexibility of using different modes for different legs of a trip (e.g. bike share to the station in the morning but take local transit home in the evening). Furthermore, bike share provides a compelling last-mile solution at a number of stations for passengers to travel to their destination from the station.

Figure 4: LEFT - The GO Pickering pedestrian bridge spans Highway 401 and the Lakeshore East Rail Corridor. RIGHT - secure bike parking in a Washington D.C. Metro parking structure

3.2 Local Transit Interventions

Providing facilities such as customer waiting areas, bus bays, bus loops, priority access lanes, and operator facilities allows transit agencies to provide better service and gives customers using transit an improved experience, with purpose-built facilities catered to them and faster access/egress into the station. A number of our stations have some or all of these facilities, but there are a number of places where they can be improved and expanded. Priority access over other vehicles is the number one request we hear from local transit providers to help them get customers quickly into the station.

Locating the bus stops close to the platform access points helps shorten time and distances for customers when transferring between services. On the surrounding municipal road network, transit priority measures, such as transit signals, transit-only lanes etc. helps bus riders bypass traffic congestion. Increasing the frequency of service and improving scheduling alignment on routes that are high use, and/or have the potential to be high use, enhances the attractiveness of transit to GO as on option for customers, as it reduces their wait times.

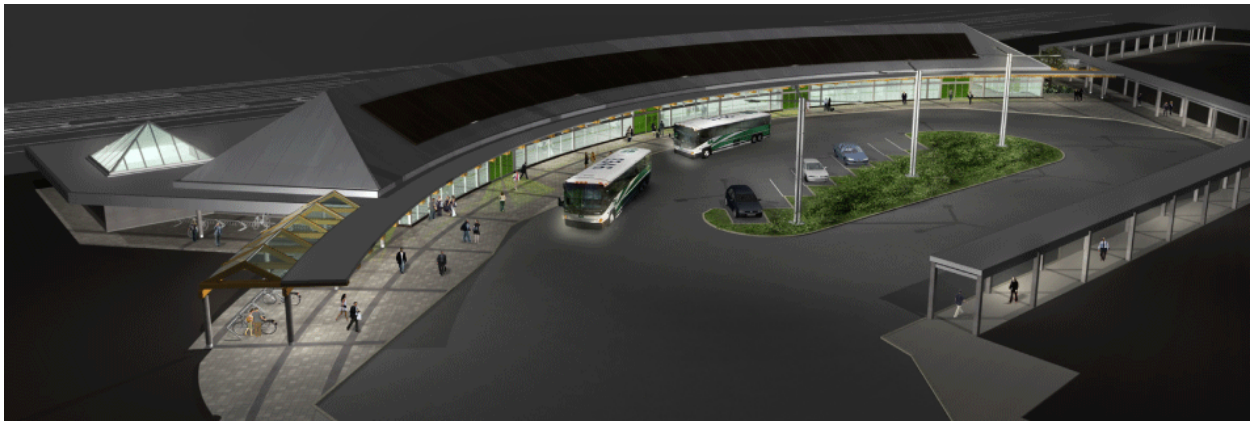


Figure 5: Rendering of new bus loop under construction at Burlington GO station for local and GO Transit

3.3 Pick-up/Drop-off Interventions

Continuing to provide pick-up and drop-off (PUDO) facilities close to the station building and platform access, particularly with dedicated access lanes from the municipal road network, helps customers get to their trains faster if being dropped off by private vehicle and the growing/emerging market of on demand services[2]. The analysis completed indicates that there is demand for expanded facilities at the following GO stations: Allandale Waterfront, Newmarket, Guelph, Etobicoke North, Erindale, Mimico, Rouge Hill, Pickering, Ajax, Agincourt, Milliken, Unionville, Centennial, Markham, Oriole and Richmond Hill.

In addition to the current queuing style of PUDO facilities, short term parking (e.g. 10 minute limit) provides another alternative for customers using PUDO at peak times when the high frequency of trains means the conventional PUDO may result in people being delayed in queue.

Figure 6: LEFT – Current qeueing-style of PUDO with taxi lane at Oakville GO/VIA Station. RIGHT – Short term parking style of PUDO at Kipling TTC east station entrance.

[2] On-demand services refers to range of current (e.g. taxi) and emerging ride-haul (e.g. Uber), dynamic carpooling, micro-transit services and technologies (e.g. autonomous vehicles).

3.4 Parking

Managing parking provides a range of options for customers who drive and park and helps make the other access modes more competitive. This includes expanding the proportion of parking that is reserved, so regular customers who are willing to pay have greater certainty on parking availability. Likewise, expanding the amount of carpool parking provides more carpooling customers certainty of a parking space, and a priority location close to the platform.

Figure 7: GO Transit offers carpool parking at almost every station where there is GO parking.

Cordoning off some parking during the peak morning period and opening it after the peak ensures there is parking available for off-peak customers. This is of particular use at stations where they may not be adequate off-peak local transit service to the station.

Where parking expansion is warranted, there are a number of ways to provide additional parking:

Peer-to-Peer: There is an emerging peer-to-peer market akin to Airbnb where private parking providers, from individual home owners to commercial landlords, can rent out their spaces using an online tool. The promotion of this type of service provides another parking option for customers that does not require Metrolinx to build more spaces.

Shared Parking: Sharing parking with other facilities, particularly those that have complementary and not competing parking needs, such as movie theatres, is another way to provide additional customer parking without overbuilding.

Remote Surface Parking: In some places, where land for parking at the station is not available or it is not the highest and best use, a remote lot may be a solution for customers wanting to drive and park. These lots are served by shuttles or where applicable, by a rapid transit line, such as an LRT or BRT.

Surface parking: Surface parking is simple and relatively quick and easy to build, so it can satisfy short term customer demand without significantly compromising or precluding a more sustainable longer term use for the land, such as transit oriented development. It is also something that be provided easily provided on leased land. Its sprawling nature means that it tends to have multiple access points, allowing for faster egress for customers when compared to a parking structure. That said, adding new surface parking does result in increased negative environmental and aesthetic impacts and longer, less comfortable walks to the station for customers.

Structured parking: In addition to the negative urban form and traffic impacts (large parking garages structures can be overpowering in smaller communities) structured parking is very expensive (construction costs: $35-40K per space) and takes significant time to build, making its construction disruptive for customers. With a large number of cars and limited access points, egress can much slower when compared to surface parking.

The current practice of locating structures adjacent to the station building and/or platform offers customers who drive and park direct, weather-protected access to the platform; but in locations where space is tight, this can come at the expense of bringing other modes close to platform. Parking structures do tend to provide enough capacity that offers driving and parking customers more certainty of availability.

Structures can limit flexibility for future transit oriented redevelopment, which can offer new customers walk-in access and an improved walking environment; but it also uses land more efficiently, which can allow for the redevelopment of surface parking.

3.5 Customer Information Interventions

Providing integrated information in mobile applications as well as at the station in digital displays and kiosks on the full range of modes serving the station lets customers know all of their options and make informed choices on the best one for them. It also allows services such as reserved parking, carpool parking, and secure bike parking to be delivered in an integrated and customer-focused manner.

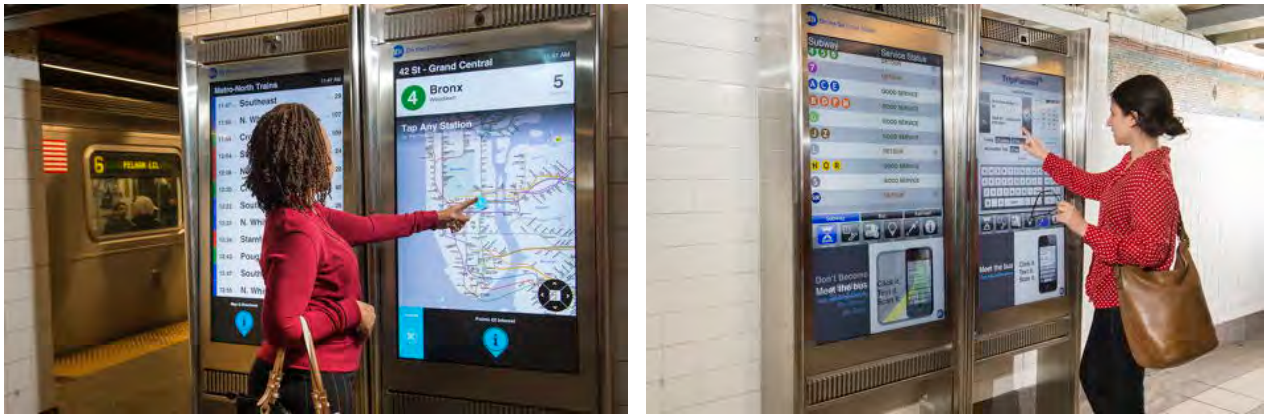


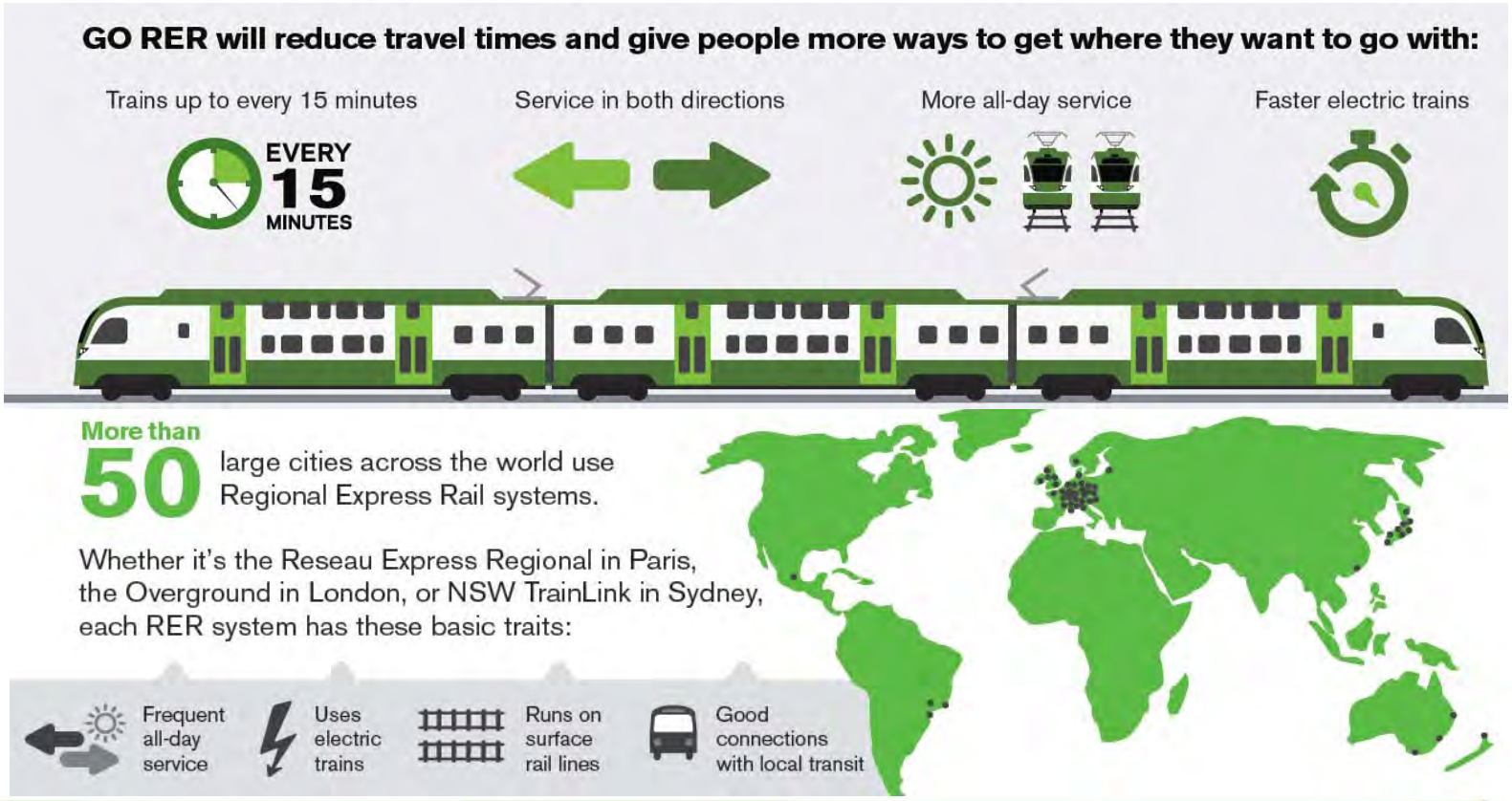
Figure 8: Customer information screens at Grand Central (left) and Penn (right) Stations in New York City let subway customers with information about their complete trip, from planning and service status to information about nearby destinations.

APPENDIX 2
GO Regional Express Rail 10-Year Program: New Stations Analysis

Board of Directors Report
June 28, 2016

METROLINX
An agency of the Government of Ontario

Defining RER – The Vision

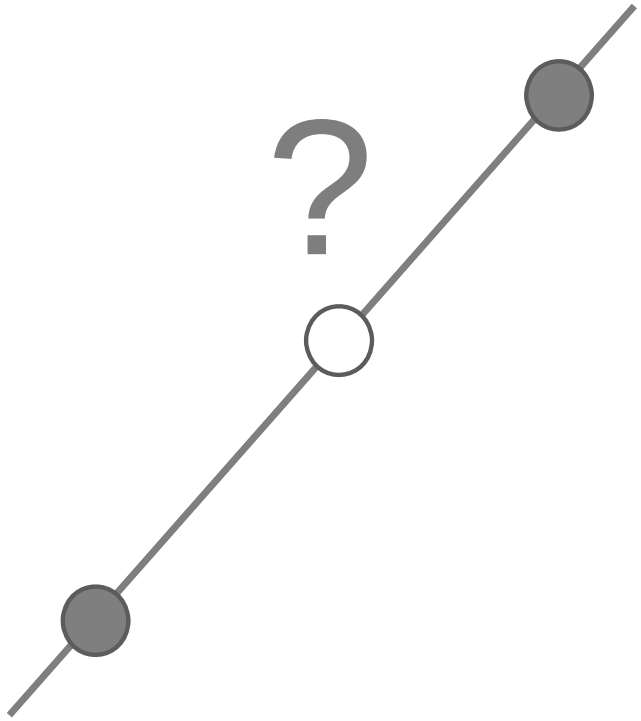


METROLINX

RER 10-Year Program and New Stations

Objectives of New Stations

- Improve service and add riders
- Minimize impact on trip time for existing customers
- Maintain appropriate station spacing for the vehicle technology
- Support existing regional and municipal plans
- Consider the different roles and needs of each location (e.g. adapt to urban and suburban context)

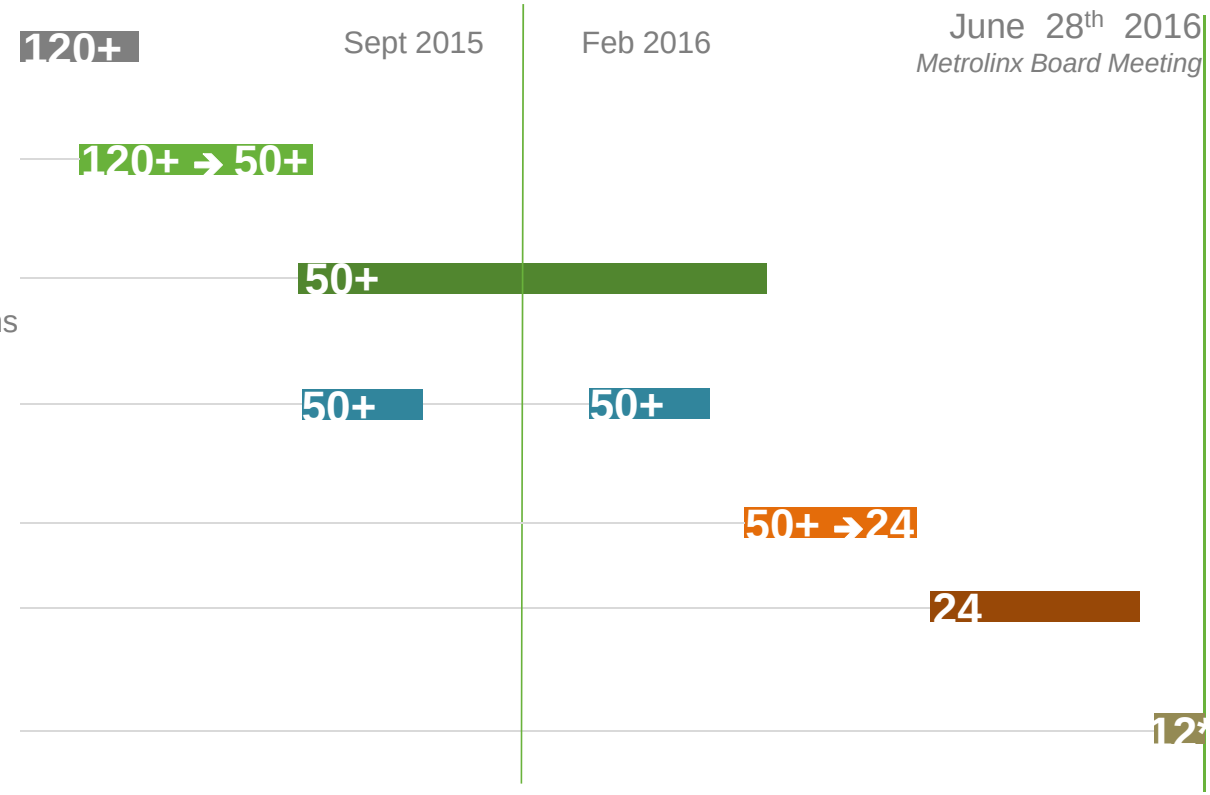


Think Regionally

- RER is part of a larger regional transit network in Regional Transportation Plan
- Scope of new stations work is GO system-wide
- Scope of impacts from any new station are corridor-wide
- Current focus is on new stations that should be included in the RER 10-Year Program.
- In the longer term it is expected that GO service increases will be commiserate with regional growth, prompting the ability to add more new stations.

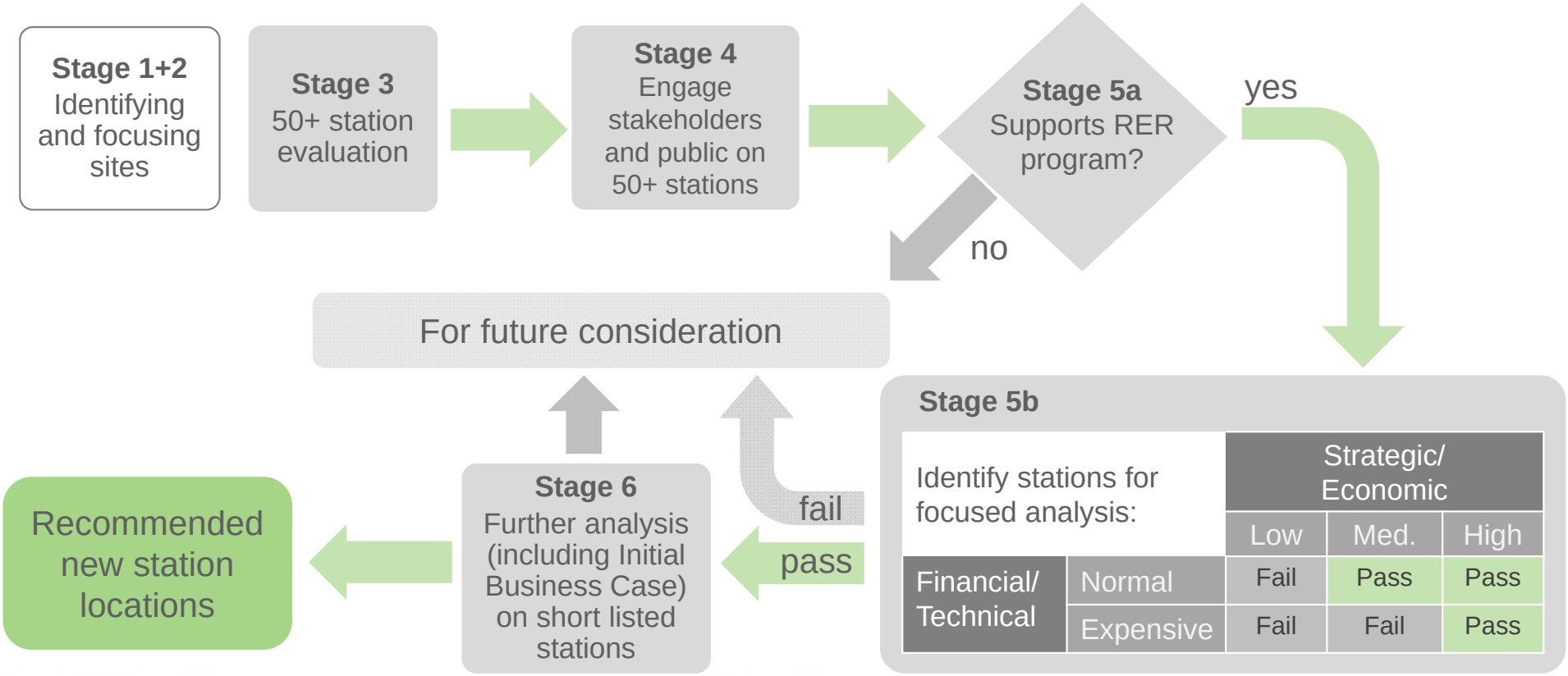
Process to Date

1. Identified an initial list - Identified an initial list 120+ sites using key site and network considerations.
2. Focusing analysis - Analyzed site factors, service considerations and historical requests, to scope list to 50+ sites.
3. Evaluating - Analyzed strategic, economic, technical/operational and cost/revenue considerations of 50+ sites.
4. Municipal & Public engagement - Consultation meetings and online, feedback and review of 50+ sites.
5. Refining the List - Following public engagement, scoped sites for further analysis.
6. Further analysis (IBCs) - A more detailed business case analysis on shortlisted sites to inform recommendations.
7. Recommended New Stations – for inclusion in the 10-Year RER Program*



*Subject to conditions identified in the GO Regional Express Rail Update Report to the Metrolinx Board of Directors, June 28, 2016

Decision Making Process



Stage 4: Municipal and Public Engagement

- The list of 50+ stations was presented to municipal staff for feedback over Fall 2015 and early Winter 2016
- Feedback was sought from the public through a series of consultations. Metrolinx hosted 19 regional Open Houses in total, with approximately 1872 members of the general public that attended.
- MetrolinxEngage.com saw 4249 visitors between February 16 and April 4th, 2016; over 200 public comments posted
- Municipal and public feedback was used to inform the preliminary evaluation and refinement of the locations moved forward for initial business case analysis, and the initial business cases themselves, for example:
  - Developer interest around station sites
  - City of Toronto's Feeling Congested Framework was considered when developing the strategic case criteria

Stage 5 – Evaluation Process Summary

- The initial results of Stage 3 (Evaluating) and Stage 4 (Municipal and Public Engagement) provided a preliminary evaluation of locations.
- Stations were analyzed based on 38 measures. However, nine key criteria were identified that significantly differentiate stations from each other and are better predictors of overall performance. More consideration of policy alignment and development potential in proximity to the potential station was included in the key criteria, based on stakeholder feedback.
- Assumptions about station configuration were based on the context of each location, with most urban locations assumed to provide no parking.

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Stage 5 – Refining the List

Identifying locations for further analysis

- Best feasible sites identified so they can be considered in ongoing RER network service planning, infrastructure planning, design and engineering for the 10-year program
- Focus on the locations that will do best in current and future contexts in terms of connections to rapid transit and development potential
- Public and stakeholder consultation ensured the evaluation accurately reflects conditions and expectations.

Criteria	Action
Stations performing well and moderately	Proceed with initial business case
Locations not performing well	Remaining for future consideration

Stage 5 – Refining the List
Key criteria*

* As per February 10th, 2016 Metrolinx Board of Directors RER Stations Update Presentation

Category	Objective	Criteria	Measure/Metric
Strategic/ Economic Planning	Connectivity and Ridership Drivers	How many trips will start and end at this station?	Sum of boardings + alightings
		Does the station connect to other higher order transit modes and have potential to improve network and/or corridor service?	Distance to existing and planned routes
		Does the station connect to key destinations?	Number of nearby destinations and places of interest
	Travel Time Savings	What are the time savings associated with the new station?	Ratio for time penalty of existing riders to minutes saved for new station users
	Market Potential	How well situated is the station in relationship to future market demand?	High level assessment of market potential
	Development Potential	Can the station support future development and intensification? What is the likely timing?	Soft sites; number and scale of recent development proposals
	Policy Alignment	Does the station area align with Growth Plan policy?	Location relative to urban growth centre, built up area, or rural area
Financial/ Technical	Affordability	What is the cost to construct the station?	Relative expected cost
	Ease of construction	Can the required facilities be constructed?	Degree of site constraint

Stage 5 – Refining the List

Why Some Locations Did Not Perform as Well as Others

Locations that do not perform well share similar challenges and constraints, such as:

Prohibitive construction costs or challenges, such as corridor or track limitations:

- e.g. Adding a platform under major roads may impact substantial retaining walls and bridge columns, which may require grade separations to be rebuilt, or corridor widened through significant property acquisition

High time-cost impact, many passengers delayed, few save time through boarding or alighting here:

- e.g. In general, locations closer to Union can delay thousands of passengers already on a train. However, a location performs well if it saves many nearby passengers time by shortening their overall trip time from origin (e.g. home) to final destination (e.g. work), counterbalancing the effects of delays to passengers already on the train

Few nearby regional destinations:

- e.g. Some locations have very few regional destinations such as employment, schools, government services, or a confluence of unique retail

Stage 5 – Refining the List

Why Some Locations Did Not Perform Well as Others (cont'd)

Unsupported by Provincial growth policy, constrained by Greenbelt or area of limited growth:

- e.g. A station in or near designated Greenbelt lands would have constrained future development potential, and may be inefficient for local transit to access and serve

Unsupportive of current or planned land uses and/or low densities, such as warehouses, mature residential neighbourhoods:

- e.g. Light industrial and warehouse areas are often more car-dependent and do not facilitate transit ridership; the large properties and intersection spacing limit walk-up access surrounding single family homes limit potential ridership compared to areas where multi-unit dwellings are the norm; established neighbourhoods may be less supportive of introducing higher densities in future

No major new infrastructure to facilitate station construction within current RER program, such as the Richmond Hill Line, Milton Line

Stage 6 – IBCs Conducted on these Locations (24 sites)

Initial Business Cases Completed

GO Corridor	Location	Municipality
BA	Spadina	Toronto
BA and KI	DOWNTOWN WEST: LIBERTY VILLAGE, DUFFERIN-QUEEN WEST, LANSDOWNE	Toronto
BA	Bloor-Davenport	Toronto
BA	St. Clair (Barrie Line)	Toronto
BA	HWY 7-CONCORD, YORK UNIVERSITY	York (Vaughan), Toronto
BA	Kirby	York (Vaughan)
BA	Mulock	York (Newmarket)
BA	Innisfil	Simcoe (Innisfil)
KI	St. Clair (Kitchener Line)	Toronto
KI	Breslau	Waterloo (Woolwich)
LSE and SV	DOWNTOWN EAST: DON YARD, UNILEVER, QUEEN-EASTERN	Toronto
LSE and SV	GERRARD: DUNDAS EAST-LOGAN, GERRARD	Toronto
LSE	Whites	Durham (Pickering)
LSW	PARK LAWN, MIMICO	Toronto
SV	Lawrence East	Toronto
SV	Ellesmere	Toronto
SV	Finch East	Toronto

- Initial Business Cases (IBC) were undertaken on the refined list of 17 locations (24 individual station sites, with some analyzed as part of a cluster).
- Sites analyzed through multiple lenses:
  - Strategic
  - Economic
  - Financial
  - Deliverability/operational considerations

LEGEND
CAPS = “clusters”: several locations in close proximity, only one to be recommended

Decision Making

Stage 6
17 IBC analyses (24 sites)

Step 1
Rank sites based on IBC performance

- High
- Medium
- Low
- Very Low

Step 2
Consider sites based on network fit and community support

+ −

Step 3
Categorize and recommend sites for inclusion in RER Program

- Included
- Not Included

Step 1 – Individual Station Performance

Initial Business Cases inform the relative ranking of stations based on the four cases and key sensitivities, including:

Strategic
- Policy alignment
- Natural environment
- Proximity to low-income community

Economic
- Net Present Value*
- Ridership, safety, GHG
- Travel time impacts
- Capital and operating costs recovery
- Development potential

Financial
- Capital and operating costs
- Ridership and new revenue

Deliverability/Operational
- Constructability
- Operating/service impacts

Magnitude of impact for sensitivities
- Alternate fare scenarios
- Alternate development scenarios

*See Appendix on Economic Analysis

High	all stations with **positive** economic performance: bring economic value to the region, meet key station objectives
Medium	sites with **marginal** economic performance but advantaged by strategic factors or sensitivities with **likely** positive impacts.
Low	sites with **marginal** economic performance but disadvantaged by strategic factors or sensitivities with **likely** negative impacts **OR** sites with **poor** economic performance but advantaged by strategic factors or sensitivities
Very Low	stations with **lowest** economic performance, which are not advantaged by strategic factors or likely sensitivities

Step 2 – Network Fit Considerations

- Apply a broader network lens that prioritizes individual stations *within* their corridor (versus across corridors) depending on:
  - connections to rapid transit
  - support from the wider community
  - effect on opportunities for future stations
  - spacing in relation to other existing or new stations on the line to ensure that impact on travel times is minimized

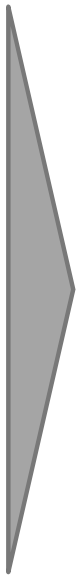
Examples:

High	>>	=	High
Medium	Effect on opportunities for future stations	—	Low
Low	Major development potential; Rapid transit connection	+	Medium

Step 3 – Station Recommendations

Rank potential stations along each corridor to account for distribution and optimize corridor performance:

- Identify **two stations** per line to preserve the trip time savings gained through electrification
- Provide for **one additional station** if it is located toward the end of the line, which would impose less travel time delay
- Consider up to **one additional station with network fit advantages** on the condition of more detailed assessment of network capacity and service plan impacts



Included in GO RER 10-Year Program

Stations based on individual performance and/or with Network Fit, subject to further detailed analysis and conditions required to address contextual issues and/or determine network capacity

Not Included in GO RER 10-Year Program

1) Stations in **clusters** that are relegated based on superior performance of alternate location (i.e. may not be inherently poor performers but only one in cluster can proceed)
2) **Very Low** stations and **Low** without Network Fit factors. These are locations that will not be pursued within 10-year RER program

Recommendations: Barrie corridor

Corridor	Station	Category	Conditions
Barrie	Spadina	Included	Subject to review of long-term (beyond 10-year RER program) train storage needs
	Bloor-Davenport	Included	Subject to further analysis of corridor service implications and commitment by the City of Toronto to provide accessible, weather-protected, pedestrian connection to Lansdowne Subway Station
	St. Clair West	Not Included	
	Highway 7-Concord	Not Included	
	Kirby	Included	Subject to corridor service planning and further analysis of service implications
	Mulock	Included`	A grade separation at the location as well as further Metrolinx analysis are required
	Innisfil	Included	Subject to existing financial agreements between City of Barrie and Town of Innisfil, confirmation of specific station location by the Town of Innisfil / County of Simcoe, and potential EA amendment or new EA.

LEGEND
Included = Included in the GO RER 10-Year Program
Not Included = Not Included in the GO RER 10-Year Program

Recommendations: Kitchener and Lakeshore corridors

Corridor	Station	Category	Conditions
Kitchener	Liberty Village	Included	Subject to further development of corridor service plan and track configuration
	St. Clair West	Included	Subject to corridor service planning and further analysis of service implications
	Breslau	Included	Subject to confirmation of specific station location by Township of Woolwich / Region of Waterloo
Lakeshore East	Don Yard/Unilever	Included	See Stouffville Corridor for Conditions (serves both corridors)
	Gerrard	Included	See Stouffville Corridor for Conditions (serves both corridors)
	Whites	Not Included	
Lakeshore West	Park Lawn	Not Included	

LEGEND
Included = Included in the GO RER 10-Year Program
Not Included = Not Included in the GO RER 10-Year Program

Recommendations: Stouffville Corridor

Stouffville	Don Yard/Unilever	Included	Specific location subject to further technical analysis, corridor service plan, and discussion with public and private landowners
	Gerrard	Included	Subject to detailed consideration of specific station location with the City of Toronto
	Lawrence East	Included	Subject to corridor service planning and further analysis of service implications
	Finch	Included	Subject to corridor service planning and further analysis of service implications
	Ellesmere	Not Included	

LEGEND
Included = Included in the GO RER 10-Year Program
Not Included = Not Included in the GO RER 10-Year Program

GO Network

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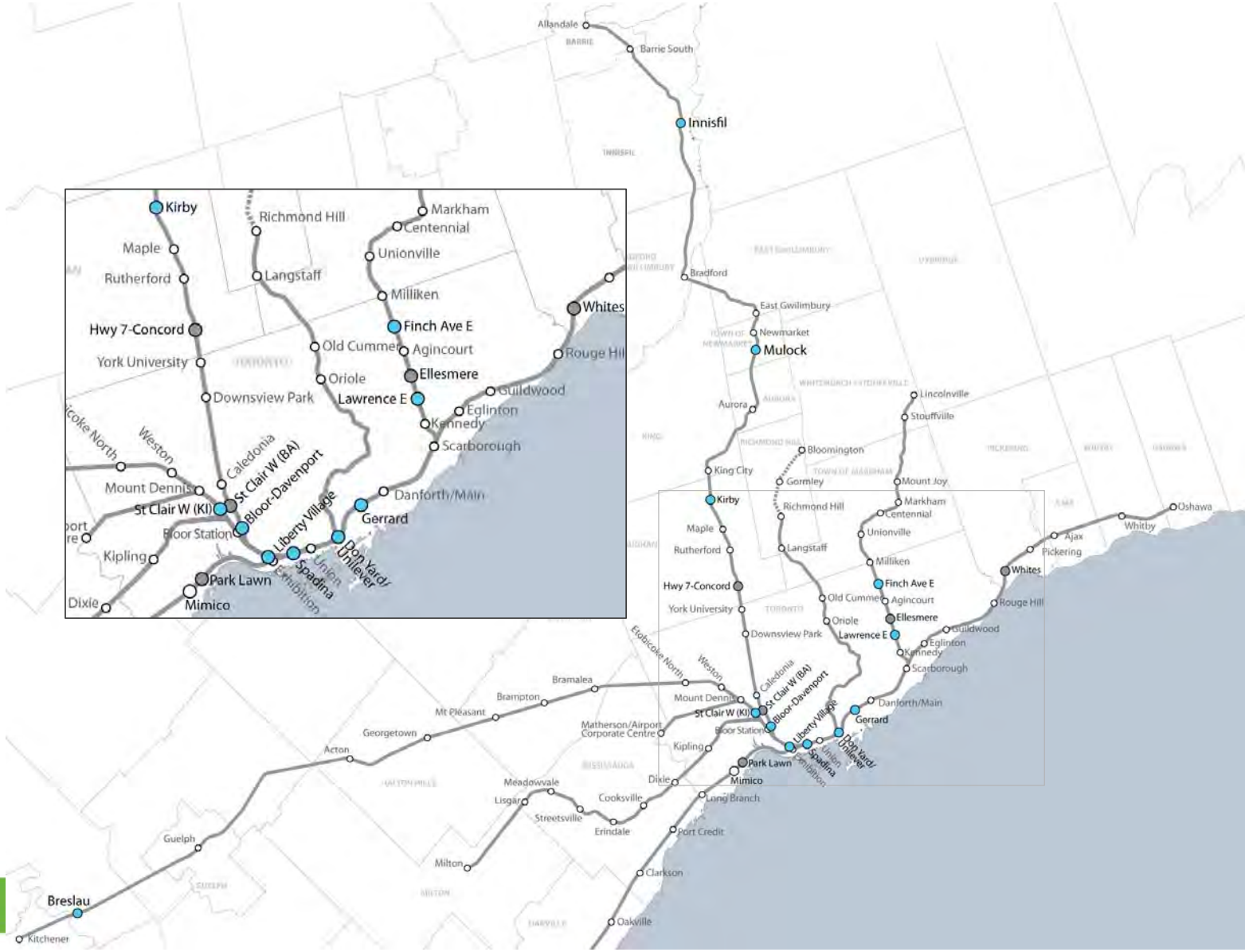
- Included in the GO RER 10-Year Program
- Not Included in the GO RER 10-Year Program
- Existing/Committed



Next Steps

1. Proceed with recommended New Stations

as set out in staff report of June 28th 2016 subject to:

- Formal confirmation by of funding and any conditions identified in the June 28th Metrolinx staff report
- Detailed technical analysis of corridor service plans

2. Detailed station planning and procurement

(2016+)

- Business case updates on recommended sites as required
- Begin TPAP/EAs
- Preliminary and detailed design

3. Construction (2018+)

- Construction (staged within RER program)

Next Steps (continued)

The following stations are not being included in the GO RER 10 year program at this time. However, this does not mean that the stations will not be considered for inclusion in the GO rail network in the future. Metrolinx will continue to work with municipalities to improve the strategic, economic, financial, and operations cases for these locations and bring them forward for consideration. Additional factors for consideration will include land use in the area that supports transit-oriented development and optimizes provincial transit infrastructure investments:

- Barrie Corridor: Highway 7–Concord
- Lakeshore West Corridor: Park Lawn, Walkers Line-Cumberland
- Kitchener Corridor: Woodbine-Highway 27

The remaining 24 stations that did not undergo initial business case analysis are identified for future consideration in the context of longer term regional transportation planning.

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APPENDIX A

Locations For Future Consideration – Would Require IBC Analysis

Stage 5 – Locations For Future Consideration – Would Require IBC Analysis

GO Corridor	Location	Municipality
BA	Bathurst/Side Road 15	York (King)
KI	Woodbine-Highway 27	Toronto
KI	Islington	Toronto
KI	Heritage	Peel (Brampton)
LSE and SV	Parliament-Cherry	Toronto
LSE and SV	Jones	Toronto
LSE and SV	Greenwood	Toronto
LSE and SV	Coxwell	Toronto
LSE	Lakeridge	Durham (Ajax/Whitby)
LSW	Roncesvalles	Toronto
LSW	Kipling	Toronto
LSW	Winston Churchill	Peel (Mississauga) / Halton (Oakville)
LSW	Maple Grove	Halton (Oakville)
LSW	Dorval	Halton (Oakville)
LSW	Walkers Line/Cumberland	Halton (Burlington)

(continued next page…)

LEGEND
CAPS = “clusters”: several locations in close proximity, only one to be recommended

* per the Decision Making Framework, locations on corridors that are not significantly impacted by the GO RER program (i.e. electrification and major track infrastructure improvements) were not considered at this time.

Stage 5 – Locations For Future Consideration – Would Require IBC Analysis (continued)

GO Corridor	Location	Municipality
MI	EAST MALL/WEST MALL*	Toronto
MI	Cawthra Rd/Dundas W*	Peel (Mississauga)
MI	Trafalgar*	Halton (Milton)
RH	WEST DON: Queen, Dundas, Gerrard*	Toronto
RH	Millwood [CN Leaside]*	Toronto
RH	Eglinton [CN Leaside]*	Toronto
RH	Don Mills-Bond*	Toronto
RH	York Mills*	Toronto
RH	John St-Green Ln*	York (Markham)
RH	16th Avenue*	York (Richmond Hill)
SV	14th Avenue	York (Markham)

LEGEND
CAPS = “clusters”: several locations in close proximity, only one to be recommended

* per the Decision Making Framework, locations on corridors that are not significantly impacted by the GO RER program (i.e. electrification and major track infrastructure improvements) were not considered at this time.

APPENDIX B

Economic Analysis

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Economic Analysis vs Financial Analysis

Economic Analysis plays an important role in Business Cases assessment as it measures *value of things that matter to people* and society, broadly taking account of all the ways a project affects people, irrespective of whether those effects are registered in conventional financial accounts. All costs and benefits to society are translated into dolllar values for purpose of analysis. These include valuation of

- Travel Time Savings
- Vehicle Kilometres Traveled (VKT)
- Vehicle Operating Cost Savings
- Decongestion
- Safety
- Greenhouse Gas

Financial Analysis deals only with *money spent or received*. The analysis includes:

- Fare Revenue
- Additional Station Operating Costs
- Additional Train Operating Costs
- Capital Costs

Net Present Value (NPV) is an analytical tool that shows the total present value of all future benefits minus the present value of all future costs expressed in monetary terms (dollars). The NPV of the economic benefits and economic costs is a key measure used for this analysis.

NPV and BCR Two Sides of the Same Coin

NPV and BCR are both measures of the same respective things in economic and financial evaluations, but they illustrate them differently.

Net Present Value (NPV)	Benefit Cost Ratio (BCR)
The total present value of all future benefits minus the total present value of all future costs	The indicator of value for money for an option/project It is calculated by dividing the present value of total benefits by the present value of total costs
Net Present Value = Present Value* Benefits - Present Value* Costs	Benefit Cost Ratio = Present Value * Benefits / Present Value * Costs
Value to the economy lost or gained over the period of analysis (in present $)	Ratio indicating the value of every dollar invested in the project. <1 = losing money for every $ spent
Shows the $ value of benefit or loss	Shows the scale of benefit or loss

* **Present value** is the current worth of a future sum of money or stream of cash flows at a specified rate of return

APPENDIX 3

INTEGRATED GO RER-SMARTTRACK OPTIONS

INITIAL BUSINESS CASE
JUNE 2016

TABLE OF CONTENTS

Glossary of Terms

Appraisal	Analysis of a program, investment or intervention that has not yet been implemented and focuses on estimated or forecasted evidence.
Benefits Case Analyses (BCA)	Reports produced by Metrolinx between 2008 and 2012 focusing on select economic impacts and financial costs of major proposed Metrolinx transit projects. BCAs have subsequently been replaced by the new Business Case framework.
Business Case	A suite of evidence on the potential strategic, economic, financial, deliverability and operational impacts of a proposed program, intervention or investment to inform decision-making throughout the project lifecycle. Metrolinx Business Cases are an enhancement and replacement of Metrolinx's former Benefits Case Analyses reports.
Cost Benefit Analysis	A form of evaluation that focuses on comparing certain economic impacts (generally benefits) to the cost of an investment. Cost Benefit Analysis is used in the Economic section of Metrolinx's Business Case framework and was also used to inform previous Benefits Case Analyses.
Economic Case	One component of the Metrolinx Business Case that examines or reviews the impacts of proposed investments or interventions. Economic impacts include transportation user benefits (journey time impacts, road decongestion impacts, safety/accident reductions, etc.), environmental impacts (changes in emissions levels, vibration, etc.), social and community impacts (the distribution of benefits among populations, severance/isolation impacts, etc.), wider economic benefits (agglomeration/productivity impacts, etc.) and public funding impacts (property tax revenues, etc.). The Economic Case generally includes a cost-benefit ratio.
Financial Case	One component of the Metrolinx Business Case that examines the lifecycle costs and revenues of proposed investments or interventions.
Delivery and Operations Case	One component of a Metrolinx Business Case that examines the impacts of proposed investments or interventions on operations, the delivery of the proposal, potential risks, procurement and related commercial or management issues.
Strategic Case	One component of a Metrolinx business case that examines the alignment of proposed programs, investments or interventions with strategic plans and goals. Involves the presentation of transportation planning information, including traffic forecasts, related travel patterns, drivers and interdependencies.

Acronyms

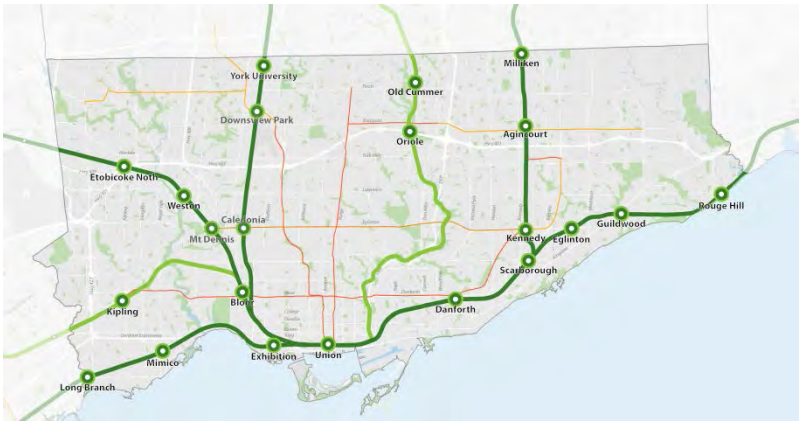
BCR	Benefit cost ratio
NPV	Net Present Value
PV	Present Value
RTP	Regional Transportation Plan, *The Big Move, 2008*
GO RER	GO Regional Express Rail
TTS	Transportation Tomorrow Survey
VKT	Vehicle Kilometres Travelled

1.0 EXECUTIVE SUMMARY

In 2015, the Province of Ontario committed funding of $13.5 billion for extensive rail improvements through the GO Regional Express Rail (RER) program. Metrolinx is currently implementing the program, a change which will bring fast, two-way, all-day GO service to provincially owned rail corridors. Five GO corridors will be upgraded to RER service levels – 15 minutes (or better) service in both directions throughout the day. Trains will be electrified which shortens trip times by up to 20%. Implementing GO RER is expected to add 4,500 weekly train trips and increase GO ridership by 140% over the next fifteen years. GO ridership in 2014 was approximately 54 million annual trips. With the implementation of GO RER on five corridors, ridership is forecast to climb 140 percent to 127 million annual trips. This package of GO enhancements is a step-change for rail service in the Greater Toronto and Hamilton Area, transforming it from what is now largely a commuter service to a true regional rail system, comparable to similar systems in world-class cities across the globe. The full program of GO upgrades, including service, infrastructure, costs and benefits, is presented in the GO RER Initial Business Case.

All seven GO corridors run through the City of Toronto, stopping at 19 stations, and meeting at Union Station. As is evident in the map below, the GO corridors largely run through Etobicoke and Scarborough, providing downtown access opportunities to neighbourhoods located at a distance from the subway. By bringing fifteen minute two-way service to five of the GO corridors (highlighted in darker green on the map), GO RER will bring more flexible travel options for residents and jobs within the City and to the broader region.

Figure 1: GO Service in the City of Toronto



The GO RER program, and particularly plans for GO RER within the City of Toronto, sets the context for SmartTrack. SmartTrack proposes utilizing the GO network to provide a more urban transit service than originally contemplated with GO RER. In February 2015, Toronto City Council directed the City Manager to carry out a SmartTrack workplan and requested that Metrolinx include a number of SmartTrack elements in GO RER. SmartTrack includes a number of components including new stations, TTC fares, TTC service integration, frequency improvements on the Kitchener and Stouffville corridors, as well as an LRT along Eglinton Avenue West to the Mississauga Airport Corporate Centre and Pearson Airport.

The SmartTrack proposal triggered more intensive consideration of the potential for GO expansion within Toronto to improve access for residents and greater connectivity of the transit networks. Metrolinx and the City of Toronto are working closely together to advance options that integrate GO RER and SmartTrack. These options leverage planned GO RER investments to deliver additional new riders and added benefits, particularly in Toronto. Separate RER and SmartTrack concepts were deemed too infrastructure intensive and costly as well as a duplication of service and are not being considered further. In March 2016, City Council endorsed focusing analysis on two integrated RER-SmartTrack options, proposing either four to five new stations or seven to eight new stations.

This document presents a plan for integrating GO RER and SmartTrack and provides the business case evidence in support of that plan.

Figure 2: Illustration of the Integrated GO RER-SmartTrack Geography

The GO RER-SmartTrack Initial Business Case analyzes four options for integrating the SmartTrack proposal with the committed GO RER program on the Kitchener and Stouffville corridors.

- Option A: Increased frequencies, 5 new stations
- Option B: Express and local service, 8 new stations
- Option C: Committed RER frequencies, 7-8 new stations
- Option D: Committed RER frequencies, 4-5 new stations

Each of these options assumes an optimized LRT on Eglinton Avenue West. A separate business case process has been undertaken to assess the Eglinton West LRT.

This GO RER-SmartTrack Initial Business Case builds on and expands the analysis completed for the GO RER Initial Business Case in order to determine the impact of SmartTrack on the RER benefits and costs. The RER Initial Business Case analysis is premised on the current fare structure, including existing GO fare structure for GO RER service, TTC fares, and existing transfer policy. The GTHA Fare Integration Strategy will serve as a vehicle for rationalizing GO and TTC Fares and transfer policy as well as address other fare issues across the region. In the absence of a complete and comprehensive regional fare integration strategy, the analysis in this report assumed the existing fare structure as an input. The City of Toronto has conducted analysis assuming TTC fares which is presented in Appendix C of this document.

GO RER is expected to utilize the available and planned track and corridor capacity. In this light, integrated GO RER-SmartTrack options were screened to determine the extent of additional infrastructure that they would require over and above that which is required for GO RER. Through this analysis, it was determined that Options A and B would each require extensive additional track infrastructure, resulting in the need for corridor widening, property acquisition, consequent community impacts, and other deliverability challenges. In light of these findings, Options A and B were screened out and detailed analysis focused on Options C and D.

Strategic Case analysis suggests that GO RER will go a long way towards growing the attractiveness of GO rail as a travel option for Torontonians. Over and above RER, both Options C and D achieve the central objectives of integrating GO RER and SmartTrack in terms of improving access to GO within the City of Toronto. Both options increase ridership about nine to ten percent above GO RER. Because Option C includes more new stations than Option D, it goes further in increasing transit accessibility within Toronto but also lengthens travel times for medium and long distance passengers and imposes greater negative travel time impacts in comparison to Option D.

In terms of the Financial Case, Options C and D are relatively similar in terms of financial performance and affordability. Option C is slightly more expensive to both build and operate, compared to Option D, but the difference is marginal in the context of the larger GO RER infrastructure costs. It should be noted that capital cost estimates are preliminary and may not reflect the full costs of associated structure works required to deliver the stations or comprehensive fleet costs, depending on ongoing operational analysis.

Economic Analysis measures the costs and benefits of a project including benefits such as travel time savings and congestion relief. This lens of analysis monetizes those benefits and then compares them to costs to provide one indication of the extent to which a project is a worthwhile investment. For the GO RER Kitchener and Stouffville corridors benefits such as the dollar value of travel time savings exceed the capital and operating costs by a ratio of approximately 2:1. Economic analysis of the integrated options in the context of the overall analysis suggests that Option C would have a negative impact on the overall GO RER benefit-cost ratio, bringing about a decrease of approximately thirty percent while Option D would have a smaller negative impact, decreasing the GO RER benefit-cost ratio by approximately 18 percent. This suggests that Option D performs better than Option C from an economic perspective.

In summary, based on the full business case analysis, Option D is the best performing option for SmartTrack and GO RER integration. There are a number of next steps required to more fully understand the options. The final number of new stations and their locations are being determined through the outcomes of the new stations analysis. The GTHA Fare Integration Strategy is progressing and learnings from that analysis will need to be incorporated into this work, in particular to understand the impacts of fare integration on ridership. Finally, the construction program to deliver GO RER electrification and service levels is extremely aggressive and it will be important to understand how these options might impact RER delivery.

Table 1: Deliverability Screening Summary Table

Indicator	Option A: Increased Frequencies, 5 new stations	Option B: Express and local service, 8 new stations	Option C: Committed RER Frequencies, 7 -8 new stations	Option D: Committed RER Frequencies, 4 - 5 new stations
Total Nominal Capital Costs ($M 2014, costs do not include escalation, financing costs, lifecycle and operating and maintenance)	$6,900-7,500	$9,000 -10,600	$1,100-1,700	$700 – 1,000
Deliverability Issues	Screened Out - Extent of infrastructure requirements, need for corridor expansion, property acquisition, and community impacts is unacceptable	Screened Out - Extent of infrastructure requirements, need for corridor expansion, property acquisition, and community impacts is unacceptable	Deliverable with a minimum of new infrastructure	Deliverable with a minimum of new infrastructure

Table 2: Business Case Summary Table

Indicator	Base Case – GO RER, Kitchener and Stouffville	Option C: Committed RER Frequencies, 7-8 new stations	Option D: Committed RER Frequencies, 4 -5 new stations
Fit with Strategic Objectives	-	Builds on the GO RER program to improve access to GO within Toronto	Builds on the GO RER program to improve access to GO within Toronto
Ridership (annual)	28 million	+2.4M	+2.8M
Total Nominal Capital Costs ($M 2014, costs do not include escalation, financing costs, lifecycle and operating and maintenance)*	$3,600 (does not include RER system costs)	+$1,100-1,700	+$700 – 1,000

Nominal Annual Operating Costs ($M 2031)	$140	+$8.7	+$5.3
Nominal Annual Revenue ($M 2031)	$210	+$11.8	+$15.1
Cost Recovery Ratio (2031)	150%	149%	155%
Net Benefits ($M PV)	4,100	($1,100)	($400)
Impact to GO RER Kitchener-Stouffville Benefit Cost Ratio	-	31% decrease from 2.0 to 1.37	18% decrease from 2.0 to 1.64

2.0 INTRODUCTION

Metrolinx and the City of Toronto have worked closely together to develop options for integrating GO RER and SmartTrack, conduct analysis of those options through the initial business case, and put forward a direction to proceed. GO RER is a committed $13.5 billion program to expand GO service across the GTHA, including on the Kitchener and Stouffville corridors. SmartTrack proposes upgrading service on the Stouffville and Kitchener Corridors with new stations, TTC fares, TTC service integration, and increased frequency and a rapid transit option on the Eglinton West corridor. The SmartTrack proposal spurred further consideration of options to upgrade and intensify rail service within Toronto and the GO RER-SmartTrack Integration Initial Business Case will develop, present, and analyze these different options for integration. Options have been developed with regard to a number of policy objectives:

- Serving People – choice, experience, social equity
- Strengthening Places – shaping the City, healthy neighbourhoods, public health and environment
- Supporting Prosperity – affordability and supporting growth

Figure 3: SmartTrack Geography in the Context of the Transit Network

This work will touch on a number of different aspects of GO RER-SmartTrack integration including rail service and infrastructure and new stations. Evaluation of the options will provide indications of their performance from deliverability, strategic, economic, and financial perspectives. The outcome of this work will be a preferred option supported by the evaluation.

Study Objectives

- Identify promising options for integrated GO RER-SmartTrack options
- Conduct an alternatives analysis and develop a business case on the integrated options
- Ensure ongoing delivery of the funded GO RER program
- Identify a preferred direction for GO RER-SmartTrack integration that provides benefits and is practically feasible
- Make the case for investment in the preferred option indicated by the study

This document will present an overview of the methodology used to develop and analyze options. It will then present a problem statement and go through each integrated GO RER-SmartTrack option. From there, the report will outline business case analysis for the options beginning with a deliverability screen and proceeding to strategic case analysis, economic case analysis, and financial case analysis.

3.0 METHODOLOGY

The approach to developing the plan for integrating GO RER and SmartTrack mirrors the approach to developing the full RER program. The work began with the establishing of the study objectives set out in Section 2.0. Based upon these objectives, as well as on a vision and problem statement, the four options were developed. These options were then tested through an analysis of the infrastructure required to build and operate each option. This analysis included developing a sample schedule and, using the station locations, track layouts, and train speeds, mapping out the different train trips and assessing whether the existing tracks were sufficient to accommodate the service or whether and where additional tracks might be required. Based on the results of this analysis, Options A and B were screened because of the extent of new infrastructure, beyond that which is already required for RER. The analysis largely confirmed that GO RER will utilize the majority of capacity on the rail corridors. A full business case was then developed to provide more evidence on how Options C and D perform in relation to the full GO RER program. That business case is presented in this document.

Figure 4: Integrated GO RER-SmartTrack Methodology

4.0 OPTIONS FOR INTEGRATED GO RER-SMARTTRACK

Options Development

The work to identify an option for integrating GO RER and SmartTrack has considered a number of elements:

- Service frequency on the Stouffville and Kitchener corridors
- New stations
- Kitchener and Stouffville through service

In developing the options, Metrolinx and the City of Toronto looked at the funded GO RER program as a starting point and worked to incorporate elements of the SmartTrack proposal. The GO RER service concept and infrastructure program was developed through an extensive iterative process of service assessment and capital and operating cost estimates to arrive at an optimal scenario. The SmartTrack proposal identifies an opportunity to further upgrade service on the Kitchener and Stouffville corridors within Toronto, going beyond the committed GO RER program. By highlighting ways that GO RER could better serve the mobility needs of the City of Toronto, the SmartTrack plan initiated a more thorough analysis of the potential to upgrade service and add new stations.

This analysis began with the development of different options to integrate GO RER and SmartTrack. These options attempt to balance improving service for Toronto residents with maintaining a high quality of service for longer-distance commuters. Adding new stations can boost ridership by enticing new passengers who either board or alight at a new station location, but it can also deter some existing riders because of the longer travel times associated with additional station stops. Achieving the optimal balance is a critical component of developing the integrated options.

Fare and service integration are important components of the SmartTrack proposal but are being explored through separate workstreams. As the GTHA Fare Integration Strategy progresses, outcomes will be incorporated into the analysis of RER-SmartTrack integration options. This analysis is premised on the existing fare structure.

Options Summary

This section describes five options for GO RER-SmartTrack integration.

Table 3: Integrated GO RER-SmartTrack Options

Option	Service on the Stouffville and Kitchener corridors	New stations
Committed GO RER	• Peak o 6-10 minute service from Unionville – Union Station – Bramalea* • Off-peak o 15 minute service from Unionville – Union Station – Bramalea • Stouffville and Kitchener service terminate at Union Station	Existing GO stations
A. Increased frequencies, 5 new stations	• Frequencies doubled from committed GO RER service concept (5 minute peak service, 7.5 minute offpeak service) • Kitchener and Stouffville service connected	• 5 new stations on Kitchener, Lakeshore East and Stouffville
B. Express and local service, 8 new stations	• 20 minute service for each of express service and local service (10 min combined service); Unionville – Union Station – Bramalea • Kitchener and Stouffville service connected	• 8 new stations on Kitchener, Lakeshore East and Stouffville
C. Committed RER frequencies, 7-8 new stations	• Planned GO RER frequency in the peak • Travel time increases for medium and long distance trips, due to new stations • Kitchener and Stouffville service connected	• 7-8 new stations
D. Committed RER frequencies, 4-5 new stations	• Planned GO RER frequency in the peak • Slight travel time increases for medium and long distance trips • Kitchener and Stouffville service connected	• 4-5 new stations

* Peak headways are derived by summing all of the service planned for each corridor. For example, on the Stouffville corridor, in the peak period and direction, the service concept calls for 4 trips from Unionville to Union Station and 3 trips from Lincolnville to Union Station, resulting in a total of 7 trips in the peak hour, or roughly 8.5 minute service frequency.

Committed GO RER Service Concept

The GO RER program commits to electrification of the Stouffville corridor from Union Station to the end of the line, at Lincolnville and to electrification of the Kitchener corridor from Union Station to Bramalea. Electrified service is planned to run every 15 minutes, all day, from Unionville Station on the Stouffville corridor to Union Station and from Bramalea Station on the Kitchener corridor to Union Station.

Layered on top of this core service are longer distance services to Lincolnville and Kitchener. Service to and from Lincolnville is planned at every 20 minutes in the peak period and peak direction and every 60 minutes, bidirectional, in the offpeak. From Kitchener, 30 minute peak

direction service is planned in the peak period as well as an additional 30 minute peak-direction service from Mt. Pleasant Station. In the offpeak, Mt. Pleasant will be served by 60 minute bidirectional service, continuing the midday service introduced in 2015. As well, UP Express will continue to provide bidirectional 15 minute service to between Weston, Bloor, and Union Stations which augments GO service.

A. Increased frequencies, 5 new stations

Option A focuses on achieving service frequencies significantly over and above what has been planned for GO improvements in both the peak and off-peak. This option would include a limited number of new stations, focusing on those which provide the most benefits.

Service summary

- 5 minute frequency in peak and 7.5 minute frequency in the off-peak (doubling GO RER service levels); Unionville - Union Station - Bramalea
- 5 new stations
    - Stations include Gerrard, Unilever, Bathurst-Spadina, Liberty Village, St. Clair West
- Kitchener and Stouffville through service

Figure 5: Option A

B. Express and local service, 8 new stations

Option B would change parts of the Kitchener, Lakeshore East, and Stouffville corridors into an express and local service pattern. Eight new stations would be added across those three corridors; express trips would bypass new stations, stopping at existing stations and local trips would stop at all stations including new and existing. This type of service split allows longer distance passengers

to continue to benefit from fast journey times, while also adding a finer-grained service to increase access along the route by adding stations in the City of Toronto.

Service summary

- 20 minute frequency for each of express service and local service (10 min combined service); Unionville – Union Station – Bramalea
- Express service would stop only at existing GO stations; local service would stop at existing stations as well as new stations
- 8 new stations
    - Stations include Gerrard, Don Yard, Bathurst-Spadina, Liberty Village, St. Clair West, Lawrence, Ellesmere, and Finch
- Kitchener and Stouffville through service

Figure 6: Option B

C. Committed RER frequencies, 7-8 new stations

Option C would preserve the GO RER service concept as defined in the Initial Business Case and would integrate SmartTrack by adding seven to eight new stations, providing increased access to GO within Toronto. In the peak period, GO RER will already provide between five and ten minutes service frequencies between Unionville and Union Station and ten minute frequencies between Mt. Dennis and Union Station. Because of the added new stations, travel times would be increased by up to 35% for some passengers, with people boarding in Markham and Scarborough experiencing the largest percent changes to their journey times.

Service summary

- Greater access to rapid transit within the City of Toronto
- Longer travel times on the Stouffville and Kitchener corridor, due to new stations
- 7-8 new stations: Stations tested include Gerrard, Don Yard, Liberty Village, St. Clair West, Lawrence, Ellesmere, and Finch

- Kitchener and Stouffville through service through Union Station

Figure 7: Option C

Eglinton West LRT shown in red

D. Committed RER frequencies, 4-5 new stations

Option D would preserve the GO RER service concept as defined in the Initial Business Case and would integrate SmartTrack by adding four to five new stations, targeting the stations that appear most promising in terms of ridership and benefits. In the peak period, GO RER will already provide between five and ten minutes service frequencies between Unionville and Union Station and ten minute frequencies between Mt. Dennis and Union Station. This option would also include 4-5 new stations which would slightly increase travel times.

<u>Service Summary</u>

- Greater access to rapid transit within the City of Toronto
- Slightly longer travel times on the Stouffville and Kitchener corridor, due to new stations
- GO RER will already provide better than 15 minute service in the peak period and 15 minute service throughout the day
- 4 new stations, based on outcomes of the Metrolinx New Stations Analysis. Stations tested include Gerrard, Don Yard, Liberty Village, and St. Clair West
- Kitchener and Stouffville through service

Figure 8: Option D

RER 10-Year Service Concept for Kitchener, Lakeshore East, and Stouffville corridors AM Peak Hour, Peak Direction

Eglinton West LRT shown in red

5.0 DELIVERABILITY AND OPERATIONS

The deliverability and operations case speaks to the question of whether the options are achievable and documents the engineering and operational issues and challenges. This analysis assumes a baseline of the tracks, grade separations, and Union Station capacity that is required to operate GO RER service, already a significant expansion over today's infrastructure.

Early analysis, including sensitivity testing around train frequencies, suggests that planned GO RER service fully utilizes rail and corridor capacity and that some of the options would require significant infrastructure investments, including a number of new tracks and other infrastructure needs beyond the existing corridor right-of-way and with substantial property requirements and community impacts. As such, two options were screened out through the deliverability and operations case, and two options have been carried forward for full assessment through the other chapters of the business case.

SmartTrack provided an important impetus to further test the planned GO RER service concept and infrastructure to determine if any additional service increases would be possible given existing infrastructure. Ultimately, the analysis provides valuable additional understanding of the extent to which rail capacity is utilized by GO RER service levels.

4.1 Deliverability and Operations Analysis Methodology

The deliverability and operations analysis was conducted by translating the different proposed service levels in each option into infrastructure needs and then assessing the significance of those infrastructure needs. There are several steps to this translation process.

1. First, a sample time-table is created based on the proposed service level. For the integrated RER-SmartTrack options, it is important to note that these service levels were layered on top of planned RER service. On the Kitchener corridor, for example, this includes diesel express service from Kitchener and diesel all-stop service from Mt. Pleasant, as well as UP Express service.

2. Once a sample time table has been created, it is mapped out onto the track layout, using information about train speeds, station locations, and stopping time at stations. This creates a visual representation of points where, for example, two trains traveling in opposite directions might meet, or where a faster electric train might overtake a slower diesel train. At points where trains meet or cross, a separate track is required for each train to prevent service delay or collision. On corridors with relatively simple bidirectional service, this analysis typically yields requirements for two tracks but on corridors like Kitchener with multiple train technologies and speeds, local and express service, and bidirectional service, more than two tracks are likely required.

3. Track requirements for each option can then be compared with the number of tracks planned for GO RER and with the total right-of-way in each rail corridor. This determines

whether (a) a sufficient number of tracks is already planned as part of GO RER, or (b) there is available width in the corridor right-of-way to add additional tracks, beyond what is planned for GO RER. This process would also be applied to bridges and below-grade sections of track, to determine how intensive and disruptive constructing new infrastructure might be.

Further detail on this process is contained in Appendix A.

Table 4: Deliverability Screening Summary

Option	Status
A. Increased frequencies, 5 new stations	Not Carried Forward
B. Express and local service, 8 new stations	Not Carried Forward
C. Committed RER frequencies, 7-8 new stations	Carried Forward
D. Committed RER frequencies, 4-5 new stations	Carried Forward

4.1 Description of Screening Triggers

Screening triggers or fatal flaws are impacts considered to be significant enough to screen the option from further study and without identifiable solutions. This section describes screening triggers which were uncovered in early analysis of the options because of impacts to the Kitchener and Stouffville Corridors.

As part of the GO RER program, a fourth track will be constructed on the Kitchener corridor between Bramalea and Union Station which uses the available right-of-way within the corridor. The need to construct additional 5th or 5th and 6th tracks on the southern section of the corridor could likely not be accommodated within the right-of-way and would entail property acquisition affecting approximately 200 to 300 individual properties including commercial, industrial, and residential. It would also likely require rebuilding major infrastructure recently completed in the context of the Georgetown South project including the West Toronto Diamond and the Strachan Grade Separation. Those implications present substantial costs and community impacts and are considered fatal flaws. Options which trigger the need for any additional track on the Kitchener corridor have been screened out.

Like the Kitchener corridor, the double-tracking planned within the RER program will use the available right-of-way within the existing Stouffville corridor. The need for 3rd and 4th tracks on the Stouffville corridor would also likely trigger major property acquisition affecting approximately 600 to 700 individual properties including commercial, industrial, and residential to the extent that options which trigger the need for additional tracks were also screened out due to this "fatal flaw."

4.2 Union Station

Currently, Union Station accommodates approximately 30 trains in the peak hour. In the context of the GO RER program, Union Station will be expanded to accommodate 45 to 50 trains in the peak hour which is sufficient to support the RER service concept, a massive step change in service. However, service levels beyond the committed GO RER program will require further investment in Union Station expansion, which would be costly.

4.3 Detailed Option Specific Screening

The following table summarizes additional track requirements for each of the options. Further information on the operational analysis supporting these findings is provided in Appendix A.

Table 5: Track Requirements Summary

	Number of Tracks Required		
	Stouffville Corridor	Lakeshore East Corridor (USRC to Scarborough Junction)	Kitchener Corridor
Current Number of Tracks (2016)	1	3	3
GO RER	2	4	4
Option A: Increased frequencies, 5 new stations	2	5	5 (USRC to Airport Spur)
Option B: Express and local service, 8 new stations	4	5	6 (USRC to Airport Spur)
Option C: Committed RER frequencies, 7-8 new stations	2	4	4
Option D: Committed RER frequencies, 4-5 new stations	2	4	4

4.4 Additional tracks on the Stouffville corridor:

In order to provide local and express service (Option B), two additional tracks are required on the Stouffville corridor, beyond what will be constructed for GO RER. As described in section 4.1, this was determined by mapping out the service and identifying locations where trains would meet or pass each other. Based on an analysis of the service associated with Option B, layered on top of planned GO RER service, there are a number of locations where four trains would be meeting or passing, meaning that four tracks would be required along the corridor from Scarborough Junction to Unionville. Because there is insufficient right-of-way in the existing corridor to construct two additional tracks, this new infrastructure would trigger property acquisition. The extent of this infrastructure, the cost, and the community impact is unacceptable and contributes to the screening of Option B.

4.5 Additional infrastructure on the Lakeshore East corridor (USRC to Scarborough Junction): Based on the analysis of service and a mapping out of the service associated with the RER-SmartTrack integration options over and above planned RER service, both Options A and B would trigger the need for an additional track in the Lakeshore East corridor between the USRC and Scarborough Junction.

For Option A the need for the additional track is triggered by the effective doubling of service between Unionville, Union Station and Bramalea that would be operating in this segment. The service pattern results in a much denser train pattern when local and express Lakeshore East trains are taken into account. There are a number of locations along this segment of the corridor where a number of trains meet or cross paths. In the absence of an additional track, trains moving at different speeds might be delayed behind one another to avoid collision while trains travelling in opposite directions might be blocked.

For Option B the need for an additional track is triggered by the different stopping patterns of the local and express Kitchener-Stouffville trains and also the express and local Lakeshore East service. Each unique stopping pattern has a different speed profile and without the additional tracks, the local and express service pattern along with the Lakeshore East service pattern would result in trains meeting or being unable to pass. Similar to Option A, in the absence of additional infrastructure, trains moving at different speeds might be delayed behind one another to avoid collision while trains travelling in opposite directions might be blocked.

4.6 Additional tracks on the Kitchener corridor

Based on an analysis of the higher frequencies set out in Option A, over and above what is planned for GO RER, this option triggers the need for a 5th track between the USRC and the Airport Spur. Because the heightened frequencies reduce the amount of time between trains, there is less flexibility to accommodate the many different types of service planned for the Kitchener corridor. In order to ensure that faster train trips are not held up behind slower train trips, the additional track is required.

Because of the local and express service set out in Option B, layered on top of the different services identified in the planned RER service concept, this option triggers the need for 5th and 6th tracks between the USRC and the Airport Spur. The complexity of what would be five different speed profiles (diesel express service from Kitchener, diesel local service from Mt. Pleasant, UP Express service, and electrified all-stop service from Bramalea) combined with the service traveling in the opposite direction, a 5th and 6th track would be required in the corridor. Without these additional tracks, there would be numerous points where trains travelling at different speeds or in different directions would meet.

As discussed above, because insufficient space exists within the corridor for these tracks the expansion would require substantial property acquisition, including both a 5th track and 5th and 6th tracks. It would also require major modifications to the recently completed Strachan Grade Separation and the West Toronto Diamond. These impacts are severe and contribute to the screening of Options A, and B from further consideration.

4.7 Sensitivity Testing of Option A

Option A proposes a doubling of GO RER electrified service from every 15 minutes to every 7.5 minutes. As outlined in section 4.1, this was tested by developing a sample time-table and mapping it onto the track layout to identify points where trains would meet and thus require additional tracks. For 7.5 minute frequencies, this analysis indicated that an additional track would be required for both the Kitchener and Lakeshore East.

After it was determined that 7.5 minute frequencies triggered additional tracks, 10 and then 12 minute frequencies were tested. For each of these tests, it was determined that a 5th track would be required on the Kitchener corridor to accommodate even 12 minute frequencies, or just one additional train per hour. As discussed above, because the Kitchener corridor accommodates a large number of diverse rail services, each with a unique stopping pattern and speed profile, the capacity of the corridor is fully utilized with the committed GO RER service concept to the extent that even one more train per hour cannot be accommodated.

Figure 9: Infrastructure Requirements for Option A

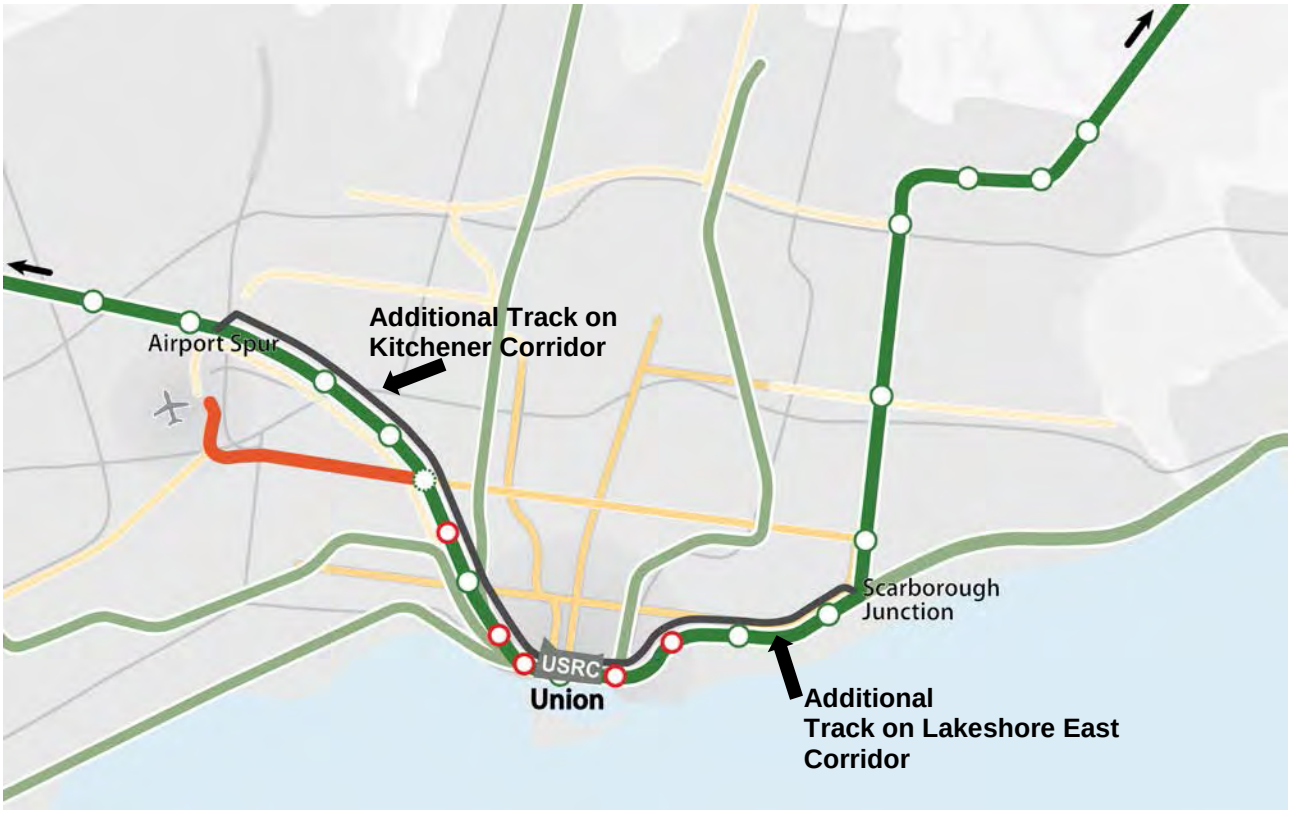


Figure 10: Infrastructure Requirements for Option B

4.7 Options Being Carried Forward to Further Evaluation

High-level analysis of sample time tables indicates that both Options C and D are workable without additional track requirements. For both of the workable options, the Kitchener corridor requires careful planning. Because GO RER service on the Kitchener corridor will be comprised of a mix of fleet (diesel locomotive, diesel EMU, and electric) types, service (local and express) types, and train speeds, service patterns are complex and delicately balanced. Any changes to that balance, including adding new stations which slows service down, may trigger other counter-balance alterations. Options C and D each include the addition of St. Clair and Liberty Village stations on the Kitchener corridor. In order to accommodate these stops on the local, electrified service, service from Kitchener, planned to run express from Bramalea to Union Station would need to add at least two station stops. With these adjustments, though, Options C and D are feasible.

6.0 STRATEGIC CASE

The Strategic Case discusses the extent to which the options under consideration support a larger vision for transportation in the Greater Toronto and Hamilton Area (GTHA), and, given the context of GO RER-SmartTrack integration, of the City of Toronto specifically. This section also includes the problem statement and discussion of how and to what extent the options address the problem statement. It also includes analysis of ridership patterns and markets, travel behaviour, and social equity.

The aim of the Strategic Case is to answer the questions:

- Do the options align with broader policy objectives?
- How do the options fit into the larger context of GO Regional Express Rail?
- To what extent do the options address the problem statement and achieve the vision?
- How do the project options address the problem statement and impact broader travel behaviour?

Because Options A and B were screened out from further consideration through the Deliverability and Operations Case, strategic analysis will focus on Options C and D.

6.1 Policy Objectives

Metrolinx and City of Toronto policy objectives are compatible and mutually supportive. The Big Move, the regional transportation plan, is explicit in its vision of increasing transit ridership and reducing the distance that people drive each day. Also emphasized in The Big Move, as the first goal, is increasing transportation choices so that people have a wider range of options for getting around. In analyzing the integrated GO RER-SmartTrack options, an important objective for Metrolinx was achieving balance in expanding travel options for Toronto residents while preserving a competitive travel experience for medium and longer distance passengers.

The City of Toronto's key transit objectives include:

- Increase accessibility and choice for residents throughout the City, particularly for lower income residents.
- Provide additional transit capacity and relieve constrained portions of the network, particularly the Yonge Subway and Bloor-Yonge Station.
- Increase transit efficiency by balancing load across the network and resiliency (in terms of providing an integrated network of alternative routes).

The integrated RER-SmartTrack options would increase overall transit ridership and also reduce the distances travelled by car. These options would also increase transportation choices and accessibility, for both Toronto residents who live or work near a new station as well as for suburban GO passengers who would have new options for stations serving additional destinations.

The City of Toronto's Feeling Congested? framework for project evaluation is also an important lens for Strategic Case analysis.
The strategic value of transit investments in Toronto can be viewed and understood through a framework developed through *Feeling Congested?*, the recent review of Transportation Policies in Toronto's Official Plan. The framework focuses on three principles:

- Serving People
- Strengthening Places
- Supporting Prosperity

These three principles are further articulated as eight criteria:
Serving People

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

Strengthening Places

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

Supporting Prosperity

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

6.2 Vision for Transportation Options

The $13.5 billion committed RER program will bring about a transformational shift in travel options throughout the GTHA. Currently, the GO rail network functions largely as a commuter system, bringing people into downtown Toronto in the morning and returning them to their homes in the evening. GO RER is not an incremental change to the current commuter network but a sea-change that will bring electrified, two-way, all-day, 15 minute service to many parts of the region. This upgrade in service will change the way that people consider their travel options – rapid transit will now be readily available for mid-day trips, weekend trips, and also non-downtown work trips. Another anticipated positive impact of substantial upgrades to GO service, particularly on the Stouffville corridor, is relief to crowded the Yonge Subway. This effect was borne out in Metrolinx's analysis through the Yonge Relief Network Study.

The existing GO rail network enables suburban commuters to easily work in downtown Toronto and GO RER will also support the growing number of downtown dwellers commute to suburban employment locations. While the existing GO rail network provides service to Toronto residents who live near a GO station and work downtown, with all-day RER service there is potential to improve integration with TTC so that GO rail service can become relevant to a wider swath of Torontonians, as SmartTrack proposes. GO RER's 15 minute service also goes a long way toward making GO service more competitive with frequent TTC service. Whereas existing GO frequencies of up to 30 minutes in the peak period mean that travelers are bound by schedules, 15 minute service approaches the point where travelers turn up at the station without consulting a schedule, making travel considerably more flexible. The GTHA Fare Integration Strategy aims to further contribute to making GO a more relevant transportation choice for Toronto residents by looking at fares and transfer policy and when that work is complete, outcomes will be incorporated into analysis of these options. Overall, the upgrade of the GO network will go a long way toward making GO a more accessible and relevant transportation option for many Torontonians, especially if coupled with fare and service integration, both of which are components of the SmartTrack proposal.

All seven GO corridors run through the City of Toronto, stopping at 19 stations, including 8 on the Kitchener and Stouffville corridors, and meeting at Union Station. The GO corridors largely run through Etobicoke and Scarborough, providing downtown access opportunities to the neighbourhoods located at a distance from the subway. This includes the Stouffville and Kitchener corridors which are the focus of SmartTrack.

SmartTrack proposes upgrading service on the Stouffville and Kitchener Corridors as a layer over and above the GO RER program, further integrating these rail corridors into the urban rapid transit network and providing enhanced transit accessibility to Toronto residents. To achieve this integration, SmartTrack includes new stations, TTC fares, and increased frequency, as well as an LRT along Eglinton Avenue West and provides an opportunity to improve access to the GO network for Toronto.

It is within this context that the RER-SmartTrack integration options were developed. Through the Strategic Case, they will be evaluated based on how they further improve transit accessibility for Torontonians, beyond what RER will already bring about, while still preserving a high quality of service for suburban travelers. This will be assessed through the problem statement, through an analysis of ridership and travel patterns, and through a look at social equity. Analysis in this business was developed assuming the current fare structure, including existing GO fare structure for GO RER, TTC fares, and existing transfer policy.

Problem Statement

As the City of Toronto has grown, the transit network's capacity during the peak periods has proved insufficient to support the demand. In particular, the need to relieve overcrowding on the Yonge Subway line has grown acute. In addition, the distribution of population and employment within Toronto has shifted with concentrations of lower income city residents increasing in outer areas of the city. These residents have relatively poor transit access to major job concentrations due to long journey times and congestion.

Seven GO corridors currently travel through Toronto, but given train schedules and peak-only service on most lines, opportunity exists to improve GO accessibility for Toronto residents. GO RER will go a long way toward addressing these issues by expanding GO service, transforming it to be faster and more frequent through the day.

SmartTrack proposes to go above and beyond GO RER, further increasing the options for moving through the network. SmartTrack is an opportunity to integrate transit services within Toronto, enabling GO corridors to provide new transit capacity for trips to, from, and within the City of Toronto. To this end, SmartTrack proposes to increase use of the Stouffville and Kitchener lines with new stations and improved service frequency, and an integrated fare. This study analyzes different options to integrate SmartTrack with GO RER to continue to serve medium and long distance commuters, as well as meet more of the transportation needs for people wanting to travel to, from, and within the City of Toronto.

Problem Statement and Vision Performance Discussion

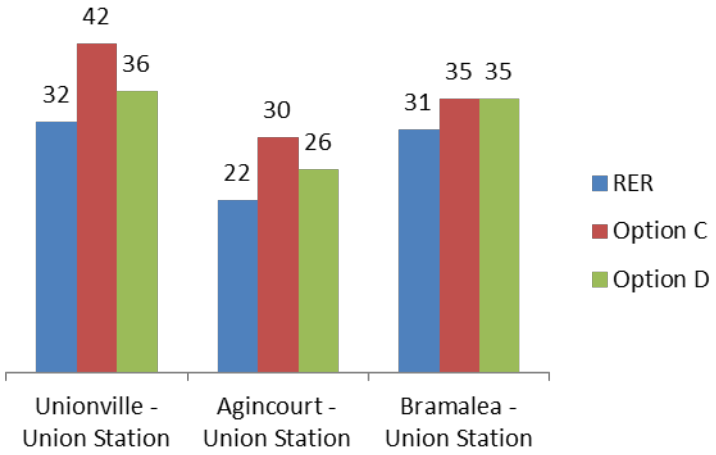
Options C and D each seek to address the problem statement in different ways.

Option C adds seven to eight new stations within the City of Toronto, making GO service more accessible to Toronto residents and connecting a larger number of origin and destination points. This option would preserve the GO RER service concept with some minor modifications to Kitchener express service. Of the new stations, 2-3 would be between Bramalea and Union Station and 5-6 would be between Unionville and Union Station. These additional stations would increase net ridership and transit accessibility and choice within Toronto but have an impact on travel times, especially for medium and longer distance passengers. For example, passengers travelling between Milliken Station at Steeles Avenue and Union Station would see their trips lengthened by more than 35%. Overall, in Option C, more passengers lose time on their trips than the passengers who save time via the new stations.

Option D adds 4-5 new stations within the City of Toronto. Like Option C, this option would preserve the GO RER service concept with some minor modifications to Kitchener express service. Option D attracts new riders but also imposes some travel time increases – for example, approximately 15% for Milliken passengers travelling to Union Station – but the increases are slight. Because Option D focuses on adding the stations with the most potential for new ridership, it adds marginal travel time to medium and long distance passengers but also saves time for other passengers. However, because fewer new stations are added, Option D does not go as far as Option C in terms of adding new access points to the GO network, resulting in smaller increases to transit accessibility and travel choice for Toronto residents.

Options C and D have different advantages and disadvantages. Option C goes further to increasing travel choice for Toronto residents but at the expense of travel times for medium and longer distance passengers. Option D does not go as far in expanding transit accessibility within Toronto but also better serves medium and longer distance travelers, including those boarding at Toronto stations like Milliken and Agincourt.

Figure 11: Sample Travel Time Comparison of RER with Option C and Option D



Experience

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

Ridership growth is an important indication of Experience. GO ridership in 2014 was approximately 54 million annual trips. With the implementation of GO RER on five corridors, ridership is forecast to climb 140 percent to 127 million annual trips. On the Kitchener and Stouffville corridors, current ridership is 9 million annual trips and it is forecast to grow threefold to 27 million annual trips with GO RER.

Ridership analysis of the integrated RER-SmartTrack options suggests that they would increase ridership by approximately ten percent over and above what is forecast for GO RER. Options C and D are forecast to attract similar levels new ridership to the system – 2.4 to 2.8 million annual new riders beyond GO RER. Both options would provide relief to Bloor-Yonge station and on Line 1. It should be noted that this analysis assumes the existing fare structure; ridership on the integrated RER-SmartTrack options may increase with fare integration. The City of Toronto has conducted ridership modelling of Options C and D using their new transportation model and assuming a TTC fare on the Kitchener and Stouffville corridors between Mt. Dennis station and Milliken station. Even with a TTC fare, City of Toronto modelling provides similar indications as Metrolinx modelling in terms of relative station performance and the relative performance of Options C and D. Results from these forecasts are included in Appendix C.

Table 6: Ridership and Travel Time Summary

Options	Ridership			Travel Time Savings with RER (million minutes)
Base Case: Committed GO RER	127 million total 27 million, Kitchener + Stouffville			358.7 (Kitchener + Stouffville)
	Ridership (Boardings and alightings at new stations incl. new and existing riders, Annual)	Ridership (Net new to system, Annual, Incremental to RER)	Percent Change (Incremental to RER)	Transit Rider Travel Time Savings with Integrated Options (million minutes)
Option C: Committed RER frequencies, 7-8 new stations	7.1 million	+2.4 million	+9%	253.9
Option D: Committed RER frequencies, 4-5 new stations	5.1 million	+2.8 million	+10%	323.9

Travel Behaviour Discussion

Equally important as knowing the forecast ridership of each option is understanding how the options influence travel behaviour and what factors drive the differences between options.

New stations have a number of influences and impacts. They serve additional locations and attract new riders but also impose new capital and operating cost, increase travel times, and potentially contribute to a loss in upstream passengers. Each new station increases travel time by two to three minutes, although electrification works in the opposite direction, reducing travel times by approximately fifteen to twenty percent.

- *For both Options C and D the new stations yield a net increase in GO ridership.*
    - Both options cause a net reduction in vehicle kilometres (i.e., less driving overall) in the GTHA because they take car trips off the road by inducing drivers to switch to transit.
    - Both options would yield an increase in GO revenue, on the order of $10 to 15 million per year in 2031.

- For both options, the new stations cause a net increase in travel time (negative travel time savings) and would reduce the total travel time savings brought about by RER on the Kitchener and Stouffville corridors. For Option C, this effect erodes approximately thirty percent of the time savings; for Option D, it erodes approximately 10 percent of the time savings.

- The package of new stations in Option D yield more favourable results than those in Option C for ridership, time savings, and vehicle kilometres travelled metrics.

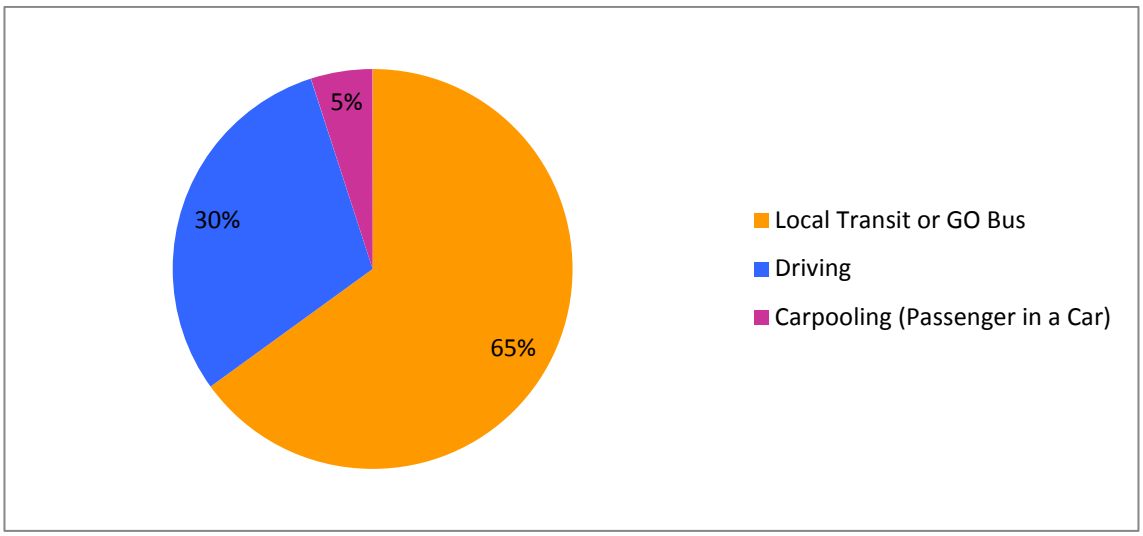
- *Findings suggest that the new stations attract ridership primarily as destinations not as boarding.*

    - Proposed new stations near downtown with significant job clusters nearby are more promising than proposed stations in more residential areas. For example, a Liberty Village station is promising largely due to alightings at the station. Liberty Village is an emerging employment hub and a GO station in the area is extremely attractive to people who work there.

    - Option D is more successful than C because its constellation of new stations is more heavily weighted towards those located near downtown with clusters of jobs surrounding, while Option C includes both stations in residential areas and those around downtown.

- *For both Options C and D, the majority of passengers are switching to GO from local transit or GO bus*

Figure 12: Chart Showing Previous Travel Modes of New Passengers



- *Options C and D attract similar numbers of new passengers, but they are not necessarily the same passengers.*

    - Option C attracts more new passengers because of a higher number of new stations but it also deters more existing passengers due to longer travel times.

    - Option D attracts new passengers, mostly those alighting at new downtown stations, but the modest number of new stations does not deter many existing passengers.

Choice

The project's impact on choice can be understood both in terms of how many opportunities there are to transfer to other rapid transit lines that serve destinations that people want to travel to (more opportunity is positive), and how many transfers riders need to make to reach their destinations (fewer transfers is assumed to be good).

There are a number of key transit connection points on SmartTrack, including:

1. Union (Downtown);
2. Eglinton-Mount Dennis;
3. Markham Centre (Unionville); and
4. Renforth Gateway (at Mississauga Airport Corporate Centre).

All of these points are identified as Mobility Hubs by Metrolinx, and should be planned as important connection points in the future. These hubs act as intermediary points on many transit trips to downtown Toronto and elsewhere in the city, in addition to being important destinations in their own rights.

SmartTrack would connect with a significant number of existing rapid transit lines. Each of the other rapid transit lines currently under study by the City would also connect with SmartTrack.

Currently, Union Station serves as the terminus for all of the GO lines. SmartTrack envisages connecting the Stouffville and Kitchener lines and running a continuous service from Bramalea to Unionville, removing the need to transfer between GO trains for many users.

Both SmartTrack options include all of the stations with connections to other rapid transit lines. Option C, with its additional stations, provides more connections to local bus routes.

The number of connections to major walking and cycling infrastructure is also related to transportation choice. Examples of this type of infrastructure include downtown's PATH system for pedestrians, the Waterfront Trail system or the West Toronto Rail Path. SmartTrack would connect to the PATH at Union Station. The options do not differ significantly in their impacts or ability to connect to any such pedestrian or cycling facilities.

On balance, all options perform equally well with respect to Choice.

Social Equity

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

SmartTrack would serve a moderate number of disadvantaged residents. Option C, by nature of its additional stations, serves more low income residents.

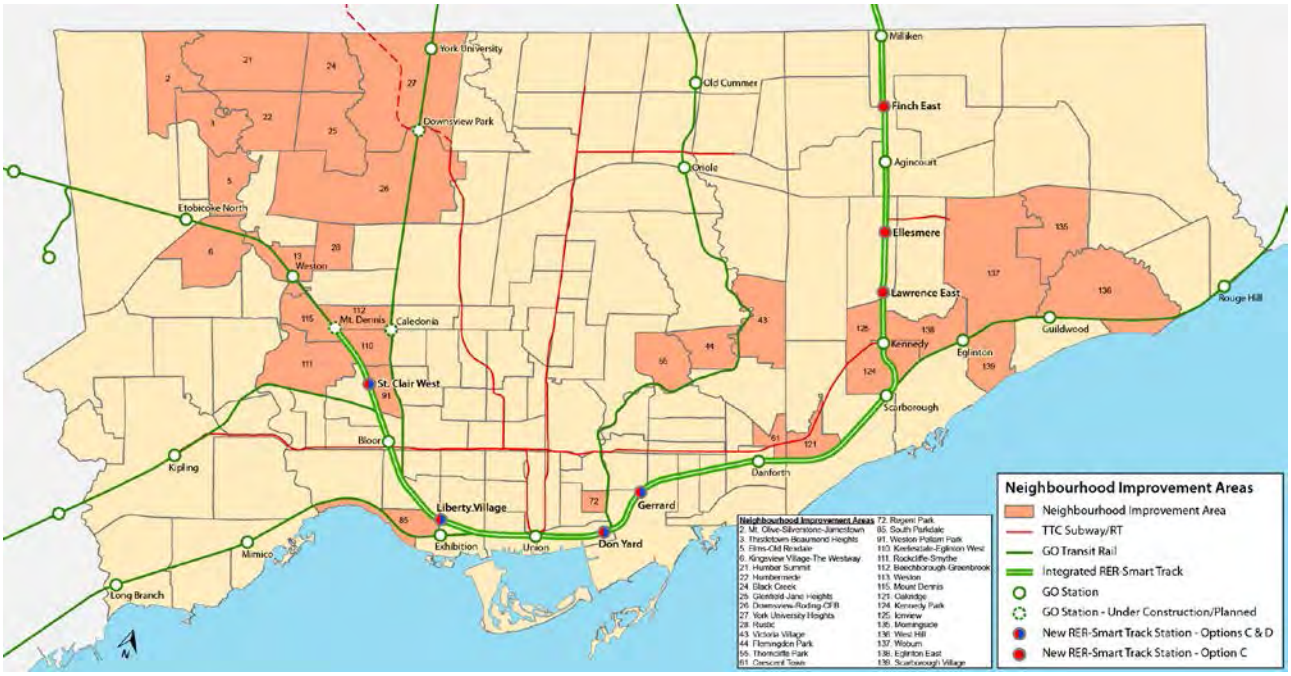
Access to jobs for residents of NIAs would also increase (measured by the change in jobs accessibility for NIA measure, data is forthcoming).

On balance, all options perform equally well with respect to Social Equity.

Table 7: Social Equity

	Option C	Option D
Change in Rapid Transit Coverage (Toronto is approximately 640 km^2)	+5.2 km^2	+3.7 km^2
Change in Disadvantaged Residents Served	+9,900	+8,000

Figure 13: GO Corridors with Existing Station Locations and Neighbourhood Improvement Areas



Strengthening Places

Shaping the City

Transit investments can play a very significant role in the residential development of the city. Rapid transit may be constructed to serve areas of high population density in order to relieve congestion and increase capacity of local transit services, or rapid transit can be built in areas planned for higher population density in order to increase transportation accessibility and thus incent residential development in appropriate areas.

Existing population represents an established market which makes benefits associated with serving it more certain than those associated with serving growth. However, it is still important in the evaluation of a project's impact on Shaping the City to consider how the project would serve residential growth areas to support and guide their development.

SmartTrack serves the key growth areas in the Downtown and Liberty Village. It would also bring a station (Unilever) much closer to the significant growth occurring and planned for the Portlands. The station at Ellesmere in Option C is also close to Scarborough Centre, which has been designated for mixed-use development.

By virtue of its additional station at Ellesmere, Option C provides some additional benefit over the base and Option C with regards to Shaping the City. This benefit may be captured in Option D as well pending the findings of the additional stations assessment.

Table 8: Residential Growth

		Option C	Option D
Existing Population	existing GTHA population	+24,100	+20,500
	existing GTHA population density	4,600 people/km^2	5,600 people/km^2
Service to residential growth areas	area of land designated for population growth	0.7 km^2	0.5 km^2
	proportion of land designated for population growth	14%	14%
Population Growth	projected population growth	+5,300	+5,000
	projected increase in population density	+1,000 people/km^2	+1,400 people/km^2

Healthy Neighbourhoods

Just as transit investments can be a powerful force in shaping the city, they can also have long-term detrimental impacts on existing, stable neighbourhoods. A modest proportion of the SmartTrack study area is recognized as stable neighbourhoods, to which adding a station could bring unwanted development pressure and change. Option C is in close proximity to 1.0 km^2 of stable neighbourhoods and Option D is 0.7 km^2 (19% and 20% respectively).

All options perform equally well with respect to Healthy Neighbourhoods.

Public Health & Environment

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

SmartTrack would enable a savings of approximately 500,000 km per day. Option C and Option D perform similarly, with the reduction in vehicle kilometers travelled associated with Option D being slightly greater.

There are some technical challenges with environmental impacts associated with locating a SmartTrack station at Unilever. However, these affect each of Option C and Option D equally.

The Stouffville, Lakeshore East and Kitchener GO corridors pass over a number of river and creek systems presently. None of the options represent significant impacts to any of the systems.

All options perform equally well with respect to public health and the environment.

Supporting Prosperity

Supports Growth

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

Existing employment density can be used as a proxy for what future employment density will be, however this projection is less certain than for population due to how employment growth tends to occur. Different types of employment develop at certain nodes, depending on how economies grow and change – Toronto's Liberty Village is an example of how a dominant sector (technology) has developed very quickly in a relatively small area. This rapid development may not have been predictable 10 or 20 years ago. Strategically, the more important evaluation of a project's impact on supporting growth relates to how the project would serve employment growth areas. For example, the Unilever site has recently emerged as potential significant employment node. Recent proposals have suggested as many as 70,000 jobs could be located on the site. High quality transit options would be required to support such a concentration of employment.

SmartTrack serves the key growth areas within the City including Downtown, Liberty Village, and Unilever as well as the Mississauga Airport Corporate Centre and Markham Centre, significant employment nodes with additional growth potential, outside the City. The Ellesmere Station in Option C would also provide a close connection to Scarborough Centre, an area identified by the Official Plan for mixed-use intensification.

The Finch, Ellesmere and Lawrence stations are located in close proximity to Employment Areas. Although the areas currently contain low density employment uses, this could change over time, particularly with the introduction of regional transit services.

Option C is preferred from the perspective of Supporting Growth.

Table 9: Employment Growth

		Option C	Option D
Existing Employment Density	existing employment	19,000	12,400
	existing employment density	3,600 jobs/km^2	3,400 jobs/km^2
Service to Employment Growth Areas	area of land designated for employment growth	1.9 km^2	1.1 km^2
	proportion of land designated for employment growth	36%	31%
Projected employment growth	projected employment growth	30,600	28,400
	projected increase in employment density	5,800 jobs/km^2	7,700 jobs/km^2

Strategic Analysis Discussion Summary

GO RER represents a significant improvement in GO service for the GTHA as a whole and for the City of Toronto. Especially when combined with fare and service integration, the GO RER program will substantially improve access to the GO network for Torontonians and its relevancy as a travel option.

Over and above this improvement, there is room to go further, and by adding new stations, both of the integrated RER-SmartTrack options do this. Both Options C and D address the problem statement and further the vision for integrating GO RER and SmartTrack. Option C goes further than Option D in opening up new access points to GO within Toronto and thus performs better with regards to shaping the city and supporting growth. In particular, Option C increases accessibility to the downtown job market from nearby areas lacking rapid transit downtown access, which will promote intensification. The two options also have similar ridership increases, and outcomes with respect to choice, social equity, healthy neighbourhoods, public health and the environment. Option D has a strategic advantage over Option C in that it has less negative impact to medium and long distance commuters and does not deter passengers from those markets from choosing GO by imposing significant additional travel time. Option D does this by focusing on adding the most promising new stations, mostly those near employment clusters. In terms of coming to the optimal balance between local access and regional service, Option D is the strongest performer.

7.0 FINANCIAL CASE

The financial case aligns with the *Feeling Congested?* affordability metric and seeks to understand the investment costs and the ongoing operating costs throughout the whole life of the asset. The financial accounts are summarized in the following tables:

Table 10: Financial Information Summary

Nominal Dollars	Base Case GO RER Kitchener+Stouffville	Option C: Committed RER frequencies with slower long-distance service, 7-8 new stations	Option D: Committed RER frequencies, 4-5 new stations
Capital Costs (Rail only, $M, 2014, costs do not include escalation, financing costs, lifecycle and operating and maintenance)	$3,300	+$1.1-1.7	+$0.7 - 1.0
Nominal Annual Operating Costs ($M 2031)	$140	+$8.7	+$5.3
Annual Incremental Revenue to GO ($M, 2031)	$210	+$11.8	+$15.1
Cost Recovery Ratio (2031)	150%	149%	155%

Capital Cost Caveats:

Detailed capital costs are included in an appendix. The capital costing prepared to date is at a high-level and should be understood with a number of caveats:

- Capital costs broadly align with the New Stations analysis and are presented with appropriate contingency.
- Costs do not include escalation, financing costs, lifecycle, and operating and maintenance costs.
- Corridor infrastructure costs are built from numerous component costs including bridge widening, additional electrification, tracks and signals; each element will require further design and costs are subject to change.
- Property acquisition costs have been estimated for new corridor infrastructure. Further work is required to confirm property requirements and costs for new stations.
- Cost estimates for Union Station, fleet, and other system costs were developed based on high-level assumptions and may change as further analysis is conducted.

Financial Analysis Discussion

Options C and D are relatively similar in terms of financial performance. Option C is slightly more expensive to both build and operate, compared to Option D because it involves a larger number of new stations and consequently incur larger costs to build and maintain. Options C and D have similar ridership and because the operating costs for Option C are higher due to additional stations, it has a lower cost recovery ratio as compared to Option D.

8.0 ECONOMIC CASE

The economic case measures, quantifies, and monetises transport impacts (benefits) and seeks to compare those benefits with costs to understand relative performance and value-for-money of each investment option. There are other benefits, like ambiance and comfort, which are not monetized or included in the benefit cost ratio. The following benefits were monetized and incorporated into the analysis:

- Travel time impacts (savings and delays to both new and existing users)
- Unperceived vehicle operating cost savings comprised of savings for people who switch from auto to transit
- Fare revenue
- Reduction of emissions, collisions, and congestion due to reduced vehicle-kilometres travelled (VKTs)

Table 11: Economic Information Summary

2014$ Value	Base Case GO RER Kitchener+Stouffville (Compared with Do-Minimum Scenario)	Option C: Committed RER frequencies, 7-8 new stations	Option D: Committed RER frequencies, 4-5 new stations
Total Lifecycle Costs ($M, PV)	$6,900 (does not include system costs; includes RER Do-Minimum Scenario costs)		
Incremental Lifecycle Costs ($M, PV)	$4,100 (Incremental to the GO RER Do-Minimum Scenario)	$1,000-1,600 (Incremental to GO RER)	$600-800 (Incremental to GO RER)
Net Benefits (PV)	$4,100	($2,200)	($1,100)
Benefit Cost Ratio (Incremental Benefits/Incremental Costs)	2.0	Negative	Negative
GO RER Kitchener and Stouffville corridors Combined Benefit Cost Ratio	-	2.0	
Impact to Kitchener-Stouffville RER Benefit Cost Ratio	-	31% decrease to 1.37	18% decrease to 1.64

Table 12: Economic Benefits Breakdown*

2014$ Value, $M	Base Case GO RER Kitchener+Stouffville (Compared with Do-Minimum Scenario)	Option C: Committed RER frequencies, 7-8 new stations	Option D: Committed RER frequencies, 4-5 new stations
Travel Time Impacts (negative result indicates delay)	$3,200	($1,200)	($600)
Auto Operating Cost Savings (due to mode shift from auto to transit)	$3,800	$20	$110
Collision Reduction Savings (due to mode shift from auto to transit)	$400	under $5M	$10
Congestion Relief (due to mode shift from auto to transit)	$800	$10	$40
Environmental Benefits	$20	under $5M	under $5M
Total Benefits	$8,200	($1,100)	($400)

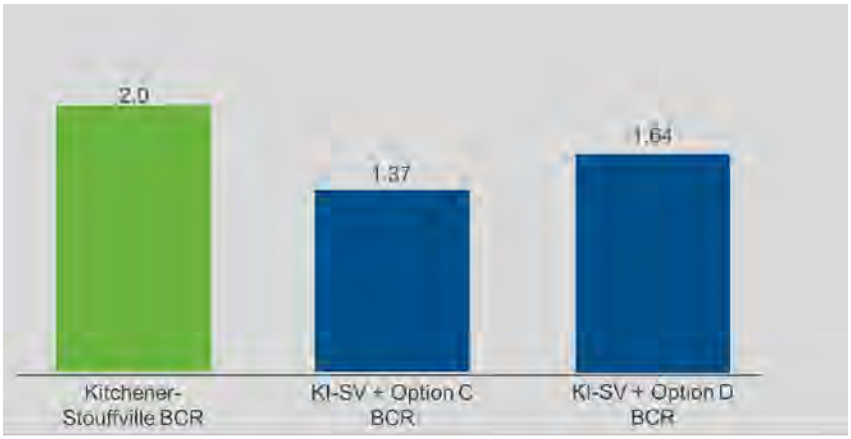
* It should be noted that the City of Toronto has also conducted some economic analysis which is presented in Appendix C of this document.

Economic Analysis Discussion

Overall, Option D is a stronger performer than Option C, when assessed through an economic lens. The primary lens through which economic performance was analyzed is through an assessment of each option's impact to the established GO RER benefit-cost ratio. The GO RER benefit-cost ratio is 3.1, meaning that the benefits of the investment, including travel time savings and auto operating cost savings exceed the life cycle costs (including capital and operating) by a factor of three. For the Kitchener and Stouffville corridors, the combined benefit-cost ratio is 2.0. This was calculated by adding up total benefits for Kitchener and Stouffville and dividing by the sum of the total costs for the two corridors. In order to measure the economic impacts of Options C and D, the change to the combined Kitchener and Stouffville benefit-cost ratio was assessed.

Option C has a negative impact and would reduce the RER benefit-cost ratio from 2.0 to 1.37. Option D has a smaller negative impact and would shift the combined benefit-cost ratio from 2.0 to 1.64. For both options, the benefit-cost ratio remains above 1:1. Option C has a stronger negative effect than Option D.

Figure 14: Impact of Options C and D to GO RER Kitchener-Stouffville Benefit-Cost Ratios



The net benefits for both Options C and D are below zero, meaning that for both options, the dis-benefits outweigh the positive benefits. For both of the options, this is due to travel time penalties associated with the addition of new stations. While a small number of passengers benefit substantially from the new stations, a larger number of passengers incur small time penalties at each added station. In aggregate, the time lost to the larger group of passengers outweighs the smaller number of passengers who would save time.

Options C and D differ in terms of auto operating cost savings. While both options have a similar number of new riders, Option C attracts more City of Toronto residents making shorter trips and deters passengers making longer trips, leading to a smaller reduction in vehicle kilometres travelled. Option D attracts more passengers making longer trips and alighting at new downtown stations. Because Option D adds fewer new stations, it does not deter as many long distance travelers as Option C, leading to a larger reduction in vehicle kilometres travelled, compared to Option C. Accident reduction savings and congestion relief are both related to reduction in vehicle kilometres travelled and thus have comparable patterns to auto operating cost savings, with Option D performing slightly better than Option C.

9.0 CONCLUSION AND NEXT STEPS

Based on the analysis in the business case, Option D is the strongest performing option for integration SmartTrack with GO RER. Option D has an advantage in overall ridership and strikes the optimal balance in terms of advancing local access within Toronto while preserving service quality for longer distance passengers. While both options perform less positively through the lens of economic analysis, Option D has a smaller negative impact to the GO RER Kitchener and Stouffville benefit-cost ratio.

Next steps include:

- The number and locations of new stations are being determined through the new stations analysis, which includes business cases on each potential location.
- The GTHA Fare Integration Strategy is progressing and is currently conducting analysis on the different integration options, including ridership and revenue assessments. As a clearer direction emerges on fare integration, the impacts on ridership, particularly at City of Toronto GO stations will be incorporated into overall GO RER analysis and into analysis of the integrated options.
- Work is ongoing to better understand different aspects of Union Station, including a more nuanced understanding of capacity that takes train flows through the entire Union Station Rail Corridor into account. As this work moves forward and is applied to an updated understanding of how GO RER will operate, it will likewise be applied to the integrated RER-SmartTrack options.

10.0 APPENDIX

Appendix A:

Technical Methodology supporting the Deliverability Screening

Operational Feasibility

Operational feasibility measures the practicality of an option from different angles, such as infrastructure requirements, crewing and fuel options. At the screening phase, infrastructure requirements are deemed the most significant constraints among other considerations. Options will be advanced for further analysis beyond the screening phase if it satisfied the infrastructure requirements, which is explored in detail in the following section.

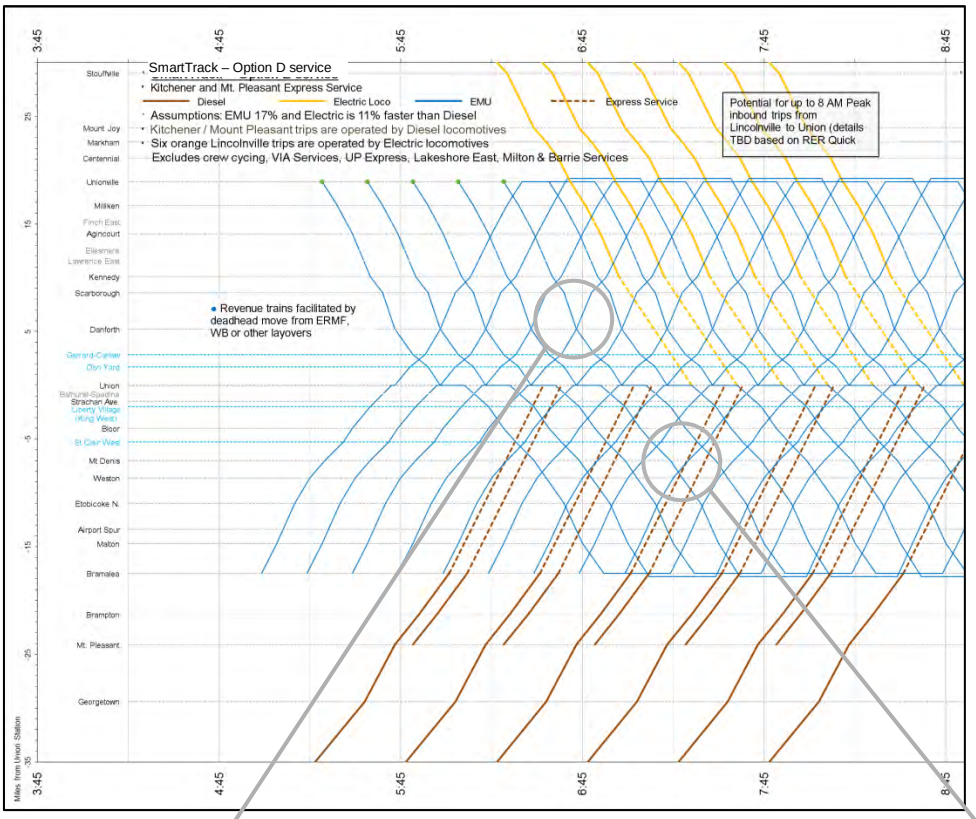
Infrastructure Requirements

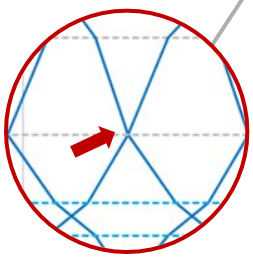
Each SmartTrack option has its own infrastructure requirements, such as track and train storage needs. In order to achieve the transportation objectives and deliver within the given timeframe, the key infrastructure constraint is to utilize only the existing and planned infrastructure within the scope of GO RER.

Track Requirements

To determine track requirements for each option, a preliminary timetable is developed using a list of assumptions that are shared among all options, such as train speed for electrified service and station dwell times.

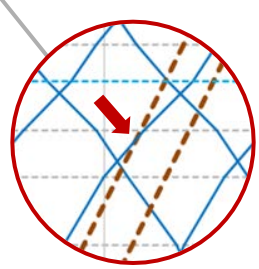
The timetable is then converted to a time-distance plot, which displays each and every train as a line on the plot based on its schedule and routing. See below for a sample time-distance plot.





Zoom-in #1: An example of two trains travelling in different directions meeting at a location where two tracks will be required

Zoom-in #2: An example of a faster express train overtaking a slower local all-stop train



A time-distance plot creates a visual assessment of potential conflicts. For example, when two lines intersect, it represents two trains are "meeting" at that specific location; see Zoom-in #1. Trains can "meet" regardless of the direction in which they are travelling. Trains travelling in the same direction may intersect when a faster train overtakes a slower train; see Zoom-in #2. Where train-meet occurs, a minimum of two tracks are required to avoid conflicts. And the more trains meet at a location, the more tracks are required.

When there is insufficient track infrastructure to accommodate all the movements, the schedule of one or more trains can be advanced or postponed to shift the train meet location to where there are sufficient tracks. In some cases, converting trains between an express service and local all-stop service provides more flexibility in altering the train-meet locations. As a last resort, a new siding or an additional mainline track will need to be constructed to accommodate all the movements. The choice between constructing a siding or mainline track is dependent on the frequency and

proximity of the train meet locations. In cases where multiple train-meet locations are in relatively close proximity, it may be more efficient to build an additional mainline track than multiple sidings.

During the assessment, it was determined that some options achieved the goal of increased travel options for Toronto residents, but that increase came at the expense of triggering new infrastructure at one or more locations that are beyond the scope of GO RER.

Storage Requirements

Trains need storage when they are out of service, thus the number of train required, or fleet, has a direct impact on storage requirement. Once a timetable is developed for each option, fleet size can be estimated based on the journey time and service frequency. Essentially, the longer the journey time and the higher the service frequency, the more trains are required. While all options involve electrification, which offer journey time savings through train speed improvements, the time saved may not be able to offset additional station stops or higher service frequency in some options. As a result, an expanded fleet can be expected in some options.

It was determined that some options achieved the goal of growing ridership through higher service frequency and additional stations, but that growth came at the expense of expanded fleet and additional storage requirements that are beyond the scope of GO RER.

Appendix B
Integrated GO RER-SmartTrack Options – Incremental Capital Cost Estimates

Introduction

This document presents capital cost estimates for the integrated GO RER-SmartTrack options. It contains six tables, the first of which presents the portion of committed GO RER capital costs which are attributable to advancing the SmartTrack proposal. The remaining five tables present capital costs, incremental to GO RER, for integrated options A, B, C and D. All costs are in 2014$ and exclude escalation, financing costs, lifecycle and operating and maintenance.

The costing prepared to date is at a high-level and should be understood with a number of caveats:

- Costs for new stations are built on placeholder costs for average GO stations and do not necessarily reflect the individual designs that may be required for different sites. As such, a range of costs has been provided.
- Corridor infrastructure costs are built from numerous component costs including bridge widening, additional electrification, tracks and signals; each element will require further design and costs are subject to change.
- Property acquisition costs have been estimated for new corridor infrastructure. Further work is required to confirm property requirements and costs for new stations.
- Cost estimates for Union Station, fleet, and other system costs were developed based on high-level assumptions and may change as further analysis is conducted.
- Eglinton rapid transit costs are preliminary and may need to be reassessed with further work. For example, further engineering and design work is required to fully capture utility conflicts and potential utility relocations. Contingency has been allocated in the estimate; however, it may need to be reassessed if there are significant underground utility conflicts.

Table B1: Breakdown of Base GO RER Costs Common to SmartTrack

Element	GO RER Costs ($B)	Common Costs ($B)	
Corridor Costs			
Kitchener Segment (Toronto)	2.1	1.1	Includes a fourth track on the Kitchener corridor from Mt. Dennis to the USRC as well as associated bridge reconstruction and grade separations, and electrification
Lakeshore East Segment (Toronto)	1.3	0.5	Includes fourth track between Scarborough Junction and the USRC as well as associated bridge reconstruction and grade separations, and electrification
Stouffville Segment (Toronto)	0.9	0.6	Includes double tracking and electrification of the Stouffville corridor from Unionville to Scarborough Junction as well as associated bridge reconstruction and grade separations
Stouffville Segment (York Region)		0.2	
Other Corridors	3.1	NA	Includes Lakeshore West, Milton, Barrie, and Richmond Hill corridors
System Costs			
Union Station	0.9	0.2	Two of the twelve Union Station platforms will be used for Kitchener and Stouffville service (~%17)
Fleet	2.6	0.7	Assumes 13 8-car EMU consists would be required + 20% spare coaches at $0.044B per 8-car consist
Other Costs	2.6	0.4	Of the 221 route miles for RER, 36 miles are common to SmartTrack for a proportion of 16%.
Total	**13.5**	**3.7**	

Table B2
Option A: Increased frequency, 5 new stations

Element	Capital Cost ($B, costs do not include escalation, financing costs, lifecycle and operating and maintenance)	Notes
New Stations	0.9-1.5	Station locations should be considered representative; specific locations will be recommended through the ongoing new stations analysis. New station infrastructure for 5 new stations at Gerrard/Carlaw, Unilever, Bathurst/Spadina, Liberty Village, and St. Clair West.
Corridor Infrastructure: Stouffville	0.0	Additional storage tracks required at Unionville to support higher service frequency ($26M)
Corridor Infrastructure: Kitchener	2.9	1 additional track required (5th track) between USRC and the Airport Spur. Additional storage tracks required at Bramalea to support higher service frequency
Corridor Infrastructure: Lakeshore E	1.1	5th track required on Lakeshore East between USRC and Scarborough Junction
Union Station	0.9	Placeholder cost for Union Station upgrades
Fleet	0.8	Assumes additional EMU fleet
Other System Costs	0.3	System costs for dispatching office and additional end of line maintenance/storage facilities.
Total	**6.9-7.5**	

Table B3
Option B: Local and Express service with 8 new stations

Element	Capital Cost ($B, costs do not include escalation, financing costs, lifecycle and operating and maintenance)	Notes
New Stations	1.2-1.8	Station locations should be considered representative; specific locations will be recommended through the ongoing new stations analysis. New station infrastructure for 8 new stations at Finch, Ellesmere, Lawrence, Gerrard/Carlaw, Unilever, Bathurst/Spadina, Liberty Village, and St. Clair West.
Corridor Infrastructure: Stouffville	1.0-2.0	Includes 3rd and 4th Track and associated improvements, as well as full property takings up to Unionville for 2 additional tracks.
Corridor Infrastructure: Kitchener	3.9	5th and 6th additional tracks on the Kitchener corridor from Strachan Avenue to the Airport spur. Requires major modifications to Strachan Grade Separation and West Toronto Diamond and significant property takings
Corridor Infrastructure: Lakeshore E	1.1	5th track along the Lakeshore East corridor between Scarborough Junction and the Union Station Rail Corridor
Union Station	0.9	Requires up to two new platforms at Unions Station. Costs provided for Simcoe Station concept - Underground Station with tunnel entrance just to the West side of Union Station. Costs from USRC EP Report based on the completed high level conceptual design
Fleet	0.5	Assumes additional EMU fleet
Other System Costs	0.4	System costs for dispatching office and additional end of line maintenance/storage facilities.
Total	**9.0 -10.6**	

Table B4
Option C: Eliminate long-distance express service with 7 new stations

Element	Capital Cost ($B, costs do not include escalation, financing costs, lifecycle and operating and maintenance)	Notes
New Stations	1.0-1.6	Station locations should be considered representative; specific locations will be recommended through the ongoing new stations analysis. New station infrastructure for 7 new stations at Finch, Ellesmere, Lawrence, Gerrard/Carlaw, Unilever, Liberty Village, and St. Clair West. Bathurst-Spadina was not included as analysis indicates that it will not be workable for Kitchener service.
Fleet	0.1	Assumes additional EMU fleet
Total	**1.1-1.7**	

Table B5
Option D: Full GO RER with 4 new stations

Element	Capital Cost ($B, costs do not include escalation, financing costs, lifecycle and operating and maintenance)	Notes
New Stations	0.7 – 1.0	Station locations should be considered representative; specific locations will be recommended through the ongoing new stations analysis. New station infrastructure for 4 new stations at Gerrard/Carlaw, Unilever, Liberty Village, and St. Clair West. Bathurst-Spadina was not included as analysis indicates that it will not be workable for Kitchener service.
Total	**0.7 - 1.0**	

Appendix C: Modelling Results Prepared Using the City of Toronto's GTA Model

This appendix presents ridership and related information for GO RER on the Kitchener and Stouffville corridors as well as Options C and D. The ridership forecasts were developed using the City of Toronto's GTA model V4.0 for 2031. The modelling assumes a TTC fare for GO RER passengers between Milliken on the Stouffville Corridor and Mt. Dennis on the Kitchener Corridor (the SmartTrack geography). In terms of land use, it uses a low population, medium employment scenario with land use effects generated by SmartTrack.

Table 1: Business Case Summary Table (TTC Fare)

Indicator	Base Case - GO RER (Kitchener-Stouffville)	Option C with TTC Fare	Option D with TTC Fare
Ridership (annual)	27.4M	+8.5M	+9M
Nominal Annual Revenue ($M 2011 Equivalent)		+$8.8	+$12.6

* 2031 Forecast year

** Land Use: Low population, Medium Employment with SmartTrack Influence

*** Revenue calculation only accounts for GO and TTC/SmartTrack Fares

Table 2: Ridership and Travel Time Summary (TTC Fare)

Options	Ridership	Net New Riders	Transit Rider Travel Time Savings Compared to Base RER (million minutes)
GO RER	27.4 million on Kitchener-Stouffville		
Option C with TTC Fare	+26 million* on Kitchener-Stouffville	+8.5M	491.6**
Option D with TTC Fare	+25.1 million* on Kitchener-Stouffville	+9M	517.4**

* The Option C ridership captures both TTC paying customers and those using the new stations. This calculation is done by comparing the ridership in the effected corridors before and after Option C. This incorporates any negative effect to long-distance riders.

**Compares back to 2031 Base RER Concept

Table 3: Financial Information Summary (TTC Fare)

Nominal Dollars (2011$ Value)	GO RER	Option C with TTC Fare	Option D With TTC Fare
Annual Incremental revenue to GO ($M 2011)*		+$8.8	+$12.6

* Revenue calculation only accounts for GO and TTC/SmartTrack Fares

Table 4: Economic Benefits Breakdown (TTC Fare)

	Option C with TTC Fare	Option D With TTC Fare
Annual Travel Time Benefit (Compared to GO RER), $M, 2011	131.1**	138**
Annual Auto Time Savings (back to GO RER) - due to congestion relief from mode shift	12.8**	26.6**

* 2031 Forecast Year

* Assumes a Value of Time of $16/hour

** This is an annual travel time benefit. This requires a net-present value calculation to be comparable

Appendix D: Ridership, Benefits & Economic Analysis Methodology

Introduction

The RER-SmartTrack analysis of alternative options relies upon an estimate of passenger behaviour in response to changes in service. For Options C and D, the primary change to the service is the introduction of new stations on the line. Those stations have both positive and negative effects for transit passengers:

- Passengers who *use* the new stations save travel time. The *station access time* is lower than it would be without the new station, when access would have to be to the next closest station.
- Passengers who *do not* use the new stations experience a travel delay, due to the extra time required for the train trip due to the new station, typically 2-3 min. per station.
- As a result of the travel time savings and delays, some travellers may shift their route or mode of transportation. There will be both gains and losses of RER passengers due to these route and mode shifts. Some passengers are attracted to RER by the new stations and will shift from an all-TTC transit route to an RER trip or a combined RER+TTC trip. Other passengers are *diverted from RER* due to the longer total travel time and will shift from an RER trip to a bus+subway trip or a driving trip.

To account for the impacts of these new stations on passengers, it is helpful to categorize the different types of passengers into five groups, shown in Table 2.

Table 2: Segmentation of demand into five groups of passengers, each of whom experiences a new station differently. In the table below "downstream" means locations closer to Union Station than the new station site.

	Description	Would ride GO/RER without new station(s)?	Would ride GO/RER with new station(s)?	Delayed by new station(s)?	Accesses/ egresses via new station(s)?
Group A	Existing & unaffected GO/RER riders (e.g., "downstream" or express riders)	✓	✓	×	×
Group B	Existing "upstream" GO/RER riders (affected but do not change behaviour)	✓	✓	✓	×
Group C	Shift GO/RER access station (existing but would prefer new station)	✓	✓	×	✓
Group D	Attracted to GO/RER (shift route/mode due to easier access/egress)	×	✓	×	✓
Group E	Diverted from GO/RER (existing, shift	✓	×	✓	×

route/mode due to delay)

We can see that combining these groups in different manners helps us understand what happens to overall GO/RER ridership:

- **C + D = Gross riders** at the new station(s)
- **D – E = Net new riders** on the RER/GO system due to the new station(s)
- **B, C, D, E**: all *affected* by addition of new stations, and experience either a positive or negative time impact. The impact is different for each group.

Using this categorization, a set of metrics can be defined that are useful for understanding the impact of the new stations. The metrics are outlined in Table 3 and Table 4.

Table 3: Metrics for ridership and benefits, and the approximate associated mathematical formula. See following table for a guide to the notation in the formulas.

Metric	Formula
Gross riders	$n_C + n_D$
Net new riders	$n_D - n_E$
Transit rider time savings due to new stations	$n_B \times \Delta t_B + n_C \times \Delta t_C + \frac{1}{2}(n_D \times \Delta t_D - n_E \times \Delta t_E)$
Transit rider time "break even" metric (ratio of "positive" benefits to "negative" benefit. With this metric, a ratio of 1.0 means the two are balanced and give a net zero benefit.)	$\frac{n_C \times \Delta t_C + \frac{1}{2} n_D \times \Delta t_D}{-\left(n_B \times \Delta t_B - \frac{1}{2} n_E \times \Delta t_E\right)}$
Vehicle kilometre travelled (VKT) savings due to new stations	$n_D \times \text{auto}_D \times d_D - n_E \times \text{auto}_E \times d_E$
Net new revenue to Metrolinx/GO due to new stations	$n_D \times \$_D - n_E \times \$_E$

Table 4: Notation used in metric formulas.

Notation	Meaning
$\boldsymbol{n_X}$	Number of riders in group X (trips)
$\boldsymbol{\Delta t_X}$	Change in travel time for group X (weighted min. / trip)
$\boldsymbol{\text{auto}_X}$	Percentage of riders who would otherwise switch modes and drive for the trip (%)
$\boldsymbol{d_X}$	Average distance driven for group X (km / trip)
$\boldsymbol{\$_X}$	Average GO fare for group X ($ / trip)

Generally, the primary drivers of benefits within this framework are:

- Positive benefit: very high employment or full-time post-secondary institution within 1 km (i.e., high AM peak alighting activity)
- Positive benefit: a "through" service stopping at the station after letting most passengers off at Union Station
- Positive benefit: new boarding riders within 1km of station
- Negative benefit: high number of upstream passengers with no express service option to bypass the new stations.
- Negative benefit: high delay at station (e.g., on a diesel locomotive-hauled trip)
- Negative benefit: presence of an attractive parallel transit service (e.g., TTC subway)

Implementation

Typically, Metrolinx generates these types of metrics using a four-stage travel demand model such as the Greater Golden Horseshoe Model. However, Metrolinx staff find that it is quite challenging to obtain this level of geographic accuracy for GO Transit services within a four-stage model, particularly when trying to study a wide swath of different station sites. Doing this kind of work requires accurate *station-level* and even *zone-level* forecasts of travel behaviour, on both the access and egress end of the trip.

As an alternative, a spreadsheet analysis system was developed to provide estimates of these metrics at each station with a reasonable level of confidence for this type of finer geographic analysis. In a few cases, key numbers were cross-checked using the Greater Golden Horseshoe Model.

An overview of the analysis approach is shown in Figure 1.

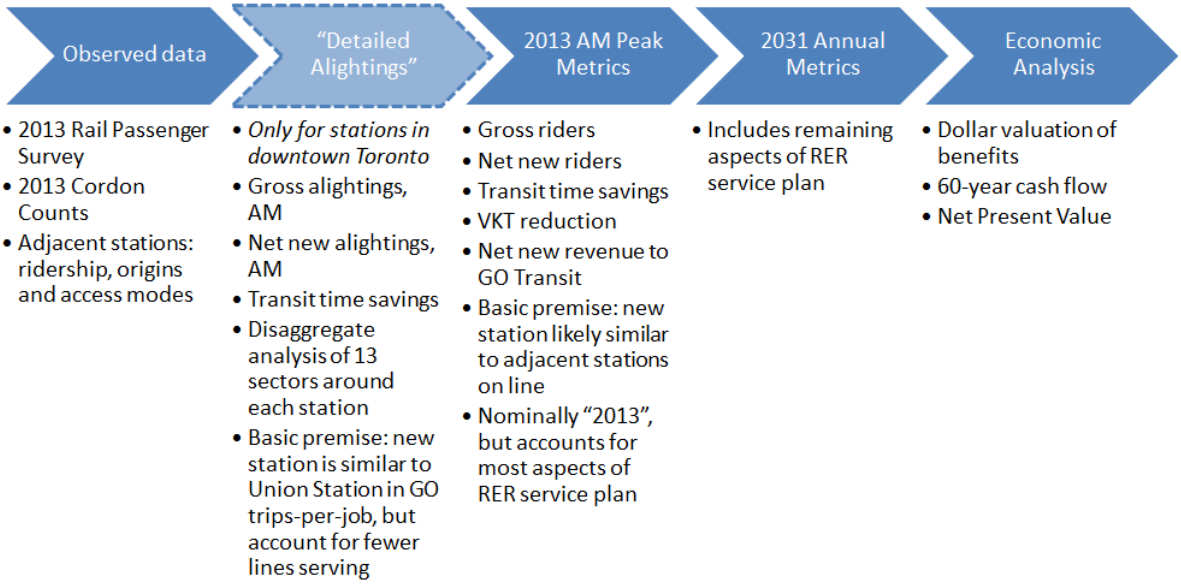


Figure 1: Overview of analysis approach

Assumptions

A few key assumptions applied within this framework are shown below:

- **RER ridership and annual growth rates:** based on ridership data from the GO Rail 2031 Ridership (Regional Express Rail scenario 5) report, February 2016. This captures the effects of population/employment growth across the region and the effects of the RER service introduction.
- **Future real estate development** and population/employment growth**:** generally, based on the assumption that population growth due to development at each "new station" site is similar to the growth at other stations on the line. In two special cases where very major office developments are committed and proceeding close to potential station sites in downtown Toronto, they have been included in the analysis (The Well at Spadina/Front St. W, Globe & Mail Centre at King E/Berkeley).

Developments that are *conditional* on a new station are not typically included in this type of cost-benefit analysis.

- **Transit network assumptions:** based on the inclusion of all committed rapid transit projects: the Toronto-York Spadina Subway Extension, Mississauga Transitway, York Region VIVA on Higway 7 and Yonge St., Eglinton Crosstown LRT, Sheppard E LRT, Finch W LRT, Scarborough Subway Extension, Hurontario LRT, and Hamilton LRT. For local transit, today's network is largely assumed, except for inclusion of several new downtown Toronto routes. For downtown Toronto, the Waterfront streetcar plan was included, based on the concept prior to the recent "reset" of planning.
- **Detailed alightings analysis:** this more elaborate calculation framework was applied for several downtown station sites, specifically all station sites between Lansdowne/Dundas and Gerrard/Pape.
- **Fare integration:** based on today's transit fare structure. There is currently work underway to define potential alternate regional fare structures, but a decision has not yet been made about a preferred structure, and a multi-agency revenue sharing agreement.
- **Access modes:** are assumed to be fairly similar to today. Drive ("park & ride"), passenger drop-off / carpool ("kiss & ride") and walking are the predominant access modes. Transit access is quite modest, just 4% of trips within the City of Toronto and 9% outside the City of Toronto. Walk access is particularly important for stations within the City of Toronto, making up 23% of all trips.
- **Services at downtown stations:** at the Unilever and Gerrard E station sites, only passengers who are travelling on the Kitchener and Stouffville lines are considered. (It may be feasible to provide service from several lines - passengers who live on Lakeshore East, Lakeshore West or the Richmond Hill lines may also be able to travel directly to these station locations.) All services are considered simultaneously in a separate study on the new stations individually.
- **Independent analysis of new stations**: the new stations are analyzed independently and their riders and benefits are simply added. For the stations under consideration here, this is deemed appropriate.
- **Services through Union Station:** in the peak period, many Kitchener and Stouffville trains will go out of service after Union Station. Only a partial set of services will operate "through" Union, allowing (say) an Agincourt passenger to access a potential new station at Liberty Village. Many Kitchener/Stouffville stations in the outer ends of the lines will not have any "through" service to access stations beyond Union. For this analysis, it is assumed that 50% of Kitchener and Stouffville passengers have easy access to a train that continues past Union Station in revenue service to access new stations on the other side.

Several of the more detailed ridership and economic assumptions are shown in the following tables.

Table 5: Table of general benefits and ridership assumptions for RER-SmartTrack analysis.

Benefits and Ridership Parameters	Value	
Train Schedule Effects of New Station		
EMU train	2.0	min.
12-car electric locomotive train	2.5	min.
12-car diesel locomotive train	3.0	min.
Reduced delay for stations in "slow" track sections	-0.17	min.
Passenger delay associated with waiting at Union Station, for through trips	5.0	min.
Travel Time Weighting/Calculations		
Walk Speed	5.0	km/h
Walk time weight	2.5	x
Wait time weight	2.5	x
Transfer penalty (surface)	12.5	min.
Transfer penalty (to subway)	5.0	min.
Line-level average statistics		
Elasticity of ridership w.r.t. in-vehicle time		
Kitchener	-0.5	
Stouffville	-0.8	
Miscellaneous		
Concession fare factor	0.76	
% of new/lost riders switching from/to auto drive mode	20%	
Annual Growth Rates		
For 2013-2031, including the one-time effect of introducing RER service ("RER" from GO 2031 ridership report)		
Kitchener	4.6%	
Stouffville	4.0%	
For 2032-2044, based on the "natural" growth rate of ridership ("Do Nothing" from GO 2031 ridership report)		
Kitchener	3.0%	
Stouffville	1.9%	

Interpretations to account for RER changes		
% of Kitchener outer passengers who use express trains	50%	
% of Kitchener line passengers who can alight at a new station on non-express section	90%	
% of Kitchener passengers whose closest station has a peak service that goes "through" Union	50%	
% of Stouffville passengers whose closest station has a peak service that goes "through" Union	50%	
Peak-to-Daily factors		
Generic		
Conversion from peak ridership to daily, for a peak-only service	2.0	
Conversion from peak ridership to daily, for an all-day 15 min. service	2.9	
Conversion from peak ridership to daily, for an all-day 60 min. service	2.4	
Line-specific, usually based on RER service		
Kitchener inner - Bramalea and closer	2.9	
Kitchener outer - Beyond Bramalea	2.0	
Stouffville inner - Unionville and closer	2.9	
Daily-to-Annual factors		
Generic		
No weekend service	250	weekday-equivs/year
For a weekend 15 min. service	300	weekday-equivs/year
For a weekend 60 min. service	265	weekday-equivs/year
Line-specific, usually based on RER service		
Kitchener inner - Bramalea and closer	300	
Kitchener outer - Beyond Bramalea	250	
Stouffville inner - Unionville and closer	300	

Table 6: Table of economic assumptions for RER-SmartTrack analysis.

Economic Assumptions	Value	
General		
Project Evaluation Period	60	years
Discount Rate	3.5%	
Growth Cap – Year all growth set to 0%	2044	
Valuation and Growth Rates		
Value of Time	$16.13	$/hr ($2015)
Value of Time Growth Rate	1.6%	
Auto Operating Cost	$0.63	$/km ($2015)
Auto Operating Cost Growth Rate	0.7%	
Accident Reduction Benefit	$0.08	$/km ($2015)
Accident Reduction Benefit Growth Rate	0%	
Congestion Reduction	0.01	hrs/km
Congestion Reduction Growth Rate	0%	
Environmental Benefits	$0.01	$/km ($2015)
Environmental Benefit Growth Rate	0%	

APPENDIX 4

ENHANCED EGLINTON WEST RAPID TRANSIT

INITIAL BUSINESS CASE ANALYSIS

JUNE 2016

Cover Image: Marcus Bowman

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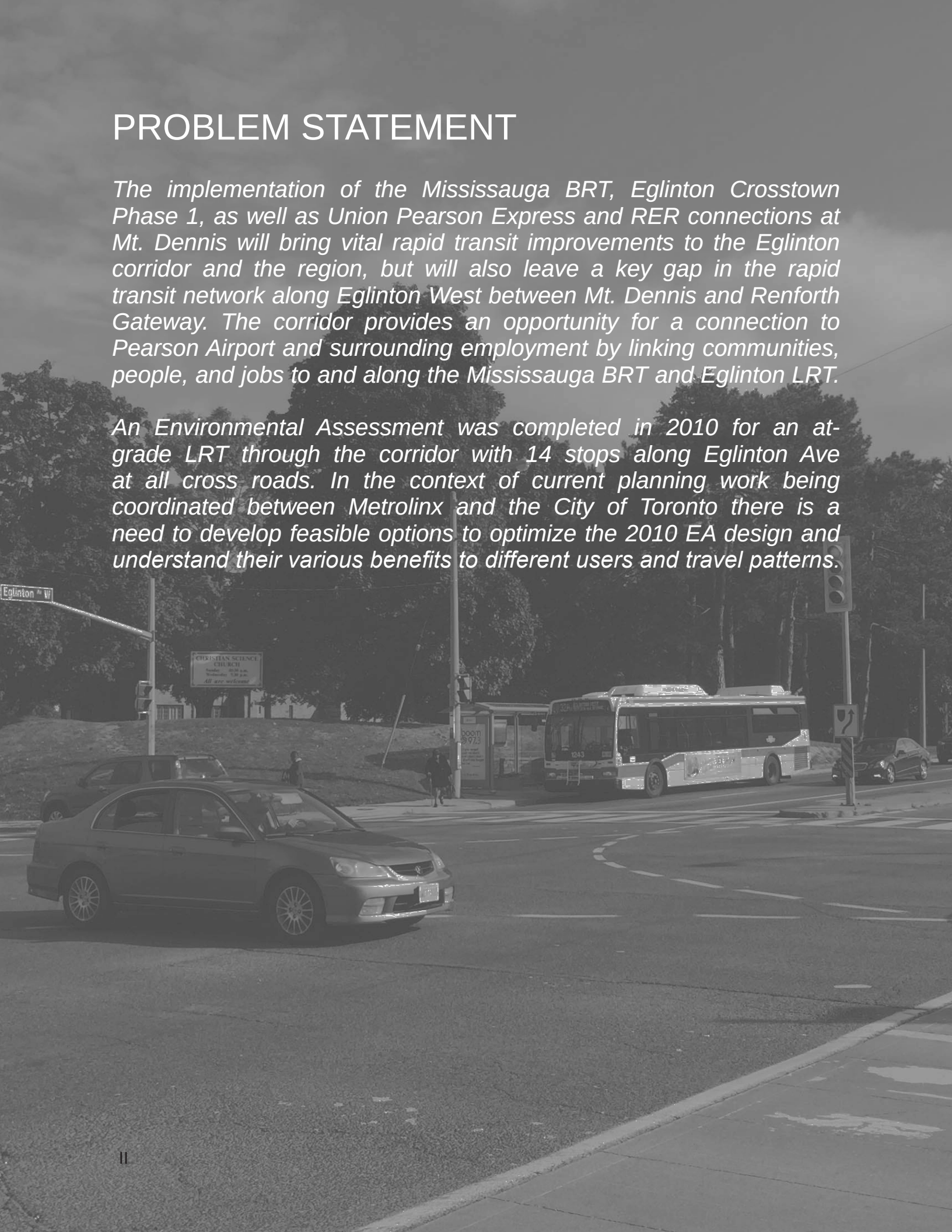
PROBLEM STATEMENT

The implementation of the Mississauga BRT, Eglinton Crosstown Phase 1, as well as Union Pearson Express and RER connections at Mt. Dennis will bring vital rapid transit improvements to the Eglinton corridor and the region, but will also leave a key gap in the rapid transit network along Eglinton West between Mt. Dennis and Renforth Gateway. The corridor provides an opportunity for a connection to Pearson Airport and surrounding employment by linking communities, people, and jobs to and along the Mississauga BRT and Eglinton LRT.

An Environmental Assessment was completed in 2010 for an at-grade LRT through the corridor with 14 stops along Eglinton Ave at all cross roads. In the context of current planning work being coordinated between Metrolinx and the City of Toronto there is a need to develop feasible options to optimize the 2010 EA design and understand their various benefits to different users and travel patterns.



1.0 INTRODUCTION

Eglinton West: A Gap in the Regional Rapid Transit Network

The Greater Toronto and Hamilton Area's Regional Transportation Plan, The Big Move, was adopted in 2008 and set out a 25-year vision for supporting growth in the region. It put forward policies and programs that advance the sustainable movement of people and goods across the region and identified needed investments in building regional rapid transit, including the transformation of the GO Transit service to Regional Express Rail (RER), and new subways, Light Rail Transit (LRT) and Bus Rapid Transit (BRT). A number of projects are already in operation or under construction, including the VIVA BRT in York Region, the Mississauga BRT, the Spadina Subway Extension, the Eglinton Crosstown LRT, the Finch West LRT, the Union Pearson Express and major expansions to GO rail and Union Station.

What is in plan for Eglinton West?

In the context of the Eglinton West corridor, The Big Move identified three important priorities:

- *The need to provide rapid transit along Eglinton Ave from Kennedy Rd to Pearson Airport*
- *The need for the Mississauga BRT*
- *The need for improved connections to the airport from all directions*

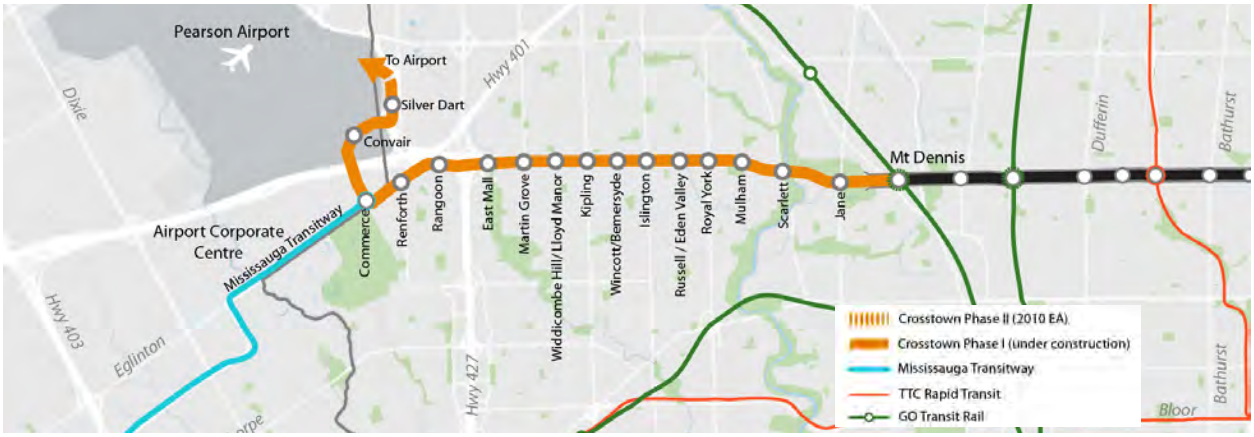
The Mississauga BRT and the Union Pearson Express are now in operation, and construction of rapid transit along Eglinton Ave is well underway as Phase 1 of the Eglinton Crosstown LRT between Kennedy Station and Mt. Dennis. These projects provide much needed transit connections to the region, particularly to the airport. However, a gap exists along Eglinton between Mt. Dennis and the Airport. An Environmental Assessment that included this segment was approved in 2010 but was not funded with the rest of the project. Extension of rapid transit through the Eglinton West Corridor will fill in this missing link.

Why Now?

Recently, renewed interest has been taken in advancing rapid transit in the Eglinton West Corridor. The City of Toronto, in coordination with Metrolinx, is advancing the SmartTrack concept, which contemplates using the GO rail corridors to provide improved access for Toronto residents to rapid transit and to connect major employment nodes. A feasibility review of the SmartTrack Western Corridor, which coincides with the Eglinton West Corridor, has concluded that heavy rail would come at a high cost, have negative community impacts, and attract comparatively lower ridership to an LRT. In March 2016, Toronto City Council endorsed removing the heavy rail option for the Western Corridor in favour of further studying of the Eglinton West LRT by reviewing the Environmental Assessment to optimize the design.

2.0 CONTEXT

In 2010, an Environmental Assessment (EA) was completed by the City of Toronto and the Toronto Transit Commission (TTC) for LRT on Eglinton Avenue from Kennedy Station in the east to Pearson Airport in the west. The project received funding from Province of Ontario and Metrolinx assumed responsibility in 2012. However, due to funding constraints, the project was subsequently split into two phases. Phase 1 stretches 19 kilometers from Kennedy Station to Weston Road in Toronto's Mt. Dennis neighbourhood, with a 10 kilometre underground section between Laird Drive and Keele Street. This part of the project, commonly referred to as the Eglinton Crosstown, is currently under construction and expected to be complete by 2021. At the western terminus of Mt. Dennis, a new GO Station is planned that will see substantially increased levels of two-way GO train service in the coming years, along with an additional stop for the Union Pearson Express (UP Express). The original 2010 EA envisioned Phase 2 of the project, the subject of the current study, as a surface LRT between Mt. Dennis Station and Pearson Airport, with 14 stops along Eglinton Avenue, and another 3 additional stops in a segment that leads into the airport. The EA did not establish an alignment on the Pearson Airport property, deferring this to future work.



Many people living in Toronto, Etobicoke, and Mississauga travel across the region to jobs in Downtown Toronto and the Pearson Airport Area, which includes employment surrounding the airport and the Mississauga Airport Corporate Centre (MACC). Outside of Downtown Toronto, the Pearson Airport Area has the second largest number of jobs in the GTHA, making it a key regional destination.

A review of current trip patterns for this part of the region using the Transportation Tomorrow Survey provides some detail about the number of trips to these key employment areas. For trips starting in Etobicoke, about 25% stay within the area, while another 25% are headed downtown or to destinations located to the east along Eglinton Avenue, 25% are headed north and south, and about 10% are headed to the airport area. The total number of trips originating in the area, bound for employment hubs is modest compared to other areas. For example, trips from Etobicoke to downtown and the Eglinton Corridor are about 12,300 trips, while from Mississauga to the same areas is about 19,500 trips.

The Transportation Tomorrow Survey is a household survey of trip patterns conducted every 5 years since 1986 by the Data Management Group at the University of Toronto. The 2011 survey contains over 850,000 trips in South Central Ontario. The survey incorporates all modes (car, transit or other). The survey reflects morning commuting trips (AM peak period) but does not fully capture all airport passengers

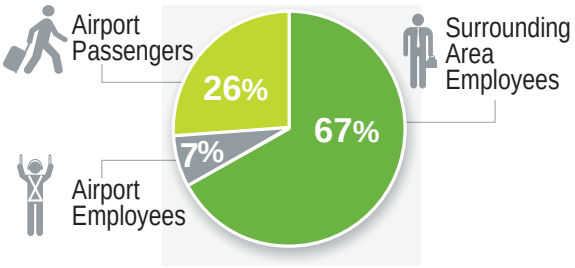
For the Pearson Airport Area and Mississauga Airport Corporate Centre (MACC), current trips predominantly come from the west, with few trips coming from Etobicoke and the Eglinton Avenue corridor; reflective of the poor transportation links from the east along the Eglinton corridor. Trips from Mississauga to Downtown Toronto and the

Eglinton West corridor north of downtown, are significant at 19,500 trips, and represent 9% of all outbound trips from this area. Trips to Etobicoke and Eglinton West are fairly low at about 2% of trips or 2,600 trips. Morning commuting trips to Mississauga are predominantly from the west, with few trips currently from Toronto.

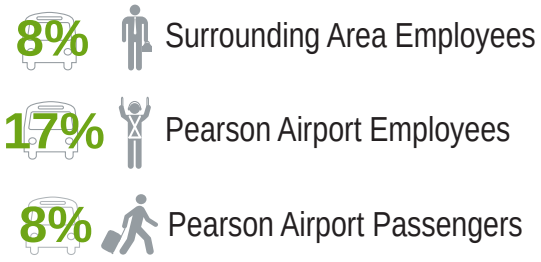
The 'Transportation Study of the Pearson Airport Area,' completed by Metrolinx in 2015, estimates that about 40,000 people are employed within the airport proper, and another 245,000 jobs are located in the surrounding Pearson Airport Area. Together, this makes up more than 280,000 jobs, which is more than the number of jobs in the central business districts of either Calgary (140,000 jobs) or Vancouver (145,000 jobs). By 2031, this number is expected to increase by 41%. More specifically, there are approximately 35,000 jobs within the Mississauga Airport Corporate Centre (MACC), and by 2041, another 10,800 jobs are expected for this sub-area. In addition to this, about 33 million passengers move through Pearson Airport annually. This number is expected to increase by 92% by 2031.

Despite being a major area of activity in the region, only a small percentage of people use transit to access the airport and the surrounding area. Even under free flow conditions, only 18% of trips can be made within 30 minutes by public transit, making the area challenging to access by transit. Despite planned and ongoing implementation of numerous transit projects in this part of the region, namely Mississauga BRT, Renforth Gateway, Eglinton Crosstown Phase 1, UP Express, and GO RER, a key gap in the rapid transit network still remains along the Eglinton Avenue West Corridor. Direct access to Pearson Airport will improve with the implementation of these higher order transit projects. However, employment in the greater Pearson Airport Area, even within the Mississauga Airport Corporate Centre (MACC), is dispersed and more difficult to serve with rapid transit alone. These areas will require the support of a strong local transit network with connections to key hubs to complement higher order services.

Who travels to the Pearson Airport Area?



What percent take transit?



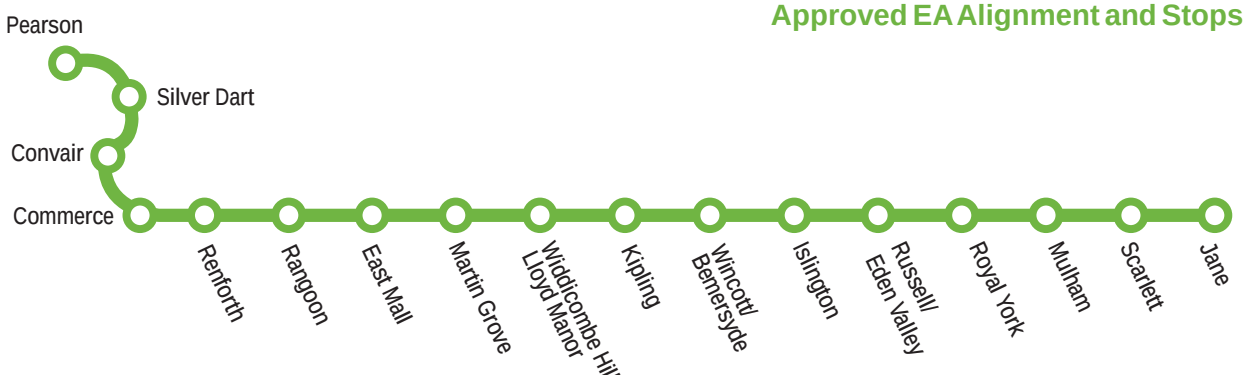
The Greater Toronto Airport Authority recently released the study 'Pearson Connects: A Multi-Modal Platform for Prosperity', which similarly identified the urgent need for a new, multi-modal transit hub at the airport. The report suggests that a multi-modal transit hub, comparable in scale to Union Station, would fill a critical missing link in the regional transit system, connecting air travel and regional transit to local services to the surrounding areas.

Rapid transit in the Eglinton West corridor contributes to the objective of creating a multi-modal hub at Pearson Airport. It opens up an opportunity to provide an additional connection to the airport and surrounding employment area, and completes the link between the Eglinton Crosstown LRT in the east and the Mississauga BRT in the west. Extension of the rapid transit connection through Eglinton West would also provide additional opportunity for Etobicoke residents transferring to rapid transit from north-south feeder buses, and serve to improve the overall redundancy of the regional transportation network.

3.0 STUDY OVERVIEW

Metrolinx, The City of Toronto and the TTC have undertaken a study of rapid transit options for the Eglinton West corridor to better understand people's travel needs; to estimate how many people would use and benefit from different transit options and configurations, and the benefits and costs for implementing different transit options. This work was done in coordination with the SmartTrack Western Corridor, lead by the City of Toronto, which examined the feasibility and costs of a heavy rail option with three stops in this segment of Eglinton Avenue. The study concluded that heavy rail would be excessively expensive to construct, disruptive to the local community and attract lower ridership than the base case LRT option. In March 2016, Toronto City Council directed that the heavy rail option be removed from consideration and that options to enhance the LRT design be studied instead.

Approved EA Alignment and Stops



The base case for this study is the Eglinton Crosstown Phase 2 LRT option, approved in the 2010 EA. Phase 2 extends the Eglinton Crosstown LRT from Mt. Dennis, westward to Renforth Gateway and Pearson Airport, with 14 at-grade stations along Eglinton Avenue, and an additional 3 stations in the airport segment.

Key Considerations

In the development of options for rapid transit in the corridor, the following were key considerations:

1 **Local access vs. travel speed.** The number of stops determines the extent to which a transit line provides for local access as compared to faster travel times for people going longer distances. This study looked at options with 17, 11, and 6 stops in order to understand how many people might use the system and the travel time benefits associated with each.

2 **Extent of separation from road traffic.** The extent to which a rapid transit line is mixed with road traffic impacts the speed and reliability of the service. This study looked at four types of options to align the LRT either above, below or at the roadway: 1. the EA option, where LRT travels at-grade in the centre of the road separated from traffic, but still interacts with traffic at intersections; 2. fully separated from traffic, either elevated or in a tunnel; 3. a hybrid option where grade separation only occurs at intersections; and 4. targeted grade separations where the LRT is strategically separated from traffic to avoid congestion, use natural topography or improve transfers.

3 **Type of transit technology.** In addition to LRT, a BRT option was also explored. BRT can often provide rapid transit service levels at lower cost and with greater service flexibility. BRT is typically used in corridors where potential transit ridership is higher than a standard bus, but where the capacity of an LRT is not yet warranted.

Options Overview

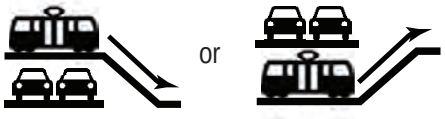
A total of 6 representative options, including the approved EA option, were studied to isolate how various design features may impact the cost, function, and effectiveness of rapid transit in this corridor. With the key considerations in mind, the options were altered from the EA option to have varying numbers of stops and stop spacing, different levels of grade separation, and technology.

At-Grade LRT

1. 17 stops (14 on Eglinton) Approved EA option
   Designed for local access
2. 11 stops (8 on Eglinton)
   Designed to balance speed and access
3. 6 stops (3 on Eglinton)
   Designed for higher speed and longer trips

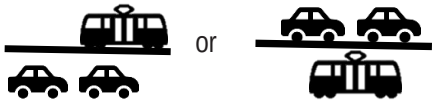
\+ Potential Targeted Grade Separations

At-Grade LRT, with Grade Separations at Arterials



4. 6 stops (3 on Eglinton)
   Designed to avoid intersection delay

Fully Grade Separated LRT



5. 6 stops (3 on Eglinton)
   Designed for maximal speed and longer trips

At-Grade BRT

6. 17 stops (14 on Eglinton)
   Designed for local access

The LRT options have been designed as extensions of the Eglinton Crosstown LRT using the same fare and service pattern assumptions. A rider traveling westbound from the Eglinton Crosstown LRT would not have to transfer at Mt. Dennis in order to continue traveling through the Eglinton West Corridor. However, those wishing to continue into Mississauga via the Mississauga BRT would have to transfer onto the bus at Renforth Gateway, the eastern terminus of the transitway.

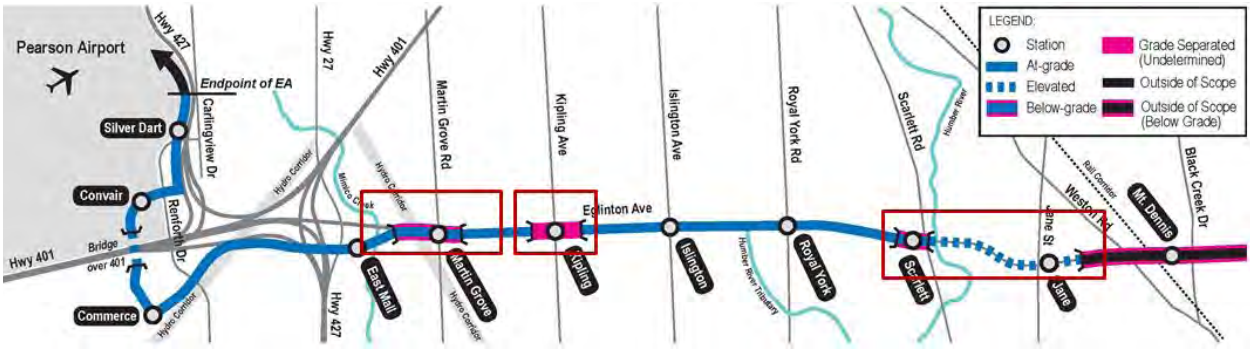
The at-grade LRT options (#1-3) also included study of targeted grade separations, places where specific infrastructure interventions could be used to address potential impacts or improve the benefits of the project. This analysis included high-level costing and feasibility assessment of three targeted grade separation

The BRT option in this study was designed to be comparable to the 17 stop at-grade option in the Approved EA. As an extension of the Mississauga BRT, it would interface with Phase 1 of the Eglinton Crosstown LRT at either Jane Station, or Mt. Dennis. A connection at Jane Station would require that the Eglinton Crosstown LRT be extended to Jane Street from its current terminus at Mt. Dennis, as it would in all the LRT options. A connection at Mt. Dennis would, likewise, require a short underground segment to avoid corridor constraints in this segment of Eglinton Avenue.

For modelling purposes it was assumed that this BRT segment acts as one leg of the BRT, with half of all buses from the Mississauga Transitway diverted to the Eglinton Corridor instead of to Kipling Subway Station, Pearson Airport, or to Malton. In the westbound direction, the same buses make the return trip, and are joined by other buses destined for Pearson Airport, giving the airport segment a higher combined frequency.

Targeted Grade Separations

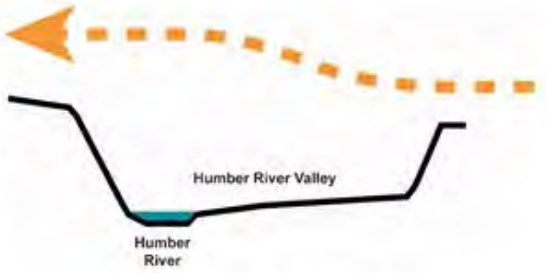
The Eglinton West Corridor was studied for locations where targeted grade separations could provide benefits. Three potential areas were identified and developed further to assess high level costs and feasibility. These included: Jane and Scarlett, Kipling and Martin Grove. These separations could be added to the at-grade options (#1-3).



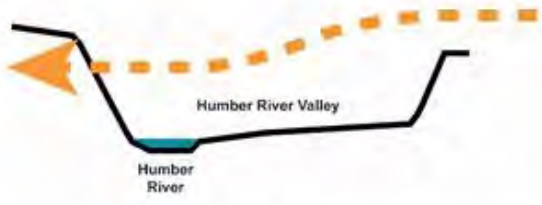
Jane and Scarlett Grade Separation

A grade separation in this area may provide benefits through mitigation of traffic impacts, improving passenger transfers with intersecting transit services, and taking advantage of the natural topography.

Grade separation of the Eglinton LRT at Jane and Scarlett would require the LRT operate to the north of Eglinton Avenue, over Jane Street, Emmet Avenue, and the Humber River Valley. At Scarlett Road, the LRT would either go over the roadway before tying back in to the centre median of Eglinton Avenue, or descend into the valley and underneath the roadway before emerging from a portal in the centre median.



LRT elevated over Scarlett Road



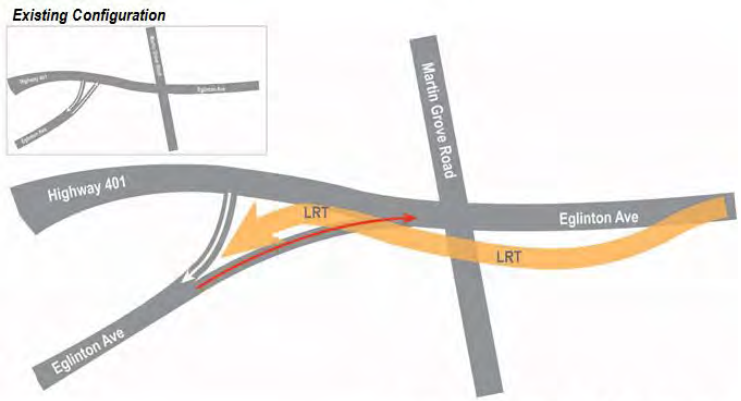
LRT under Scarlett Road, into western embankment

Kipling Grade Separation

The Kipling stop is located near the mid-portion of the study area. The primary reason for grade separation at Kipling would be to provide a more convenient bus to LRT transfer. Grade separation at Kipling would likely require lowering the LRT into a trench below the roadway to prevent negative impacts on the surrounding residential communities.

Martin Grove Grade Separation

Martin Grove is located in the western portion of the study area and is one of the busiest intersections along the project corridor, with significant eastbound left turns during both the AM and PM peaks. Eglinton Avenue connects directly into Highway 401 just west of Martin Grove, contributing to large volumes of traffic. Because of the highway, continuing west on Eglinton Avenue, requires a left turn at an angular intersection.



Proposed Reconfiguration of Eglinton Avenue

Community consultation has indicated that traffic volumes are further exacerbated by drivers seeking alternate routes during lane closures on Highway 401. Due to the height limitations imposed by the hydro corridor, grade separation in this area would likely be below-grade. The LRT would enter a tunnel east of Martin Grove Road and emerge from a portal in the middle of a reconfigured Eglinton Avenue west of the on-ramps to highway 401.

Method of Analysis

To better understand the impacts of the various options, detailed analysis of the six options was undertaken using the four chapter Metrolinx Business Case framework. The City's 'Feeling Congested' framework was applied to better understand the differences between the 17-stop and 11-stop options (Options 1&2) and was incorporated into the Strategic Case. The Strategic Case also included a corridor analysis, market analysis and ridership projections. A corridor analysis of the project area examined the types of development and destinations that exist today, and identified potential areas for new development or redevelopment along the corridor. The market analysis was used to examine current travel patterns based on information contained in survey data of households in the region (from the University of Toronto's Transportation for Tomorrow Survey). Ridership projections were produced through travel demand modeling to predict future travel patterns that will result from growth in the region, and in response to implementation of each option.

Order of Magnitude costing was developed based on the conceptual layout of each proposed option, which have been adjusted to overcome the major constraints of the corridor. The economic case involved quantification of costs and benefits for all options, which accounts for travel time savings for transit users, new fare revenue, and reductions in travel by personal vehicles. A review of right of way allowances and other constraints along the corridor informed the operations and deliverability case.

Key Findings

Eglinton West represents a gap in the regional rapid transit network, serving medium and longer distance trips:

- Extension of rapid transit would fill a gap in connectivity between ECLRT Phase 1 and the Mississauga Transitway,
- Westbound travel from Toronto to Pearson Airport, the Airport Corporate Centre, and elsewhere in Mississauga is significant,
- Based on 2031 forecasted boardings the line is mostly served by transfers from N-S buses (50%) and from the Mississauga Transitway (30%), with walk-on ridership comprising the balance (20%).

This study finds that LRT is an appropriate rapid transit solution for the Eglinton West corridor, with between 17 and 11 stops LRT and some targeted grade-separation. This effectively balances local accessibility for the community and travel speeds for people who travel longer distances within Toronto and to Mississauga.

4.0 STRATEGIC CASE

Options were assessed based on their strategic effectiveness to meet the objectives of higher order transit service in this area. An effective rapid transit connection in the Eglinton West Corridor would bridge the gap in the transportation network, effectively balance the needs of both local and regional markets and advance broader city building objectives. An optimal option also must comfortably accommodate projected travel demands through the corridor, and be able to attract a sustainable level of ridership.

The strategic case begins with a summary of key high-level findings considering the above criteria. followed by a more detailed strategic analysis of the two emerging preferred options. The detailed analysis was conducted only on Options 1 and 2 and used the City of Toronto's 'Feeling Congested' framework. This framework was developed through the recent review of the City's Official Plan transportation policies and is applied by the City across all transit projects. By applying the framework to Options 1 & 2 which are differentiated by the number of stations on Eglinton Avenue West, preliminary analysis is available to inform finalization of station locations in the next phase of this work.

Strategic Case Key Findings:

- Eglinton West represents a gap in the regional rapid transit network serving longer distance trips
- An Eglinton LRT extension improves transit for Etobicoke residents, particularly Northern Etobicoke
- The LRT option in the approved EA can be further refined, including consideration of reducing the number of stops
- LRT better serves the travel market in the corridor compared to BRT
- A hybrid option with at-grade LRT and grade separations at select targeted locations may provide benefits.

Structure of the 'Feeling Congested' Framework

Principle	Criterion
People	**Experience** *Capacity to ease crowding / congestion; reduce travel times; make travel more reliable, safe and enjoyable*
	Choice *Develop an integrated network that connects different modes to provide for more travel options*
	Social Equity *Allow everyone good access to work, school and other activities*
Places	**Shaping the City** *Develop an integrated network that connects different modes to provide for more travel options*
	Healthy Neighbourhoods *Changes in the transportation network should strengthen and enhance existing neighbourhoods; promote safe walking and cycling within and between neighbourhoods*
	Public Health & Environment *Support and enhance natural areas; encourage people to reduce how far they drive; mitigate negative impacts*
Prosperity	**Supports Growth** *Investment in public transportation should support economic development: allow workers to get to jobs more easily; allow goods to get to markets more efficiently*
	Affordability *Improvements to the transportation system should be affordable to build, maintain and operate*

4.1 Strategic Case Findings

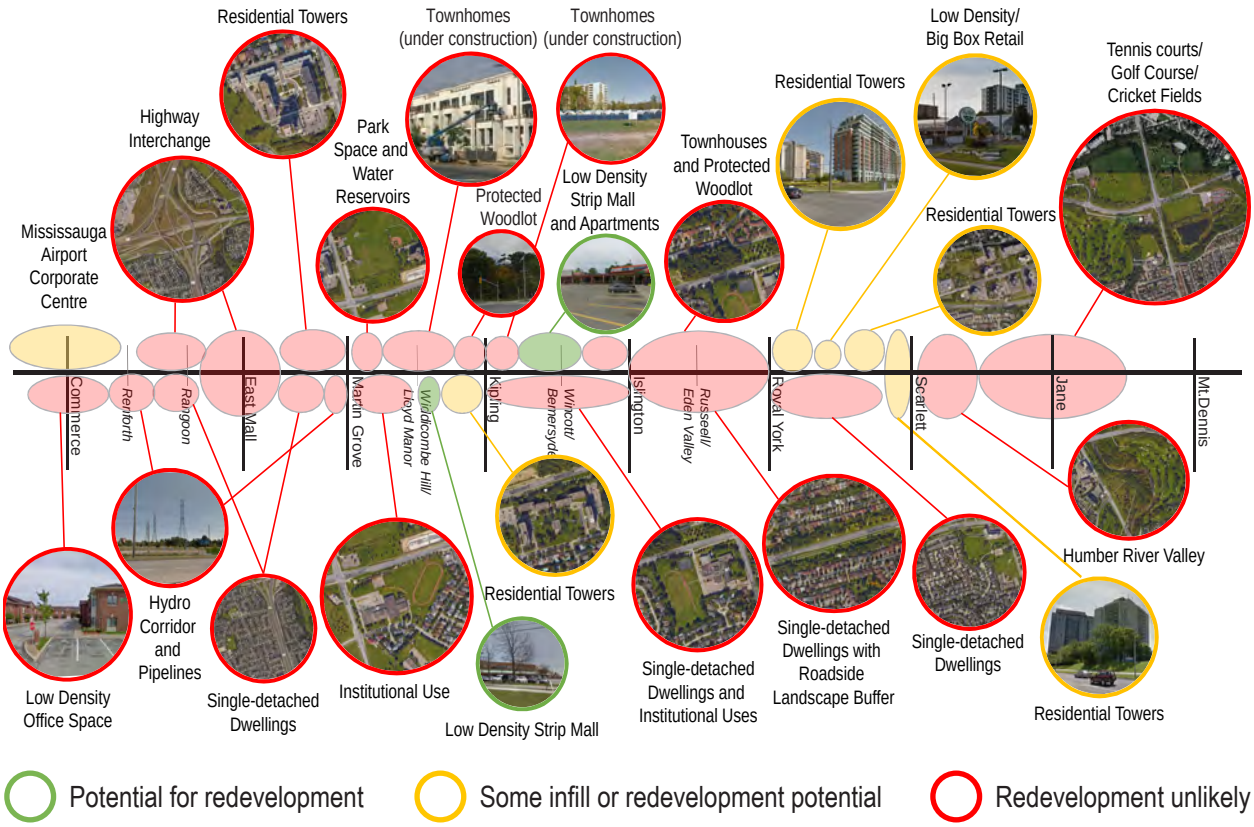
Eglinton West represents a gap in the regional rapid transit network serving longer distance trips.

Particularly trips connecting:

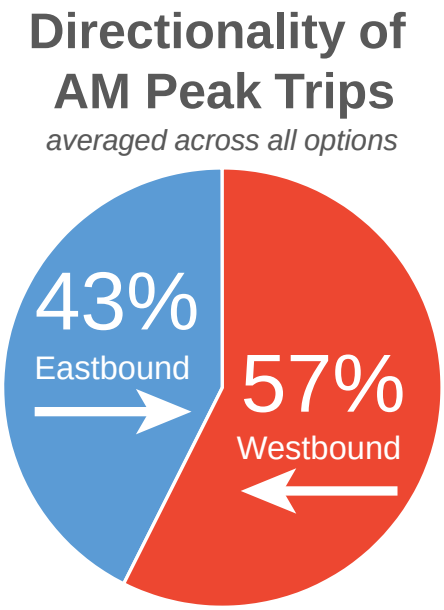
- → *City of Toronto residents to Pearson Airport and the broader Airport Employment Area;*
- → *Etobicoke with York University, Downtown Toronto, and the Pearson Airport Area*
- → *Mississauga with Downtown Toronto and York University*

The Eglinton West corridor has few major destinations as compared to the rest of the Eglinton corridor, and the adjacent land use to the north and south is predominantly single-detached homes. While redevelopment is unlikely along many portions of the corridor, there are opportunities for intensification which may be encouraged by new rapid transit. The corridor hosts a mix of longer-distance and local travel.

Development Potential on Eglinton Ave



While travel demand is present in both directions, demand during the morning rush period was observed to be stronger in the westward direction for all options explored, connecting Toronto and Etobicoke to the Airport and Pearson Airport Area. This is unsurprising given the findings of the Transportation Study of the Pearson Airport Area, which recognizes the airport as a major regional node. Although the study showed that travel demand for employment in the surrounding airport area originates predominantly from Brampton and Mississauga in the west, a significant amount of airport employee and passenger traffic also comes from the east, from western Toronto and the rest of the GTHA.



An analysis of traveler benefits generated from travel time savings reveals that people destined for Pearson Airport are likely to receive the most significant benefits. To a somewhat lesser extent, York University, Downtown Toronto, and Etobicoke destined travelers are also likely to benefit from notable travel time savings. Extension of rapid transit through the Eglinton West corridor benefits most of the region with regards to access to the airport, with those originating from Toronto, but located just outside of the Union Station catchment area, benefiting the most.

Those travellers who begin their trips in Etobicoke and along the Eglinton Corridor also enjoy a strong travel time savings. Transit users coming from Mississauga experience some travel time savings, but because they are coming from a wider geographic area and they have a large range of viable travel options to Downtown Toronto, the relative benefit is not as strong as for travelers coming from the City of Toronto in the opposing direction.

An Eglinton LRT extension improves transit for Etobicoke residents, with a particular **emphasis on benefits for the northern portion of Etobicoke.**

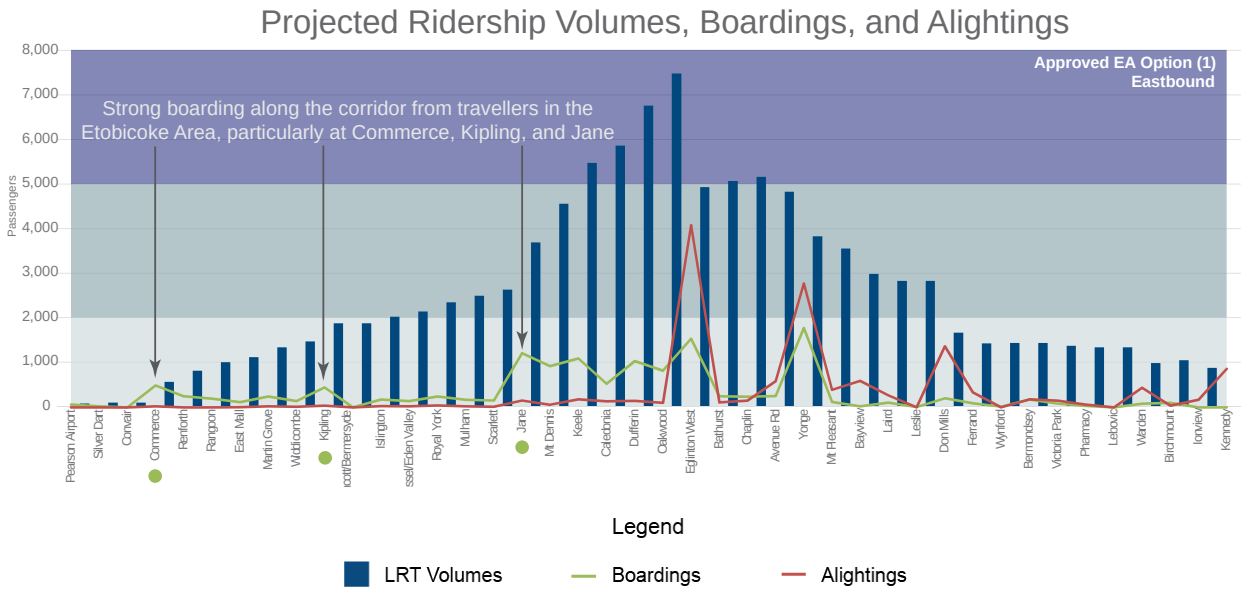
An extension of the Eglinton LRT improves transit for Etobicoke residents, serving the local community through north-south bus connections on the major roads. The travel benefits are strongest north of Eglinton, where fewer high-order transit options exist as compared to those living south of Eglinton who can more easily access the Bloor-Danforth Subway (TTC Line 2).

The LRT option in the approved EA can be further refined, including consideration of a reduced stop option that may better target the travel market and provide improved travel time savings.

The LRT option in the approved EA was developed as part of the wider Eglinton Crosstown LRT project. Not surprisingly, the option has merit as part of the overall network, but may benefit from further refinement to improve the business case.

A key adjustment that may bolster the benefits of the LRT is a refinement in the number of stops along the corridor. The number of stops along a corridor, and the resulting distances between them, presents a trade-off between the ease of local access and faster journey times. Decisions about the number of stops will have to consider the numbers of riders that will be attracted to the service by the benefits of local access versus higher travel speed, striking a balance between these two opposing objectives.

Given the value of longer distance trips for travelers across the region, an option with fewer stops appears to be more favourable in improving the economic case. Detailed analysis was undertaken for both 17-stop and 6-stop options, and suggested that some intermediate number of stops may be optimal as there is some ridership gain with moderate increase in stop spacing, and decrease in number of stops. While the 6 stop option creates larger stop spacings, and as a result, faster journey times, it provides limited local access along the corridor, which makes the services less



attractive for some users. From the analysis, this effect was most evident in the eastbound direction of travel, where the benefit of faster journey times from the 6 stop option is superseded by the access benefits of having more stops. Ridership and benefits approximated for an intermediary 11 stop option resulted in a more favourable business case than both the 17 and 6 stop options, but more comprehensive analysis is still needed to identify an optimal number of stops due to the complexities of travel demand modelling on a local scale.

Further analysis is recommended in two key areas; undertaking transportation modeling and benefits case analysis to fine tune the number of stops and to undertake detailed traffic analysis and simulation of the refined options to fully understand the impacts and benefits at a fine-grain level.

A hybrid option with at-grade LRT and grade separations at select targeted locations **may provide benefits.**

A fully grade-separated LRT would cost almost twice as much as an alignment at grade and could have significant impacts on the community. However, there are recognizable benefits to grade separation, including reducing traffic impacts, avoiding geographical constraints and improved transit connections. Some of these benefits can be achieved through targeted grade separations at specific points of opportunity or constraint. Incorporating select grade separated treatments into an at-grade LRT may improve the operational efficiency and provide travel time savings as compared to a full grade separated option while managing costs and community impacts.

LRT better serves the travel market in the corridor compared to BRT.

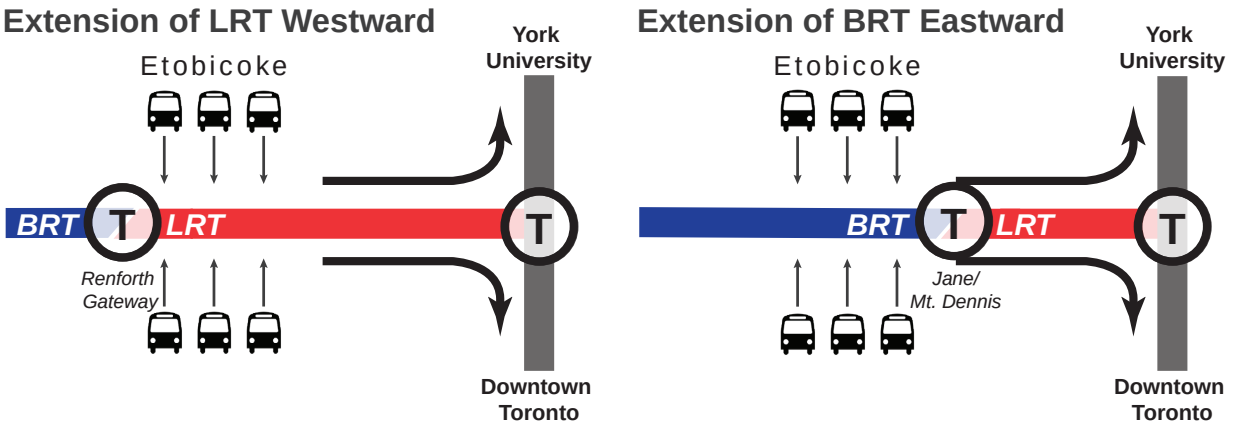
BRT was considered as a potentially lower cost alternative to LRT, with many of the same benefits in terms of quality of service and journey times. The BRT option assessed in this study was envisioned to be similar to the VIVA Rapidway project in York Region, operating in the centre median, separated from traffic except where it crosses intersections.

A key consideration in the evaluation is how Eglinton connects to the Mississauga BRT and whether the transfer between LRT and BRT should occur at Renforth Gateway in the west, or at Jane/Mt. Dennis in the east.

Those traveling eastbound from Mississauga to destinations beyond Etobicoke, which represents the majority of eastbound travelers originating from Mississauga, have to transfer at some point from BRT to LRT regardless of where the transfer is located, so the location has little to no impact. In the opposite direction, the impact of the transfer location is dependent on each traveler's intended destination. Similar to the eastbound direction, westbound travelers who wish to continue beyond the length of the project corridor into Mississauga would be unaffected by the transfer location since they will have to switch from LRT to BRT regardless, but those looking to end their trip at or before Pearson Airport, and the Pearson Airport Area, would experience added inconvenience if the transfer was located in the east at Jane/ Mt. Dennis. In this case, the predominance of westward travel from Toronto and Etobicoke to the airport and airport employment areas suggests that extending the LRT and having a transfer free trip better serves the broader market. In addition, the Greater Toronto Airports Authority (GTAA) is advancing significant plans for improving transit accessibility to the Pearson Airport Area.

In addition, LRT is more favourable for the Etobicoke market as it serves as a core service for local buses to feed into, giving improved access to Downtown Toronto and York University. With BRT, Etobicoke residents on local buses would be required to transfer to BRT, then again to LRT before they can enter the larger rail network, adding an additional transfer to their journey. The diagrams below show the impact of the BRT to LRT transfer location on Etobicoke riders, with the BRT extension adding an extra transfer point for eastbound Etobicoke travelers.

LRT provides reliable, quiet, energy efficient, accessible and higher-level public transit that meets the demand projections for the corridor and helps to advance Provincial and Municipal land-use goals. Taking all factors into consideration, light rail would meet the future projected travel needs on Eglinton Avenue, as well as provide capacity for future growth, in the most cost-effective way possible.



4.2 Detailed Analysis of Option 1 & Option 2

Serving People

Experience

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

It is estimated that Option 2 would incent marginally more riders than Option 1 to use transit daily. However, Option 2 increases the average generalized transit travel times slightly. More investigation will be conducted to determine the degree to which this represents travel time savings for trips or a shift towards shorter trips being taken by transit.

SmartTrack also provides much needed relief to congested Bloor-Yonge Station and on Line 1 (Yonge-University Subway) south of Bloor.

Option 1 and Option 2 perform similarly from an Experience perspective.

Choice

The project's impact on choice can be understood both in terms of how many opportunities there are to transfer to other rapid transit lines that serve destinations that people want to travel to (more opportunity is positive), and how many transfers riders need to make to reach their destinations (fewer transfers is positive).

The Eglinton West LRT makes the key transit connection between the Renforth Gateway at the Mississauga Airport Corporate Centre and the rest of SmartTrack at Mount Dennis.

Each of these points is identified as a Mobility Hub, and should be planned as important connection points in the future. These hubs act as intermediary points on many transit trips to downtown Toronto and elsewhere in the city, in addition to being important destinations in their own rights.

The Eglinton West LRT would be constructed as an extension to the Eglinton Crosstown LRT and also connect with the Mississauga Transitway. The connection with the rest of SmartTrack and GO Rail at Mount Dennis is significant.

Option 1 and Option 2 do not differ significantly from one another in terms of the average number of transfers required.

The number of connections to major walking and cycling infrastructure is also related to transportation choice. Examples of this type of infrastructure include downtown's PATH system for pedestrians, the Waterfront Trail system or the West Toronto Rail Path. The options do not differ significantly in their impacts or ability to connect to any such pedestrian or cycling facilities.

On balance, all options perform equally well with respect to Choice.

Social Equity

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

The Eglinton West LRT would serve a moderate number of social equity seeking individuals. Option 1 would serve nearly 20% more than Option 2, by virtue of its additional stations. There may be an opportunity to strategically include specific stops from Option 1 in the final list of stop locations in order to improve access to NIA residents. The additional stations in Option 1 would also result in increasing coverage by over 28%.

Option 1 performs better than Option 2 with respect to Social Equity.

Summary of Social Equity Metrics

	Option 1 (17 stops)	Option 2 (11 stops)
Change in Coverage	8.2 km^2	6.4 km^2
Change in Social Equity Seeking Individuals Served	12,700	10,700

Strengthening Places

Shaping the City

Transit investments can play a very significant role in the residential development of the city. Rapid transit may be constructed to serve areas of high population density in order to relieve congestion and increase capacity of local transit services, or rapid transit can be built in areas planned for higher population density in order to increase transportation accessibility and thus incent residential development in appropriate areas.

Existing population represents an established market which makes benefits associated with serving it more certain than those associated with serving growth. Option 1 serves over 20% more existing residents than Option 2. Population growth expected for the area is similar between the two options with Option 1 being slightly higher. Although the line serves areas outside the City of Toronto's borders, all of the population served is within Toronto.

By virtue of its additional stations, Option 1 provides some additional benefit over Option 2 with regards to Shaping the City.

Summary of Shaping the City Metrics

	Metric	Option 1 (17 stops)	Option 2 (11 stops)
Existing Population	Existing GTHA population	28,700	23,400
	Existing GTHA population density	2,800 people/km^2	2,800 people/km^2
Service to residential growth areas	Area of land designated for population growth	0.1 km^2	0.1 km^2
	Proportion of land designated for population growth	0.8%	0.9%
Population Growth	Projected population growth	2,800	2,500
	Projected increase in population density	300 people/km^2	300 people/km^2

Healthy Neighbourhoods

Just as transit investments can be a powerful force in shaping the city, they can also have long-term detrimental impacts on existing, stable neighbourhoods. A significant proportion of the Eglinton West LRT study area is recognized as stable neighbourhoods, to which adding a station could bring unwanted development pressure and change. Option 1 is in close proximity to 3.3 km^2 of stable neighbourhoods and Option 2 is 2.4 km^2 (40% and 38% respectively). This means that approximately half of the additional coverage provided by stations only in Option 1 is recognized as stable neighbourhoods.

Option 1 is associated with a greater likelihood of unwanted development pressure and change in the area. Therefore, Option 2 performs better with respect to Healthy Neighbourhoods.

Public Health & Environment

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

Option 2 is associated with a very slight reduction in daily vehicle kilometres travelled relative to Option 1.

The Eglinton West LRT has some environmental challenges associated with it, in the crossing of the Humber Valley and Mimico Creek. However, these challenges affect Option 1 and Option 2 equally. All options perform equally well with respect to public health and the environment.

Summary of Public Health & Environment Metrics

	Option 1 (17 stops)	Option 2 (11 stops)
Auto Mode Share	55%	55%
Significant Environmental Challenges	None	None

Supporting Prosperity

Supports Growth

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

As for population, existing employment represents an established market. The benefits associated with serving existing employment are more certain than those associated with serving growth.

The key growth areas served by the Eglinton West LRT is the Mississauga Airport Corporate Centre and Toronto Pearson which are served equally well by Option 1 and Option 2.

Option 1 and Option 2 perform similarly from the perspective of Supporting Growth.

Summary of Supporting Growth Metrics

	Metric	Option 1 (17 stops)	Option 2 (11 stops)
Existing Employment	Existing Toronto employment	4,500	4,100
	Existing non-Toronto employment	21,500	21,500
	Existing employment density	2,600 jobs/km^2	3,100 jobs/km^2
Service to Employment Growth Areas	Area of land designated for employment growth	0.5 km^2	0.5 km^2
	Proportion of land designated for employment growth	7%	8%
Projected employment growth	Projected employment growth	14,300	14,100
	Projected increase in employment density	1,400 jobs/km^2	1,700 jobs/km^2

Affordability

Affordability considerations are covered in the Financial Case, but it also plays an important role in understanding the strategic case for a project. Capital costs are the most important consideration, however life-cycle costs and cost recovery are also key parameters. Removing stops means that Option 1 has lower capital costs however the difference is within the range of total costs. Option 2 may require parallel TTC bus service because of the distance between stops, which would increase its life-cycle costs. Parallel bus service for the 11-stop option is not included in the Initial Business Case analysis.

5.0 FINANCIAL CASE

Costs were developed to support a comparative study of the options. The dollar amounts generated are not intended to define the precise capital costs to construct each option, but rather to give a sense of how different design features, such as the number of stops, or the level of grade separation, influences the overall cost.

The estimates were calculated using standard estimating procedures from the Toronto LRT Program for order-of-magnitude costs. Calculations and unit values were based on information from the 2010 EA report, parametric estimates from Metrolinx, a review of the corridor and options, calculation of major quantities and validation of major cost drivers with external cost data. Capital costs do not include escalation, financing costs, lifecycle and operating and maintenance.

Each cost includes an 'Airport Allowance' to account for the segment of the line that connects into Pearson Airport. As the alignment on the Pearson Airport property has not yet been established, costs were not broken out into greater detail. Key decisions about the alignment of the route leading into the airport property will have to be determined before a more accurate estimate can be developed. For the purpose of this study, an 'Airport Allowance' of $0.28B was included in the capital cost estimates for all LRT options, while $0.14B was included for the BRT option. This estimate covers the segment of the project from the stop at Silver Dart Drive, where the EA approved alignment ends, to a terminus Toronto Pearson International Airport. Further work is required, in coordination with the Greater Toronto Airports Authority (GTAA), to determine the best way to provide access to the airport property. Metrolinx, the City of Toronto and major stakeholders are coordinating with the GTAA on the 'Pearson Connects' study which proposes significantly improving the accessibility of transit to Pearson Airport and its surrounding area.

Operating and maintenance costs for the options with only three stops on Eglinton Ave include provision for a parallel TTC local bus service. Although not currently costed, the 11-stop option may require a parallel local bus. This will be confirmed in a future phase of this work.

More detail about financial case assumptions is available in the appendix.

Comparing the options to the approved EA option, BRT introduces significant capital cost savings. Decreasing the number of stops also has the effect of decreasing capital cost, though to a lesser extent. Grade separation, even with the number of stops decreased to 6, is significantly more expensive.

Summary of Costs

	Order of Magnitude Costs (2014 $billions)					
	At-Grade LRT			At-Grade LRT, with Grade Separations at **All** Arterials	Fully Grade Separated LRT	At-Grade BRT
Option	1	2	3	4	5	6
Stops	17	11	6	6	6	17
Airport Allowance	$0.28	$0.28	$0.28	$0.28	$0.28	$0.14
Capital Cost*	$1.4 - $1.8 With Targeted Grade Separations: $1.5 - $2.1	$1.4 - $1.7	$1.3 - $1.7	$1.7 - $2.1	$2.0 - $3.0	$1.0 - $1.3
Operating and Maintenance Cost	$0.9	$0.8	$1.0	$0.9	$0.8	$0.2

*Capital costs do not include escalation, financing costs, lifecycle and operating and maintenance

Total Project Cost Estimates with Targeted Grade Separations (2014 $billions)

Grade Separations	Jane and Scarlett Kipling Martin Grove	Jane and Scarlett Kipling Martin Grove	Jane and Scarlett Kipling Martin Grove	Jane and Scarlett Kipling Martin Grove
Total Project Capital Cost	$1.5 - $1.8	$1.5 - $1.9	$1.6 - $2.0	$1.7 - $2.1

6.0 ECONOMIC CASE

A benefit-cost analysis (BCA) was conducted to assess the relative economic merits of each option. All options were compared to a "Do Minimum" base case, defined as maintaining the existing local (all-stop) bus service operating along Eglinton Avenue (TTC Route 32) west of the Mt. Dennis station. The following benefits were monetized and incorporated into the analysis:

- Travel time savings (existing and new users);
- Reliability/quality benefits, converted to a time-savings equivalent (existing users);
- Unperceived vehicle operating cost savings (auto switch users);
- Fare revenue from local transit agencies and GO transit (transit agencies); and
- Reduction of emissions, accidents, and congestion due to reduced VKTs (external benefits)

The following are the outcomes of the benefit-cost analysis:

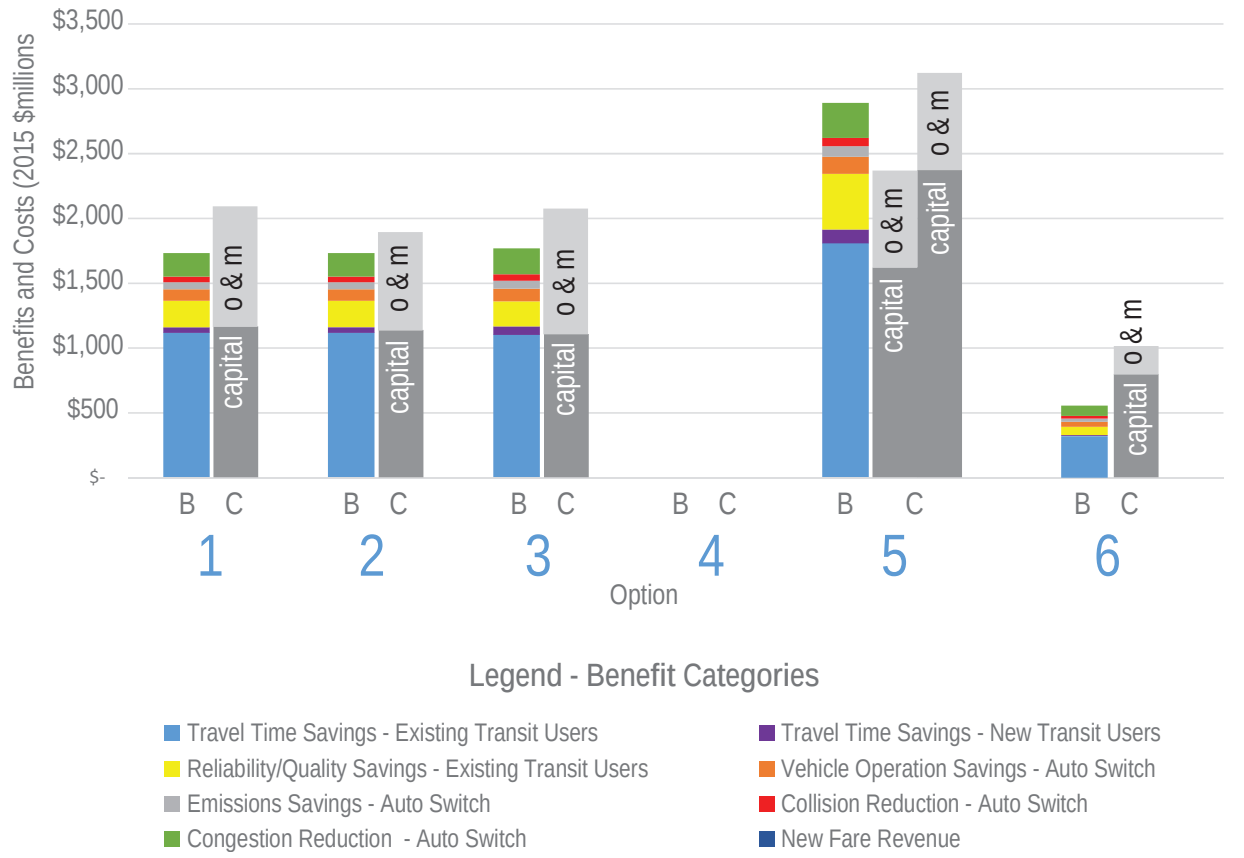
	Benefit-Cost Ratios					
Option	1 At Grade 17-stops	2 At Grade 11-stops	3 At Grade 6-stops	4 Partially Grade Separated 6-stops	5 Grade Separated 6-stops	6 BRT
Benefits	1.9	1.9	1.8		2.8	0.6
Costs (Lifecyle, NPV)	2.1	1.9	2		2.4-3.1	1
Benefit -Cost Ratio (BCR)	0.9	1	0.9		0.9-1.2	0.6

Through development of the conceptual layout of option 4, it became apparent that the vertical profile of having an LRT that ascends and descends in repetition would not only be challenging to design and construct, but also be operationally challenging and be of major disbenefit to passenger comfort. Though these factors are not quantified within the current benefit-cost calculation framework, they were deemed sufficient in justifying the elimination of option 4 from the list of potential options. As such, a benefit-cost ratio was not calculated for option 4.

For the grade separated option, option 5, a range of benefit-cost ratios have been calculated to capture the large variability in costs - a difference of $1 billion between the highest and lowest costs. With a benefit-cost ratio of 1.2 at the lower end of the cost range and 0.9 at the higher end, it can be seen that the variability in cost can impact the performance of the service.

Out of all the options, option 6, the BRT option, resulted in the most unfavourable benefit-cost ratio at 0.6. Although the cost of constructing BRT is significantly lower than LRT, this study has revealed that BRT would be much less suitable for meeting the needs of travellers in this corridor. As discussed in the strategic case section, a key factor influencing the suitability of either mode is the location of the transfer point. As the BRT option would be an extension of the Mississauga BRT, the transfer point between LRT and BRT would be located at either Jane or Mt. Dennis. However, because a greater portion of travellers travel westbound beyond this point, a transfer at either Jane or Mt. Dennis results in a disbenefit to a larger portion of travellers. As a result, the BRT option would only be able to attract a nominal amount of ridership compared to the LRT options.

Breakdown of Benefits (B) and Costs (C) by Option



Legend - Benefit Categories

- Travel Time Savings - Existing Transit Users
- Travel Time Savings - New Transit Users
- Reliability/Quality Savings - Existing Transit Users
- Vehicle Operation Savings - Auto Switch
- Emissions Savings - Auto Switch
- Collision Reduction - Auto Switch
- Congestion Reduction - Auto Switch
- New Fare Revenue

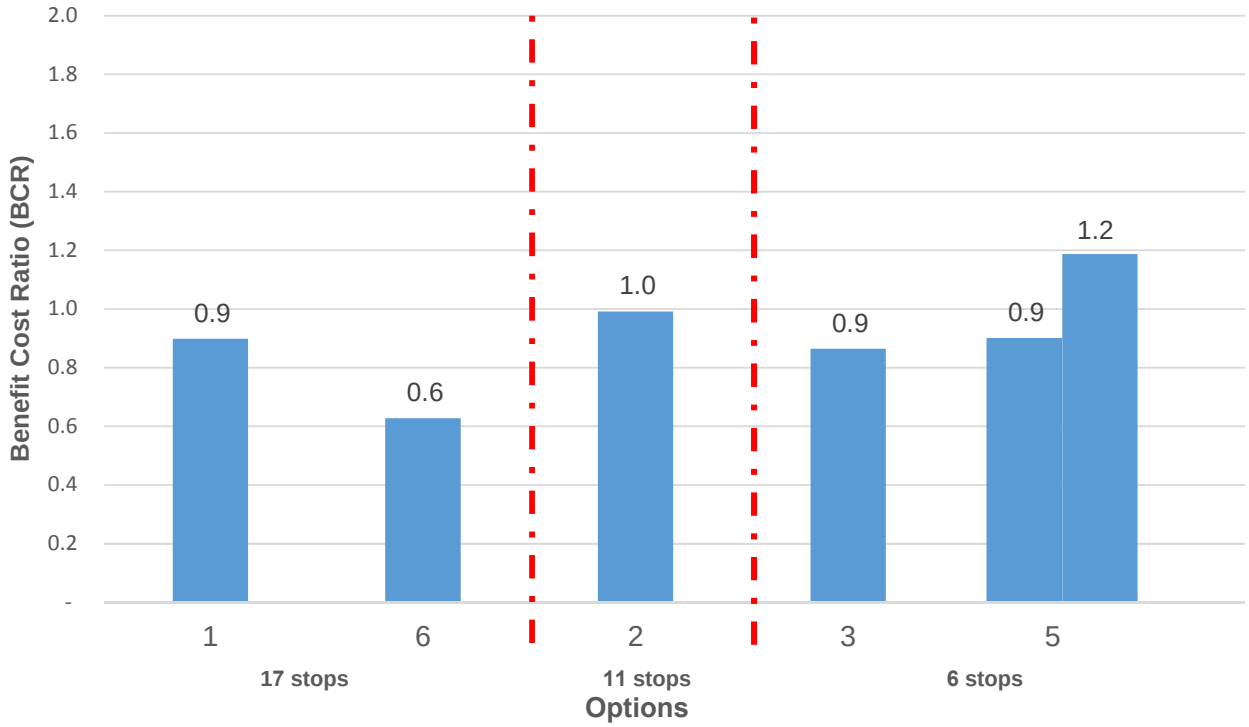
The LRT option in the approved EA can be further refined to strengthen the business case, including consideration of a reduced stop option that may better target the travel market and provide improved travel time benefits.

The LRT option in the approved EA was developed as part of the wider Eglinton Crosstown LRT project. Not surprisingly, the option has merit as part of the overall network, but may benefit from further refinement to improve the business case.

Based on the current method of analysis, the business case for the LRT option, as developed in the EA, approaches a positive benefit. A key adjustment that may bolster the benefits of the LRT is a refinement in the number of stops along the corridor. The number of stops and the resulting distances between them, presents a trade-off between the ease of local access and faster journey times. Decisions about the number of stops will have to consider the numbers of riders that will be attracted to the service by the benefits of local access versus higher travel speed, striking a balance between these two opposing objectives.

Given the value of longer distance trips for travelers across the region, an option with fewer stops appears to be more favourable in improving the economic case. While detailed analysis was undertaken for a 17-stop and 6-stop option, it appears that some intermediate number of stops may be optimal as there is some ridership gain with moderate increase in stop spacing, and decrease in number of stops. While the 6-stop option creates larger stop spacings, and as a result, faster journey times, it provides limited local access along the corridor, which may make the service less attractive to some.

Benefit-Cost Ratio by Number of Stops



A fully grade-separated option presents a positive benefits case but is costly and may be difficult to implement.

Because of the need for longer distance travel through the corridor, speed and reliability have particularly strong impacts on the benefits that each option brings to travellers. As a result, the lower range of the cost for option 5, the grade-separated option, produced a positive business case even with significantly higher costs. However, this assessment does not account for the visual impact that the elevated structure would have on the surrounding community, and the traffic implications of having the support structures in the median of the road, particularly where there are stations. While a below-grade option could provide similar benefits without these community impacts, it generates a fairly unfavourable benefit-cost ratio due to significantly higher costs.

The fully grade separated options range from three to two times as costly as a surface LRT option, with an estimated capital cost on the order of approximately $2B to just over $3B (not including escalation, financing costs, lifecycle and operating and maintenance). In the context of other regional transit priorities, it may be difficult to dedicate such substantial capital investment to this corridor even when considering the long-term operating and travel time benefits.

More information about assumptions used in the economic case is available in the appendix.

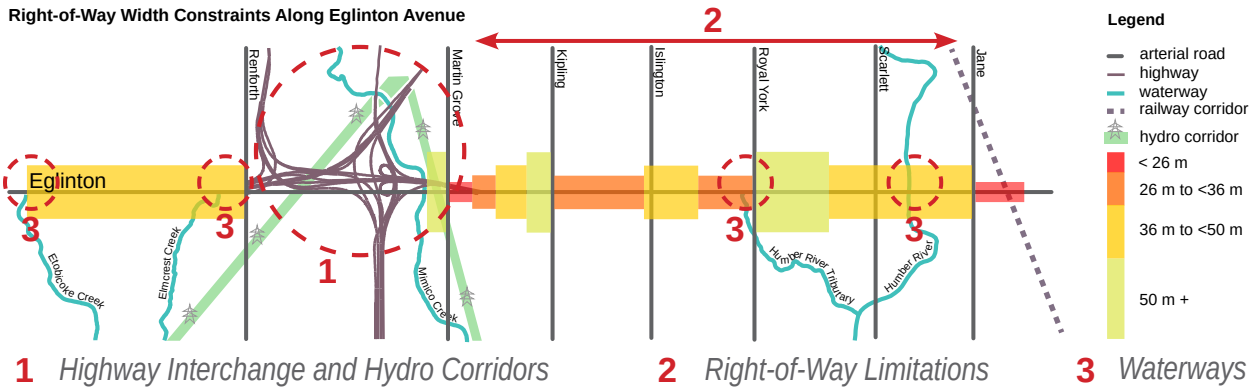
7.0 DELIVERABILITY AND OPERATIONS CASE

In addition to the quantifiable costs and benefits captured in the economic case, additional factors that influence the deliverability and operations of the project must be considered. Despite receiving a high benefit-cost ratio, some options may face barriers to implementation or result in undesirable impacts that are difficult to quantify accurately. This section captures some of the externalities that need to be considered in choosing the appropriate rapid transit option for the Eglinton West Corridor.

There are several constraints along the corridor which impact deliverability, right of way is largely available for the approved EA design.

A number of constraining features exist along the Eglinton West Corridor, limiting the options that can be implemented. The following diagram identifies some of the challenging structural and geographical features that need to be overcome at each part of the project corridor.

Existing Road Right-of-Way Along Eglinton Avenue



1 Highway Interchange and Hydro Corridors

The highway interchange between Highway 401, Highway 427, and Highway 27 poses one of the biggest challenges along this corridor. Located between Martin Grove Road and Renforth Drive, the highway interchange takes up a large portion of land, and provides virtually no opportunity for new development. To get through this area, Eglinton Avenue passes under 8 bridges, which may need to be widened if rapid transit is to operate at-grade without any loss of road space for motorists.

The hydro corridors, located in this same area, present additional challenges. Particularly to the west of Martin Grove Rd, the vertical elevation of the alignment is limited by the height of overhead hydro lines. Underground grade separation is possible, but comes at a higher cost, and potentially greater risks, particularly for flooding.

2 Right-of-Way Limitations

Long protected for the construction of the Richview Expressway some land has been incrementally sold off by Build Toronto for development purposes while protecting for the EA design. Right-of-way width along the Eglinton West Corridor has become varied, potentially making it difficult to accommodate rapid transit within the existing road allotment that differs from the EA option. One key pinch point with private property is in the section between Jane

and Mt. Dennis. For all options, it has been assumed that the connection through this area would be accomplished through an extension of the grade separated alignment from Eglinton Crosstown Phase I. Other segments along the corridor with insufficient right-of-way would require additional property acquisition much of which is already in public ownership. Several woodlots along the corridor are protected, and will require additional consideration as the design of the alignment is further refined.

The Eglinton West Corridor intersects several waterways, including Humber River and Mimico Creek. Eglinton Ave currently crosses over the Humber River using a bridge, while the other waterways are either channelized or buried beneath the roadway. Implementation of at-grade options would require the bridge over the Humber River to be widened to accommodate rapid transit in the centre median, while the design of grade separated options, particularly those underground, would have to be mindful of the constraints imposed by these waterways.

Full grade separation is costly, and can have major short and long term community impacts.

Though all options analyzed will likely require reconstruction of the roadway, grade separation comes with the highest cost, and greatest short and long term impacts on the community. Construction of grade separated infrastructure tends to be more complex, and require more time, meaning that the community surrounding the corridor would be faced with a longer period of disruption. Impacts on local businesses and the inconvenience brought to residents during construction is difficult to capture quantitatively, but is a widely recognized implication of all infrastructure projects.

While grade separation may be used to overcome some of the corridor constraints along Eglinton Avenue, full grade separation, particularly fully elevated options, can have long term impacts on the community. Much of the alignment would liley be visually obstructive with impacts on the character of the surrounding neighbourhood. Transit stops elevated above the centre median at intersections would also introduce traffic complications, as the centre median would have to be widened to fit elevators and stairs for accessing the platform, making left turns more difficult. A fully underground option would not have these same issues, but would be significantly more costly, without introducing any additional travel time savings benefits.

9.0 NEXT STEPS

Following this work, a number of outstanding decisions remain for this project, including:

- Project funding
- Project proponency
- Procurement method
- Interface with the City of Toronto transit network planning process

Subsequent work, will further refine the project and help to inform these key decisions. This work includes:

1. Formalizing workplan and project coordination between Metrolinx, City of Toronto and the TTC

2. Further develop and study the options for targeted grade separation including consultation, refined analysis of costs and benefits and micro-simulation of operations

3. Detailed traffic analysis study following up on the 2009-10 EA to more fully understand the impacts and mitigation of different options on traffic operations

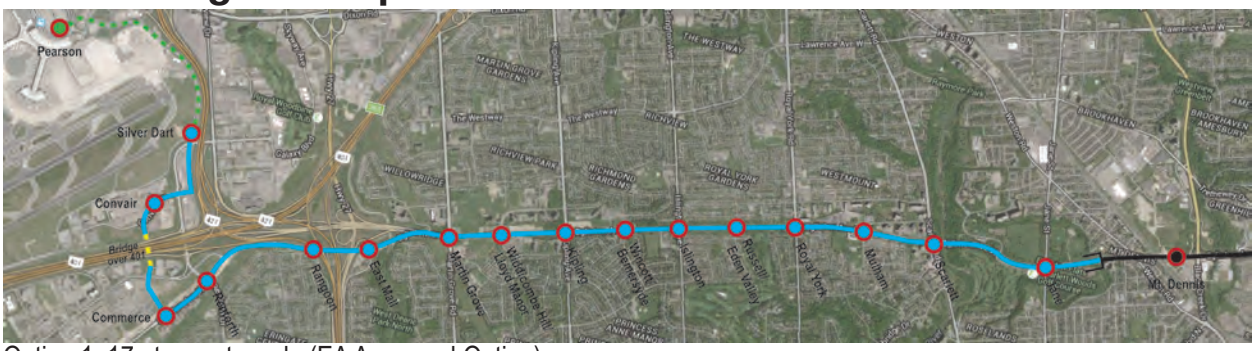
4. Planning and design work on the Pearson Airport segment with the GTAA and City of Mississauga

5. Continued consultation with the local community to understand benefits and impacts and share findings

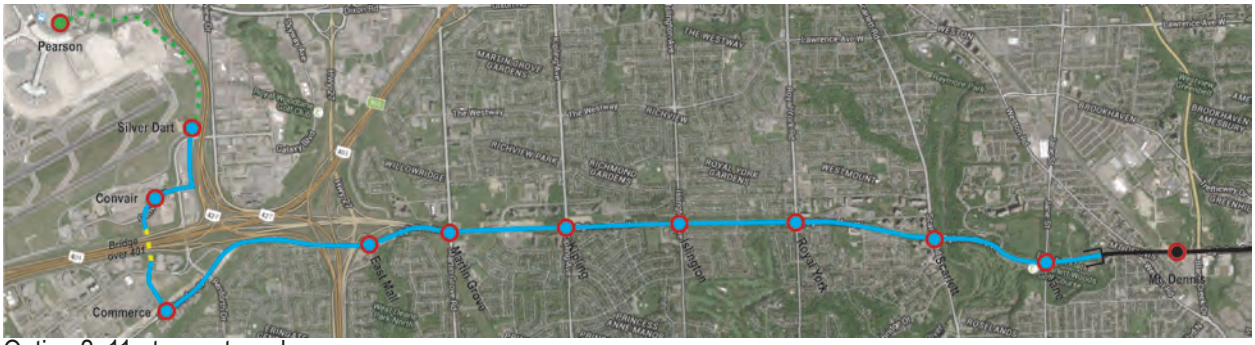
6. EA amendment, if necessary

APPENDIX

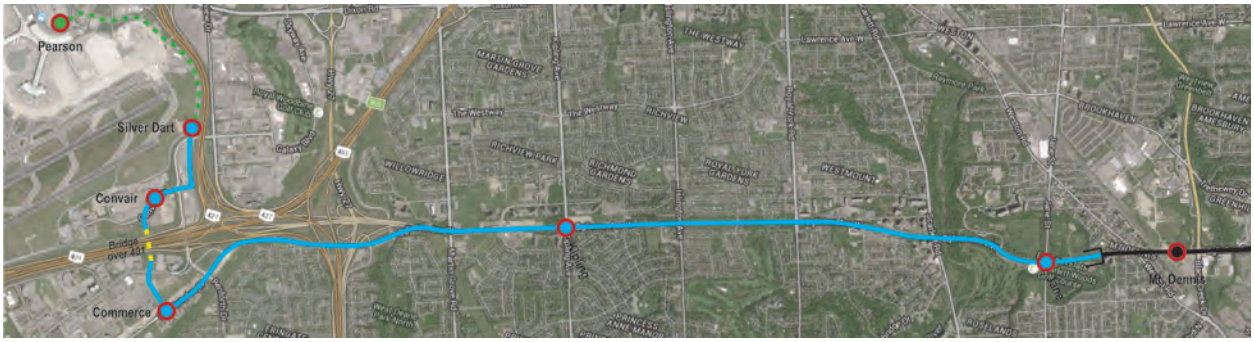
Aerial Images of Options



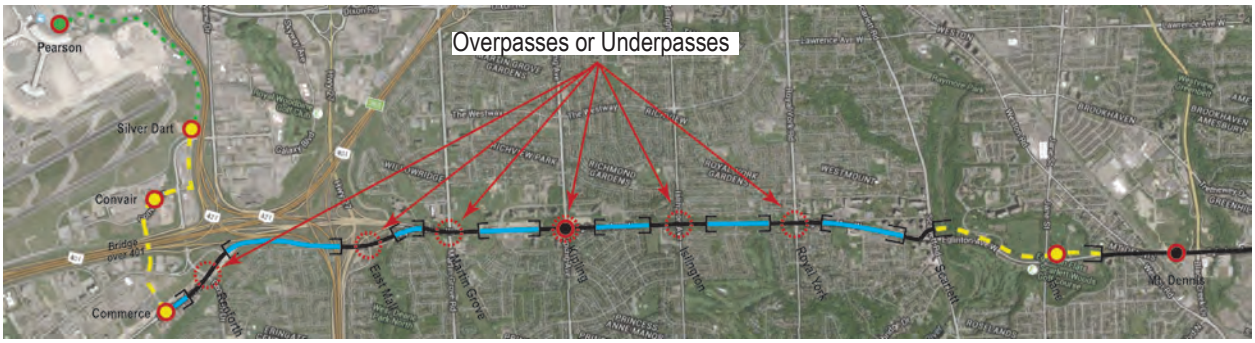
Option 1: 17-stops, at-grade (EA Approved Option)



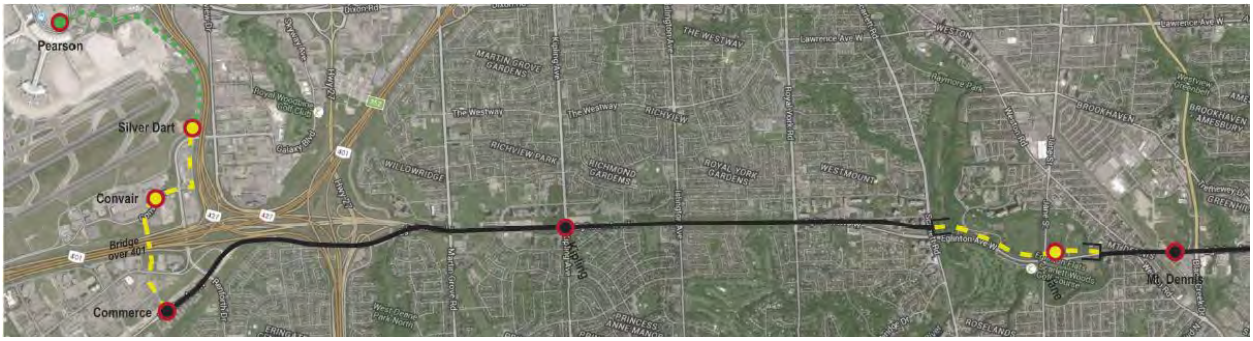
Option 2: 11-stops, at grade



Option 3: 6-stops, at grade



Option 4: 6-stops, grade separated at intersections



Option 5: 6-stops, fully grade separated

Option 6: 17-stops, Bus Rapid Transit

Summary of Assumptions

Capital costs do not include escalation, financing costs, lifecycle and operating and maintenance.

Operating and Maintenance Costs:

Options 1-2 are not assumed to require parallel local bus service, Options 3-6 do assume continued operation of a local bus service. The costs for this local bus service are based on the existing costs of the TTC bus on the route, scaled down to reflect that the service would likely only operate to Mt. Dennis. Detailed analysis of local accessibility in future work may indicate that a parallel bus service is also required in Option 2.

For the LRT option O/M costs are based on standard Metrolinx assumptions for the Toronto LRT projects.

For the BRT option O/M costs are based on the US National Transit base, converted to Canadian Dollars and adjusted to reflect typical TTC costs.

Life-cycle:

60 Years

Escalation Factors:

Value of Time escalation factors: 0.91% (2020-2024), 0.83% (2025-2043), and 0% (2044 and beyond)
PHT, VKT, Fare Revenue growth rates: 0.8% and 0% (2044 and beyond)

In-Service Date:

Construction start: 2020
Operational start: 2024

Benefits Formulas:

$$\text{Transit time change (existing)} = n_{T0} \times (t_{T1} - t_{T0})$$

$$\text{Transit time change (new)} = (n_{T1} - n_{T0}) \times \frac{t_{T1} - t_{T0}}{2}$$

$$\text{Auto km change} = (n_{A1} - n_{A0}) \times d_{A0} + n_{A0} \times (d_{A1} - d_{A0})$$

t_T	transit travel time (min.), weighted
t_A	auto travel time (min.)
n_T	transit demand (# of trips)
n_A	auto demand (# of trips)
d_A	auto distance (km)
subscript 0	base case / business as usual
subscript 1	build scenario 1