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EGLINTON CROSSTOWN RAPID TRANSIT BENEFITS CASE

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Eglinton Crosstown Rapid Transit

Benefits Case

Final Report

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Prepared for:

Metrolinx
20 Bay Street, Suite 901
Toronto ON M5J 2N8

Prepared by:

Steer Davies Gleave
1000 - 355 Burrard Street
Vancouver, BC V6C 2G8

In Association with:
Economic Development Research Group
Metropolitan Knowledge International

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Executive Summary

In 2006 the Province of Ontario created the Greater Toronto Transportation Authority, later renamed Metrolinx in December 2007. The primary responsibility of the new organisation is to provide leadership in the planning, financing and development of the Greater Toronto and Hamilton Area's (GTHA) multi-modal transportation network and to conform to the objectives and vision set out in the *Places to Grow Act*, 2005.

Part of Metrolinx' mandate and one of its first deliverables was the development of the *Regional Transportation Plan* (RTP), a 25-year plan that presents the road map for the implementation of the Province's *MoveOntario 2020* vision of 52 new rapid transit projects in the GTHA by 2020.

As the rapid transit projects contemplated in the RTP move closer to implementation, a Benefits Case will be prepared for each project. The purpose of the Benefits Case is to undertake a comparative analysis of feasible options for a specific rapid transit project and present the results in such a way that it will assist decision makers to select a preferred option for implementation.

This report is about the Eglinton Crosstown (Eglinton) project which is one of the rapid transit projects announced by the Premier as part of *MoveOntario 2020* initiative and identified in the RTP. The project involves a 30 kilometre east-west rapid transit line that follows the Eglinton corridor from Kennedy subway station in the east to Pearson International Airport in the west and is part of Toronto Transit Commission's (TTC) Transit City Light Rail Plan.

In consultation with Metrolinx and TTC three options were identified.

- **Option 1**: **LRT -** primarily an in-street LRT in partially exclusive right-of-way with signal priority in intersections along with a tunnelled section.
- **Option 2: LRT Plus –** similar to Option 1 but with an extended tunnel and slightly higher speeds achieved by removing one underground station and three surface stations.
- **Option 3: Fully segregated LRT/ALRT** – a totally segregated transit system. For the purposes of costing, an ALRT system was assumed, but the option is intended to be a representative example of a fully segregated LRT or ALRT system.

The assessment showed the trade-offs among the options as they were developed in discussions between Metrolinx and TTC. However, based on the ridership modelling results it was clear that there was a potential to "optimize" the project to improve the benefit-cost ratio – especially for Option 3 where ridership is concentrated in the Middle and Eastern sections. Two sensitivity analyses were undertaken to explore how Option 3 could be improved.

- **Option 3a** examines the effect of a direct connection to the Scarborough Rapid Transit (SRT) project i.e. services would operate seamlessly along Eglinton and the SRT right-of-

way, thereby eliminating the need for transfer at Kennedy Station for east-west travel; and

- **Option 3b** assumes the direct connection to SRT, as contemplated in Option 3a, but with a western terminus at Weston Road and the Georgetown GO rail corridor[1] rather than at the Pearson International Airport. Bus services would allow passengers to continue their westward journey in the direction of Pearson Airport.

Each of the options is compared to a Base Case which is defined as the existing bus network along the Eglinton corridor growing over time to accommodate increased demand. The table below summarizes the key characteristics of the options.

SUMMARY OF OPTIONS

	Option 1	Option 2	Option 3 (and 3a)	Option 3b
Year in Service	2016	2016	2016	2016
Total Capital Costs ($bn)	3.93	3.98	5.40	4.01
2031 Passenger Capacity Per Hour Per Direction	7,100	7,700	13,700	13,700
2021 AM Peak headway (tunnel)	4'00"	3'00"	2'45"	2'45"
2031 AM Peak headway (tunnel)	3'00"	2'00"	1'45"	1'45"
Number of LRT Vehicles	168	150	---	---
Number of ALRT Vehicles	---	---	306	234
Travel Time	68 min	62 min	51 min	36 min

The assessment of the options is done using a Multiple Account Evaluation (MAE) methodology. The MAE is a framework that provides a systematic identification and analysis of broader public policy implications and criteria of an option, not only costs and user benefits. The MAE framework is based on a number of evaluation "accounts" that together address the most significant project performance and policy considerations for a specific project:

- Transportation User Benefits
- Financial Impacts

[1] In addition to GO rail services, the planned Airport Rail Link to Pearson Airport will operate along the Georgetown GO rail corridor.

- Environmental Impacts
- Economic Development Impacts
- Socio-Community Impacts

The assessment is done by comparing each option to the Base Case and identifying any incremental impacts, costs or benefits that are generated by each option. The analysis is done over a 30-year period (2009-2038). In order to compare the options on a "like-to-like" basis the monetized values are discounted to today's value. The values are discounted at a real discount rate of 5% and expressed in net present value in 2008 dollars.

The table below summarizes the results from the evaluation for Options 1, 2 and 3. The results for the sensitivity analyses, Options 3a and 3b are shown below in comparison to Option 3.

MULTIPLE ACCOUNT EVALUATION SUMMARY

	Option 1	Option 2	Option 3
Transportation User Account			
Transportation User Benefits (PV $m)	1,388	2,262	3,876
Qualitative User Benefits	✓✓	✓✓	✓✓✓
Financial Account			
Costs (PV $m)	(3,330)	(3,370)	(4,785)
Benefits Less Costs (PV $m)	(1,942)	(1,109)	(909)
Benefit-Cost Ratio	0.42	0.67	0.81
Environmental Account			
GHG Emissions (PV $m)	2.5	7.7	19.5
Qualitative Environmental Impacts	✓✓✓	✓✓✓	✓
Economic Development Account			
Economic Impacts During Construction	✓✓	✓✓	✓✓✓
Long-term Economic Impacts	✓	✓✓	✓✓✓
Land value increase ($bn)	$1.6 - $4.9	$1.5 - $4.4	$2.3 - $5.4
Social Community Account			
Land Use Shaping	✓✓✓	✓✓✓	✓✓✓
Health	✓✓	✓✓	✓✓✓
Accessibility	✓✓	✓	✓

The analysis shows that all of the Eglinton-Crosstown project options, in their current design, have costs that outweigh the benefits generated by the project. Option 3 (the ALRT option) has the highest benefit-cost ratio of 0.81, Option 2 has a lower benefit-cost ratio of 0.67 while Option 1 has the lowest benefit-cost ratio of 0.42.

As shown in the table below, the direct connection with SRT will have a major impact on ridership and increase travel time savings by 14% at a value of $541 million in net present value terms. The overall net cost is estimated at $368 million in net present value terms and the benefit-cost ratio increases from 0.81 to 0.92.

Option 3b, which includes the combined effect of the direct connection to SRT and the shorter alignment, further improves the results. The net present value of costs is further reduced by $185 million to $183 million and the benefit-cost ratio increases to 0.95.

SENSITIVITY ANALYSIS SUMMARY

All Values PV $m	Option 3	Option 3a *SRT Connection*	Diff. (3a-3)	Option 3b *SRT Connection + Weston as western terminus*	Diff. (3b-3)
NPV Transportation User Benefits	3,876	4,417	+14% $541m	3,406	-12% ($470m)
NPV Costs	(4,785)	(4,785)	---	(3,589)	-25% $1,196m
Net Benefits (Cost)	(909)	(368)	$541m	(183)	$726m
Benefit-Cost Ratio	**0.81**	**0.92**		**0.95**	

Due to its faster travel time and higher service frequency, the ALRT technology option (Option 3) attracts the highest ridership and generates the most transportation user benefits among the three options. The value of the transportation benefits is estimated at $3.9 billion in present value terms for Option 3; $4.4 billion for Option 3a; $3.4 billion for the lower-cost Option 3b; $2.3 billion for Option 2; and $1.4 billion for Option 1. The ridership demand in Options 3, 3a, and 3b is heaviest between Kennedy Station and Eglinton West Station, while for Options 1 and 2 the ridership demand is more evenly spread along the whole corridor with higher demand between the Eglinton Station and Eglinton West Station.

While the demand profiles are quite different for options 3, 3a, and 3b compared to Options 1 and 2, as expected, the highest demand flows for all are in the Middle Section. The demand for Options 1 and 2 is fairly evenly spread along the entire alignment with the maximum loading demand between Eglinton and Eglinton West subway stations while Option 3, 3a, and 3b's demand is the heaviest between Don Valley Parkway and Eglinton West subway station with the maximum loading point just east of Eglinton Station. Ridership demand decreases further west and diminishes quickly west of Keele Street. The rapidly declining ridership demand on the Western Section in the reason Option 3b was created as an additional sensitivity analysis.

Options 3 and 3a have the highest cost as both options require a segregated right-of-way along the whole corridor. The higher service frequency vis a vis Options 1 and 2 also results in higher annual operating costs. Total capital and operating costs, in net present value terms, are estimated at $4.8 billion for Options 3 and 3a, $3.4 billion for Option 3b and $3.3 billion for Options 1 and 2.

In terms of environmental impact, the higher performance of grade separation attracts more people out of their cars and reduces automobile usage more than at-grade LRT. This results in a reduction of greenhouse gas emissions by more than 41,000 tonnes annually by 2031 for Option 3 compared to 16,000 tonnes annually for Option 2 and 5,000 tonnes for Option 1. A segregated right-of-way may have a more intrusive environmental impact on some areas of the alignment, as it will require trenching or other form of grade separation.

All options will have a significant economic development effect as a result of the large investment. Option 3 (and Option 3a) which has the highest capital cost will have, not surprisingly, the largest impact on employment, income and GDP during construction. It is estimated that Option 3 will generate a total of approximately 48,000 person-years of employment, some $4.7 billion in GDP and $1.8 billion in wages[2]. Option 3 will also have the largest impact during operations as a result of the faster and more frequent service and is estimated to create more than 1,000 additional jobs by 2031. Option 2 is estimated to generate approximately 90% and Option 1 approximately 70% of Option 3's impacts.

The potential land value uplift in the corridor as a result of building the Eglinton project is expected to be significant. The grade-separated Options 3, 3a and 3b demonstrate the highest potential land value uplift due to larger station impact areas and more convenient and frequent service. The value ranges from $2.3 billion to $5.4 billion for Option 3 and 3a. Option 3b is expected to have a somewhat lower value compared to Options 3 and 3a due to eight fewer stations west of Weston Road, but still be higher than Options 1 and 2. The land uplift for Option 1 ranges from $1.6 billion to $4.9 billion, while Option 2 has a lower uplift ($1.5 billion to $4.5 billion) due to fewer stations. All numbers are expressed in today's dollars.

[2] Includes direct and indirect impacts.

All the options will have the potential to positively influence the creation of more compact and dense communities along the Eglinton corridor, but the fully grade-separated options may promote more "clustering" around the stations while the at-grade LRT segments will promote more even development along the entire alignment. The nature of the development would depend on local land use plans and zoning as well as how the grade-separated sections are built (trenched or underground).

Finally, a unique network benefit of Options 3a and 3b are the wider network benefits not specific to the Eglinton line, and therefore not fully captured by this study. The seamless connection at Kennedy Station, together with the speed and reliability of those options, has the potential to divert some trips from the Bloor-Danforth subway. This could potentially defer the need for capacity upgrades on the Bloor-Danforth line, similar to those being considered at considerable expense on the Yonge-University-Spadina line. Furthermore some transfer pressures experienced at the Bloor-Yonge interchange would be transferred to the new transfer point at Yonge-Eglinton interchange and would generally improve east-west trip reliability.

Part A Project Rationale

Introduction

Purpose of Report

In 2006 the Province of Ontario created the Greater Toronto Transportation Authority, later renamed to Metrolinx in December 2007. The primary responsibility of the new organisation is to provide leadership in the planning, financing and development of the Greater Toronto and Hamilton Area's (GTHA) multi-modal transportation network and to conform to the objectives and vision set out in the *Places to Grow Act*, 2005.

Part of Metrolinx' mandate and one of its first deliverables was the development of the *Regional Transportation Plan* (RTP), a 25-year plan that presents the road map for the implementation of the Province's *MoveOntario 2020* vision of 52 new rapid transit projects in the GTHA by 2020.

As the rapid transit projects contemplated in the RTP move closer to implementation, a Benefits Case will be prepared for each project. The Benefits Case will describe a range of feasible options including the business-as-usual scenario for each project, be it different technology, capacity or length of alignment, and demonstrate the benefits and costs associated with each of the options.

The Eglinton Crosstown Rapid Transit (Eglinton) project is one of the rapid transit projects contemplated in *MoveOntario 2020* and in the RTP. The project involves the implementation of a 30 kilometre east-west rapid transit line along Eglinton Avenue from Kennedy subway station in the east to Pearson International Airport in the west and is part of TTC's Transit City Light Rail Plan.

Three different rapid transit options were identified for the corridor and this document presents the comparison of these options against the Base Case (which is defined as "business as usual"). The assessment of the options includes the relative strengths and weaknesses of each option on people, the economy and the environment compared to the cost of implementing the option. The objective of the assessment is to clearly outline the trade-offs among the criteria to enable decision makers to make an informed decision.

Report Structure

This report is structured as follows:

- **Part A - Project Rationale**: This section describes the policy context, the broader regional and project objectives, the characteristics of the corridor and the issues and opportunities to be addressed by the proposed project.

- **Part B – Project Options**: This section describes the options that are evaluated.
- **Part C – Project Assessment:** This section describes the evaluation methodology, the analysis and the summary results.

Project Rationale

Context and Need

The Eglinton-project is one of seven light rail transit (LRT) lines contemplated in the Toronto Transit Commission's (TTC) Transit City Light Rail Plan. The Transit City Light Rail Plan provides a network of rapid transit throughout Toronto as well as connections to neighbouring regions and cities as shown in Figure 1. The City of Toronto endorsed the plan in March of 2007.

FIGURE 1 TRANSIT CITY LIGHT RAIL NETWORK

The Transit City Light Rail Plan and the Eglinton-project support the *Places to Grow Act* which supports higher densification and transit oriented land development; and the *Toronto Official Plan* which outlines the need for serving priority neighbourhoods and to promote reurbanization. It is also part of the Government of Ontario's *MoveOntario 2020* initiative.

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The Eglinton project has been identified by the City and TTC as one of the priority corridors for the initial development of the Transit City network because it is a project that has extensive existing ridership with high potential for further ridership growth; provides an east-west connector; has good inter-regional connections; and has potential for further densification.

The need for an east-west rapid transit connection along Eglinton Avenue is not a new vision. Plans to improve transit in this corridor have been discussed for more than 30 years and the need has only become more pressing as time has passed. In 1993, TTC and Metro Toronto underwent the Environmental Assessment process seeking approval for the Eglinton West Rapid Transit project, a subway or a combination of at-grade/subway, from Eglinton West Station to Martin Grove and from Martin Grove to Pearson International airport. The connection between Martin Grove and Renforth Drive was contemplated to be a rapid bus on dedicated right-of-way. The construction of the project began in 1994, but was subsequently cancelled in 1995 due to lack of funding.

Project Objectives

The Eglinton project supports the following key objectives:

- Offer higher order transit to promote usage of transit and increase transit modal share in the corridor;
- Reduce greenhouse gas emissions by increasing transit modal share;
- Stimulate land development and support intensification and "Urban Growth Centres"; and
- Improve access and connectivity to inter-regional transportation links.

Project Overview

The Eglinton-Crosstown rapid transit line is planned to run from the Kennedy Station in the east, along Eglinton Avenue to an as yet to be determined western terminus at Toronto`s Lester B. Pearson International Airport.

The Eglinton corridor is approximately 30 kilometres in length and is the corridor with the highest volume of existing ridership among the Transit City projects with approximately 32 million riders per year[3]. The transit mode share within the corridor is currently estimated at 29%.

The Eglinton corridor traverses one of the most populous areas of Toronto and includes major employment and population centres, specifically (west to east):

- Pearson International Airport;

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3 *Transit City Light Rail Plan - Evaluation and Comparison of Routes*, Toronto Transit Commission, November 14, 2007

- The southeast edge of the Airport Corporate Centre, west of Highway 427;
- Extensive high-rise residential development between Highway 427 and Kipling Avenue, at Scarlett Road, at Spadina, at Bermondsey Ave., at Victoria Park, and between Birchmount and Kennedy;
- The very large mixed-use cluster of high density development at Yonge, extending east to close to Bayview Avenue;
- Dense "Avenue" type street-front commercial development, with medium density residential neighbourhoods, almost continuously from Keele to Yonge Street;
- Secondary schools at Kipling, Islington, Trethewey, Spadina, Mount Pleasant, Bayview;
- Large office uses and high density residential near the Don Valley Parkway;
- Big box retail and some large corporate headquarters (Celestica) east of Laird Drive;
- The "Golden Mile" retail area between Warden and Victoria Park, including the Eglinton Square shopping centre;
- Extensive employment uses east of Victoria Park, including the Toronto East Detention Centre; and
- Centennial College.

In addition to improving transit service to these centres, the Eglinton project will also enhance important connections to existing and future inter-regional and local transportation choices, including:

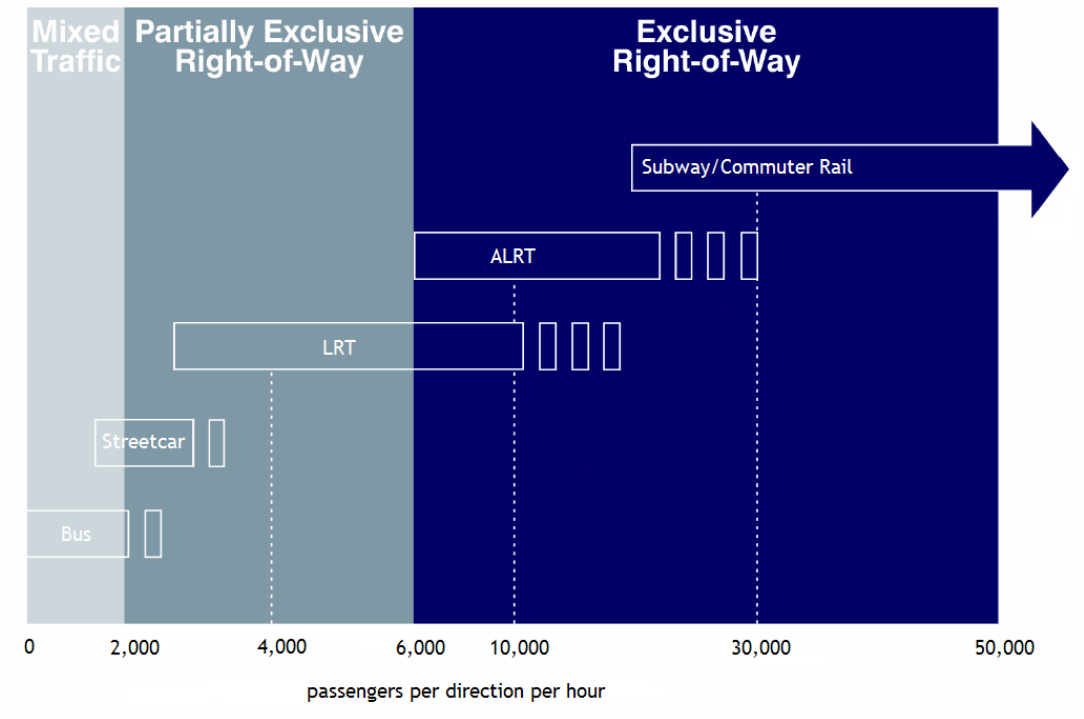
- **Subway** – connections to Eglinton West, Eglinton and Kennedy stations.
- **GO Transit** – connections to the existing Kennedy station on the Stouffville GO line, connections with potential new stations on the Richmond Hill, Barrie and Georgetown GO lines, and potential future GO lines to Bolton and through mid-town Toronto to Havelock and Seaton.
- **Transit City LRT** – future connections to planned Don Mills, Scarborough-Malvern and Jane LRTs.
- **Bus Rapid Transit (BRT)** – possibility to connect with the planned Mississauga Transitway BRT and with regional and local services connecting at and/or near the airport.
- **Inter-regional bus** – connection with regional bus routes servicing Toronto, Peel, and potentially York region.
- **Airport** – direct connection to Pearson International Airport which is planned as the "Western Gateway" and a major centre for different modes of transportation.

The Eglinton project will also connect three priority neighbourhoods – Weston-Mt. Dennis; Flemingdon Park – Victoria Village; and Eglinton East – Kennedy Park.

The Eglinton corridor today is serviced by buses and carries approximately 2,000 passengers in the peak hour and peak direction. Future ridership in the corridor will be affected by the performance and quality of service that is chosen for the Eglinton project and future connections to the overall network. A light rail system envisioned as part of the Transit City Plan is estimated to generate 5,400 passengers per hour per direction in 2031[4] while a faster and fully segregated service in concert with the network of projects and connections contemplated in the Regional Transportation Plan would generate as much as 16,000 passengers per hour per direction based on the assumption that the network is fully built out in 2031[5].

As shown in Figure 2, given this range in ridership demand, LRT and ALRT appear to be the most suitable technologies. Bus Rapid Transit (BRT) system would not have sufficient capacity to meet the anticipated ridership demand and a subway would be underutilized relative to its capacity.

FIGURE 2 TRANSIT TECHNOLOGIES AND CAPACITIES



[4] Estimate by TTC. The RTP model shows 7,600 passengers per hour per direction in 2031.

[5] Based on the RTP model assuming a fully built out network in 2031.

Regardless of technology, sections of the alignment will be tunnelled. The section between Leslie Street and Keele Street is too narrow to support on-street light rail or segregated busways without seriously disrupting the mobility of pedestrians, cyclists, and other vehicles and restrict access to retail outlets. Constraints on the right-of-way prohibit widening due to substantial build-up of businesses, retail and residences along the route. The section from Martin Grove to the airport is also assumed to be tunnelled at this point as the alignment has to navigate through a major interchange of highways. The configuration of this alignment will be confirmed in a separate study. The degree of grade separation in the western and eastern sections depends on the options described in Part B of this report.

The construction of the Eglinton project is expected to start in 2010 and be open for service by 2016.

Part B Options

Project Options

Three options have been identified for the Eglinton project. Each one will be compared to the Base Case. A summary of each of these options is provided below. A more detailed description of each option is provided in the Eglinton-Crosstown Rapid Transit Project Definition Report.[6]

- **Base Case:** Business as usual.
- **Option 1**: **LRT -** an in-street LRT in partially exclusive right-of-way with signal priority in intersections, with a tunnelled central section.
- **Option 2: LRT Plus –** similar to Option 1 but with an extended central tunnel and slightly higher speeds achieved by removing one underground station and three surface stations.
- **Option 3: Fully segregated LRT/ALRT** – a totally segregated transit system. For the purposes of costing, an ALRT system was assumed, but the option is intended to be a representative example of a fully segregated LRT or ALRT system.

For the purpose of the Benefits Case, it is assumed that the western terminus will be the same for all options (except a sensitivity-test option 3b; see below) and be located at Pearson International Airport. The road capacity reductions as a result of the LRT/ALRT project are assumed to the same for all options.

In addition to the fully developed options, two sensitivity analyses Options 3a and 3b were undertaken to optimize Option 3. The main difference of Option 3b is that it terminates at Weston Road/Mt. Dennis, to connect with the Georgetown South Rail corridor, where improved GO rail services and the Airport Rail Link will run. A study is currently underway by TTC in consultation with the Greater Toronto Airports Authority (GTAA) to determine the optimum connection into the airport and the results are expected in 2009.

Base Case

The Base Case is defined as a network consisting of:

- Existing bus network along the Eglinton corridor growing over time to accommodate increased demand;

[6] Metrolinx Benefits Case, Project Definition Report – Eglinton Rapid Transit, October 20, 2008 prepared by Steer Davies Gleave

- Spadina subway extension being in place by 2015; and
- Any improvements to the Scarborough RT project being in place by 2015.

The existing bus service in the corridor includes eight bus routes of which three service the entire length of Eglinton Avenue: #32 from Yonge Subway to Pearson International Airport; #34 Yonge Subway to Markham Road; and a small section of #54 Yonge Subway to Starspray Loop. The combined ridership of these three routes is almost 102,000 riders per day. The capacity at peak hour, peak direction in the corridor is currently approximately 1,800 to 2,000 passengers.

Option 1 – Partially segregated LRT

This option includes an LRT operating within its own reserved lanes along Eglinton Avenue from Kennedy Station westward to Pearson International Airport. The connection to the airport envisioned under this option is consistent with the potential extension contemplated in the Transit City Light Rail Plan. The LRT runs predominantly at-grade (except in the tunnelled sections) with signal priority in intersections.

The route has been divided up in four segments:

- **Eastern Section**: This section runs from Kennedy Station to Leslie Street, a distance of approximately 7 km. The LRT runs on the surface in its own exclusive right-of-way in the median of the road with signal priority at intersections.
- **Middle Section**: From approximately Leslie Street to Keele Street[7], the LRT runs in a 10 km tunnel.
- **Western Section**: In the 8-km section from Keele Street to Martin Grove Road, the roadway again widens and the LRT will run on the surface in its own right-of-way with signal priority at intersections.
- **Airport Section**: Work is currently ongoing to determine the alignment from Martin Grove Road into the airport, a distance of approximately 4-5 km. For the purposes of evaluation, this section is assumed to be tunnelled.

The average speed of the LRT in the at-grade sections is assumed to be 22 kph based on stations located every 500 metres and 35 kph with stations every 900 metres in the tunnel. It is assumed that the local bus service will be discontinued and replaced with the LRT service. Forecast demand at maximum loading point in 2031 is estimated at 7,100 passengers per hour per direction.

[7] The exact locations of the tunnel portals are not yet confirmed.

There are a total of 39 stations proposed for this option of which 14 will be underground. Table 1 lists the stations/stops contemplated in this option. These correspond to the concept reviewed in the public consultation process[8].

TABLE 1 STATION LOCATIONS – OPTION 1

	Station Locations (East to West)	
Eastern Section (in-street)	1. Kennedy Station 2. Lonview Road 3. Birchmount Road 4. Warden Avenue 5. Lebovic Avenue 6. Pharmacy Avenue 7. Victoria Park Avenue	8. Bermondsey Road 9. Swift Drive 10. Wynford Drive 11. Ferrand Drive 12. Don Mills Road 13. Leslie Street
Middle Section (bored tunnel)	14. Brentcliffe Road 15. Bayview Avenue 16. Mount Pleasant Road 17. Yonge Street 18. Avenue Road 19. Chaplin Crescent	20. Bathurst Street 21. Eglinton West-Allen 22. Oakwood Avenue 23. Dufferin Road 24. Caledonia Road 25. Keele Street
Western Section (in-street)	26. Black Creek Drive 27. Weston Road 28. Jane Street 29. Emmett Avenue 30. Scarlett Road 31. Mulham Place 32. Royal York Road	33. Russell Road/ Eden Valley Road Islington Avenue 34. Wincott Drive/Bemersyde Drive 35. Kipling Ave. 36. Widdicombe Hill Blvd/ Lloyd Manor Road 37. Martin Grove Road
Airport Section[9] (cut and cover)	38. Renforth	39. Pearson International Airport

The estimated travel time from end to end is 68 minutes. Despite signal priority in intersections, the travel time will vary dependent on traffic congestion. Table 2 below shows the estimated

8 "*Welcome to Our Open House",* Presentation material prepared by TTC for Open House meetings, July 2008

9 This section is not part of the TTC Open House meetings. A study is underway to determine the alignment, stations and connection to the airport and is expected to be completed in the fall of 2008.

travel times based on assumed average speeds and station spacing. The average speed is based on the assumption that there are no major delays, due to cross-traffic, congestion or accidents.

The operational reliability of the route will vary along its length depending on the level of segregation provided. Where completely segregated, the runtimes will be consistent whereas where the route is at-grade service may be delayed even with significant signal priority. Experience from similar tram/LRT systems shows that this delay is in the order of 10%, which on the proposed route could provide a variation in runtime of about 4 minutes. This potential variability in journey time can result in differential headways which at peak times can increase the dwell times of vehicles at busy stops potentially increasing the travel time further.

TABLE 2 TRAVEL TIMES AND SPEEDS – OPTION 1

	Distance	Average Speed	Station Spacing	Travel Time
Eastern Section	7 km	22 kph	≈500 m	19 min
Middle Section	10 km	32 kph	≈850 m	19 min
Western Section	8 km	22 kph	≈500 m	22 min
Airport Section	5 km	35 kph	≈2,000 m	8 min
TOTAL ROUTE	**30 km**			**1 hour 8 min**

Each LRT vehicle is assumed to carry 130 passengers and each train is assumed to contain 3 vehicles (390 passengers). To achieve the capacity of at least 7,100 passengers per hour per direction[10] the trains have to operate at a headway of approximately 3 minutes.

A total of 168 light rail vehicles, including 25 spares, will be required to provide the required service level and capacity in 2031. Due to the large fleet of vehicles a new, large stand-alone maintenance facility will be required.

The estimated capital costs for this option is $3.9 billion.

Option 2 – LRT Plus

This option is similar to Option 1, but with an extended tunnel in the Middle Section to improve speed, reliability and capacity of the service. The proposed tunnel would be extended by 3 km

[10] This estimate is based on RTP model runs. It assumes a fully built out network. The projected demand in 2031 of 7,100 passengers per direction per hour is based on today's network.

from east of Don Mills to just west of Jane Street and would avoid running at-grade through the busy intersections at Eglinton/Don Mills and Eglinton/Jane. Two underground stations (Oakwood and Chaplin) have also been removed to improve the travel speed.

It would also improve connections for users of two future Transit City lines (Jane LRT and Don Mills LRT) by connecting them directly to the higher speed section of the proposed alignment.

There are 35 stations in total under this option with 13 stations underground and 22 stations at-grade. It is assumed that the stations at the end points of the tunnel (Don Mills and Jane Street) will be at-grade to minimize cost.

TABLE 3 STATION LOCATIONS – OPTION 2

	Station Locations (East to West)	
Eastern Section (in-street)	1. Kennedy Station 2. Lonview Road 3. Birchmount Road 4. Warden Avenue 5. Lebovic Avenue 6. Pharmacy Avenue	7. Victoria Park Avenue 8. Bermondsey Road 9. Swift Drive 10. Wynford Drive 11. Ferrand Drive 12. Don Mills Road
Middle Section (bored tunnel)	13. Brentcliffe Road 14. Bayview Avenue 15. Mount Pleasant Road 16. Yonge Street 17. Avenue Road 18. Bathurst Street	19. Eglinton West-Allen 20. Dufferin Road 21. Caledonia Road 22. Keele Street 23. Weston Road
Western Section (in-street)	24. Jane Street 25. Emmett Avenue 26. Scarlett Road 27. Mulham Place 28. Royal York Road 29. Russell Road/ Eden Valley Road Islington Avenue	30. Wincott Drive/ Bemersyde Drive 31. Kipling Ave. 32. Widdicombe Hill Blvd/ Lloyd Manor Road 33. Martin Grove Road
Airport Section (cut and cover)	34. Renforth	35. Pearson International Airport

With the proposed station configuration, the system will be able to achieve an average speed of 29 kph. This will result in an estimated travel time between the end points of 62 minutes assuming an average dwell time at stations of 20 seconds. Estimated travel times within each segment of the alignment are shown in Table 4 below.

TABLE 4 TRAVEL TIMES AND SPEEDS – OPTION 2

	Distance	Average Speed	Station Spacing	Travel Time
Eastern Section	6 km	22 kph	≈500 m	16 min
Middle Section	13 km	35 kph	≈1000 m	22 min
Western Section	6 km	22 kph	≈600 m	16 min
Airport Section	5 km	35 kph	≈2,000 m	8 min
TOTAL ROUTE	**30 km**			**62 min**

The projected demand in 2031 at the maximum loading point is 7,700 passengers per hour per direction. To service this demand, trains would have to operate at a headway of approximately 2 minutes in the Middle Section where the demand is the heaviest. This capacity is close to the limits of the capabilities for a non-automated light rail technology.

To achieve the different service frequency in the Middle Section, one third of the trains will be short-turned at Don Mills and Jane Street stations. Sidings must be provided at each of the proposed locations by extending the station box to allow the trains to short-turn.

A total of 150 light rail vehicles, including 20 spares, will be required and due to the large fleet of vehicles a new, large stand-alone maintenance facility will be required.

The capital cost for this option is estimated at $4 billion. Even though this option has higher construction costs due to longer tunnelling, the increase in cost is offset by slightly fewer vehicles and fewer underground stations.

As with Option 1, the operational reliability of the route will vary along its length depending on the level of segregation provided. Where completely segregated the runtimes will be consistent whereas where the route is at-grade service may be delayed even with significant signal priority. Experience from similar tram/LRT systems shows that this delay is in the order of 10%, which on the proposed route could provide a variation in runtime of about 4 minutes. This potential variability in journey time can result in differential headways which at peak times can increase the dwell times of vehicles at busy stops potentially increasing the travel time further.

Option 3 – Fully Segregated LRT/ALRT

This option contemplates a fully segregated option capable of an average speed of 35 kph. The demand is forecast to reach 13,700 passengers per hour per direction at the maximum loading point in 2031[11].

To service this level of demand a fully automated system will be required with operating headways slightly over 2 minutes. For the purpose of this assessment, it is assumed that an ALRT system similar to Canada Line in Vancouver is implemented.[12]

The alignment for this option is similar to the one in Option 1:

- **Eastern and Western Sections**: These sections will be fully grade-separated to allow the operation of transit at higher speeds, capacity and reliability. This will be achieved with at-grade or trench sections in areas such as the never-realized Richview Expressway between Keele Street and Martin Grove Road.
- **Middle Section**: A 10-km tunnel similar to the one contemplated in Option 1.
- **Airport Section**: Same as for Options 1 and 2.

There are 26 stations in total located approximately every 850–1,000 metres, similar to the stop spacing on the Bloor-Danforth Line along the Danforth segment and similar to the underground section of Option 1. The stations will be located at major intersections to provide good connectivity to local bus routes and suitable local access to support the corridors vision for Eglinton as described by Toronto's Official Plan. Table 5 lists the proposed 26 station locations.

11 Based on the RTP model and today's network.

12 It is assumed that an automated technology utilised for the Eglinton corridor would be consistent with the technology selected to operate the upgraded Scarborough Rapid Transit (SRT) line. A separate Benefits Case has been prepared for the SRT which examines the technology along with the merits of an extension of the existing SRT line. It is understood that the final decision on technology for SRT may depend on the results of this Eglinton Rapid Transit Benefits Case.

TABLE 5 STATION LOCATIONS – OPTION 3

	Station Locations (East to West)	
Eastern Section (sunken guideway)	1. Kennedy Station 2. Birchmount Road 3. Warden Avenue 4. Victoria Park Avenue	5. Bermondsey Road 6. Wynford Drive 7. Don Mills Road
Middle Section (bored tunnel)	8. Brentcliffe Road 9. Bayview Avenue 10. Mount Pleasant Road 11. Yonge Street 12. Avenue Road	13. Bathurst Street 14. Eglinton West-Allen 15. Dufferin Road 16. Caledonia Road 17. Keele Street
Western Section (sunken guideway)	18. Weston Road 19. Jane Street 20. Scarlett Road 21. Royal York Road	22. Islington Avenue 23. Kipling Ave. 24. Martin Grove Road
Airport Section[13] (cut and cover)	25. Renforth	26. Pearson International Airport

This option will have an average speed of 35 kph resulting in an estimated end-to-end travel time of 51 minutes as shown in Table 6 below. In addition to the faster travel time, it will also be more reliable as the system is fully segregated and does not mix with traffic at intersections.

TABLE 6 TRAVEL TIMES AND SPEEDS – OPTION 3

	Distance	Average Speed	Station Spacing	Travel Time
Eastern Section	7 km	35 kph	≈900 m	12 min
Middle Section	10 km	35 kph	≈1000 m	17 min
Western Section	8 km	35 kph	≈1000 m	14 min
Airport Section	5 km	35 kph	≈2,000 m	8 min
TOTAL ROUTE	**30 km**	**35 kph**		**51 min**

13 This section is not part of the TTC Open House meetings. A study is underway to determine the alignment, stations and connection to the airport and is expected to be completed in the fall of 2008.

The projected peak loading point is at Eglinton Station with the heaviest demand on the Eastern section (connecting to SRT). The service headway will be 2 minutes with 6-car trains (or 1 minute and 25 seconds with 4-car trains) for the Eastern and Middle sections where the demand is heaviest. Each ALRT vehicle[14] is assumed to carry 78 passengers[15]. The service will be short-turned to provide increased service frequency in the busy sections. The projected demand is slightly lower in the Western Section. A service frequency of 3 minutes and 45 seconds with a 6-car train will be sufficient to meet demand.

Under this option, the Eglinton rapid transit is assumed to be integrated with SRT and run in a continuous route to Malvern Town Centre. The SRT has a peak load demand of 10,000 passengers[16] which can be accommodated with the service frequency on Eglinton. A more detailed analysis will be required to develop the optimal operational plan if this option is selected as the preferred option.

A total of 306 MKII type vehicles, including 42 spares, were assumed for the purposes of this assessment as required. Due to the large fleet of vehicles, an additional maintenance facility over and above what is planned for SRT will be required. The capital cost for this option is estimated at $5.4 billion.

Two sensitivity analyses were undertaken to optimize the performance of Option 3. The results are discussed in detail in the Sensitivity Analysis section of this report:

- Option 3a is the same as Option 3 except it assumes a direct connection to the Scarborough Rapid Transit line (SRT) at Kennedy Station. This means that there will be a continuous service for passengers travelling east-west between Scarborough Centre and destinations along Eglinton.
- Option 3b is a truncated version of Option 3a. The line would end at Weston Road where passengers would transfer to local buses for trips further west. This option has eight fewer stations than Option 3 and a 10-kilometer shorter guideway resulting in lower capital costs of $4.0 billion. Service frequency is assumed to be the same, but as it is a shorter route, and operating costs are lower.

14 Based on MKII type vehicles and similar to the vehicles used on SkyTrain in Vancouver

15 Based on the TTC's design guidelines.

16 Based on the TTC's estimates. See Scarborough Rapid Transit Project Definition Report.

Summary of Options

Table 7 provides a summary of the key characteristics of the options.

TABLE 7 SUMMARY OF OPTIONS

	Option 1	Option 2	Option 3 and 3a	Option 3b
Year in Service	2016	2016	2016	2016
Total Capital Costs ($bn)	3.93	3.98	5.40	4.01
2031 Passenger Capacity Per Hour Per Direction	7,100	7,700	13,700	13,700
2021 AM Peak headway (tunnel)	4'00"	3'00"	2'45"	2'45"
2031 AM Peak headway (tunnel)	3'00"	2'00"	1'45"	1'45"
Number of LRT Vehicles	168	150	---	---
Number of ALRT Vehicles	---	---	306	234
Travel Time	68 min	62 min	51 min	36 min

Part C Assessment

Evaluation Framework

The comparative analysis uses a Multiple Account Evaluation (MAE) methodology. The MAE is a framework that provides a systematic identification and analysis of broader implications and criteria of an option. It systematically compares the impacts on costs, users, environment, economy and community and shows the trade-offs among the often conflicting criteria.

The MAE framework includes a number of evaluation accounts that together address the most significant project performance and policy considerations for a specific project. The criteria and the accounts can be tailored for a project. The accounts for this analysis are:

- Transportation User Benefits
- Financial Impacts
- Environmental Impacts
- Economic Impacts
- Socio-Community Impacts

It is important to note that the options defined in this report have only been developed to a level of technical detail sufficient to enable a comparative analysis for the purpose of selecting a preferred option. Project scope, costs and service plans need to be developed in more detail for funding and implementation.

The assessment is done by comparing each option to the Base Case and identifying any incremental costs or benefits that are generated by each option. Hence, the results should not be interpreted as "total" values, but as the incremental impact compared to the Base Case.

Although this Benefits Case strictly compares the costs and benefits of the Eglinton Crosstown project options, it is recognized that the Eglinton project is part of the overall network and any changes implemented in the Eglinton corridor will affect the assessment of other projects and vice versa.

In particular, the assessment of the SRT project is closely linked on the Eglinton Crosstown as the two lines connect at Kennedy Station. On the one hand the Benefits Case for SRT is awaiting the Eglinton analysis before it can be finalized while on the other hand the results for Eglinton are affected by what improvements are assumed for SRT. To resolve this dilemma, it was decided to approach the modelling analysis for Eglinton in two steps:

- Model the improvements contemplated in Eglinton Options 1 through 3 on a base network that includes the upgrades to SRT and the extension to Malvern Town Centre (with either

LRT or ALRT), but without a direct connection between Eglinton and SRT, and conduct the comparative assessment among the options.

- Test the impact on having a direct connection to SRT by modelling Option 3 as a continuous service from Pearson International Airport to Malvern Town Centre.

The analysis is done over a 30-year period (2009-2038). Where possible the impacts are monetized and quantified. In order to compare the options on a "like-to-like" basis and to reflect time value of money the monetized values are discounted to today's value at a real discount rate of 5%. These values, and other input variables used in this analysis are shown in Appendix A.

Transportation User Benefits

This account considers the incremental benefits to the transportation users as a result of the investment in the Eglinton project. The monetized benefits are measured in travel time savings for both transit users and road users; automobile operating cost savings achieved by individuals as their trip times or overall automobile usage declines; and reduction in accidents as a result of declining automobile usage.

In addition to the monetized benefits, there are qualitative user impacts which may include passenger comfort, accessibility and reliability. In most instances they are captured in the ridership and travel time savings, but in some instances they can be isolated and identified separately if significantly different among the options.

All transportation user benefits described below are incremental to the Base Case.

Travel Time Savings

Travel time savings are included for both transit and non-transit users. With the improvement of transit services in the Eglinton corridor, the analysis shows that the investment will generate considerable time savings for existing transit users (those that currently travel on buses), new transit users and auto users.

The value of time is estimated at an average of $13 per hour[17] and is expected to grow, in real terms, by 1.6% per year over the period.

The present value of travel time savings for both transit and auto users over the period 2009-2038 are the largest for Option 3 at $2.4 billion. Option 1 has approximately half of the savings, $1.2 billion and Option 2 is estimated at $1.7 billion.

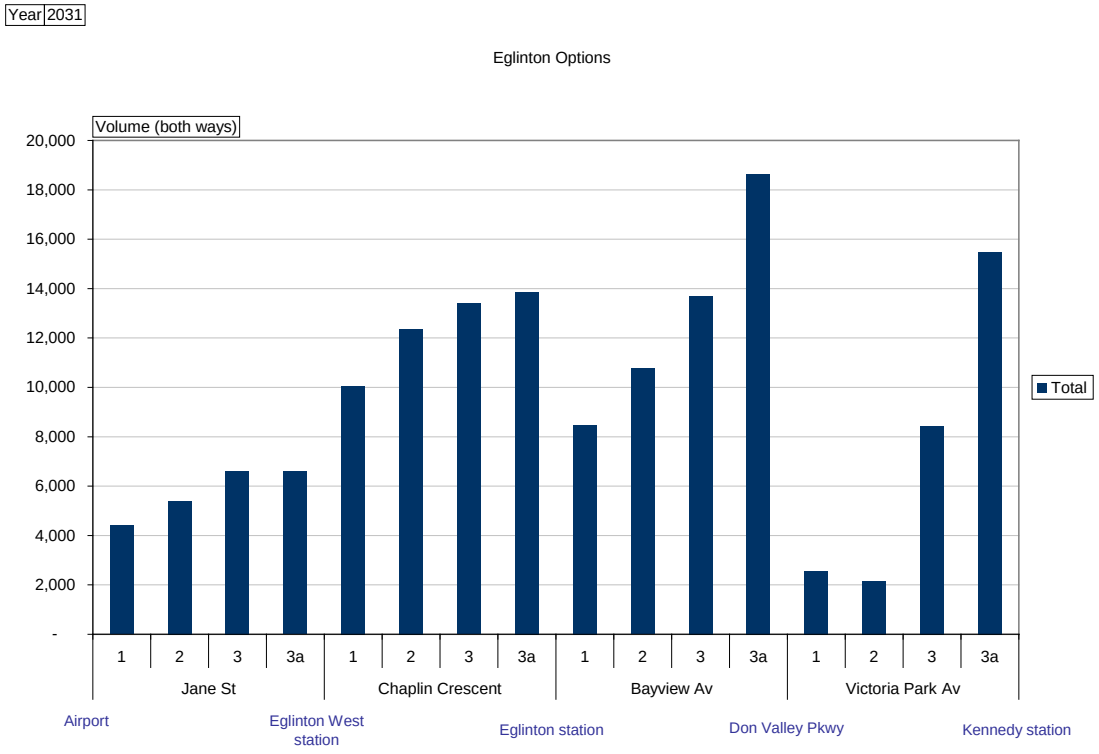
The higher travel time savings for Option 3 is a reflection of the faster travel time and more frequent service provided by a fully grade separated service. The higher travel time savings for Option 2 versus Option 1 is due to the higher speed and reliability in the tunnelled (Middle) section where the heaviest ridership demand is found, together with the increased service frequency.

While the demand profiles are quite different for the different options, as expected the highest demand flows are in the Middle Section. As shown in Figure 3, for the LRT options with at-grade sections (Options 1 and 2) demand is fairly evenly spread along the entire alignment with the maximum loading demand between Eglinton and Eglinton West subway stations.

[17] See Appendix A for details.

In the grade-separated option (Option 3) the demand is the heaviest between Don Valley Parkway and Eglinton West subway station with the maximum loading point just east of Eglinton Station. Ridership demand decreases further west and diminishes quickly west of Keele Street.

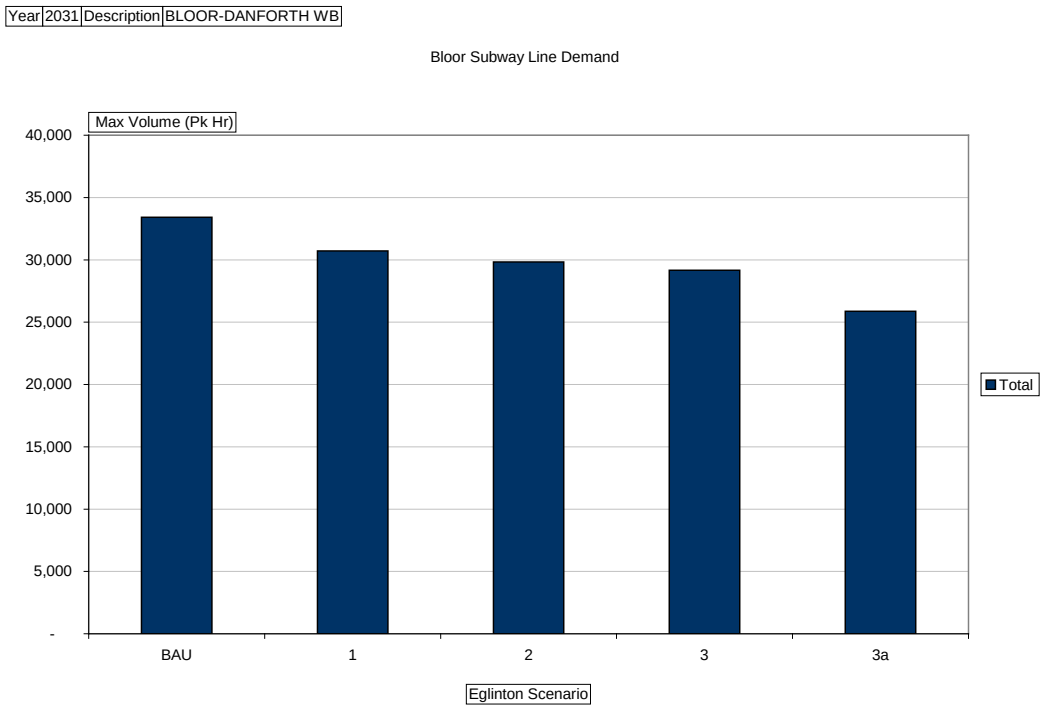
FIGURE 3 PASSENGER VOLUME AM PEAK HOUR 2031



The greater ridership east of Eglinton subway station for Options 3 and 3a, as compared to options 1 and 2, is caused primarily by the decreased travel time and improved frequency in the eastern section which attracts travellers from other east –west corridors (Bloor-Danworth and Sheppard subway corridors). Note that option 3a assumes a seamless connection with Scarborough SRT and is the reason for the highest ridership east of Don Valley Parkway.

Figure 4 shows the effect the Eglinton project has on the maximum load of the Bloor subway line in 2031 (east of Bloor-Yonge station). Option 3a, followed by Option 3, appear to be seen by transit passengers as a good alternative to the Bloor subway for east-west travel due to the higher speed and frequency of the service. The effect of reducing future loads on the Bloor-Danforth Subway has the added benefit of potentially deferring the need for capacity Improvements on the Bloor-Danforth line, a considerable saving based on current plans being undertaken on the Yonge-University-Spadina line at significant expense. Additionally, there is the added benefit of transferring some transfers at the critical Yonge-Bloor Station interchange to a future Yonge-Eglinton interchange.

FIGURE 4 PEAK PASSENGER LOAD ON BLOOR SUBWAY 2031



Automobile Operating Cost Savings

Automobile operating costs savings are derived from a reduction in auto kilometres as a result of the transit investment. The analysis shows that there is a significant reduction in vehicle kilometres - approximately 25 million kilometres for Option 1 to more than 200 million kilometres annually for Option 3.

The present value of the automobile operating cost savings over the period is estimated at $173 million for Option 1; $533 million for Option 2; and $1.35 billion for Option 3.

Safety Benefits

The reduction in accidents follows from the fewer kilometres driven. The average saving of an accident is assumed to be 7 cents per km. The present value of safety benefits over the period is estimated at $17 million for Option 1; $54 million for Option 2; and $136 million for Option 3.

Qualitative Transportation User Benefits

The upgrades and enhancements proposed under each of the options will result in a series of qualitative improvements from a transit user's perspective. All options will provide enhanced comfort as offered by rail and new vehicles and infrastructure with more capacity; and more frequent and reliable service than is currently provided by bus.

Option 3 will provide the most reliable and highest quality service due to the technology being fully segregated. Option 2, due to a longer tunnel, will have more reliable and faster service than Option 1. These considerations are to some extent captured in the ridership and transit travel time savings discussed above.

Summary

Table 8 summarizes the incremental transportation user benefits associated with the Eglinton project.

TABLE 8 INCREMENTAL TRANSPORTATION USER BENEFITS

All Values in NPV $m	Option 1	Option 2	Option 3
Travel Time Savings	1,198	1,675	2,390
Automobile Cost Savings	173	533	1,350
Accident Reductions	17	54	136
Transportation User Benefits	**1,388**	**2,262**	**3,876**

Financial Account

This account includes the assessment of the direct incremental "cash" items, primarily costs and revenues, from the owner's perspective for each option over the assessment period. Costs include incremental capital and operating costs incurred by each option compared to the Base Case. Incremental revenues, such as fare revenues, advertising, and proceeds from disposal of assets are also shown in this account. Any savings resulting from the implementation of the options are also included.

Ridership and Revenues

Annual ridership and fare revenues have been projected using the Greater Golden Horseshoe Travel Forecasting Model[18]. The analysis shows that in 2021 Option 1 would generate an additional $5 million of annual fare revenues; Option 2 would generate $8 million; and Option 3 $12 million. Over the whole period (2009-2038) additional fare revenues would amount to $64 million for Option 1; $94 million for Option 2; and $140 million for Option 3 expressed in net present value terms.

Capital and Operating Costs

The capital costs include all costs associated with the construction and acquisition of the infrastructure, revenue collection, vehicles, and maintenance centre. The estimates also include, design, management & administration, insurance, environmental permitting, property and contingencies. Interest during construction has not been included.[19]

The construction period is assumed to be the same for all three options and for the purposes of this analysis is assumed to start in 2010 and completion by 2015 for opening of service in 2016. Table 9 shows the capital costs, operating costs and bus savings for each option expressed in 2008 dollars.

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[18] This model has been used for the development of the Regional Transportation Plan (RTP) and ensures consistency with that work. The model is strategic in nature and the effect of small projects can be minimal. However the main purpose of the benefits case work is of a comparative nature and we consider the model adequate for this purpose.

[19] It should be noted that the cost estimates in this report have been developed for use in the Benefits Case appraisal and should be considered indicative. The costs will be refined as the project moves through the implementation process.

TABLE 9 CAPITAL AND OPERATING COSTS

All Values in 2008 $m	Option 1	Option 2	Option 3
Capital Costs	3,925	3,975	5,404
Annual Operating Costs (2031)	67	71	92
Annual Bus Savings	(31)	(31)	(24)

The bus savings under Options 1 and 2 assume all bus service along Eglinton will be discontinued. Under Option 3 some bus service must be retained due to the wide spacing of stations and the annual cost of this service is estimated at $7 million.

Summary

Table 10 shows the present value of capital costs, operating costs, bus savings and incremental fare revenues. The net present value cost of Options 1 and 2 is similar - $3.3 billion - while the cost for Option 3 is estimated at $4.8 billion.

The present value of incremental ridership revenues amount to $64 million for Option 1, $94 million for Option 2 and $140 million for Option 3, equivalent to 10%-15% of operating costs.

TABLE 10 INCREMENTAL COSTS AND REVENUES

All Values in NPV $m	Option 1	Option 2	Option 3
Capital Costs	2,981	3,043	4,185
Operating Costs	651	629	834
Bus Savings	(302)	(302)	(234)
Total Incremental Costs	**3,330**	**3,370**	**4,785**
Incremental Fare Revenues	64	94	140

Comparing Benefits and Costs

Comparing the results from the Transportation User Benefits and Financial accounts show that all options have higher costs compared to the benefits they generate. While Option 3 has the highest net benefits of the three options in net present value, it does carry a very high cost, resulting in a negative present value of approximately $900 million and a benefit-cost ratio of 0.81.

Option 2 has the second best net present value of benefits, a negative value of approximately $1.1 billion. While it is a considerable net cost the results show that the improvements in the Middle Section (the extended tunnel) generate benefits that outweigh the costs. This is where the ridership demand is the highest and where speed and reliability can attract substantial ridership.

TABLE 11 COMPARISON BENEFITS AND COSTS

All Values in NPV $m	Option 1	Option 2	Option 3
Transportation User Benefits	1,388	2,262	3,876
Incremental Costs	3,330	3,370	4,785
Net Benefit (Cost)	**(1,942)**	**(1,109)**	**(909)**
Benefit-Cost Ratio[20]	0.42	0. 67	0.81

The results for the sensitivity analyses, which build on the analysis conducted for options 1, 2, and 3, above, are shown below.

The direct connection with SRT, analysed in Option 3a, has a major impact on ridership and there is an increase in travel time savings of 14% or $541 million in net present value terms. The overall net cost is estimated at $368 million in net present value terms and the benefit-cost ratio increases from 0.81 to 0.92.

Option 3b, which includes the combined effect of the direct connection to SRT and the shorter alignment stopping at Weston-Mt. Dennis, further improves the results. The net present value of costs is further reduced by $185 million to $183 million and the benefit-cost ratio increases to 0.95.

[20] The benefit of increased ridership and fare revenues has been captured in travel time savings and is therefore not included in the calculation of the benefit-cost ratio

SENSITIVITY ANALYSIS SUMMARY

All Values in NPV $m	Option 3	Option 3a *SRT Connection*	Diff. (3a-3)	Option 3b *SRT Connection + Weston as western terminus*	Diff. (3b-3)
Transportation User Benefits	3,876	4,417	+14% $541m	3,406	-12% ($470m)
Incremental Costs	(4,785)	(4,785)	---	(3,589)	-25% $1,196m
Net Benefit (Cost)	(909)	(368)	$541m	(183)	$726m
Benefit-Cost Ratio	**0.81**	**0.92**		**0.95**	

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Environmental Impacts

This account examines the environmental impacts of the Eglinton project options. The major environmental impact with respect to urban transit projects is the ability of the project to reduce greenhouse gas emissions from reduced automobile usage.

Greenhouse Gas Emissions

As mentioned in the Transportation User Benefits section, the projected reduction in automobile usage on an annual basis is estimated at 25 million kilometres for Option 1 and more than 200 million km annually for Option 3. As shown in Table 12, this translates into an annual reduction of CO_2 emissions in 2021 of between 5,000 tonnes for Option 1 to 40,000 tonnes for Option 3. The reduction in emissions under Option 3 is very significant and would go along way toward supporting the City of Toronto's goal of reducing greenhouse gas emissions by 6.6 mega tonnes by 2020.

The present value of the reduction in CO_2 emissions over the period 2009-2038, based on an average value of $0.01 per kilometre, is estimated at approximately $3 million for Option 2, $8 million for Option 2 and $20 million for Option 3, which is a relative insignificant dollar value in the overall analysis. It can be argued that the relative low value society currently puts on CO_2 emissions[21] does not fully reflect taking emissions reduction seriously, and hence the net present value should be higher. The analysis is still useful for comparison purposes, however, and it is clear that Option 3 contributes the largest reduction in GHGs.

TABLE 12 REDUCTION IN CO_2 EMISSIONS

	Option 1	Option 2	Option 3
2021 Reduction in CO_2 tonnes	5,200	16,000	40,400
2031 Reduction in CO_2 tonnes	5,300	16,300	41,200
NPV Value ($ m)	$2.5	$7.7	$19.5

[21] There are numerous sources on what the value of CO_2 emissions should be. The values range from $10 to $100 per tonne of CO_2. For the purpose of this analysis a median value of $40 per tonne was used.

Other Environmental Issues

TTC environmental assessment process examined the concept outlined in Option 1. It is assumed that as part of that process any negative environmental impacts will be mitigated and incorporated into any future design of the project.

Option 2, being very similar in its alignment and construction to Option 1 except for an extended tunnel, is assumed to have similar issues as Option 1. The entry and exit points of the tunnel will be different and can potentially have differing environmental impacts. However, it is assumed that those issues will be mitigated as part of any future planning.

Option 3, on the other hand, is more intrusive in that it requires entirely exclusive right-of-way, either through trenching, separate lane, or tunnel. At this time this option is not far enough along in the planning process to determine how and where it will affect properties and green space, and what the cost of mitigation will be.

Economic Development Impacts

This account measures the economic impacts for each scenario relative to the Base Case, including impacts from construction and economic impacts incurred from implementation of project options. These impacts are reported in terms of GDP, the change in jobs and the change in the associated labour income, and are stated in 2008$. The results reflect how the implementation of the Eglinton Project will directly affect households and businesses in the regional economy and total provincial economic impacts in terms of employment, wages and GDP generated by the construction and improvements to the transportation network.

This account also includes an assessment of the incremental impacts the options will have on land values and development in the corridor.

Temporary Economic Impacts During Construction

The implementation of the Eglinton Rapid Transit Project will generate both direct and indirect economic benefits that are temporary in nature and span the period of construction. As shown in Table 13, the project will generate substantial direct employment under all options. Option 1 will generate some 23,000 person-years of employment while Option 3 will generate more than 31,000 person-years. Another 12,000 to 17,000 person-years of employment will be created indirectly as a result of increased economic activity[22] for a total impact of more than 48,000 person-years of employment under Option 3. The substantial impact on employment, wages and GDP is driven by the large capital cost involved in building the project. Option 3, which has the highest capital cost, has also the largest employment and income impacts.

TABLE 13 EMPLOYMENT AND INCOME IMPACTS DURING CONSTRUCTION

	Direct Impacts			Regional (Direct+Indirect) Impacts		
	Employment (person years)	Wages ($m)	GDP ($m)	Employment (person years)	Wages ($m)	GDP ($m)
Option 1	22,700	860	2,200	35,300	1,300	3,400
Option 2	24,100	910	2,300	37,400	1,400	3,600
Option 3	31,300	1,180	3,000	48,600	1,800	4,700

[22] Based on Province of Ontario Multipliers, 2004.

Long-term Economic Impacts

In the long-term there will be ongoing economic benefits as a result of the Eglinton project. These benefits reflect both households' freed up vehicle operating expenditures and transportation cost savings to area businesses. The former effect is simply a redirected consumption demand by households away from purchases of gas, parking, automotive parts and services and into other consumer goods/services.

The latter reflects improved regional competitiveness for metro-area businesses that now have lower costs of doing businesses including access to a larger labour market and encountering less congestion on roadways because people are choosing to use the transit system instead of driving. The impact of the Eglinton project will be different for each business.

Implementation of the Eglinton project will also generate social benefits that can be monetized, including valuing time savings and emission benefits. These have already been captured above under transportation user benefits.

As shown in Table 14, the Eglinton project is expected to have a significant impact on jobs, wages and GDP once it is in operation. The impacts for each option are driven by the travel time provided by each option. As the results show, Option 3 which has the fastest travel time generates the most employment (1,000 jobs annually), income and GDP.

TABLE 14 LONG-TERM EMPLOYMENT AND INCOME IMPACTS

	Direct Annual Impacts in 2031			Direct and Indirect Annual Impacts in 2031		
	Employm. (Jobs)	Wages ($m)	GDP ($m)	Employm. (Jobs)	Wages ($m)	GDP ($m)
Option 1	460	$17	$45	700	$26	$68
Option 2	625	$24	$61	930	$35	$91
Option 3	720	$27	$70	1,065	$40	$104

Land Value Changes

There is evidence from a number of different jurisdictions around the world that investment in rapid transit can have a positive impact on property values in the general area and particularly within close proximity to station areas. The evidence also shows however, that the same investments may have a negative impact on some properties located along the transit right-of-way between the stations.

The area considered to be within a rapid transit stations range of influence varies depending on the type of rapid transit technology. More permanent, rail-based, higher capacity technologies typically capture a larger area of property within their area of influence than lower capacity bus-based transit facilities. As shown in Table 15, the catchment area around at-grade LRT is typically 500 metres. The catchment area around grade-separated LRT and ALRT stations is generally larger and is estimated to be 600 metres.

TABLE 15 TRANSIT INFLUENCE ON PROPERTY VALUES

Technology		Bus	BRT	LRT: at-grade	LRT: grade separated	Subway	GO Rail
Station impact Area (m)		100	400	500	600	800	800
Premium %							
Residential	Low	1%	2%	10%	15%	20%	20%
	High	2%	4%	25%	30%	50%	50%
Office	Low	1%	2%	10%	15%	20%	20%
	High	2%	4%	50%	50%	50%	50%
Retail	Low	1%	1%	10%	10%	7%	7%
	High	2%	2%	50%	50%	15%	15%
Industrial	Low	0	0	1%	1%	5%	5%
	High	1%	2%	2%	2%	5%	5%

Technology		Bus	BRT	LRT: at-grade	LRT: grade separated	Subway	GO Rail
Right of way impact Area (m)		0	0	200	200	0	300
Premium %							
Residential	Low			0	-5		-5
	High			-10	-15		-15
Office	Low			0	0		0
	High			-10	-15		-10
Retail	Low			5	5		0
	High			10	10		-10
Industrial	Low			0	0		0
	High			1	1		0
		(1)	(1)			(2)	(3)

Notes:

(1) no impact for bus right of way impact areas, given that the short distance between bus stops creates situation where station impact areas are almost adjoining each other. Note that BRT could cause negative impact along right of way due to factors including congestion and noise

(2) no impact for underground subway since right of way impact area is underground.

(3) Ref Landis et al (1994) found negative externalities from being too near commuter rail (within 300 m)

Table 16 also shows the range of premium in property values that are associated with various transit technologies[23] and various land uses. The range of premiums for residential property values shows a higher value for ALRT (a premium of 15% to 30%) compared to LRT (10% to 25%). The premium for commercial properties has a wider range - 10% to 50% - but is similar for both technologies.

Land Value Uplift for Option 1

Due to the close spacing of LRT stops in Option 1 (500 m), the corridor will be treated as a single continuous catchment area for the purpose of determining impact on land values. Options 2 and 3 have fewer stations spaced further apart, resulting in some property areas between the stations being located outside the catchment area. Appendix B shows the detailed land use throughout the whole corridor that the following analysis is based upon.

In estimating the land value uplift, the percentages shown in Table 15 were applied to the designated land use (shown in Appendix B) in each of the corridor segments. The estimates of land value uplift are based on average property values by land use type for lands within station impact areas, and on average uplift factors by land use from research of other North American transit projects. Note that the property values are derived from a variety of market data, including assessment values and transaction values, and are subject to market conditions. Property value data has not been independently verified by the consulting team. All uplift values estimates should be treated as indicative cost ranges only.

Table 16 shows the summary results for Option 1. Potential land value uplift is estimated between $1.6 billion and $4.8 billion in today's dollars.

TABLE 16 LAND VALUE UPLIFT OPTION 1

	Area Impacted	Land Uplift in %		Land Uplift in $M	
	(ha)	Low	High	Low	High
Western Section	850	5.4	14.0		
Middle Section	1050	7.5	20.5		
Eastern Section	850	4.3	14.5		

[23] The estimates are based on a 2002 comprehensive review of land value and public transport literature that references approximately 150 studies. The studies show that the premium placed on property values fluctuates widely for different transit projects, in different jurisdictions, with the same technology. The estimates included above represent the mid-range of the premiums found in the reference material.

TOTAL	**2750**	**5.9**	**16.6**	**1,650**	**4,830**

Land Value Uplift for Option 2

In Option 2, four stations have been eliminated and the impact of the removal of those stations is discussed below:

Black Creek – Eliminating this station would result in a maximum walking distance of 650m for residents in developments located at or around Black Creek drive to a station at either Keele St. or Weston Road (1300m apart). Approximately 50 hectares of lands (Keelesdale Park, the Eglinton Flats recreational complex, and industrial lands to the northwest) would no longer be within the station impact area. While redevelopment/intensification opportunities exist on the employment lands, the overall potential is relatively limited and the land value uplift will be somewhat diminished.

Oakwood – Eliminating this station means a maximum walking distance of 600m to either the Eglinton West station or to the station at Dufferin. The Oakwood area is characterized by low and medium density residential with larger commercial buildings at the intersection. The proximity to the Eglinton West station, which would have had considerable impact on properties already, means that the potential at Oakwood is limited and removing this station would have very limited effect on the overall development potential.

Chaplin Crescent – Eliminating this station means a maximum walking distance of 700m to either a station at Bathurst or to a station at Avenue Road. The area around Chaplin Crescent and Eglinton is characterized by high-density residential development to the west of the intersection and along Eglinton, and lower density commercial development to the east and northeast. Development potential is limited in this area as topography and stable residential neighbourhoods will preclude redevelopment in some areas nearby this potential station. Approximately 60 hectares of land will be outside the station impact area due to the distance between Bathurst and Avenue Road. Although the majority of these lands are low-density residential, there is a small potential for some high-density residential and commercial development, which would result in lower land value uplift.

Leslie Station – This station is located between the stations at Brentcliffe Road and at Don Mills Road, a distance of 1800m. A large high-density residential development is proposed at this intersection. To the west of the intersection is Sunnybrook Park, to the south the grounds of the Ontario Science Centre and to the east are employment lands (the former IBM headquarters, now the home of Celestica). By eliminating this station some 67 hectares of land will be outside the station impact area of which a large proportion is parkland, resulting in a moderate reduction in development potential.

Table 17 shows the summary results for Option 2. The land area subject to uplift decreases by about 9% from Option 1 to Option 2, as a result of the four stations that are not constructed. The

potential land uplift is therefore slightly smaller – between $1.5 billion and $4.5 billion - but still very significant.

TABLE 17 LAND VALUE UPLIFT OPTION 2

	Area Impacted	Land Uplift in %		Land Uplift in $M	
	(ha)	Low	High	Low	High
Western Section	799	5.5	14.0		
Middle Section	947	7.4	20.3		
Eastern Section	749	4.7	15.7		
TOTAL	**2494**	**6.0**	**15.3**	**1,500**	**4,460**

Land Value Uplift for Option 3

Option 3 includes an ALRT operating in a fully grade-separated right-of-way. The segregated right-of-way could consist of a combination of trenching, tunnelling and at-grade separation with barrier. The ALRT stations are more substantial in nature than the stops contemplated for the in street- LRT. There are 13 fewer stations than in Option 1, but as a result of the faster speeds and more permanent technology, the station impact area is assumed to be larger, 600m, compared to 500m for Options 1 and 2.

In addition to the four stations listed above in Option 2, the following nine stations would not be constructed:

Widdicombe/Lloyd Manor – This station is located midway between stations at Martin Grove Road and Kipling Ave, a distance of 1000m. The elimination of this station would not vastly affect the land development as all the land fall within a station impact area.

Wincott Drive/Bemersyde Drive - This station is located midway between stations at Islington Ave and Kipling Ave, which are about 1000m apart. Similar to the Widdicombe station there would be minimal impact on development potential since all lands are within a station impact area.

Mulham Place – The station is located midway between Royal York and Scarlett Road, which are about 1250m apart. Eliminating this station would result in a relatively small area of largely low-density residential development not being within a station impact area.

Emmett Avenue – The station is located midway, in the area of Eglinton Flats, between Scarlett Road and Jane Street, which are about 1000m apart. Eliminating this station would result in a

minor loss of potential land value uplift in the area immediately surrounding the station, however, all lands are within the 600m station impact area of the adjacent stations.

Ferrand Drive – This station is located between Don Mills Road and Wynford Drive, which are 1200m apart. There is a small area of low and medium density residential development in the immediate area with industrial and commercial lands further from the proposed station. The elimination of this station will be mitigated by the proximity of Don Mills Station to the west. To the east, the Eglinton/Don Valley Parkway interchange occupies a large land area which does not have any ay uplift potential. The overall reduction on development potential would be minimal.

Swift Drive – This is located between Wynford Drive and Bermondsey Road, which are about 950m apart. The station impact areas from Wynford and Bermondsey will overlap and lost land value uplift will be minimal.

Pharmacy Avenue and Lebovic Avenue – Pharmacy station is located at the major intersection of Pharmacy and Eglinton, some 400m east of the proposed Victoria Park station. Together with the elimination of the Lebovic Avenue station there would be a distance of about 1250m between the Victoria Park and Warden stations. The lands outside the station impact area are industrial and commercial with an area of parkland. About 12 hectares of land will not be within a station impact area.

Lonview Road – This station is located mid-block between Kennedy and Birchmount Road Stations, which are about 1100m apart. All lands between the stations would be included in the station impact area.

Table 18 shows the summary of the potential land value uplift for Option 3. As shown, the area affected in Option 3 is approximately equal to the area in Option 1 with only minor reductions. The loss of area due to fewer stations is offset by the larger station impact area. Most of the stations that were removed are mid-block areas locations with relatively short walking distances between the remaining stations. The potential land uplift is between $2.3 billion and $5.4 billion - higher than Option 1 as a result of both the larger impact areas and the increased convenience of the service with the grade-separated transit service.

TABLE 18 LAND VALUE UPLIFT OPTION 3

	Area Impacted	Land Uplift in %		Land Uplift in $M	
	(ha)	Low	High	Low	High
Western Section	795	5.3	13.4		
Middle Section	1157	7.2	19.4		
Eastern Section	783	4.5	14.3		

TOTAL	**2735**	**5.8**	**16.2**	**2,290**	**5,360**

Summary

The Eglinton project is expected to have a substantial effect on employment and the wider economy, both during construction and for the long-term. Option 3 has the highest impacts due to the higher capital cost and faster and more reliable service.

The potential land value uplift in the corridor as a result of the implementation of the Eglinton project is substantial. The premium that can be expected in the corridor ranges between a low of 6% and a high of 16% and is almost identical among the options, but as each option has a different number of stations the station impact area varies among them, which results in Option 3 having the largest land value uplift potential ranging between $2.3 billion to $5.4 billion.

TABLE 19 ECONOMIC DEVELOPMENT IMPACTS

	Option 1	Option 2	Option 3
Total Impacts During Construction Period:			
Employment (Person-years)	35,300	37,400	48,600
GDP ($m)	3,400	3,600	4,700
Income ($m)	1,300	1,400	1,800
Long-term Impacts in 2031:			
Employment (jobs)	700	930	1,065
GDP ($m)	68	91	104
Income ($m)	26	35	40
Land value increase $bn	$1.6 - $4.9	$1.5 - $4.4	$2.3 - $5.4

Social Community Impacts

This account examines each option from the community perspective with specific consideration given to the ability of each option to enhance the quality of life within a local community. This may result from land use changes or developments that can occur in response to the introduction of a new rapid transit line, as well as the improvements brought about by the enhanced accessibility, both locally and regionally, offered by the new transit alternative. This account also considers the ability of each option to positively affect the overall health of the local community and its residents through reduced auto congestion on local streets as well as the ability of transit to support a more balanced lifestyle for local residents and enhance personal safety. Visual impacts and noise are also assessed as part of this account.

Land Use Changes

Experience in other jurisdictions demonstrates that when combined with complementary local planning initiatives both at-grade and grade-separated LRT and/or ALRT can influence development, particularly around stations, and promote more compact, mixed use communities. The type and magnitude of the development is dependent upon a number of factors including the general nature of the transit corridor and the surrounding neighbourhoods.

As shown in the land value uplift section above, the Eglinton corridor is already well developed and consists of a mix of land uses – a mix of low and high density residential development, retail, commercial and industrial land uses. However, there is considerable potential for increased intensification at a number of locations along the corridor, particularly in the Middle and Eastern segments. Eglinton near the intersection with Yonge is a Provincially-designated Urban Growth Centre and can continue, with greater transit service, to expand its role as a high-density Mobility Hub.

Residential development under Options 1 and 2 will have the propensity to spread along the entire alignment as these options provide for an at-grade LRT with easy access. Under Option 3, residential development is more likely to consist of "clusters" of high-density projects around and close to stations as it is generally undesirable to live close to a trenched rail line. However, it is worthwhile noting examples in Toronto where it has been possible to have desirable real estate adjacent to a trenched metro system e.g. in the vicinity of Rosedale and Summerhill stations on the Yonge Subway line.

All options are capable of promoting the appropriate land use changes provided that the local planning and resultant zoning is consistent with the desired outcome from the community perspective.

Health

The extent to which a rapid transit line can influence and encourage mixed use densities, the greater the potential to reduce auto dependency and promote more liveable communities. As indicated above, both at-grade and grade-separated LRT and/or ALRT have been proven to support mixed use communities. In addition, the extent to which the rapid transit line can address traffic congestion within a community, the greater the health benefit to that community.

The close proximity of station stops of Option 1 may encourage more pedestrian activity compared to Option 3, for example, however, the area that is most populated and have the highest density of residential and retail, is the Middle Section – and this section is the same for all options.

The ALRT option (Option 3) attracts more people out of their cars than Options 1 and 2 and would have a more positive effect on reducing congestion and improving air quality.

From a health perspective, Option 3 may be slightly preferred, but all options have the potential to promote more pedestrian activity and reduce congestion.

Accessibility

Since all options are essentially the same through the central section, there are no accessibility differences there. However in the eastern and western section options 1 and 2 will improve accessibility to transit due to closer spaced at-grade stops. Option 3 will provide faster service, but will require a longer walk or transfer from bus in these sections, while the at-grade LRT will provide a more direct service with frequent stops.

Summary

Table 20 summarizes the key social community impacts associated with the Eglinton project.

TABLE 20 SOCIAL COMMUNITY IMPACTS

	Option 1	Option 2	Option 3
Land Use Impacts	Promotes densification along entire alignment	Promotes densification along entire alignment	Promotes densification and clustering around stations
Health	Positive impact on health	Positive impact on health	The most positive impact on health
Accessibility	Better access	Moderate access	Moderate access

Sensitivity Analysis

As mentioned earlier in the report, two sensitivity analyses were undertaken to explore how the performance of Option 3, the completely grade-separated option, could be improved – providing a direct link to SRT and shorten the line with a western terminus at Weston rather than the airport. In addition, a sensitivity analysis on the effect of various discount rates was also undertaken.

Direct Line to Malvern Town Centre

As mentioned earlier in this report, ridership demand for the comparison of options was modelled based on a transfer between the Eglinton Crosstown line and Scarborough Rapid Transit. A sensitivity analysis was done to test the effect of a direct connection to SRT resulting in a continuous line from Pearson International Airport to Malvern Town Centre. The model test was done using Option 3, but a direct connection is also possible with the LRT technology contemplated in Options 1 and 2. However, it is anticipated that the incremental benefits would be lower than for Option 3.

The results from the test model run are shown in Table 21 and indicate that a direct connection to SRT would significantly improve the performance of the Eglinton line. Total transportation user benefits increased by 14%, or $541 million. This would result in a benefit-cost ratio of 0.9 for Option 3, but there may be additional costs to reconfigure the Kennedy Station[24] to allow the direct connection and these have not been included.

TABLE 21 EFFECTS OF DIRECT CONNECTION TO SRT

All Values PV $m	Option 3	Option 3a	Difference
Travel Time Savings	2,390	2,671	+12%
Automobile Operating Cost Savings	1,350	1,586	+17%
Safety Benefits	136	160	+17%
Total Transportation User Benefits	**3,876**	**4,417**	**+14% $541 million**

[24] The Kennedy Station is contemplated to be rebuilt as part of the upgrade to SRT and any necessary reconfiguration may be done simultaneously for a marginal cost.

Shortened Line with Western Terminus at Weston Road

The forecast demand shows that the majority of ridership for the completely grade-separated option is on the Middle and Eastern sections. In order to test the effect on ridership and costs if the section west of Weston Road was deferred or eliminated, a sensitivity analysis was undertaken whereby the alignment and the direct connection to SRT as contemplated in Option 3a was adjusted to end at Weston Road and the Georgetown rail corridor (Option 3b). Passengers travelling further west would transfer to local buses at an interchange at Weston and Eglinton.

As shown in Table 22, the combined effect of Options 3a and 3b is that user benefits are lower by 12% as a result of the shorter line, but the cost savings are substantially more than the loss in ridership. Overall costs are reduced by 25% with the majority of the cost savings derived from lower capital costs. Since local bus service has to be retained west of Weston Road, the bus savings are less under Option 3b. The benefit-cost ratio increases to 0.95 and the overall net cost is reduced to $183 million for Option 3b.

TABLE 22 EFFECTS OF ROUTE ENDING AT WESTON

All Values PV $m	Option 3	Option 3b	Difference
Travel Time Savings	2,390	2,136	- 11%
Automobile Operating Cost Savings	1,350	1,154	- 15%
Safety Benefits	136	117	- 15%
NPV Transportation User Benefits	**3,876**	**3,406**	**-12% ($470 million)**
Capital Costs	(4,185)	(3,104)	
Operating Costs	(834)	(674)	
Bus Savings	234	188	
NPV Costs	**(4,785)**	**(3,589)**	**-25% $1,196 million**
Net Benefits (Cost)	**(909)**	**(183)**	**$726**
Benefit-Cost Ratio	**0.81**	**0.95**	

The results from the two sensitivity analyses show that there are considerable benefits in providing a direct link to SRT and shortening the line and make Weston Road the western terminus.

Discount Rate

Since the analysis is based on discounted cash flow and subject to changes as the discount rate changes, the robustness of the ranking of the options with respect to the benefit-cost ratio was tested under two alternative discount rates – 3% and 7%. As shown in Table 23, the relative ranking among the options does not change when the discount rate changes and with a 3% discount rate Option 3 breaks even.

TABLE 23 DISCOUNT RATE SENSITIVITY ANALYSIS

Discount Rate	3%		5%		7%	
	NPV ($m)	BCR	NPV ($m)	BCR	NPV ($m)	BCR
Option 1	(1,790)	0.5	(1,941)	0.4	(1,968)	0.3
Option 2	(584)	0.9	(1,109)	0.7	(1,385)	0.5
Option 3	87	1.0	(909)	0.8	(1,474)	0.6

Summary Results

The results of the evaluation are summarized in Table 24 below.

TABLE 24 MAE SUMMARY

	Option 1	Option 2	Option 3
Transportation User Account			
Transportation User Benefits (PV $m)	1,388	2,262	3,876
Qualitative User Benefits	✓✓	✓✓	✓✓✓
Financial Account			
Costs (PV $m)	(3,330)	(3,370)	(4,785)
Benefits Less Costs (PV $m)	(1,942)	(1,109)	(909)
Benefit-Cost Ratio	0.42	0.67	0.81
Environmental Account			
GHG Emissions (PV $m)	2.5	7.7	19.5
Qualitative Environmental Impacts	✓✓✓	✓✓✓	✓
Economic Development Account			
Economic Impacts During Construction	✓✓	✓✓	✓✓✓
Long-term Economic Impacts	✓	✓✓	✓✓✓
Land value increase ($bn)	$1.6 - $4.9	$1.5 - $4.4	$2.3 - $5.4
Social Community Account			
Land Use Shaping	✓✓✓	✓✓✓	✓✓✓
Health	✓✓	✓✓	✓✓✓
Accessibility	✓✓	✓	✓

The analysis shows that all of the Eglinton-Crosstown project options, in their current design, have costs that outweigh the benefits generated by the project. Option 3 (the completely grade-separated option) has the highest benefit-cost ratio of 0.81, Option 2 has a slightly lower benefit-cost ratio of 0.67 while Option 1 has the lowest benefit-cost ratio of 0.42.

As shown in Table 25, the direct connection with SRT will have a major impact on ridership and increase travel time savings by 14% at a value of $541 million in met present value terms. The overall net cost is estimated at $368 million in net present value terms and the benefit-cost ratio increases from 0.81 to 0.92.

Option 3b, which includes the combined effect of the direct connection to SRT and the shorter alignment, further improves the results. The net present value of costs is further reduced by $185 million to $183 million and the benefit-cost ratio increases to 0.95.

TABLE 25 SENSITIVITY ANALYSIS SUMMARY

All Values in NPV $m	Option 3	Option 3a *SRT Connection*	Diff. (3a-3)	Option 3b *SRT Connection + Weston as western terminus*	Diff. (3b-3)
Transportation User Benefits	3,876	4,417	+14% $541m	3,406	-12% ($470m)
Incremental Costs	(4,785)	(4,785)	---	(3,589)	-25% $1,196m
Net Benefit (Cost)	(909)	(368)	$541m	(183)	$726m
Benefit-Cost Ratio	**0.81**	**0.92**		**0.95**	

Due to its faster travel time and higher service frequency, the completely grade-separated option (Option 3) attracts the highest ridership and generates the most transportation user benefits among the three options. The value of the transportation benefits is estimated at $3.9 billion in present value terms for Option 3; $4.4 billion for Option 3a; $3.4 billion for the lower-cost Option 3b; $2.3 billion for Option 2; and $1.4 billion for Option 1. The ridership demand in Options 3, 3a, and 3b is heaviest between Kennedy Station and Eglinton West Station, while for Options 1 and 2 the ridership demand is more evenly spread along the whole corridor with higher demand, relative to options 1 and 2, between the Eglinton Station and Eglinton West Station.

While the demand profiles are quite different for options 3, 3a, and 3b compared to Options 1 and 2, as expected, the highest demand flows for all are in the Middle Section. The demand for Options 1 and 2 is fairly evenly spread along the entire alignment with the maximum loading demand between Eglinton and Eglinton West subway stations while Option 3, 3a, and 3b's demand is the heaviest between Don Valley Parkway and Eglinton West subway station with the maximum loading point just east of Eglinton Station. Ridership demand decreases further west

and diminishes quickly west of Keele Street. The rapidly declining ridership demand on the Western Section in the reason Option 3b was created as an additional sensitivity analysis.

Options 3 and 3a have the highest cost as both options require a segregated right-of-way along the whole corridor. The higher service frequency to meet ridership demand vis a vis Options 1 and 2 also results in higher annual operating expenses. Total capital and operating costs, in net present value terms, are estimated at $4.8 billion for Options 3 and 3a, $3.4 billion for Option 3b and $3.3 billion for Options 1 and 2.

In terms of environmental impact, the completely grade-separated options attract more people out of their cars and reduce automobile usage more than the LRT technology, which results in a reduction of greenhouse gas emissions by more than 41,000 tonnes annually by 2031 for Option 3 compared to 16,300 tonnes annually for Option 2 and 5,300 tonnes for Option 1. The completely grade-separated infrastructure, compared to at-grade infrastructure technology, may have a more intrusive environmental impact on some areas of the alignment as trenching or other form of grade separation will be required.

All options will have a significant economic development effect as a result of the large investment. Option 3 (and Option 3a) which has the highest capital cost will have, not surprisingly, the largest impact on employment, income and GDP during construction. It is estimated that Option 3 will generate a total of approximately 48,000 years of employment, some $4.7 billion in GDP and $1.8 billion in wages[25]. Option 3 will also have the largest impact during operations as a result of the faster and more frequent service and is estimated to create more than 1,000 additional jobs by 2031. Option 2 is estimated to generate approximately 90% and Option 1 approximately 70% of Option 3's impacts.

The potential land value uplift in the corridor as a result of building the Eglinton project is expected to be significant. The completely grade-separated Options 3, 3a and 3b demonstrate the highest potential land value uplift due to larger station impact areas and more convenient and frequent service. The value ranges from $2.3 billion to $5.4 billion for Option 3 and 3a. Option 3b is expected to have a somewhat lower value compared to Options 3 and 3a due to eight fewer stations west of Weston Road, but still be higher than Options 1 and 2. The land uplift for Option 1 ranges from $1.6 billion to $4.9 billion, while Option 2 has a lower uplift ($1.5 billion to $4.5 billion) due to fewer stations. All numbers are expressed in today's dollars.

All the options will have the potential to positively influence the creation of more compact and dense communities along the Eglinton corridor, but the completely grade-separated options may promote more "clustering" around the stations while the LRT options with both at-grade and grade-separated service will promote more even development along the entire alignment. The

[25] Includes direct and indirect impacts.

nature of the development would depend on local land use plans and zoning as well as how the grade-separated infrastructure is built (trenched or underground).

APPENDIX

A

INPUT VARIABLES AND ASSUMPTIONS

Factor	Value	Source
Discount Rate Sensitivity Analysis	5% (real terms) 3% and 7%	Province of Ontario
Value of Time Business Other Weighted Average	 $35.16 (2008$) $10.82 $13.02	Transport Canada, Greater Golden Horseshoe Model
Value of Time Growth	1.64% per annum	Based on GDP per capita increases, GDP/ Population estimates from www.greatertoronto.org
Average Accident Cost	$0.07 per km	Collision Statistics: 2004 Canadian Motor Vehicle Traffic Collision Statistics, TP3322. Vehicle Kilometres: Statistics Canada, Catalogue No. 53-223-XIE, "Canadian Vehicle Survey"
Greenhouse Gas Emissions 2006 2021 2031	 2.39 kg /l or 0.23 kg per km 2.35 kg /l or 0.21 kg per km 2.35 kg /l or 0.20 kg per km	Urban Transportation Emissions Calculator, Transport Canada, Greater Golden Horseshoe Model
Average Cost of CO_2	$0.01 per km $40/tonne (median cost)	Several literature sources, Transport and Environment Canada, Greater Golden Horseshoe Model and http://envirovaluation.org/index.php/2007/09/06/university_of_hamburg_forschungsstelle_n_1
Auto Operating Costs 2006 2021 2031	In 2008$ $0.60/km $0.78/km $0.95/km	Greater Golden Horseshoe Model
Annualisation Factors: Metro / LRT Road	Peak-daily/Daily-Annual 3 / 300 10 / 300	Greater Golden Horseshoe Model

APPENDIX

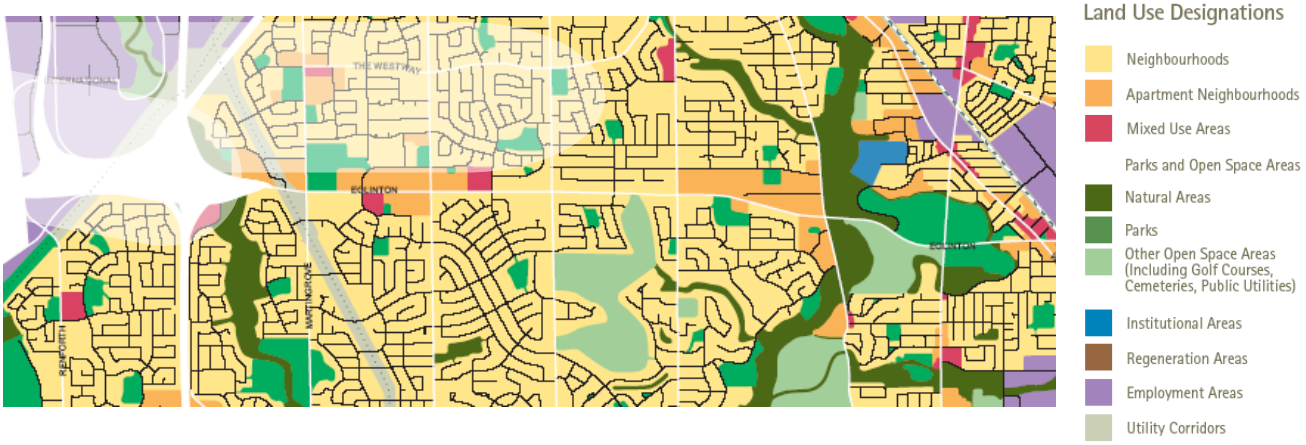
B

LAND USE

West Section and Airport Section

For the purpose of land value estimation, the Toronto Official Plan provides a useful breakdown of land use by high-level type. The maps below and on the following pages are drawn from the Toronto OP schedules (Map 13-23), showing land use by type within the study area. The table below the map indicates the approximate percentage of the land area within the corridor in each land use category. Roads and public right-of-ways have been factored into the percentages and adjusted according to land use conditions in the area.

The western section of the corridor includes several large **Parks/Natural Areas/Open Spaces** at Martin Grove Road, from Scarlett to Jane (Eglinton Flats/Scarlett Woods Golf Course), and smaller municipal parks in certain residential neighbourhoods. There are **residential high-rise** nodes at Martin Grove Road, along Eglinton Avenue to Kipling, and between Royal York and Scarlett Crescent. There are relatively few commercial areas in the impact area, except for three small shopping areas (one east of Martin Grove, one east of Kipling, one at Weston/Eglinton). There is also little to no industrial land in the impact area, except at Renforth to the west, which is within the Airport Corporate Centre. The remainder of the impact area consists of residential neighbourhoods, generally low-density in character. It should be noted that there is a wide belt of vacant lands immediately to the north of Eglinton Avenue (the Richview Expressway lands) providing ideal opportunities for transit-oriented development along nearly the entire western section of the corridor.



Roads	Parks/Open Space	Residential High Density	Residential	Commercial/ Mixed Use Area	Industrial	Institutional
25%	15%	9%	43%	2%	6%	1%

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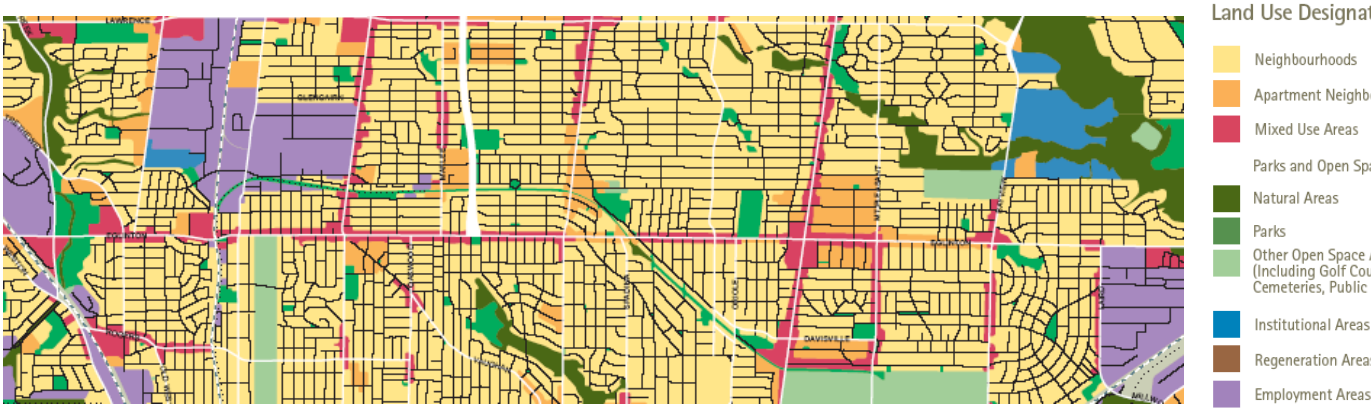
Middle Section

Eglinton Avenue through central Toronto is a classic "avenue", with several high density areas near major intersections, commercial uses fronting the street, and residential uses of varying densities (generally low) beginning one block north or south of the roadway. In this section of the corridor, from approximately Leslie Street to Keele Street, the proposed LRT will go into a tunnel, and stations will be underground with surface access at various points.

Parks/Natural Areas/Open Spaces in this area are generally municipal parks, located throughout the residential areas near the corridor. **High Density Residential** nodes exist at Dufferin, between Bathurst and Spadina, and the large area of apartments/condos at Yonge, extending to Bayview. **Commercial** uses front Eglinton along virtually the full length of the corridor, as well as certain cross streets such as Mt. Pleasant and Dufferin. There are larger commercial areas at Trethewey and Weston Road. Two **Industrial** areas are within the impact area, the Junction in old Weston and the industrial area to the east of Laird Drive. The balance of the corridor consists of broadly varied **residential** neighbourhoods, ranging from modest wartime housing, to heritage neighbourhoods, to neighbourhoods characterized by medium-density uses such as brownstones and walk-ups. There are few large institutional uses in the impact area.



Roads	Parks/Open Space	Residential - High Density	Residential	Commercial/Mixed Use Area	Industrial	Institutional
15%	6%	6%	60%	7%	5%	1%

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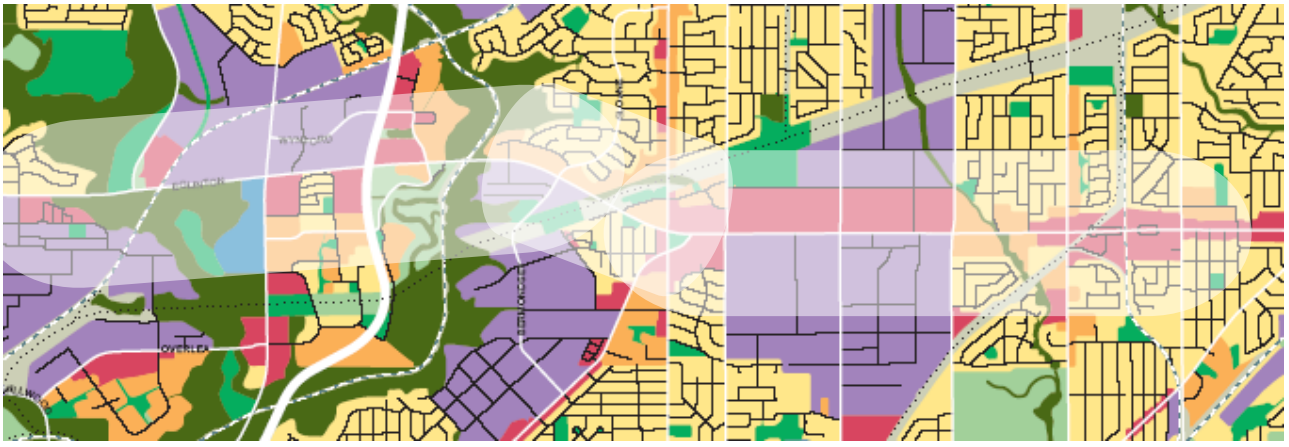
East Section

Eglinton Avenue in the eastern part of the corridor travels through a diverse series of districts. The LRT runs on the surface from Leslie Street to Kennedy Station, in an exclusive right-of-way in the median of the road, with signal priority at intersections.

Parks/Natural Areas/Open Spaces include Sunnybrook Park and the Ontario Science Centre, and the Don Valley. **High Density Residential** uses predominate from the Don Valley to Victoria Park on the north side of Eglinton, as well as to the east of Birchmount. There is a large **Commercial** area from Pharmacy to Birchmount on the north side, as well as at Kennedy. Significant **Industrial** areas are within the impact area, on the north side of Eglinton at Don Mills (including the Celestica campus), near Bermondsey, and a large area from Pharmacy to Birchmount, south of Eglinton. There are few large **institutional** uses in the impact area, with the exception of the Metro East Detention Centre (not shown on map) and the Ontario Science Centre. There are relatively few **low-density residential** areas in this portion of the corridor.



Roads	Parks/Open Space	Residential - High Density	Residential	Commercial/ Mixed Use Area	Industrial	Institutional
19%	17%	10%	15%	16%	23%	<1%