UTTRI

Research Report

SMARTTRACK RIDERSHIP ANALYSIS

Project Final Report

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June 2016

SMARTTRACK RIDERSHIP ANALYSIS

PROJECT FINAL REPORT

Prepared for the City Manager, City of Toronto

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UTTRI

Executive Summary

Project Objectives

On December 11, 2014, City Council directed the City Manager in consultation with the Province/Metrolinx to develop a work plan to undertake an accelerated review of the SmartTrack and RER plans. Council also directed the City Manager to retain the specialized services of the University of Toronto Transportation Research Institute (UTTRI) to support the planning analysis and required transit ridership modelling as a component of the overall review.[1] On February 10, 2015, City Council considered the report *EX2.2 SmartTrack Work Plan (2015-2016)*, and approved the accelerated work plan for the review of SmartTrack.[2]

The UTTRI component of this work was to provide transit ridership estimates and other key network performance measures using the City's new Regional Travel Demand Model (GTAModel Version 4.0) developed at the University of Toronto by UTTRI. As detailed in the final Terms of Reference for the UTTRI work, this work included:

- Confirming the integrated RER and SmartTrack Service Concept to be modelled.
- Completion and validation of a new travel demand model system to be used by the City of Toronto in this and similar studies of transit ridership and travel demand.
- Development and review of forecasting assumptions that provide key inputs into the transit ridership forecasts.
- Generating transit ridership forecasts for the identified range of future year networks and input scenarios.
- Analysis and comparison of ridership forecast results.
- Documentation and reporting of all work and results.

This study did not deal with:

- Detailed engineering design considerations of route alignments and stations.
- Capital and operating costs of alternative network designs.
- Financing mechanisms to pay for the construction and operation of network additions.

Thus, this study focuses solely on the transit ridership levels and other system performance measures that are likely to occur if various transit network improvements are made. While the primary focus of this analysis is on options for the proposed SmartTrack line, this line cannot be considered in isolation of the overall Greater Toronto-Hamilton Area (GTHA) transit network and, in particular, other major transit infrastructure proposed investments, notably GO RER plans, Scarborough Subway Extension (SSE) options, and Relief Line (RL) options (formerly often referred to as the Downtown Relief Line). Similarly, the future is a very uncertain place, and so ranges of estimated ridership need to be generated across a variety of possible future year growth scenarios and other assumptions. Given this, a wide range of combinations of network investment and growth scenarios are generated in this study and results are compared in detail.

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[1] http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.EX1.12.
[2] http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.EX2.2.

Ridership Forecasting Approach

The transit ridership forecasts are generated using a large computer simulation model system called GTAModel V4.0. This model system simulates all trips made by all persons in the GTHA by all modes for all trip purposes over the course of a "typical" 24-hour weekday. Travel demand forecasting model systems are routinely used by urban regions around the world to systematically estimate future transportation system usage under a variety of policy and investment scenarios. Such a detailed, comprehensive modelling approach is essential for adequately assessing the impacts of any major transportation investment such as SmartTrack for many reasons:

- The entire transit network is modelled, not individual lines in isolation. Synergistic network effects are thereby captured that cannot be accounted for in analysis of a single line.
- The actual spatial origin-destination pattern of trip-making is explicitly accounted for. In other words, the entire travel market is modelled and the role which a given line plays in serving this overall market can be explicitly examined.
- Sensitivities to transit service frequencies, fares, travel times, stop locations and spacing, etc. can be simultaneously and consistently examined.
- The model is sensitive to assumptions concerning future year population and employment distributions.
- Competition from the road network (as well as walk/bike modes) is directly modelled. Transit investment impacts on roadway usage/congestion is directly modelled, as is the impact of auto service levels on transit ridership.

Two forecast years are examined for all options:

- 2031: This is the standard GTHA forecast year. The bulk of the analysis focusses on this benchmark year. Most experience exists with generating population and employment forecasts for this year.
- 2041: This represents a longer-term "mature" system analysis end date. Population and employment forecasts are more speculative given the more distant date.

The analysis strategy involves developing for each forecast year a "base" network which consists only of existing and committed (funded) projects and which excludes SmartTrack and the other lines of interest. The various new network options are then incrementally added to the base network so that the changes in system performance due to these network additions can be assessed across a variety of ridership and other performance measures,

Ridership forecasts have been generated for a wide combination of SmartTrack scenarios concerning fares, frequencies, including:

- Alternative SmartTrack service headways (15, 10 and 5 minutes).
- Alternative SmartTrack fares (TTC; GO).
- Alternative "western alignments" of SmartTrack beyond Mount Dennis.
- Alternative population and employment scenarios.

Key Findings

(a) SmartTrack

Key findings of this study with respect to SmartTrack include the following:[3]

- The ridership analysis clearly demonstrates a very significant market potential for SmartTrack, with potentially in the order of 300,000 riders per day with a 5-minute service headway. This far exceeds any other rail project under current consideration by the City of Toronto (including the under-construction Eglinton Crosstown LRT and the proposed GO RER system) and is only exceeded by the Yonge-University-Spadina and Bloor-Danforth subway lines within the existing TTC network.
- Ridership is very sensitive to both fares and service headway (frequency). Maximization of ridership requires high frequency service and is significantly enhanced if TTC rather than GO fares are applied to the system. Considerable latent demand for transit appears to exist within the system that can be realized if attractive transit services are provided that tap into the natural spatial pattern of this demand. SmartTrack clearly does this when operated at higher frequency levels.
- The attractiveness of through-service between the Stouffville and Kitchener lines at Union Station is validated, with significant through movements occurring in both directions at Union Station, especially at higher service frequencies.
- Further, emerging/planned nodes at both Liberty Village to the west of the downtown core and the Unilever site to the east represent important new transit and development nodes that are very well served by SmartTrack. SmartTrack provides the ability to "seamlessly" extend the traditional downtown into attractive new development areas.
- SmartTrack clearly outperforms the Base RER Service Concept from a ridership perspective, even at higher headways, regardless of design scenario considered. The SmartTrack concept is one of an "urban metro" (subway) in which a greater number of stops, significantly higher frequency, and all-day, two-way service much better meets the needs of not just commuters (short- as well as long-distance) but a much wider range of trip-makers in general. As clearly shown by the ridership analysis, it is this style of service that is required to divert auto users to transit (on the one hand) and to provide enhanced transit service to beleaguered current transit riders (on the other). As noted above, such a service is capable of tapping into the latent demand for transit that exists, providing that the service concept is fully implemented.
- Largely based on cost and constructability considerations, the City of Toronto has elected to proceed on the assumption that the Eglinton Crosstown LRT will be extended west from Mt. Dennis, rather than the originally proposed continuation of the heavy-rail line branching from the Kitchener line at that point. From the ridership analysis undertaken in this study, there is relatively little difference among these alternative alignments.
- The "reverse flow" outbound in the morning and inbound in the afternoon to/from the termini of SmartTrack at the Mississauga Airport Corporate Centre (MACC) in the west and Unionville/Markham in the north-east that had been hypothesized by some to be potentially large does not materialize in this analysis to any significant degree. This,

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[3] Note that these findings generally are for the case in which TTC fares are applied to the SmartTrack, in keeping with the SmartTrack design concept as an "urban metro" and as integrated, key component of the overall Toronto transit network. Ridership is found in this study to be very sensitive to fares. Application of higher fares (such as current GO fares) would reduce ridership considerably.

however, may well reflect the current lack of good “last mile” solutions for getting commuters from the suburban train stations to their actual workplaces. This is a common challenge facing all rail lines (including the Base RER Service Concept) in attracting significant “reverse flow” into lower density suburban areas.

- Providing that key stations are included in the system (notably Liberty Village and Unilever) overall ridership does not appear to vary dramatically with the inclusion or exclusion of some of the more minor “intermediate” stations along the alignment. Thus, a “Phase 1” system with less than the full build-out is certainly conceivable and should be successful. This does not imply, however, that additional stations will not be required so as to maximize the full potential over time. Provision for the full suite of stations over the longer term should certainly be made in designing the line, and more detailed analysis of the ridership opportunities (and overall benefit-cost trade-offs) should be undertaken.
- The currently proposed “Options C and D” presented to Council in March 2016 both represent improvements over the Base RER Service Concept with respect to ridership. It is clear, however, that they do not represent optimal designs with respect to ridership maximization, which requires higher service frequencies.
- SmartTrack offers significant “relief” to the over-crowded Yonge line, especially when it is run at higher frequencies. It can both divert people travelling from the east away from using the Bloor-Danforth line (thereby reducing the number of transfers occurring at the critical Bloor-Yonge interchange station) and people travelling from the north away from the Yonge line altogether. As discussed below, none of the Relief Line “Little-J” corridors will provide adequate long-term relief to Yonge, and SmartTrack is seen to be an important element in addressing this chronic, long-term challenge. The potential extension of the Relief Line to Sheppard Avenue, however, offers the prospect of more significant long-term relief to the over-crowded Yonge line.
- SmartTrack’s catchment area – the spatial extent of the trip origins and destinations using the line – is very large. The five-minute headway catchment area covers 55,000 hectares and serves a total 2031 travel market of nearly 3 million people and 7.4 million total daily trips. Comparable numbers for the Eglinton Crosstown, for example are 18,800 hectares, 1.3 million people and 4.4 million total daily trips.
- SmartTrack provides enhanced transit network connectivity throughout much of the City of Toronto, linking with many major east-west transit routes. It makes these routes more productive, while at the same time reducing over-crowding on both the Yonge and the Bloor-Danforth subway lines. In particular, the Stouffville portion of the line provides a new “transit spine”, analogous to the Yonge line, upon which a significantly improved Scarborough transit network can be built

(b) Relief Line

Analysis of the interaction of SmartTrack with the proposed Relief Line (RL), for various RL corridors, was also undertaken. The focus of this analysis was not to provide a detailed examination of the RL, but primarily to understand the likely interaction between it and SmartTrack.

Notable findings from the Relief Line corridor analysis, presented in Chapter 5, include the following:

- Depending on the corridor, ridership on the "Little-J" RL (which links the Bloor-Danforth line from a station east of the Don River with the downtown core) is projected to range from 14,300 to 30,200 trips in the peak hour and from 86,800 to 186,800 on a daily basis. This is almost entirely existing ridership that is diverted to a less crowded and/or faster route by using the RL.
- SmartTrack is not a major competitor to the RL. A 5-minute SmartTrack service does reduce RL ridership somewhat, but not excessively.
- A primary rationale for the RL is to provide "relief" to the Yonge subway line by diverting riders (particularly in peak periods) to the RL. Findings with respect to this issue include:
  - The "Little -J" RL alone will at best bring the 2031 Yonge line ridership south of Bloor in the AM peak (the critical point in the system) to approximately the assumed line capacity of 36,000 passengers/hour.
  - This capacity shortfall becomes worse if the Yonge Subway is extended to Richmond Hill (the Yonge Subway Extension or YSE),
  - This capacity shortfall is also worse in 2041, regardless of whether the YSE is built or not.
  - The combination of the "Little-J" RL and a 15-minute SmartTrack service reduces the Yonge AM peak ridership to somewhat below capacity in 2031.
  - Much more significant reductions below the Yonge capacity is obtained with both the "Little-J" RL and a 5-minute SmartTrack service in 2031, a clearly very desirable state to achieve for a variety of reasons.
- RL corridors that include a stop at Unilever generate less relief of the Yonge line due to the more circuitous, slower route from the Danforth line into the downtown.
- From a ridership perspective, the various King corridors out-perform the Queen corridors.
- The catchment area and overall impact on network operations of the RL are much smaller than that projected for SmartTrack.
- The "Big-J" RL corridors investigated (selected "Little-J" corridors extended northward from the Bloor-Danforth line to Sheppard Avenue) provide enhanced relief for the Yonge line and, in general, attract significant ridership in the 2041 forecast year,
- Based on this ridership analysis, both the RL and SmartTrack are attractive additions to the Toronto transit network, providing significant new capacity into the downtown and significant relief to the Yonge subway line.[4] For both the 2031 "Little-J" RL and the 2041 "Big-J" RL cases examined, it appears that both the RL and a high-frequency SmartTrack service will be required to provide adequate Yonge line relief, as well as to meet other objectives for enhanced transit capacity into the Toronto downtown.

Subsequent to the analysis of the various RL corridors discussed in Chapter 5, City Planning has undertaken a more refined analysis, including updated service assumptions, of two alternative

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[4] They also both provide much-needed redundancy within the network in terms of alternative routes in and out of the downtown when the Yonge and/or University line downtown segments are temporarily shut down for one reason or another.

alignments within the Queen" corridor in support of preparing an initial Business Case for the RL. These two "Little-J" alignments are referred to as option "AQ" (Pape to downtown via Queen Street) and option "EQ" (Pape to Eastern Avenue, with a stop at the Unilever site, then on to downtown via Queen Street). These options were also examined in conjunction with the prototype integrated SmartTrack/RER service concept "Option C".

Notable findings of the refined analysis, presented in Chapter 6, include the following:

- Depending on the alignment, the projected peak hour ridership ranges between 26,800 and 28,700 and between 165,500 to 177,100 riders on a daily basis.
- The integrated SmartTrack/RER "Option C "service concept is not a major competitor to the RL. In terms of providing "relief" to the Yonge subway line, findings include:
    - The "Little J" RL will bring the 2031 AM peak hour Yonge Line ridership south of Bloor to below capacity (alignment AQ) or just above capacity (alignment EQ).
    - The combination of the "Little J" RL and the integrated SmartTrack/RER Service "Option C" reduces the Yonge AM peak hour ridership to comfortably below capacity in 2031.
    - By 2041, the "Little J" RL alone will not be able to reduce the Yonge AM peak ridership below capacity. The combination of integrated SmartTrack/RER Service "Option C" and the "Little J" RL will bring the Yonge AM Peak hour ridership to capacity (alignment EQ), or just below capacity (alignment AQ).
    - The combination of the "Big J" RL (extended to Sheppard Avenue) and the integrated SmartTrack/RER Service "Option C" that reduces the Yonge AM Peak hour ridership comfortably below capacity in 2041.
- The extended "Big J" versions of the alignments attract significant ridership and provide enhanced relief to the Yonge Line.
- The extension of the Yonge subway to Richmond Hill (the Yonge Subway Extension or YSE) was also analyzed with RL option EQ. This analysis shows that:
    - The capacity shortfall (at Yonge south of Bloor) is worsened due to the addition of the YSE.
    - The combination of integrated SmartTrack Service "Option C" and the "Little J" Relief Line alignment EQ does not provide enough relief to reduce the Yonge AM peak hour ridership to capacity.
    - By 2041, the capacity shortfall due to the addition of the YSE is further worsened. The only combination that is able to reduce the Yonge AM peak hour ridership to capacity is that of the "Big J" Relief Line alignment EQ and the integrated SmartTrack/RER Service "Option C".

(c) Scarborough Subway Extension

Various options for the Scarborough Subway Extension (SSE) were examined in relationship to SmartTrack. Initially, several three and four stop alternative alignments were considered, generating the following key findings:

- The projected ridership for the multi-stop SSE options examined is not out of range from what one might expect for the end stations of long line running into a suburban region.
- The introduction of SmartTrack does reduce SSE ridership, as expected. Somewhat analogous to the RL – SmartTrack case, the SSE and SmartTrack are primarily designed

to address different markets: the motivation for the SSE is specifically to provide a high-quality connection between the Scarborough City Centre and the rest of the TTC network; while SmartTrack provides a major new north-south "transit spine" for the entire Scarborough transit network, as well as significantly enhanced connectivity for Scarborough and Markham into the Toronto downtown. Thus, as in the RL case, it is not a question of "either/or" between SSE and SmartTrack but rather what the best design for each might be so that each best contributes to overall transit service within the City of Toronto (and beyond).

During the course of this study the concept of a "one-stop" SSE option that would provide an "express" service from Kennedy Station to the Scarborough City Centre was introduced by City Planning. This option was briefly examined within this study in conjunction with the prototype integrated SmartTrack/RER service concept "Option C". Findings from this analysis include:

- Reducing the SSE from three to one stops reduces peak hour ridership on the line by approximately one-third (from 11,100 to 7,300 and daily ridership by 38% (63,800 versus for the 3-stop case of 103,000).
- Implementation of the Eglinton East LRT has a very marginal impact on the SSE, since it is largely serving a somewhat different catchment area.

Based on the very preliminary analysis undertaken to date, the Eglinton East LRT may attract in the order of 38,000 riders per day in the 2031 horizon year.

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Chapter 1: Introduction

1.1 STUDY PURPOSE

On December 11, 2014, City Council directed the City Manager in consultation with the Province/Metrolinx to develop a work plan to undertake an accelerated review of the SmartTrack and RER plans. Council also directed the City Manager to retain the specialized services of the University of Toronto Transportation Research Institute (UTTRI) to support the planning analysis and required transit ridership modelling as a component of the overall review.[5] On February 10, 2015, City Council considered the report *EX2.2 SmartTrack Work Plan (2015-2016)*, and approved the accelerated work plan for the review of SmartTrack.[6]

The UTTRI component of this work is to provide transit ridership estimates and other key network performance measures from the City's Regional Travel Demand Model. This work includes:

- Confirming the integrated RER and SmartTrack Service Concept to be modelled.
- Completion and validation of a new travel demand model system to be used by the City of Toronto in this and similar studies of transit ridership and travel demand.
- Development and review of forecasting assumptions that provide key inputs into the transit ridership forecasts.
- Generating transit ridership forecasts for the identified range of future year networks and input scenarios.
- Analysis and comparison of ridership forecast results.
- Documentation and reporting of all work and results.

This study did not deal with:

- Detailed engineering design considerations of route alignments and stations.
- Capital and operating costs of alternative network designs.
- Financing mechanisms to pay for the construction and operation of network additions.

Thus, this UTTRI study focusses solely on the transit ridership levels and other system performance measures that are likely to occur if various transit network improvements are made. While the primary focus of this analysis is on options for the proposed SmartTrack line, this line cannot be considered in isolation of the overall Greater Toronto-Hamilton Area (GTHA) transit network and, in particular, other major transit infrastructure proposed investments, notably GO RER plans, Scarborough Subway Extension (SSE) options, and Relief Line (RL) options (formerly often referred to as the Downtown Relief Line). Similarly, the future is a very uncertain place, and so ranges of estimated ridership need to be generated across a variety of possible future year growth scenarios and other assumptions. Given this, a wide range of combinations of network investment and growth scenarios are generated in this study and results are compared in detail.

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[5] http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.EX1.12.
[6] http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2015.EX2.2.

The transit ridership forecasts are generated using a large computer simulation model system called GTAModel V4.0. This model system simulates all trips made by all persons in the GTHA by all modes for all trip purposes over the course of a "typical" 24-hour weekday. Use of such computer simulation model systems is standard practice worldwide in large urban regions such as Toronto. As is discussed further below, GTAModel V4.0 has been developed by the Travel Modelling Group (TMG) within UTTRI as the outcome of an on-going, multi-decade collaboration with the City of Toronto.

1.2 REPORT ORGANIZATION

In addition to this brief introductory chapter, this report consists of six chapters.

- ***Chapter 2: Travel Demand Modelling in the GTHA & GTAModel V4.0:*** This chapter presents a brief, non-technical introduction to how the travel demand forecasts presented in this study are generated, as well as a historical overview of travel demand modelling research and application at the University of Toronto. It also includes pointers to much more detailed technical documentation of the methods used.
- ***Chapter 3: Network Options:*** This chapter summarizes the full range of transit network options analysed in this study and the key assumptions made in developing these options.
- ***Chapter 4: SmartTrack Ridership Forecast Results:*** This chapter presents detailed forecast results generated in this study for the range of SmartTrack network options and scenarios tested across a variety of key performance measures.
- ***Chapter 5: Other Transit Line Forecast Results:*** This chapter presents the forecast results for other major rail transit proposals analyzed in this study: the Relief Line (RL), multi-stop Scarborough Subway Extension (SSE) options, and the Yonge Subway Extension (YSE). Ridership and impacts of these rail lines are assessed with and without implementation of SmartTrack. Ridership for SmartTrack and these other lines is compared to other key elements of the Toronto transit network to provide additional context for assessing their impacts on travel within the City.
- ***Chapter 6: Integrated RER/SmartTrack Service Concept Tests:*** During the course of the study, prototype options for a more integrated RER/SmartTrack service concept were developed. The ridership impacts of these options are explored in this chapter. Preliminary ridership on refined Relief Line alignments and a one-stop, "express" SSE (in conjunction with the proposed extension of the Eglinton Crosstown eastward from Kennedy station) is also explored in conjunction with the integrated RER/SmartTrack service concept.
- ***Chapter 7: Study Summary & Key Findings:*** This chapter summarizes the study and its key findings. Note that this study was not tasked with making recommendations concerning the investment options, which is clearly the task of City Council. Such decisions will also require additional findings concerning engineering feasibility, costs and financing, all of which were not within the scope of this study. Nevertheless, key findings <u>from a ridership perspective</u> concerning the options are presented for the City's consideration.

Chapter 2: TRAVEL DEMAND MODELLING IN THE GTHA & GTAMODEL V4.0

2.1 INTRODUCTION

Travel demand forecasting model systems are routinely used by urban regions around the world to systematically estimate future transportation system usage under a variety of policy and investment scenarios. While individual implementations vary from one region to another, the overall approach is quite standardized and involves the development of: (Meyer and Miller, 2001)

- A set of traffic zones that divide the urban area into a manageable number of spatial analysis units.
- Detailed estimates of the forecast year population and employment expected to be located in each traffic analysis zone.
- A detailed computerized representation of the forecast year road and transit networks, including assumptions concerning roadway speeds and capacities and transit line speeds, headways and capacities for every road and transit segment (link) in the network. Variations in this network representation are prepared for each policy scenario to be tested (e.g., transit networks with and without SmartTrack).
- A connected set of models that predict the trips that are expected to be made in the forecast year from every origin zone to every destination zone for all trip purposes by all modes of travel over the period of time being modelled.
- Road and transit network "assignment" models that determine the paths which auto and transit trip-makers will take through the road and transit networks to execute their trips.

A detailed, comprehensive modelling approach such as is sketched above and that is used in this study is essential for adequately assessing the impacts of any major transportation investment such as SmartTrack for many reasons:

- The entire transit network is modelled, not individual lines in isolation. Synergistic network effects are thereby captured that cannot be accounted for in analysis of a single line.
- The actual spatial origin-destination pattern of trip-making is explicitly accounted for. In other words, the entire travel market is modelled and the role which a given line plays in serving this overall market can be explicitly examined.
- Sensitivities to transit service frequencies, fares, travel times, stop locations and spacing, etc. can be simultaneously and consistently examined.
- The model is sensitive to assumptions concerning future year population and employment distributions.
- Competition from the road network (as well as walk/bike modes) is directly modelled. Transit investment impacts on roadway usage/congestion is directly modelled, as is the impact of auto service levels on transit ridership.

The travel demand forecasting model system used in this study, GTAModel V4.0, follows this general structure. It is described in non-technical terms in Section 2.3, with references to more detailed technical documentation. As discussed in Section 2.3, GTAModel V4.0 possesses many advanced features that make it very well suited for the present analysis. Before discussing the model system, however, Section 2.2 discusses a number of key issues and assumptions that went into its construction.

2.2 KEY MODEL COMPONENTS, DATA & ASSUMPTIONS

2.2.1 Introduction

Numerous major design decisions go into the development of any travel demand forecasting system which fundamentally affect the performance of the system. This section provides brief, high-level discussions of a number of these.

2.2.2 Traffic Analysis Zone (TAZ) System

The 2006 Transportation Tomorrow Survey (TTS) traffic analysis zone (TAZ) system is used in this study with some modifications in the vicinity of several proposed SmartTrack stations to provide additional spatial detail in these areas. Figure 2.1 illustrates this zone system, while Table 2.1 provides summary statistics for the system. For more detailed documentation of this zone system see DMG (2007).

This detailed traffic zone system is aggregated into 46 “Planning Districts” for higher-level analysis and display purposes (see Figure 2.2). This “internal” detailed traffic zone system is augmented beyond the GTHA boundary to include 26 larger “external” traffic zones representing the remainder of the Greater Golden Horseshoe (see Figure 2.3). Travel between the GTHA and this external hinterland is modelled so that these trips are included in the flows on the GTHA road and transit networks, but these trips are modelled in a more simplistic fashion than the within-GTHA travel, which is the primary focus of the model system.

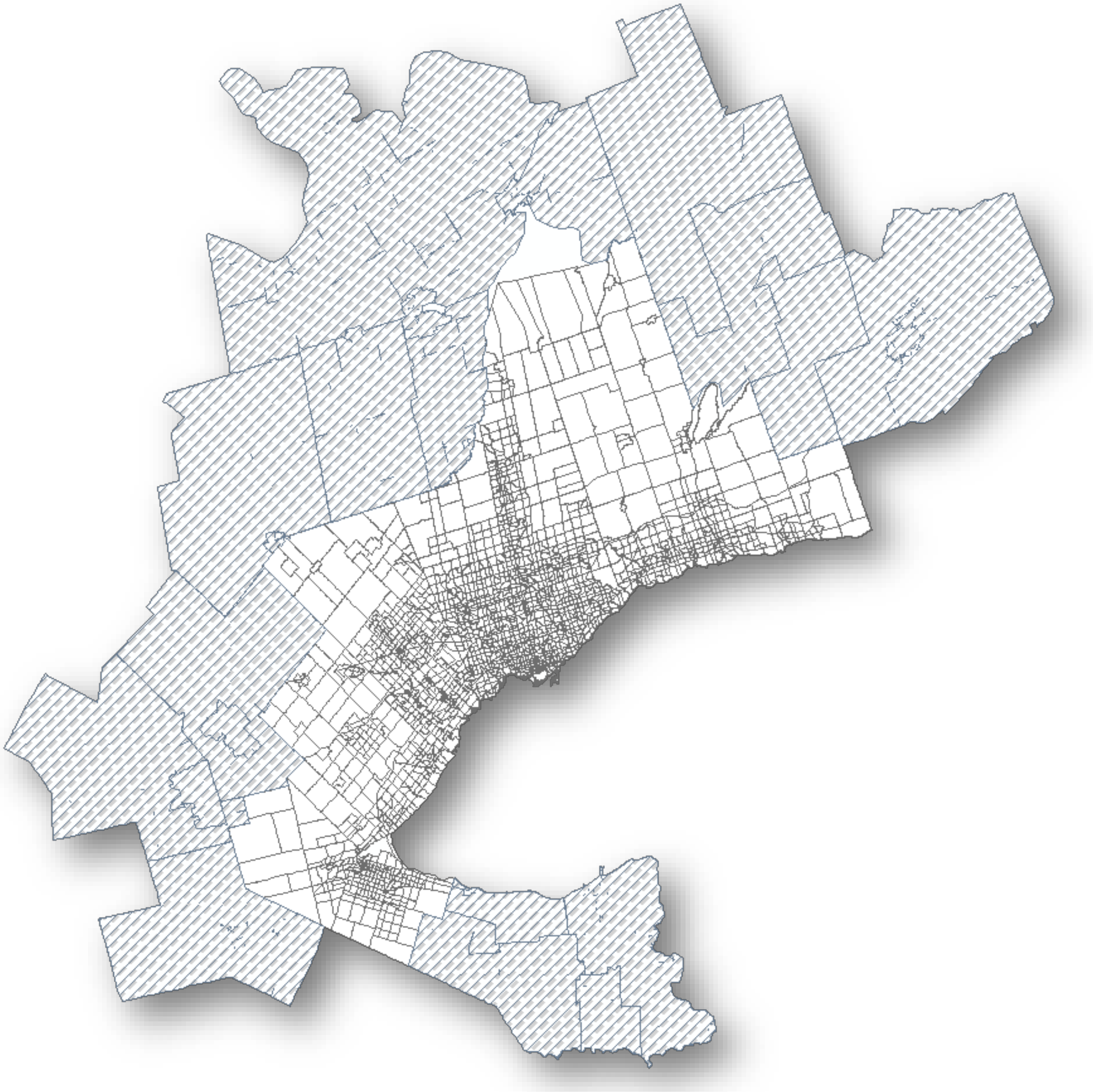

Figure 2.1: The 2006 TTS Traffic Zone System for the GTHA

Table 2.1: Summary Statistics for the 2006 TTS Traffic Zone System

Region	Planning Districts	Zones
Toronto	16	625
Durham	8	334
York	9	478
Peel	3	405
Halton	4	195
Hamilton	6	234

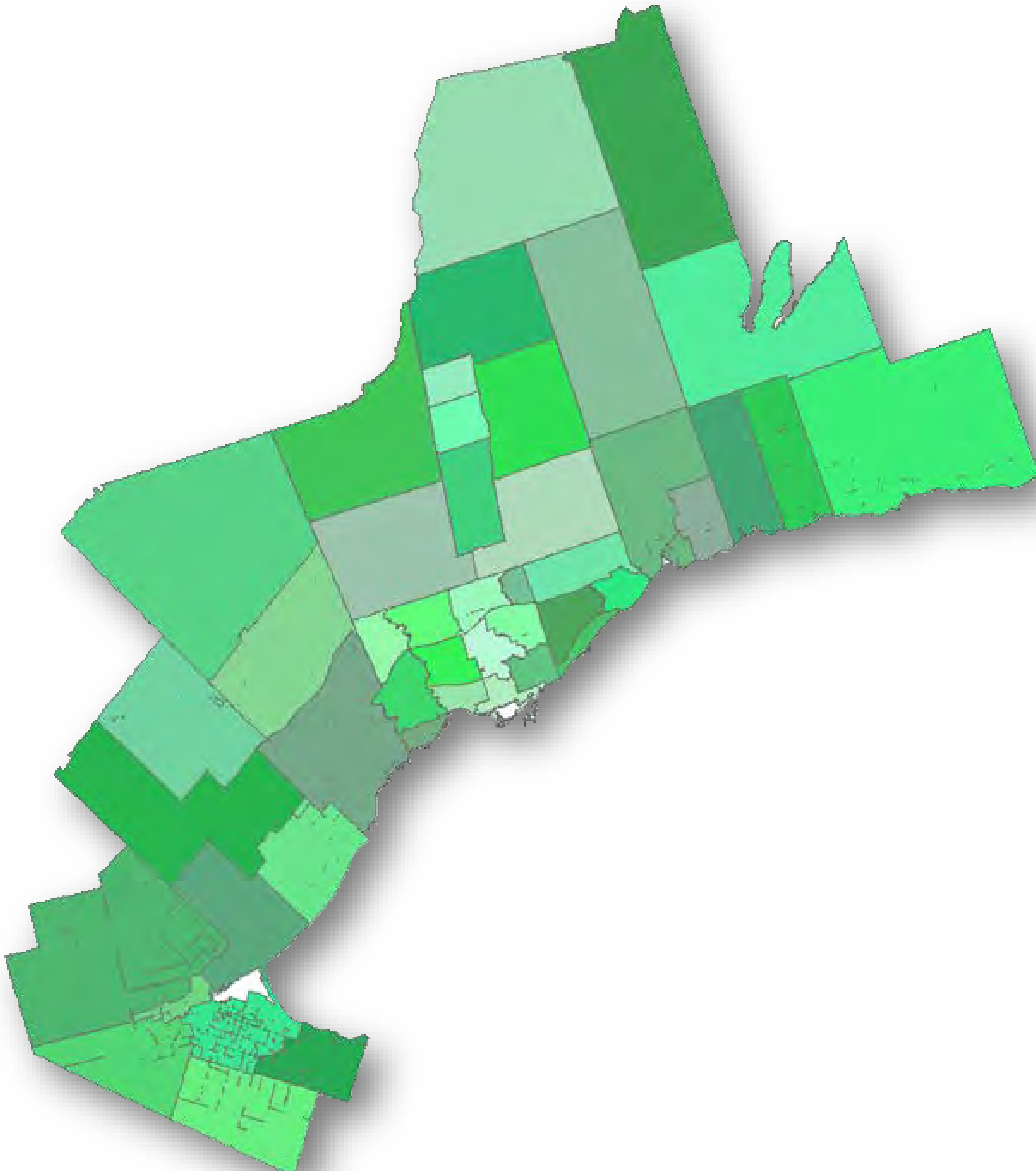

Figure 2.2: GTHA Planning Districts

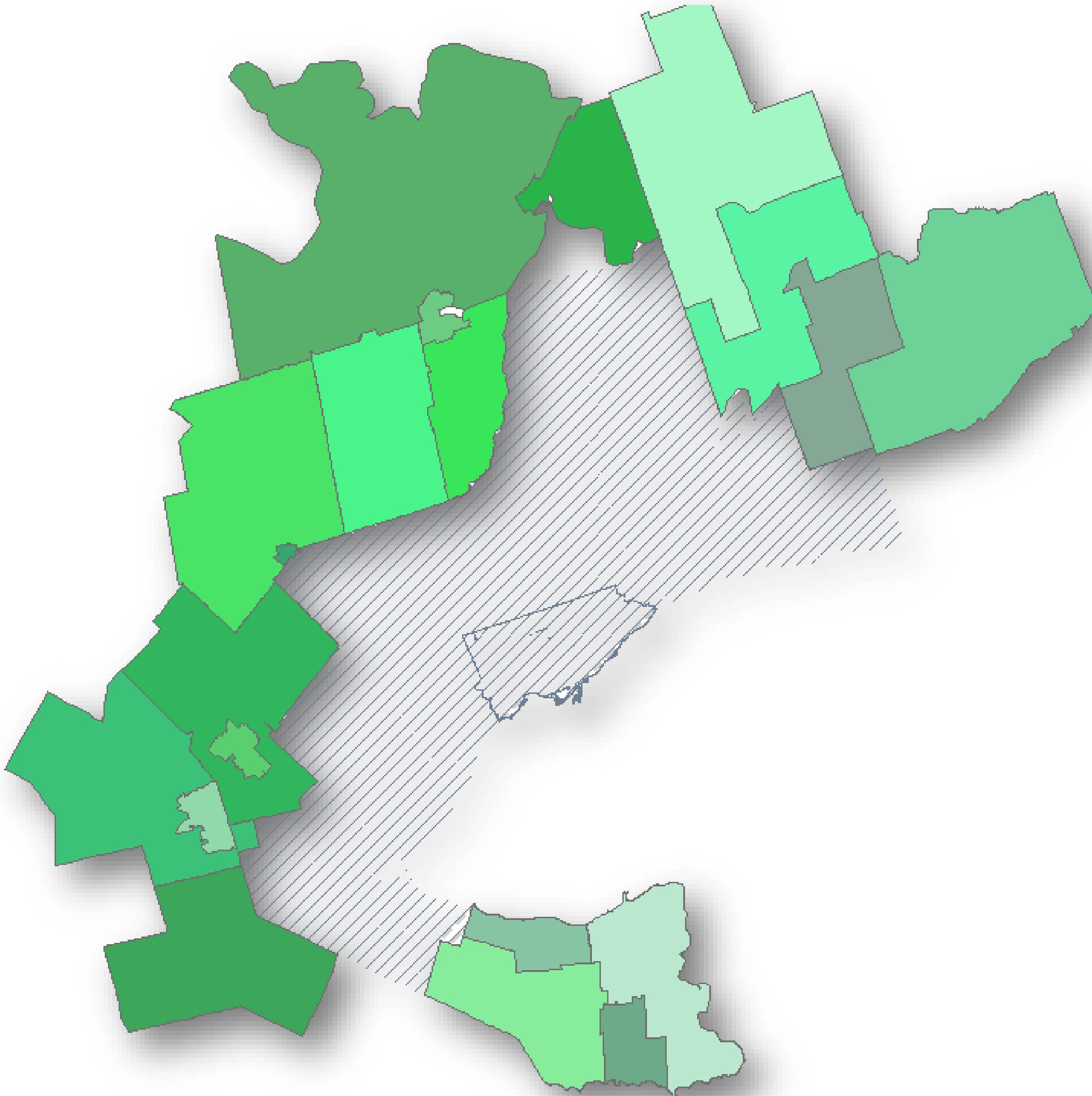

Figure 2.3: GTHA External Zone System

2.2.3 Population & Employment Scenarios

Key inputs into any forecast of future year travel demand are the detailed spatial distributions of future year population and employment for each traffic zone in the study region. These population and employment forecasts were prepared for this study by City Planning staff in consultation with Strategic Regional Research Alliance (SRRA). They have been documented by SRRA and reviewed in other reports, and so are not discussed in detail herein.[7]

[7] See SRRA (2015).

Appendix A: provides a high-level summary description of the five population and employment scenarios developed by City Planning and SRRA for this study. These scenarios are intended to provide a reasonable spread in assumptions concerning population and employment growth in the region. Of these, the two scenarios most used throughout this study are:

- "Low population / medium employment".
- "Low population / medium employment with SmartTrack Influence" (used in scenarios where SmartTrack is included in the network).

2.2.4 GTHA Base Year Travel Behaviour Data: The 2011 Transportation Tomorrow Survey (TTS)

The GTHA is fortunate to have a long history of conducting large-sample surveys of travel behaviour within the region that provide an excellent basis for transportation planning and modelling within the region. The Transportation Tomorrow Survey (TTS) data collection program has undertaken a major survey of travel within the region every five years, commencing in 1986. The study area for these surveys has grown over the years to now encompass essentially the entire Greater Golden Horseshoe. This large spatial scale, combined with the large sample sizes used, makes the TTS one of the largest urban travel survey programs in the world. These surveys are collectively designed and undertaken by all the provincial and regional transportation planning agencies within the GTHA, in collaboration with other participating municipalities within the Greater Golden Horseshoe. This data collection program receives extensive technical support from UTTRI's Data Management Group (DMG), which also stores and manages the multi-year TTS database for use by a wide variety of public, private and academic applications.

The most recent survey was conducted in the falls of 2011 and 2012.[8] The next survey in this sequence is currently being planned for the falls of 2016 and 2017. In each survey, typically 5% of all the households in the study area are contacted and detailed information concerning the household and the trips which it made on a single weekday is collected. Table 2.2 presents a few summary statistics concerning the TTS program, while Table 2.3 summarizes some of the information which it collects per household, person and trip. Further documentation of the TTS program and data can be found in DMG (2013, 2014).

GTAModel V4.0 is based on the 2011 TTS data. That is, its many model parameters have been statistically estimated and calibrated so that the model system is able to replicate as best as possible the actual regional travel behaviour as observed in the TTS data.

[8] Given the logistics involved in conducting a survey of the magnitude of the TTS, it needs to be spread over a number of months. Two fall periods are required to gather all the required data over the very large study area involved.

Table 2.2: TTS Summary Statistics

Statistic	1986	1991	1996	2001	2006	2011	% Change 2011-1986
Overall sampling rate	4.2%	1.4%	5.0%	5.6%	5.2%	5.1%	
Survey area (sq.km.)	8,750	8,750	21,000	22,300	26,400	26,690	205%
No. of household records	61,453	24,507	115,193	136,379	149,631	159,157	159%
No. of person records	171,086	72,496	312,781	374,182	401,653	410,404	140%
No. of non-transit trip records	313,633	142,453	587,676	732,649	777,173	772,145	146%
No. of transit trip records	56,615	14,896	70,295	85,095	87,164	86,703	53%
Total weighted households	1,466,077	1,709,551	2,317,185	2,417,513	2,871,250	3,117,511	113%
Total weighted persons	4,062,949	4,729,193	6,285,143	6,529,617	7,705,356	8,520,307	110%
Total weighted non-transit trips[1]	7,397,905	8,851,915	11,764,351	12,731,378	14,849,309	15,888,227	115%
Total weighted transit trips[2]	1,363,034	1,379,175	1,421,138	1,469,237	1,691,888	2,036,099	49%

Notes:
1. Primary mode of travel is not local transit, commuter rail or commuter bus. Includes school buses.
2. Primary mode of travel is local transit, commuter rail or commuter bus.

Sources:
Data Management Group (2003) 2001 *Transportation Tomorrow Survey: Data Guide* , University of Toronto Joint Program in Transportation, Toronto.
Data Management Group (2007) *2006 Transportation Tomorrow Survey: Data Guide* , University of Toronto Joint Program in Transportation, Toronto.
Data Management Group (2013) *2011 Transportation Tomorrow Survey: Data Guide* , University of Toronto Dept. of Civil Engineering, Toronto.

Table 2.3: Summary of Key Information Collected in TTS

Household	Person	Trip -- All Trips	Transit Trips
number of persons	age	start time	access mode
number of vehicles	sex	primary mode	access zone
dwelling type	driver's licence	origin purpose	egress zone
survey week	employment status	destination purpose	number of routes (lines) used
survey day	occupation	trip purpose code	route 1 number
residential location	student status	(home-based work, etc.)	route 2 number
(geocodes; TAZ, etc.)	work location (if employed)	trip origin	route 3 number
	school location (if a student)	trip destination	route 4 number
	respondent flag	trip length	route 5 number
			route 6 number
			commuter rail access station
			commuter rail egress station
			subway access station
			subway egress station

2.2.5 Road & Transit Network Modelling: Emme

In order to model travel behaviour within a large and complex region such as the GTHA, the region's road and transit networks have to be "coded" into a computerized representation suitable for modelling and analysis purposes. In particular, the routing of trips from each origin to each destination along specific paths (routes) through the network must be modelled in order to determine both origin-to-destination (O-D) travel times and costs and link travel times, costs, flows and congestion levels. This modelling of route/path choices by trip-makers through the transportation network is generally referred to as the "trip assignment" problem. Separate models used for assigning vehicle trips to the road network and passenger trips to the transit network, given the different attributes and behaviours involved in the two cases. Quite sophisticated models are required to properly handle both the road and transit assignment problems.

Standard, commercial software packages are usually used to deal with all aspects of transportation network modelling: network coding, display and database management; road and transit assignment; and analysis and display of network modelling results. The Emme network modelling software package developed and maintained by INRO is the standard software used by GTHA transportation planning agencies.[9] Given this, it is used in GTAModel V4.0 for all network modelling and analysis elements with the model system.

2.2.6 Network Coding Standards & the 2012 Base Year Network

All GTHA transportation networks analyzed in this study are coded within the Emme software system based on the 2011 Network Coding Standard (NCS11) developed by UTTRI's Travel Modelling Group (TMG), which is the agreed-upon standard for Emme-based network coding with the GTHA. See TMG (2012) for details.

The base year for the study's analysis is 2011 since GTAModel V4.0 was developed using 2011 TTS data, which represents the most recent comprehensive travel behaviour dataset for the region upon which the study can be grounded. The "2011" TTS data, however, was actually collected during the fall seasons of both 2011 and 2012, with a majority of the trips actually being recorded in the fall of 2012. For this reason, the base year network used is one which corresponds as best as possible to fall, 2012 conditions. This base 2012 network was developed and validated by TMG and is the standard base network used by transportation planning agencies in the GTHA.

2.2.7 Representation of Time in the Model System

GTAModel V4.0 models all travel occurring in a "typical" 24-hour weekday during the fall (September-December) season. The model is developed using TTS data, which are collected during the fall season, since this season is generally assumed to be the "most representative" time of the year for model development and policy analysis. TTS collects data on travel undertaken by all persons and households surveyed for one 24-hour weekday; no information on weekend travel is collected. In TTS the "day" is taken to begin at 4:00am in the morning and to end at 3:59am the following morning. Hence, the modelled day covers the time period 0400 – 2759 hrs.

Within the 24-hour weekday the start times of all trips made by all persons in the region are simulated on a second-by-second, continuous time basis over the course of the day. For purposes of assigning these trips to the road and transit networks within Emme, however, these trip start times need to be aggregated into discrete time periods, since Emme cannot deal with a continuum of trip start times. Five time periods are used in the model system, as defined in Table 2.4. Road and transit assignments are run for each of these time periods,[10] using origin-destination (O-D) flow matrices for each mode for each time period consisting of the sum of all the trips predicted to start within a given time period. In order to undertake auto assignments in Emme the O-D trips for each time period must be further factored down to a representative one-hour flow.

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[9] https://www.inrosoftware.com/

[10] No transit assignment is done for the overnight time period, since very little service or transit trips occur during this time period.

Table 2.4: Time Period Definitions

Time Period	Start Time (Inclusive)	End Time (Exclusive)
AM Peak	6:00 AM	9:00 AM
Midday	9:00 AM	3:00 PM
PM Peak	3:00 PM	7:00 PM
Evening	7:00 PM	24:00 AM
Overnight	24:00 PM	6:00 AM

2.2.8 Auto Cost Assumptions

In terms of auto travel costs, gasoline prices, parking charges and road tolls are all assumed to not change in constant dollar terms[11] relative to the 2011 base case. This is consistent with the treatment of transit fares in this study, which are expressed in terms of current (2011) values. It is also clearly a conservative assumption with respect to forecasting transit ridership since any real (i.e., inflation-adjusted) increases in auto operating costs would tend to encourage additional transit usage.[12]

2.3 GTAMODEL V4.0

As illustrated in Figure 2.4, the University of Toronto has worked closely with the Planning Department of the City of Toronto (and prior to amalgamation, Metro Toronto) for nearly 30 years in the development of travel demand forecasting models for the City's use. This resulted in a series of models labelled "GTAModel". In particular, GTAModel V2 was the standard travel demand model system used by the City of Toronto from 2002 until the adoption of V4.0 as the City's new operational model system, commencing with this SmartTrack ridership study.

[11] Throughout this analysis all costs are expressed in constant 2011 dollars.
[12] While world oil prices are currently quite low, it is unlikely that long-term gasoline prices will decrease below current values.

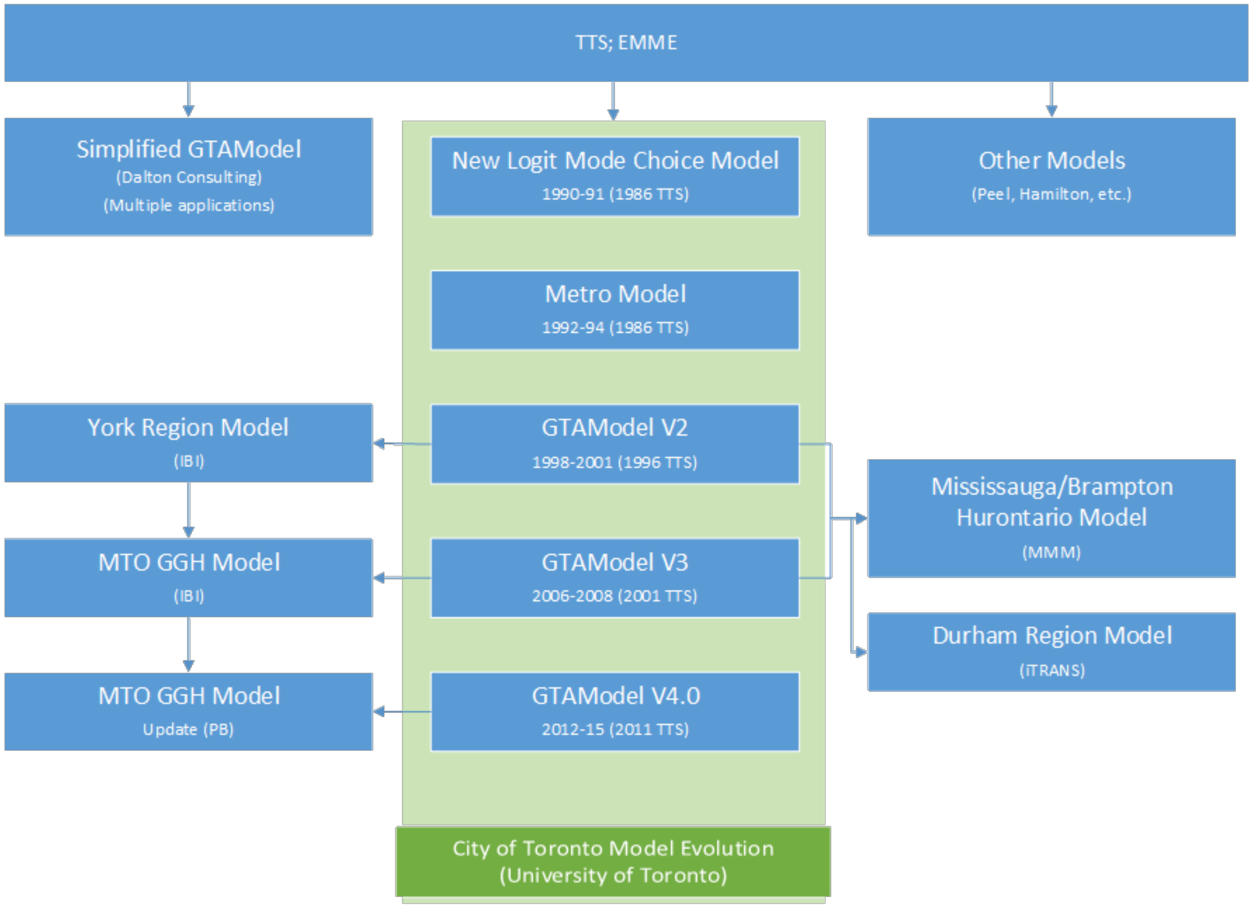

Figure 2.4: Evolution of Toronto Travel Demand Modelling in the City of Toronto and the GTHA

UTTRI's Travel Modelling Group commenced work on V4.0 as a research project in 2014. This work was accelerated and completed in 2015 as part of this study, resulting in a fully operational, validated model system. It has been subjected to independent evaluation by a peer review panel, which found it to be robust, representative of the general state of the art in travel demand modelling, calibrated to industry standards, and validated to an acceptable level of performance. Furthermore, the peer review panel concluded that the SmartTrack ridership forecasts are reasonable in comparison to the to the projected population and employment growth corridor catchment areas (Parsons, 2016).

Figure 2.5 provides a very high level overview of GTAModel V4.0 operations. Key points to note include:

- A disaggregate population of synthesized individuals and the households within which they reside is created for the population projected to reside in each traffic zone. These synthetic persons and households are statistically representative of the people expected to live in these zones in terms of their household sizes, auto ownership levels, employment characteristics, etc.
- Given where each worker lives, the worker is assigned a work location (PORPOW in Figure 2.5) given the forecast year spatial distribution of jobs and the level of

accessibility provided by the transportation system (road and transit) to these jobs. Students are similarly assigned school locations given where they live (PORPOS).

- The daily travel pattern for each person is determined given where they live, work (and/or go to school), their personal and household characteristics and the levels of service and accessibilities provided by the transportation system (road, transit, active[13]) to work, school, shopping, etc. activity locations.
- Once all the trips by all modes are determined, the auto trips are assigned to paths through the road network and the transit trips are assigned to paths through the transit network for each time period being modelled during the day. The output from the road and transit assignment models are link flows, speeds, travel times and congestion levels for each link in the road network and for the transit network:
  - Boardings and alightings at each transit line stop or station.
  - Ridership on each segment of each transit line.
  - Travel times and congestion levels on each transit line segment.

  In addition, origin-to-destination (O-D) travel times and costs for both auto and transit trips for all O-D pairs in the GTHA are computed. In the case of transit, these times are further broken down into walk access/egress times, wait and transfer times, and in-vehicle travel times. Transit costs are the average fare paid for a given trip, given the services used (GO Rail, TTC, etc.). Auto costs consist of average parking charges at the destination, any tolls paid (if Highway 407 is used) and an average "in-vehicle" cost per kilometre travelled, representing out-of-pocket fuel costs, etc. for each trip.

[13] "Active" transportation refers to the walk and bicycle modes, often referred to as non-motorized modes of travel. These modes are included in the model and are available for trip-makers to use for shorter-distance trips.

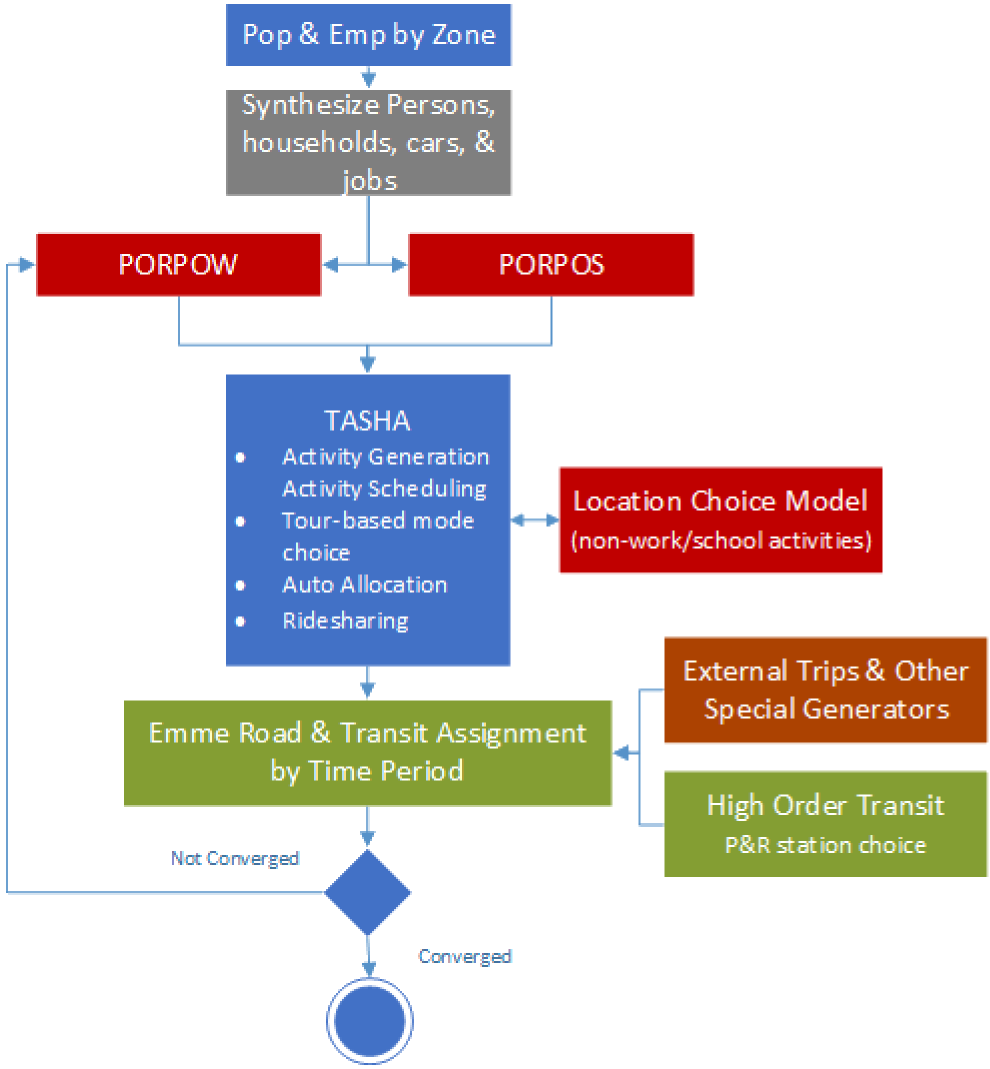

Figure 2.5: GTAModel V4.0

Considerable effort has gone into maximizing the ability of the Emme-based transit assignment model to compute transit ridership by transit line in a way that is both behaviourally accurate and policy sensitive. Three key innovations introduced in the GTAModel V4.0 transit assignment procedure are:

- It is a "fare-based" assignment, in which trip-makers choose their path through the transit network based not just on the travel times of competing paths, but also on the fare charged. Thus, the model explicitly models trade-offs between slower, cheaper routes and faster, more expensive routes. This is a particularly important feature for modelling the choice of GO Transit relative to competing "local" transit routes, given the different fare structures which currently exist among the various GTHA transit systems.
- It accounts for "crowding" on board transit vehicles. As buses, trains, etc. become more crowded, they become less attractive for use. In such cases, trip-makers may either find more attractive transit routes to use or may switch to some other mode of travel. Conversely, capacity increases on a given line will tend to attract more riders to it. Given

the very congested nature of the Toronto transit system,[14] this is an important feature to include on the model in order to properly assess the impacts of capacity improvements on ridership.

- It treats the Toronto transit network in an "integrated", "abstract" fashion, in which different services and technologies are represented by their service characteristics alone (speed, frequency, capacity, stop locations, etc.). Thus, a person travelling from Mississauga to downtown Toronto, for example, can choose alternative paths through the integrated transit network such as driving to a GO Rail station, taking a MiWay bus to the subway, etc. Choice among these paths will depend only on the competing fares, times, number of transfers, etc., not on whether one path is a "GO trip" and one path is a "subway trip". Such an approach avoids building possible biases into the model system concerning one technology or operator. This is extremely important for analyzing new services such as SmartTrack which blurs conventional distinctions between services and technology (Is it "subway" or "commuter rail"? Is it "TTC" or "GO"?).

The core component of GTAModel V4.0 is TASHA (Travel/Activity Scheduler for Household Agents). TASHA is the product of over a dozen years of research at the University of Toronto. It is an agent-based microsimulation model that generates 24-hour weekday out-of-home activity patterns and associated trips for every person and household in the GTHA. It literally simulates "a day in the life" of each synthesized person within the model in terms of the start times, durations and locations of each out-of-home activity "episode" in which they engage during the modelled day. Given these activity episode locations and start times, trips from one episode location to another are generated, thereby creating one or more home-based trip-chain or tour that the person will undertake. This process is illustrated in Figure 2.6, in which a person goes to work, shops at two different locations and also participates in one "other" out-of-home activity.

Once a person's daily activity/travel pattern is known, the travel mode used on each trip is determined within a *tour-based* mode choice model, in which each person chooses the mode (or modes) of travel within a given home-based tour that maximizes his/her personal utility, where this utility is a function of the travel times, costs, etc. provided by each mode for each trip. The tour-based approach allows for tour-level constraints to be accounted for (a person may drive to work in the morning since he/she needs the car to travel to a business meeting later that day; if a car is used to go to work, it must be used to return home again; etc.). Figure 2.7 illustrates the tour-based approach to modelling mode choice, which allows for the consistent accounting for complex, interconnected travel decisions over the course of the day.

Finally, household-level interactions and constraints are explicitly considered within TASHA:

- Joint activity/travel among household members.
- Competition for use of household cars (e.g., two drivers wanting to use the same car at the same time).
- Within-household ridesharing.

[14] Most notably the Yonge subway line, but peak-period overcrowding exists throughout the TTC and GO systems.

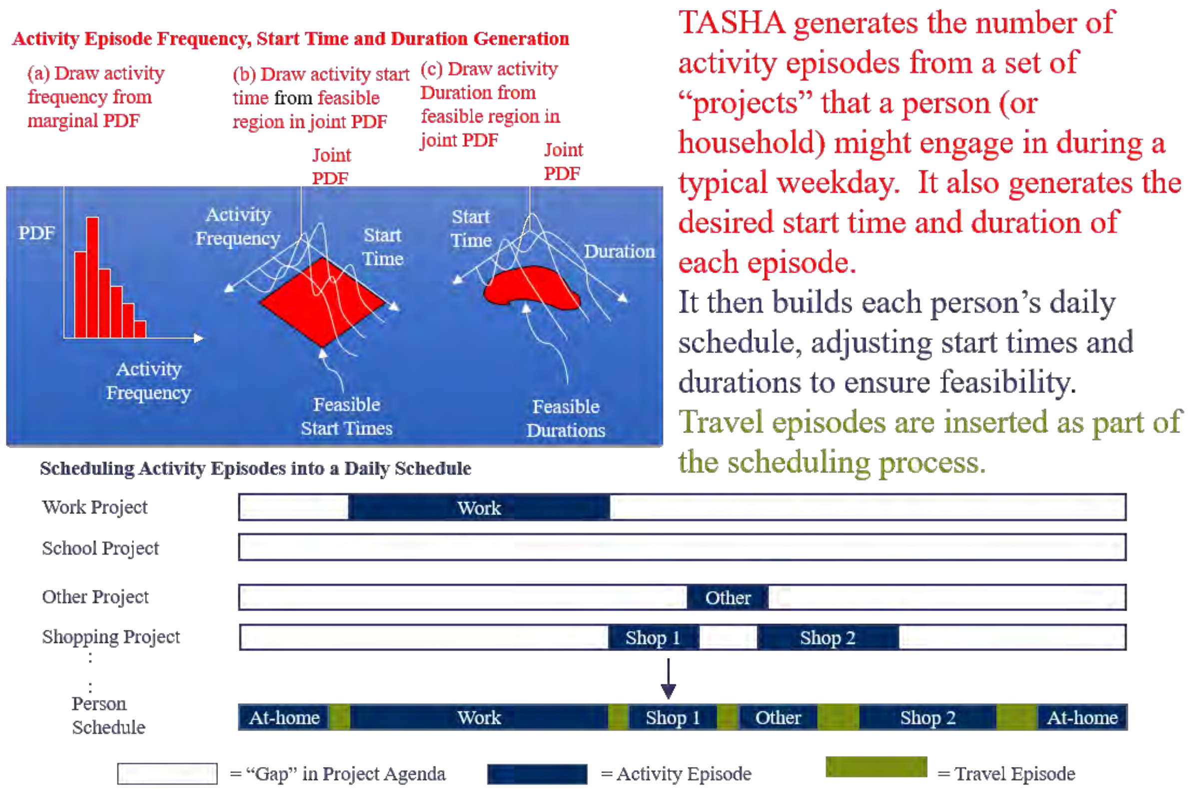

Figure 2.6: Activity Scheduling in TASHA

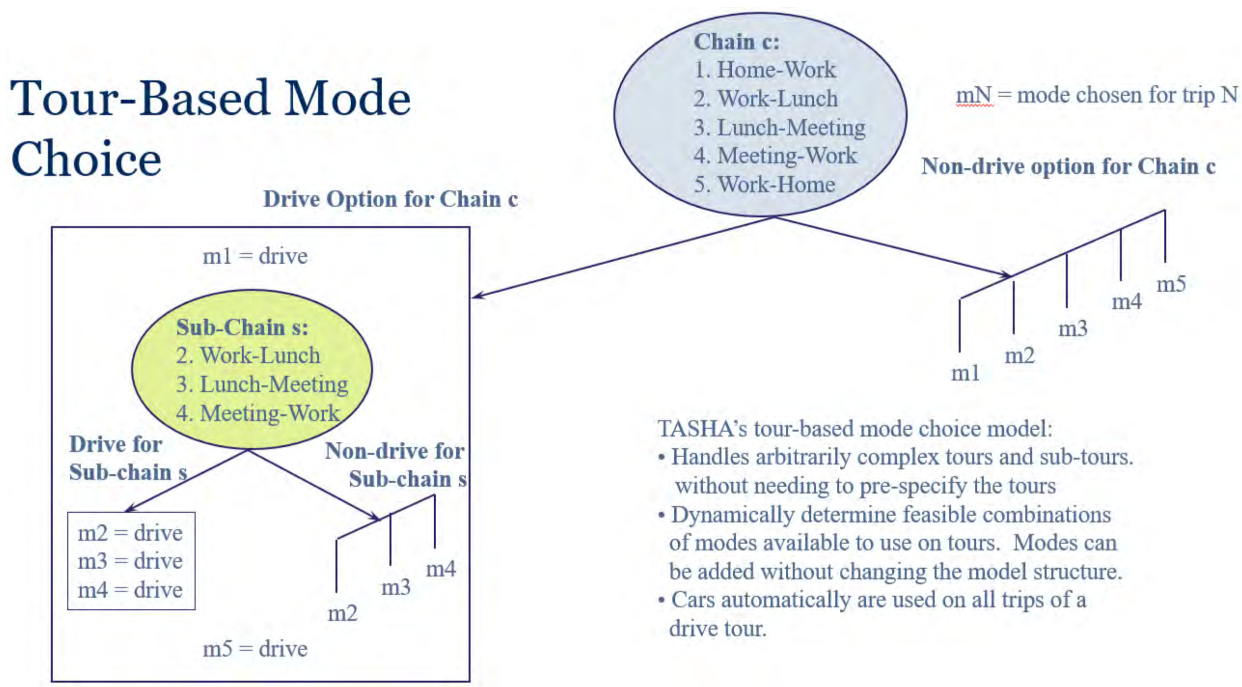

Figure 2.7: Tour-Based Mode Choice within TASHA

Both GTAModel V4.0 and TASHA are implemented within a software system developed by the TMG called XTMF (eXtensible Travel Modelling Framework). XTMF provides a very efficient, flexible, powerful software environment for the development and use of complex travel demand model systems.

Key reasons for the City of Toronto's adoption of GTAModel V4.0 for its on-going planning use and, specifically, for its use in this study include:

- It is currently the only travel demand modelling system within the GTHA that can consistently and comprehensively model 24-hour weekday travel within the region.
- It is the only agent-based microsimulation model of travel behaviour within the GTHA providing the disaggregate level of modelling required to ensure behaviourally sound predictions of travellers' responses to infrastructure investment (and other policy) options and for detailed analysis of the impacts of such policies.
- It is the only operational model system within the region which incorporates the tour-based mode choice and advanced transit assignment methods described above that are essential for analysis of transit investment alternatives.

For further documentation of XTMF and GTAModel V4.0 see TMG (2015 a, b, c).

Chapter 3: Chapter 3: NETWORK OPTIONS

3.1 INTRODUCTION

The objective of this study is to evaluate the ridership impacts of a range of transit network investment options, both in isolation and in various combinations. This chapter describes the network options investigated. The transit lines considered in this study are:

- SmartTrack.
- Relief Line (RL).
- Scarborough Subway Extension (SSE).
- Yonge Subway Extension (YSE).

With the exception of the YSE, which has an approved alignment, alternative alignments are considered for each of the other three lines.

Transit line design elements considered in the analysis are:[15]

- Alignment.
- Number and location of stations.
- Service frequency (headway).[16]
- Fare.

The specific design options for each line tested in this study are presented in Section 3.3.

Two forecast years are examined for all options:

- 2031: This is the standard GTHA forecast year. The bulk of the analysis focusses on this benchmark year. Most experience exists with generating population and employment forecasts for this year.
- 2041: This represents a longer-term "mature" system analysis end date. Population and employment forecasts are more speculative given the more distant date.

The analysis strategy involves developing for each forecast year a "base" network which consists only of existing and committed (funded) projects and which excludes SmartTrack and the other lines of interest. The 2031 and 2041 base networks are briefly described in Section 3.2. The various new network options are then incrementally added to the base network so that the changes in system performance due to these network additions can be assessed across a variety of ridership and other performance measures, as discussed in detail in Chapters 4 and 5. Sections 3.3 – 3.7, inclusive, discuss the SmartTrack, RL, SSE and YSE alignments and other design assumptions that are tested in this study in detail.

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[15] Train capacity is another design variable of interest. Very large capacities are assumed in this analysis, since the objective of the current analysis is to determine the potential demand for each service. It would be inappropriate at this stage of the analysis to impose arbitrary capacity limits. Capacity considerations should enter into subsequent analyses in which the capital and operating costs associated with alternative vehicle technologies and capacities are compared with ridership and revenues generated by these options.

[16] Frequency is expressed in trains/hour. Headway is the average time gap between trains. It is the inverse of frequency; i.e., headway = 1 / frequency. Headway is usually expressed in minutes. In this report headway is generally used to characterize the service being modelled.

3.2 FUTURE YEAR BASE NETWORKS

Developing a future year base network involves professional judgement concerning what major road and transit facilities should be included and what should not. It also requires making assumptions about how the arterial road and local bus transit networks will evolve in the future. Under guidance from City Planning, the following assumptions were made in constructing the future base year networks:

- Major transit lines currently under construction that will be operational by 2031 were included, notably the Eglinton Crosstown and the Toronto-York Spadina Subway Extension.
- Major rail transit lines with committed funding were included in the base networks. These include:
    - Metrolinx draft “Base RER” (Regional Express Rail) services.[17]
    - Hurontario LRT.
    - Finch West LRT.
    - Sheppard East LRT.[18]
    - Scarborough Subway Extension.
- Known, committed road changes for the GTHA were included, as well as known, committed transit changes for the City of Toronto, City of Mississauga and the Region of York. No transit network changes relative to the base 2012 network were made for the Regions of Durham and Halton and the City of Hamilton, reflecting both a lack of information concerning possible changes and the judgement that changes in these components of the regional network would have relatively little impact on the ridership forecasts for the SmartTrack, RL and SSE lines.

Uncommitted transit lines such as the East Bayfront LRT are not included in the base networks. Similarly, potentially significant improvements to the downtown streetcar routes (through advanced transit signal priority, etc.) are not considered.

For the SmartTrack and Relief Line tests, the “McCowan3” SSE alignment[19] is assumed within the base networks, as being representative of the SSE alignments under consideration. For the tests of the SSE alignment, it is, of course, removed from the base network. Since it is currently very unclear what a base 2031 network without some form of the SSE would consist of, for the purpose of these tests, the current Scarborough RT was assumed to be still operational.

Figure 3.1 presents a map of the City of Toronto rail system as assumed in the 2031 base network. No additional rail elements are included in the 2041 base network.

It should be noted that at various points during the course of this study City Planning and the TTC revised their assumptions concerning various aspects of these future year base networks,

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[17] Based on unpublished documents provided by Metrolinx.

[18] Although labelled “LRT”, the model is indifferent to the technology used on the line – it only responds to frequency, speed, etc. Thus the technology on the Sheppard line could be changed (for example, to BRT) without substantively altering the ridership forecasts presented in Chapter 4.

[19] See Section 3.5 for further details on this alignment.

based on continuing assessment of the network conditions that would be most likely to exist in these future years. The most notable of these probably is the TTC's identification of the 2031 capacity of the Yonge subway line as being 36,000 passengers per hour, relative to the previously assumed 32,000. The result of these evolving assumptions is that the results presented in this final project report differ somewhat from those presented in the three preliminary project reports released in early 2016. In almost all cases, the differences due these changes in base network assumptions are negligible. The biggest changes are in the estimation of Relief Line impacts on Yonge ridership, as described in Chapter 5.

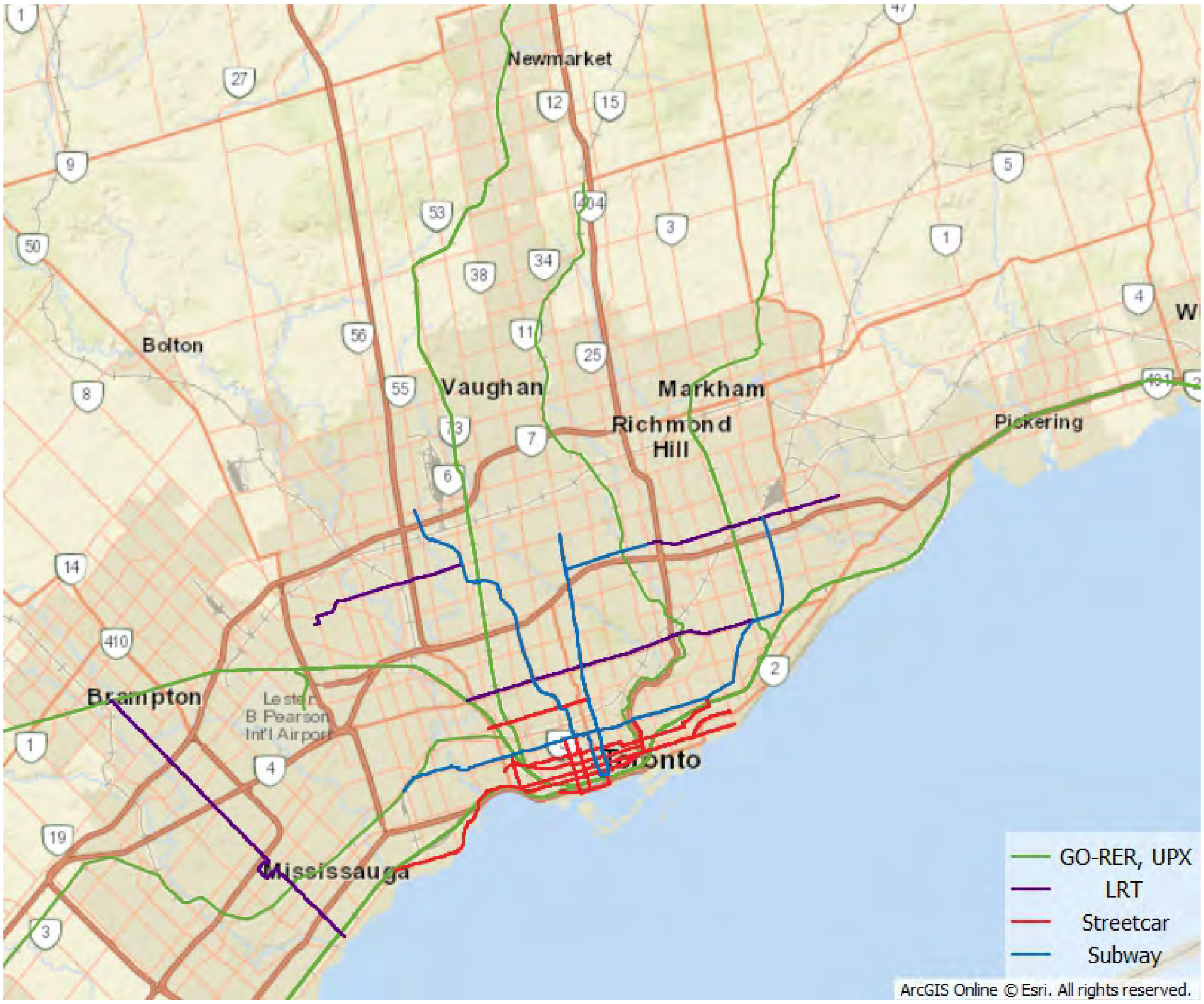

Figure 3.1: Base 2031 GTHA Rail Network

3.3 SMARTTRACK OPTIONS

3.3.1 Defining the SmartTrack Service Concept

At the outset of this study, the definition of the SmartTrack Service Concept was unclear, especially relative to the emerging Metrolinx RER Service Concept as it affected the Kitchener, Stouffville and Lake Shore East rail corridors. Arguably much of this confusion stemmed from two problems:

- The conceptual SmartTrack proposals advanced prior to this study did not address how GO Rail and SmartTrack services might co-exist within these corridors, particularly with respect to the provision of service on the Stouffville line north-east of Unionville and on the Kitchener line north-west of Mt. Dennis. The original SmartTrack concept also was developed prior to the development of the Metrolinx RER Service Concept.
- The Metrolinx RER Service Concept similarly ignores SmartTrack as any sort of independent concept / additional service.

Given these partial views of the problem, defining a suitable Metrolinx RER "base case" and a logical set of "SmartTrack" scenarios to be tested against this base case has been challenging.

This lack of clarity also reflects quite different concepts/visions on the part of Metrolinx and the City of Toronto concerning service in the corridor:

- With respect to the Stouffville-Kitchener corridors at least, the Metrolinx RER Service Concept arguably is that of a "classic" regional commuter rail service in which the primary objective of the service is to move commuters between suburban residential communities and jobs in the downtown during the morning and afternoon peak periods. Station spacing reflects this approach, with a limited number of stations located relatively far apart and largely in suburban regions outside the City of Toronto to permit relatively fast, express or near-express service between the suburbs and the downtown. A premium fare is charged, reflecting the near-express nature of the service. Service on the Stouffville and Kitchener GO Rail lines terminate at Union Station. Passengers boarding the Stouffville line wishing to continue to a station along the Kitchener line must transfer at Union Station (and vice versa).
- The SmartTrack concept is explicitly akin to that of a subway/metro service with more stations more closely spaced (resulting in somewhat slower speeds but greater integration into the local surface transit network and correspondingly higher coverage/access). It is intended to be a high-frequency (15 minute or less headways), two-way, all-day service between Unionville and the Mississauga Airport Corporate Centre (MACC), similar to the existing subway services. The Stouffville-Kitchener combined corridor was explicitly chosen within which to apply this concept since it potentially connects workers not just to jobs in the downtown but also to suburban employment centres in the suburbs at the ends of the SmartTrack Corridor in Unionville and the MACC – thereby building in the potential for significant "reverse flow". A standard TTC fare is to be charged, and no new fares will be required at interchange points with the TTC, to encourage usage and to be comparable to current subway fares. SmartTrack service between Unionville and MACC runs through Union Station as one continuous trip. In other words, a passenger boarding at Unionville does not need to transfer at Union Station – the train continues through Union Station to the MACC.

Given these observations the following definitions were used as a basis for constructing the SmartTrack network options tested as documented in Chapters 4 and 5 of this report.

- The ***SmartTrack*** service consists of all trains that have their terminal locations at Unionville and MACC,[20] running through Union Station. Design variables to be tested include:
    - Frequency (15 minute headways or less).
    - Fare (a TTC flat fare is the default).
    - Number and locations of stations (but the set of stations defined during Mayor Tory's campaign is the default).
- ***GO Commuter Rail*** service also operates in this corridor. These consist of trains that run between Union Station and Lincolnville (or any other station north of Unionville) on the Stouffville line and between Union Station and points north-west of Mt. Dennis on the Kitchener line. This definition represents today's GO Rail services in these corridors and the long-distance, "regional express" component of the Metrolinx RER Service Concept for future scenarios. The current GO fare structure applies to this service and, for the purpose of the current study, future-year frequencies and stations are specified by the Metrolinx RER Service Concept.

Given these definitions the current Metrolinx RER Service Concept for the corridor for 2031 divides into two components:

- The base case full-line GO Trains serving the two corridors (i.e., peak-period, peak-direction headways of 20 minutes Lincolnville-Union and 15-minute headways on the Kitchener line).
- A very basic "SmartTrack" service consisting of:
    - 15-minute peak-period headways.
    - Current GO stations.
    - GO fares.
    - No through movements at Union Station.
    - The western component involves 15-minute service between Union and Bramalea, rather than Union and the MACC.[21]

That is, the 15-minute headway component of the RER Service Concept corresponds to the definition of SmartTrack presented herein (albeit in a very compromised form) and is, theoretically at least, a possible "minimal implementation" of the SmartTrack concept should no upgrades to this minimal design prove to be attractive.

The "base" SmartTrack service concept assumed in Chapter 4 and 5 analyses then consists of various possible extensions to the basic RER concept in terms of:

- Up to the full set of proposed SmartTrack stations.
- Through service at Union Station.
- TTC fares.
- Two-way, all-day service.
- 15-minute (or better) headways.

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[20] Or Mt. Dennis if SmartTrack terminates there, requiring a transfer to an Eglinton Crosstown extension (or some similar service) to travel to MACC. Other "short-turn" runs within the corridor could also presumably exist, although none are currently being considered.

[21] I.e., it follows the City's SmartTrack alignment until Mount Dennis, at which point it continues north-westerly to Brampton, rather than turning west along Eglinton Avenue towards the MACC

- Through service at Mt. Dennis to MACC (as one possible Western alignment option).

Figure 3.2 presents the base combination of RER and SmartTrack services tested in Chapters 4 and 5 of this report. Numerous variations on this concept are tested in terms alternative headways, fares, stations and alignments west and north of Mount Dennis. These are discussed in the next sub-section.

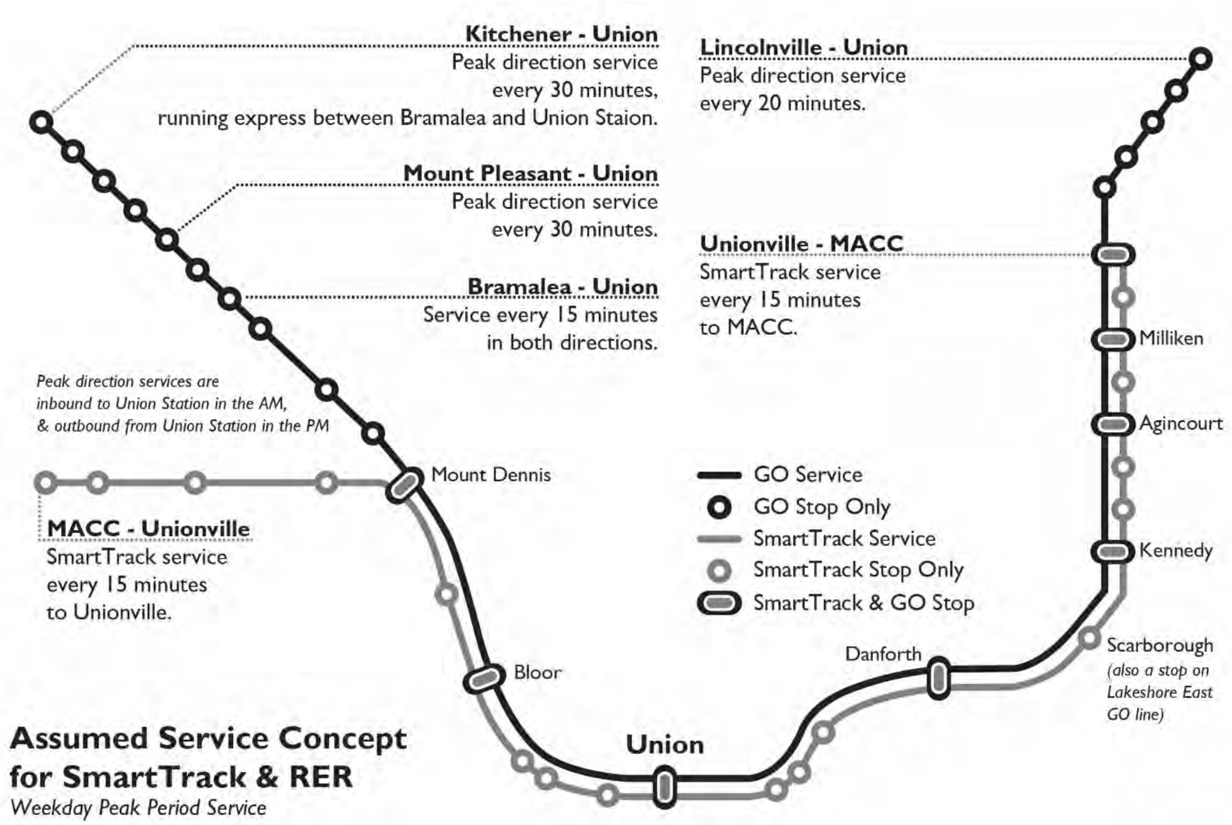

Figure 3.2: Base SmartTrack & RER Service Concepts

The base case against which the City's SmartTrack proposal is compared throughout this study is:

- The Metrolinx base RER service concept which includes the "proto-SmartTrack" 15-minute services between Bramalea and Union Station, and between Unionville and Union Station.

3.3.2 SmartTrack Alignments

The base SmartTrack scenario consists of the full alignment from Unionville in the north-east, running along the Stouffville line, with through service at Union Station[22] continuing along the Kitchener line to the Mississauga Airport Corporate Centre (MACC) in the north-west. At Mount Dennis this base alignment is assumed to leave the existing Kitchener line to continue to the MACC on a new heavy rail alignment along Eglinton Avenue. This base SmartTrack configuration is assumed to have 24 stations. See Figure B.1 in Appendix B.

[22] I.e., trains run through Union Station, connecting the Stouffville and Kitchener lines.

Two alternative alignments west/north of Mount Dennis in the western half of the line are shown in Figures B.2 and B.3 in Appendix B. These are:

- A "Northern Alignment" in which SmartTrack continues north from Mount Dennis along the Kitchener line, eventually turning west and then south, running along the eastern boundary of Pearson Airport and terminating at the MACC.
- An "Eglinton Crosstown Extension" in which the heavy rail portion of SmartTrack terminates at Mount Dennis. The Eglinton Crosstown is extended westwards from its currently planned terminus at Mount Dennis to Pearson Airport via along Eglinton Avenue via the MACC.

Building on the discussion in Section 3.3.1, when SmartTrack is implemented in the Stouffville corridor the 15-minute RER Unionville-Union service is removed. In the Kitchener corridor, the 15-minute RER Brampton-Union service is retained, since the SmartTrack service does not replace the Mount Dennis-Brampton portion of the RER service, which assumes a 15-minute service all the way to Brampton.

Through service at Union is also assumed in all cases considered.

3.3.3 SmartTrack Headways & Fares

All-day headways of 15, 10 and 5 minutes are tested for all SmartTrack configurations. Other headways are, of course, conceivable, but for the purposes of this study this range of headways was deemed appropriate for exploring the ridership potential of SmartTrack across a range of plausible headways.

Both current GO fares and the average current TTC fare are tested. As with headways, many other fare scenarios are conceivable. The City of Toronto and Metrolinx are actively engaged in discussions concerning fare policies, but guidance concerning likely alternative scenarios for use in this study is not currently available. For present purposes the two fare scenarios assumed would appear to provide useful upper and lower bounds on likely fare levels for SmartTrack.

3.3.4 SmartTrack Stations

The base set of SmartTrack stations assumed in all Chapter 4 and 5 tests is the full set of stations as specified in Figures B.1 – B.3 in Appendix B.

As noted above, subsequent to this initial analysis, alternative prototype integrated RER/SmartTrack service concepts have been proposed, which involve, at least in the first phase of SmartTrack implementation, a reduced set of stations relative to the full base SmartTrack case. The prototype integrated service concepts and associate station options is discussed in detail in Chapter 6. Test results for these options are also presented in discussed in Chapter 6.

3.4 RELIEF LINE (RL) OPTIONS

The concept of a "relief line" serving downtown Toronto that would off-load some ridership from the over-crowded Yonge Subway line has been under discussion for decades. Table 3.1 summarizes recent and on-going planning efforts to explore this concept.

Table 3.1: Summary of Recent/Current Relief Line Planning Efforts

2009	**City Council** approves Yonge North Extension EA, contingent on Relief Line and City/TTC commence study to determine need for the Relief Line
2012	**Downtown Rapid Transit Expansion Study** concludes that initial phase of Relief Line and GO Transit improvements would help ease crowding on the transit network
2012	**Relief Line** identified as part of the "Next Wave" of transit projects in the Metrolinx Big Move plan and is identified by Metrolinx as a priority for future transit investment
2014	**Relief Line Project Assessment** launched. City/TTC commence planning for the preferred route alignment and station locations for the Relief Line, to deliver planning approvals in mid-2016. The relationship between SmartTrack and the Relief Line is being reviewed as part of this work.
2015	**Yonge Relief Network Study** recommendations approved by Metrolinx Board. Allows project development for the Yonge North Subway Extension. *Affirms that the Relief Line Project Assessment should continue, to ensure that a project is ready for the future.*

Broadly speaking, three variations of the concept exist:

- A "Little-J" line that runs south from a station on the Bloor-Danforth line east of the Don Valley (Broadview, Pape etc.) and that at some point turns west, likely along either Queen or King, terminating at University Avenue.
- A "Big-J" that extends the "Little-J" line north of Danforth, crossing the Don Valley at some point and running possibly as far north as Sheppard Avenue.
- A "U" that extends the "Little-J" west past University Avenue, turning north again at some point to terminate at a Bloor-Danforth Line subway station. A variation of the "U" could include the "Big-J" extended to Sheppard Avenue.

Chapter 5 presents an initial analysis of several "Little-J" corridors. Six corridors, involving a combination of Danforth terminal stations (Broadview and Pape, east-west corridors (Queen and King) and station options (with and without a station at the Unilever site)) have been tested in this analysis. See Figures B.4 – B.6, inclusive, in Appendix B for maps defining these six corridors. Of these, four have been tested with SmartTrack: the Pape-Queen and Pape-King alignments, with and without a Unilever stop. In addition, Chapter 5 presents a preliminary, first-cut test of possible "Big-J" corridors. All scenarios tested in Chapter 5 assume RL headways of 3 minutes in the AM and PM peaks and 4.5 minutes in the off-peak periods. A standard TTC fare is assumed.

Subsequent to the analysis in Chapter 5, Chapter 6 presents additional analysis of two refined RL alignments in the Queen Corridor prepared by City Planning. This includes analysis of both "Little-J" and "Big-J" alignments. In Chapter 6, all RL scenarios assume headways of 2 minutes in the AM and PM peak periods and 3 minutes in the off-peak periods.

3.5 Scarborough Subway Extension (SSE) Options

While the primary focus of this study is on the proposed SmartTrack service, City Planning wished to take early advantage of the newly available GTAModel V4.0 to generate updated ridership estimates for various proposed alignments of the SSE, with and without SmartTrack being in place. Figures B.8 and B.9 in Appendix B display four multi-stop alignments consider in this analysis. These are:

- An alignment running along Midland Ave.
- An alignment running along Bellamy Ave.
- Two options running along McCowan:
    - "McCowan3" has three stations between the current Bloor-Danforth (BD) terminus at Kennedy station and the Scarborough City Centre (SCC), including the SCC station.
    - "McCowan4" inserts an additional station between the Kennedy and SCC stations.

All four alignments extend one further station north from SCC to terminate at Sheppard Avenue, creating a transfer node at this station with the proposed Sheppard East LRT line.

Two headway assumptions for the SSE are examined:

- SSE headways are the same as for the rest of the Bloor-Danforth line. These headways are shown in Table 3.2.
- Every second eastbound train on the Bloor-Danforth line is "short-turned" at Kennedy station, so that only every second train continues along the SSE. This effective doubles the SSE headway to approximately 4 minutes in the peak periods and approximately 6 minutes off-peak.

Table 3.2: Bloor-Danforth / SSE Headways by Time of Day

Year	Headway (min)			
	AM	MD	PM	EV
2031	2.00	2.83	2.17	3.17
2041	1.83	2.58	1.92	2.92

Subsequent to the initial analysis of these multi-stop alignments, a "single-stop" alignment providing "express" service from Kennedy station to Scarborough City Centre was introduced by City Planning (see Figure B.10, Appendix B). In combination with this express service, City Planning has also proposed using the construction cost savings of the express option (relative to the multi-stop options) to build an extension of the Eglinton Crosstown LRT eastward from Kennedy station, possibly to the University of Toronto Scarborough campus (see Figure B.11, Appendix B). The ridership potential for this proposed express SSE Crosstown East Extension option is briefly explored in Chapter 6 in conjunction with the integrated RER/SmartTrack service concept.

A standard TTC fare is assumed for all SSE alternatives examined.

3.6 YONGE SUBWAY EXTENSION (YSE) OPTIONS

The approved alignment for the Yonge Subway Extension (YSE) is shown in Figure B.7 in Appendix B. The YSE is included in this analysis in order to see the effect of both SmartTrack and the Relief Line on Yonge Subway ridership for the case in which the YSE has been built.

In this analysis it is assumed that the YSE operates with the headways shown in Table 3.3, with riders paying a standard TTC fare.

Table 3.3: YSE Headways by Time of Day

Year	Section	Headway (min)			
		AM	MD	PM	EV
2031	Vaughan - Glencairn	3.66	2.75	1.92	2.67
	Glencairn - Richmond Hill	1.83	2.75	1.92	2.67
2041	Vaughan - Glencairn	3.66	2.75	1.92	2.67
	Glencairn - Richmond Hill	1.83	2.75	1.92	2.67

3.7 BASE FUTURE YEAR FORECASTS

All transit infrastructure investment options tested in this study are compared against the base future year forecasts for the base networks for 2031 and 2041 described in Section 3.2. This allows the benefits of the proposed transit investments being investigated (ridership increases, travel time savings, greenhouse gas reductions, etc.) to be directly computed relative to the base, "do nothing" alternative. Tables 3.4 and 3.5 presents summary statistics for these two base forecast years. As shown, in these tables, the GTHA is projected to have a total population of just over 9 million people in 2031 and by another million people to over 10 million in 2041, compared to approximately 6.6 million people in 2016. It is projected to have 4.0 million jobs in 2031; 4.4 million in 2041. 3.45 and 3.76 million trips are projected to occur during the morning peak period in 2031 and 2041, respectively, while the corresponding daily weekday totals in the two forecast years are 15.58 and 17.27 million respectively. In the base case (i.e., without major new investments in transit), these trips will generate over 156 million kilometres of travel daily on the regions' roads and over 42 million kilograms of greenhouse gases in 2031, with these numbers rising to 175 million kilometres and 47 million $kgCO_2e$ in 2041. 65.2% of AM peak period and 72.7% of total daily trips are projected to be made by auto (as a driver or passenger) in 2031, with these mode shares remaining effectively unchanged in 2041. In comparison, transit is projected to attract 21.2% of AM peak period trips and 16.4% of total daily trips in 2031, with these shares again being unchanged in 2041.

Table 3.4: 2031 Base Forecast Summary Statistics

Scenario	AM Peak Period	24 Hour*
Total Trips	3,450,000	15,578,000
Average Transfers	1.84	1.71
Mode Split		
Auto	50.7%	55.4%
Carpool	2.9%	5.4%
Walk Access Transit	18.1%	14.8%
Walk	8.3%	6.6%
Bicycle	0.9%	2.1%
School bus	4.4%	2.1%
Drive Access Transit	3.1%	1.6%
Passenger	11.1%	7.5%
Rideshare	0.5%	4.4%
VKTs	45,895,000 KM	156,416,000 KM
GHG	12,405,000 $kgCO_2e$	42,279,000 $kgCO_2e$
Employment	4,014,000	
Population	9,024,000	

*does not include overnight time period

Table 3.5: 2041 Base Forecast Summary Statistics

Scenario	AM Peak Period	24 Hour*
Total Trips	3,761,000	17,269,000
Average Transfers	1.86	1.73
Mode Split		
Auto	50.1%	55.1%
Carpool	3.0%	5.7%
Walk Access Transit	18.0%	14.6%
Walk	8.4%	6.8%
Bicycle	1.0%	2.2%
School bus	5.2%	2.5%
Drive Access Transit	3.2%	1.6%
Passenger	10.8%	7.2%
Rideshare	0.5%	4.3%
VKTs	47,382,000 KM	175,292,600 KM
GHG	13,640,000 $kgCO_2e$	47,381,600 $kgCO_2e$
Employment	4,416,000	
Population	10,134,750	

*does not include overnight time period

Chapter 4: SMARTRACK RIDERSHIP RESULTS

4.1 INTRODUCTION

This chapter presents the detailed results for the ridership analysis undertaken in this study of the SmartTrack options described in Chapter 3 using GTAModel V4.0. This travel demand model system generates a very detailed description of travel within the GTHA. Section 4.2 describes the set of ridership and system performance measures extracted from the model system runs for the purposes of this study. Using these performance measures, a detailed exploration of SmartTrack ridership is presented in Section 4.3.

4.2 PERFORMANCE MEASURES

The primary question addressed in this study is the ridership potential of various proposed rail transit lines within the City of Toronto using GTAModel V4.0. The model system generates, among many other outputs, ridership for every transit line in the GTHA, by time period. Thus the predicted daily (and peak period) ridership on SmartTrack or any other transit line can be estimated. In addition, other key outputs include, by time period:

- Peak load points and volumes on any transit line.
- Boardings and alightings by transit station.
- Transit line-to-line transfers.
- Origin-destination travel times by mode.
- Origin-destination trips by mode, including trips using a given transit line. These define the "catchment area" for a given transit line.
- Total system-wide transit riders.
- Roadway and transit line congestion levels.
- Auto vehicle-kilometres travelled (VKT) and associated greenhouse gas (GHG) emissions.

Differences between a given scenario and its base case can be computed for each scenario to generate estimates of:

- Net new transit riders attracted to the system.
- Travel time savings for both transit and auto users.
- Decreases in auto VKT and GHG emissions.
- "Relief" for the Yonge Subway in terms of reduced loads on the line around the Bloor-Yonge peak load point.
- Changes in transit line catchment areas.

Debate about specific transit lines typically focuses on line ridership with little understanding of or consideration for:

- The overall "market potential" for the line in terms of the origin-destination pattern of total trips that might potentially use the line. In this study this is explored by plotting maps showing the spatial patterns of transit line riders' trip origins and destinations.

- The role that the individual transit line plays within the overall transit network. In this study this is explored by examining:
    - Changes in ridership in connecting and parallel transit lines.
    - Transfers at key interchange points.

4.3 SMARTTRACK RIDERSHIP ANALYSIS

4.3.1 Introduction

Ridership forecasts have been generated for a wide combination of SmartTrack scenarios concerning fares, frequencies, etc. Specifically, in this chapter ridership results for the following options are presented and compared to the without-SmartTrack base case:

- Alternative SmartTrack service headways (15, 10 and 5 minutes).
- Alternative SmartTrack fares (TTC; GO).
- Alternative "western alignments" of SmartTrack beyond Mount Dennis.
- Alternative population and employment scenarios. Five population/employment scenarios have been tested, as summarized in Appendix A.

In these tests, the full set of 24 SmartTrack stations is assumed. In Chapter 6 results for alternative combinations of SmartTrack stations and service frequencies are presented within the context of recently identified prototype integrated RER/SmartTrack service concepts.

Section 4.3.2 presents aggregate ridership summaries for these options for the 2031 forecast year. The comparable 2041 results are presented in Appendix C. In general, the 2041 results display the same patterns as for 2031, but at higher levels of trip-making given the growth in population and employment between the two forecast years. Sections 4.3.3 through 4.3.10 then delve deeper into the 2031 results to paint a more complete picture of SmartTrack usage and how it varies with design assumptions.

As noted in Chapter 3, at various points during the course of this study City Planning and the TTC revised their assumptions concerning various aspects of these future year base networks, based on continuing assessment of the network conditions that would be most likely to exist in these future years. The result of these evolving assumptions is that the results presented in this final project report differ somewhat from those presented in the three preliminary project reports released in early 2016. In all cases with respect to SmartTrack ridership estimates the changes are small and the conclusions that might be derived therefrom remain unchanged.

4.3.2 Summary of All-Day 2031 Ridership Forecasts, Various SmartTrack Options

Table 4.1 presents 2031 total daily SmartTrack ridership for the six headway – fare combinations investigated. Clearly, ridership is quite sensitive to both fares and headway. With respect to fares, the TTC fare is (not surprisingly) far more effective in attracting riders than the more expensive GO fare. As a result, the TTC fare is assumed as the base fare system in all other scenarios investigated.

With respect to headway, it is clear in all the scenarios investigated that moving below 15-minute headways to 10- or 5-minute headways (or other, intermediate values) has a very significant impact on usage. There appears to be a very significant latent demand for transit service in the corridor that manifests itself once the transit service becomes sufficiently attractive.

Table 4.1: 2031 SmartTrack All-Day Transit Ridership by Headway & Fare *

SmartTrack Headway	2031 TTC Fare Scenario	2031 GO Fare Scenario
15 min	74,000	34,400
10 min	151,700	57,100
5 min	307,900	102,400

* Assumes Low population/Medium employment with SmartTrack influence land use; Base SmartTrack alignment.

Table 4.2 displays projected net new daily transit riders for the same combinations of headway and fare as in the previous table and shows the same pattern of impact. Note that moving to shorter headways has a significant impact on net new ridership.

Table 4.2: 2031 All-Day Net New System Ridership by SmartTrack Headway & Fare*

SmartTrack Headway	2031 TTC Fare Scenario	2031 GO Fare Scenario
	Compared to RER Base Case	Compared to RER Base Case
15 min	22,000	14,500
10 min	32,900	17,200
5 min	52,400	20,800

* Assumes Low population/Medium employment with SmartTrack influence land use; Base SmartTrack alignment.

Table 4.3 compares the 2031 total daily SmartTrack ridership and net new system ridership for the base SmartTrack system for the five population/employment scenarios defined in Appendix A for the 15-minute, 10-minute and 5-minute headway cases. While the forecasts do vary across the land use scenarios, the changes are relatively modest relative to the overall magnitude of projected SmartTrack ridership. This is arguably a good result for present purposes in that it indicates that the forecasts are relatively robust across the currently assumed land use scenarios, which are known to have a fair amount of uncertainty associated with them

Table 4.3: 2031 All-Day SmartTrack Boardings and Net New System Ridership by Land Use Scenario & SmartTrack Headway*

Land Use Scenario	SmartTrack Headway	All Day Boardings on SmartTrack	New Net System Riders**
Low Pop / Low Emp	*15*	59,100	9,200
	10	124,000	17,700
	5	266,100	33,700
Low Pop / Med Emp without ST Influence	*15*	61,800	8,900
	10	129,400	17,400
	5	276,600	33,500
Low Pop / Med Emp with ST Influence	*15*	74,000	22,000
	10	151,700	32,900
	5	307,900	52,400
High Pop / High Emp	*15*	75,500	*** No Base Exists
	10	154,200	*** No Base Exists
	5	314,000	*** No Base Exists
Additional Regional Growth	*15*	76,700	*** No Base Exists
	10	156,300	*** No Base Exists
	5	314,300	*** No Base Exists

* Assumes Low population/Medium employment with SmartTrack influence land use; Assumes TTC fare on SmartTrack.
** Compared to the RER Base Case.
*** No base case exists for this scenario since it assumes a higher total GTHA employment level than would exist in the non-SmartTrack case.

4.3.3 Through Flow at Union Station

A major difference between the SmartTrack and RER service concepts is that SmartTrack trains are proposed to continue through Union Station rather than terminate there, thereby providing continuous, through service between the eastern and western portions of the line.

Figure 4.1 provides information on the estimated 2031 AM peak-hour flows into and through Union Station for the base alignment for the 15- and 5-minute headway cases, indicating that significant “cross traffic” between the west and east through Union exists.

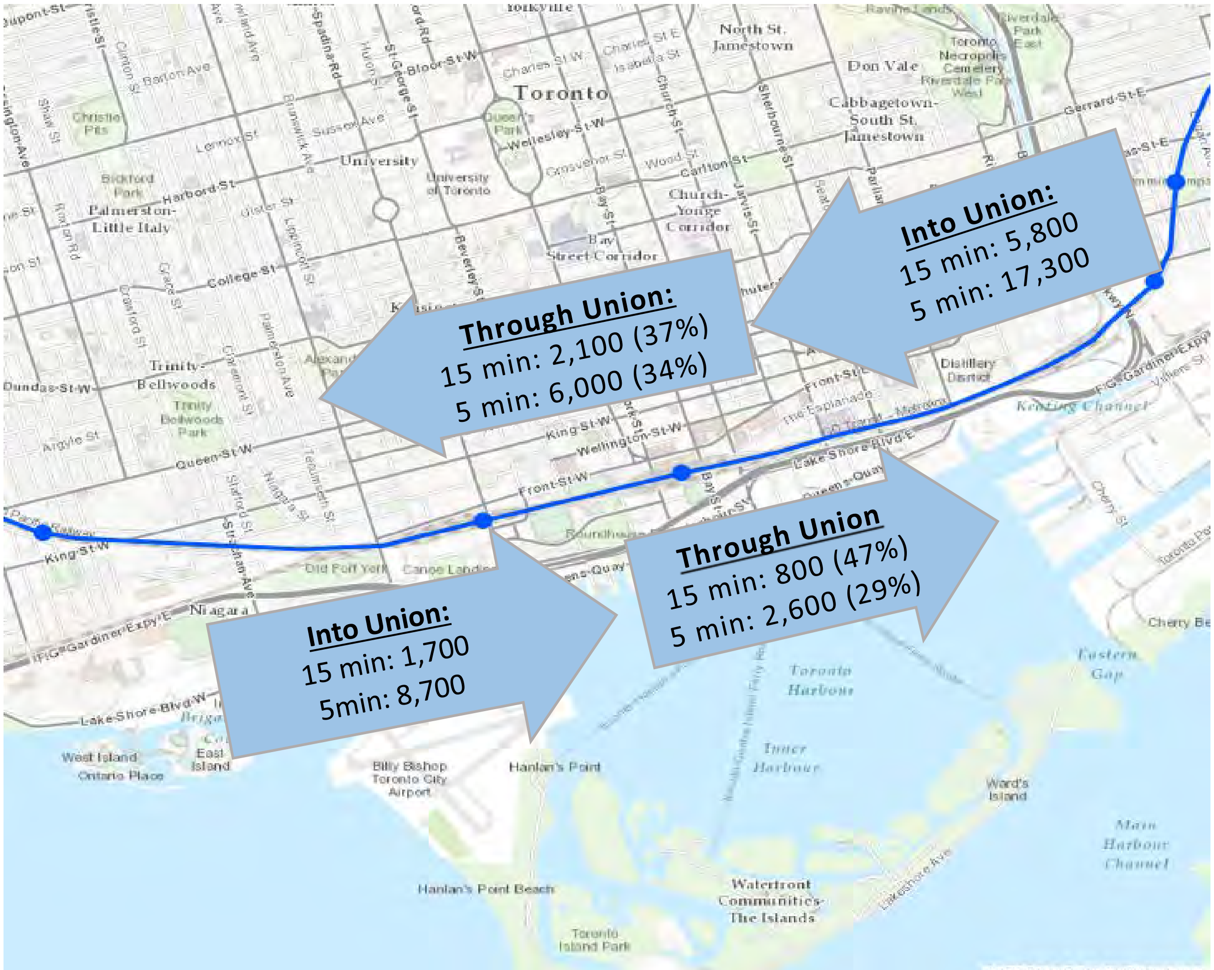

Figure 4.1: 2031 AM-Peak-Hour SmartTrack Flows through Union Station*

* Assume Low population/ Medium employment with SmartTrack Influence; TTC Fare; Heavy Rail Western Alignment.

4.3.4 Comparison of Western Alignment Options

The previous sections presented results for the base SmartTrack alignment which assumes that SmartTrack runs along a new right-of-way along Eglinton Avenue between Mount Dennis and MACC (Figure B.1, Appendix B), thereby providing “continuous” (transfer-free) travel between this corridor segment and the rest of the SmartTrack service corridor (most notably downtown Toronto).

As discussed in Chapter 3, two other alignments were considered in this study for the western portion of the service beyond Mount Dennis. One is a “Northern Alignment” which continues along the Kitchener line past Mount Dennis and then loops past Pearson Airport, terminating at the MACC. The other option is to terminate the SmartTrack service at Mount Dennis and to extend the Eglinton Crosstown LRT service along Eglinton to MACC. Note that this option would require trip-makers travelling to/from locations along the Eglinton corridor between Mount Dennis and MACC to transfer at Mount Dennis between the SmartTrack line and the Eglinton Crosstown if they are travelling to/from the Toronto downtown (or points further east).

Of course, it also eliminates a transfer for people travelling through Mount Dennis along the Eglinton corridor (e.g., from MACC to the Yonge-Eglinton area).[23]

Table 4.4 summarizes the differences in 2031 SmartTrack corridor riders and net new system ridership for the three proposed western alignments. The Northern Alignment option assumes 6 stations beyond Mount Dennis and the same headway on this section as for the rest of the SmartTrack Line. The Eglinton Crosstown extension consists of 17 stations beyond Mount Dennis and 2031 headways of 2.40 and 2.89 minutes in the AM and PM peaks, respectively, and 4.27 minutes in the off-peak periods. The "base" continuous SmartTrack service along Eglinton has 4 stations west of Mount Dennis.

Table 4.4: 2031 Forecast Summary, Alternative SmartTrack Western Alignments*

Western Alignment	SmartTrack Headway	All Day Ridership on SmartTrack	Net New System Riders
Continuous On Eglinton	*15*	74,000	22,000
	10	151,700	32,900
	5	307,900	52,400
Northern Alignment	*15*	76,300	22,100
	10	156,700	34,300
	5	314,400	55,500
*Eglinton Crosstown Phase 2***	*15*	119,800	26,300
	10	180,800	35,300
	5	312,700	52,400

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack.
** The Eglinton Crosstown Phase 2 includes riders using the Crosstown portion between Mount Dennis and MACC, so as to be comparable to the "Continuous on Eglinton" case.

As in other cases examined, the ridership results vary significantly with the assumed SmartTrack headway:

- With a 5-minute all three alignments generate similar total boardings and net new riders.
- As SmartTrack headways lengthen, The Eglinton Crosstown Phase 2 generates more daily boardings than the other two alignments. This likely results from the assumption that the Phase 2 segment of the Eglinton Crosstown will operate at the same frequency as the main Crosstown service. This is a much higher frequency than the 10- or 15-minute headway assumptions for the two heavy-rail alignments.

[23] Note that a variant on terminating SmartTrack at Mount Dennis would be to continue SmartTrack operations beyond Mount Dennis along the Kitchener line, perhaps at least as far as Bramalea. This service could replace the 15-miunte RER Union-Brampton service currently included in the base network (analogous to the treatment in this study of the Union-Unionville segment). This option has not been investigated in this study but would appear worthy of investigation.

- While the numbers are similar across the alternatives, the Eglinton Crosstown Phase 2 options consistently generates slightly more net new daily riders than the other two alignments.

Based largely on the findings of the HDR study of the engineering and cost implications of these alternative alignments, the City of Toronto identified the Eglinton Crosstown Phase 2 western extension as the preferred alignment beyond Mt. Dennis. Given this, subsequent analysis presented in this report takes this as the base case alignment unless stated otherwise.

4.3.5 Yonge Subway Relief

A major consideration in any addition of transit serves into the Toronto downtown is the extent to which the addition helps reduce AM peak period southbound loading on the Yonge line south of Bloor Station.[24] This peak load point is at or near capacity now, and future growth in the TTC system is tied in many cases to the ability to manage ridership levels at this point in the system. Planned signal improvements and other measures for the Yonge line will increase the line’s capacity somewhat, but the growth potential for this line remains limited, requiring other transit improvements to carry a greater proportion of trips into and out of the downtown in future years.

This peak loading on the Yonge line comes from two sources:[25]

- Heavy volumes of riders coming southbound from stations north of Bloor that continue to destination stations south of Bloor.
- Heavy transfers from the westbound Bloor-Danforth line (Line 2) to the southbound Yonge line (Line 1) at Bloor Station.

SmartTrack addresses both of these factors. To the extent that it provides an attractive direct route into the Toronto downtown for Scarborough and Markham residents it may attract them away from paths that involve using the Yonge line north of Bloor, on the one hand, or taking the Bloor-Danforth line to transfer to the Yonge line at Bloor Station on the other.

Table 4.5 presents the net impact of SmartTrack on the number of 2031 morning peak-hour riders on the Yonge line southbound from Bloor Station for various SmartTrack headway scenarios compared to the base, no-SmartTrack case. As can be seen, SmartTrack does, indeed, provide relief for the Yonge line, especially when operated at higher service frequencies.

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[24] This morning peak flow is taken as a surrogate for the overall loading on the Yonge line. Obviously, in the afternoon peak period the peak load point is the northbound flow near Bloor Station.

[25] Again, we are using the morning peak period case to illustrate the problem.

Table 4.5: 2031 AM-Peak Hour Yonge Line Riders, South of Bloor by SmartTrack Headway*

SmartTrack Headway	Riders	Change (Absolute)	Change (%)
Base Network without SmartTrack	40,000		
15 min	38,800	-1,200	-3%
10 min	37,400	-2,600	-7%
5 min	33,800	-6,200	-16%

* Assumes Low population/Medium employment with SmartTrack influence land use (except in base); TTC fare on SmartTrack.

Table 4.6 further explores this issues by showing changes in the morning peak westbound-to-southbound transfers at Bloor Station for various SmartTrack options, which range up to a 35% reduction for the 5-minute headway case.

Table 4.6: 2031 AM Peak Hour Westbound Bloor to Southbound Yonge Transfers*

SmartTrack Headway	Transfers	Change (Absolute)	Change (%)
Base Network without SmartTrack	10,200		
15 min	9,600	-600	-6%
10 min	8,800	-1,400	-14%
5 min	6,700	-3,500	-35%

* Assumes Low population/Medium employment with SmartTrack influence land use (except in base); TTC fare on SmartTrack.

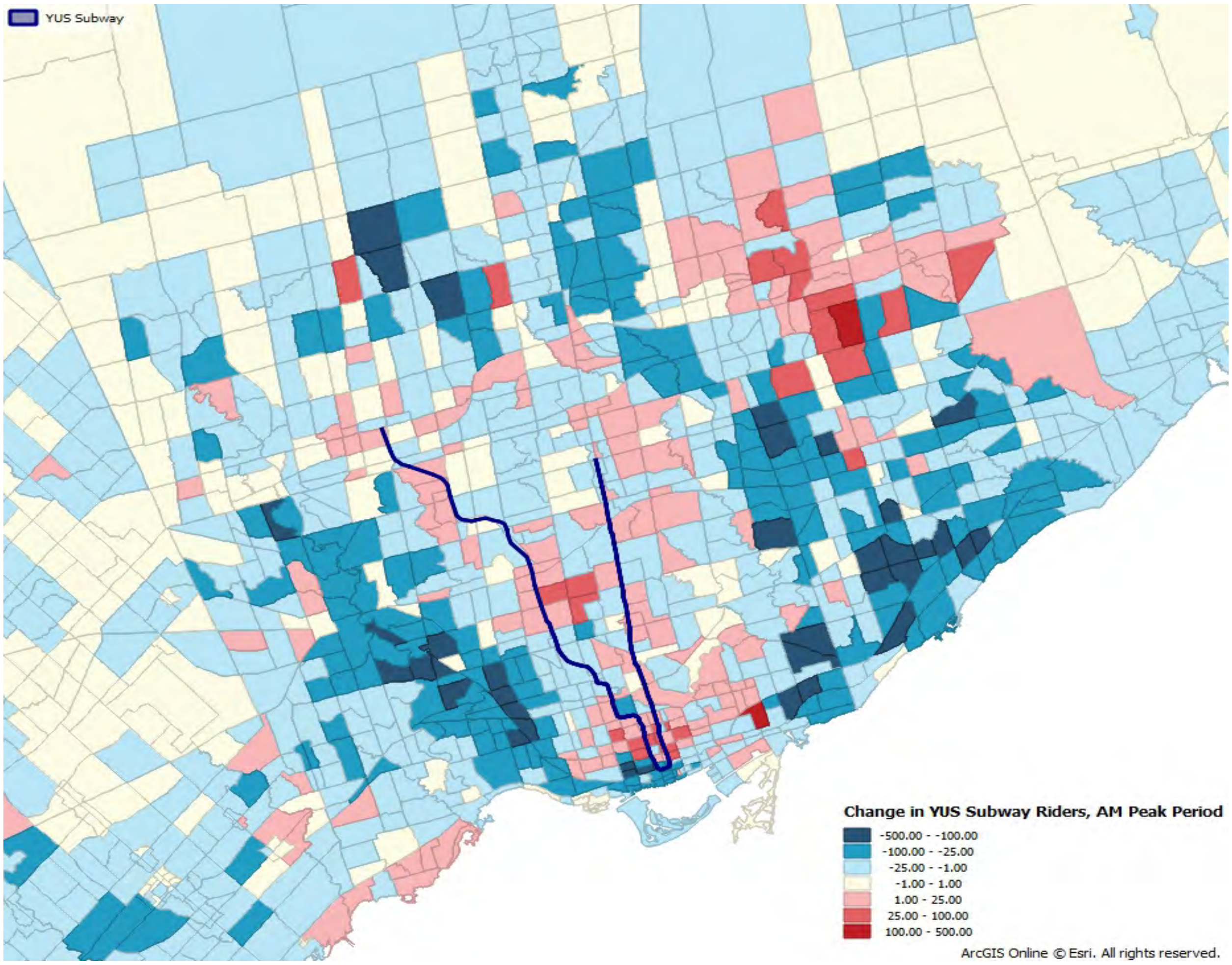


Figure 4.2: Change in AM Peak Period Trips Origins, YUS Subway Riders*

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack. Comparison is between 2031 SmartTrack (Continuous on Eglinton) and 2031 Base.

The impact on Yonge-University-Spadina (YUS) ridership, however, is far greater than these net changes in ridership numbers indicate. SmartTrack has the potential to divert large numbers of current YUS riders onto SmartTrack, thereby freeing up capacity for new users of the Yonge line. Figure 4.2 illustrates this by showing traffic zones which have reductions (shaded blue) and increases (shaded red) in YUS ridership after the introduction of a 5-minute SmartTrack service. This figure very clearly shows SmartTrack diverting former YUS riders within its service corridor. This frees up capacity on YUS for increased ridership within its more immediate service corridor. Thus, riders in both the SmartTrack and YUS corridors benefit from the introduction of SmartTrack. In total 25,000 fewer riders use YUS from the blue-shaded zones in the morning peak period, while over 2,500 more riders use YUS from the red-shaded zones with the introduction of the 5-minute SmartTrack service. It is interesting to note that most of the additional YUS trips indicated in the Markham area are actually trips that take SmartTrack to Union station and then travel northbound on YUS from Union to their final destination in the downtown.

4.3.6 SmartTrack Market Area

Figure 4.3 shows the distribution of AM peak period origins of SmartTrack riders for the 2031, 5-minute headway case. Figure 4.4 similarly displays the distribution of AM peak period destinations for the same case. Figure 4.5 puts these two maps together to show the set of traffic zones that are either trip origins or destinations (or both) for SmartTrack trips daily in 2031, using a threshold of at least 200 trips ends (origins plus destinations). This map defines the SmartTrack *catchment area*, i.e., the physical area which is served by SmartTrack as a competitive alternative to both other transit paths and other modes of travel.

Collectively, Figures 4.3 – 4.5 indicate the very significant impact that SmartTrack could have on transit usage. Its catchment/market area is very large, encompassing much of the City of Toronto and extending into significant adjacent portions of the GTHA. For comparison purposes, the 2031 all-day catchment areas for the Yonge-University-Spadina (YUS) and Eglinton Crosstown lines for the base, no-SmartTrack case are shown in Figures 4.6 and 4.7 respectively. Table 4.7 provides summary statistics for these three major lines, from which it may be seen that SmartTrack is projected to have a much bigger "footprint" than the base Eglinton Crosstown line and serve a market area that is 63.5% of the population of the YUS market area population and 77.9% of the YUS market area total trips (for the Crosstown Phase 2 western alignment case).

Finally, in discussing a major transit line's catchment area, it is important to understand that this catchment area is not simply defined by the riders who walk into one of the line's stations. A majority of the line's riders get to/from the line via other transit lines or auto access. In the 2031 AM peak period, case for example, in total 66% of trips using SmartTrack access it by transit and a further 6% by auto.

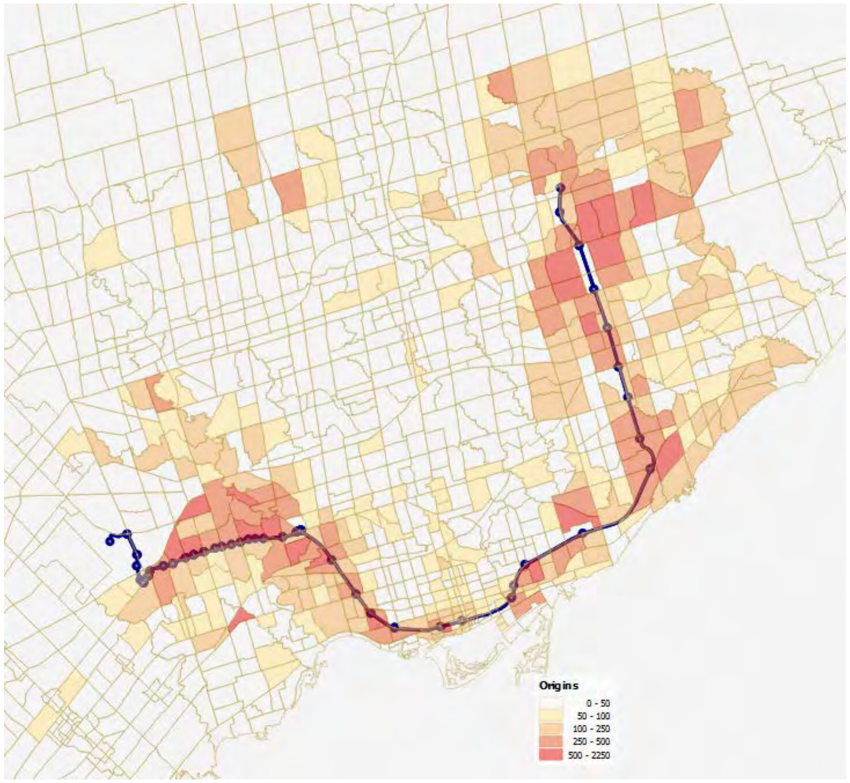


Figure 4.3: AM Peak Period 2031 Trip Origins, SmartTrack Riders*

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway Eglinton Crosstown Phase 2 western alignment

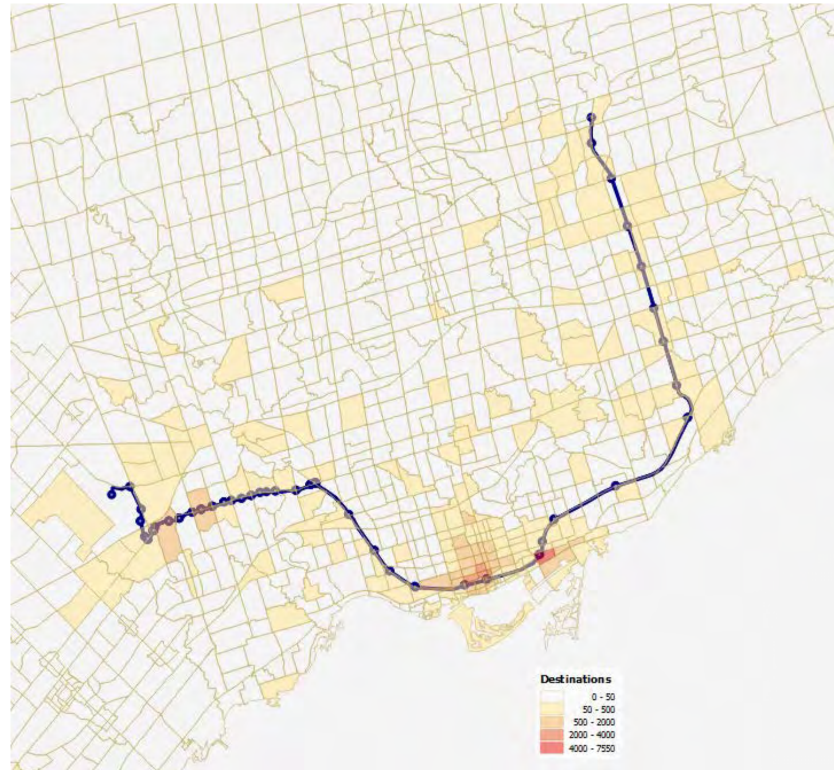


Figure 4.4: AM Peak Period 2031 Trip Destinations, SmartTrack Riders*

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway Eglinton Crosstown Phase 2 western alignment.

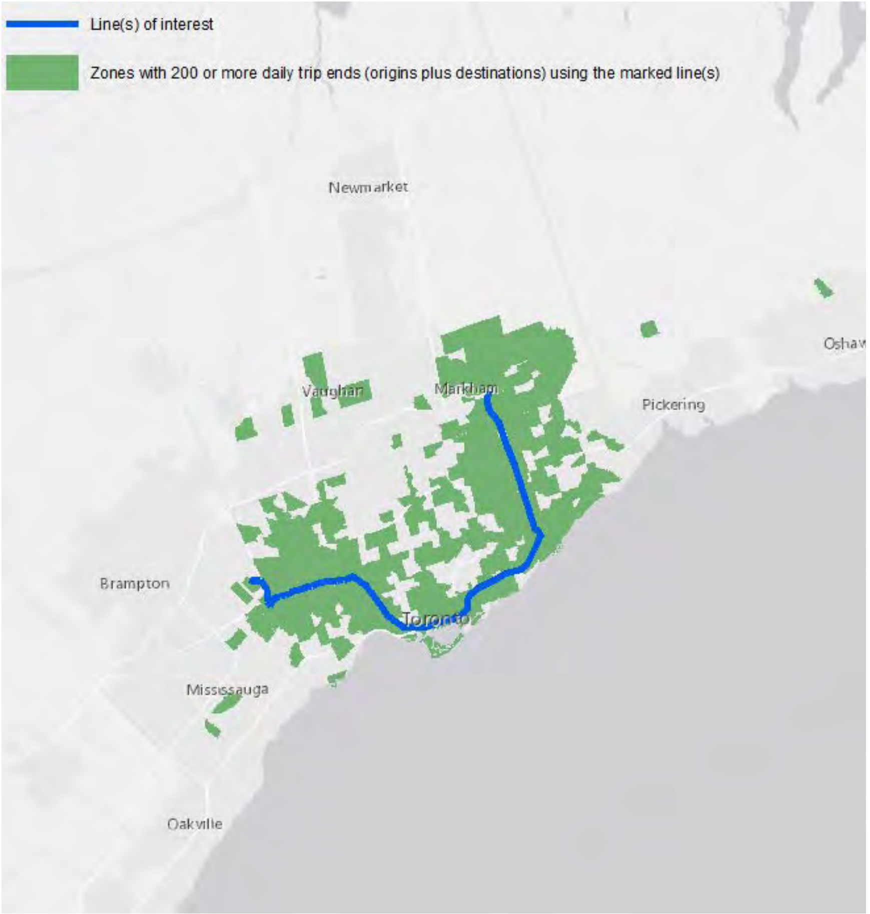


Figure 4.5: 24-Hour 2031 SmartTrack Catchment Area*

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway Eglinton Crosstown Phase 2 western alignment.

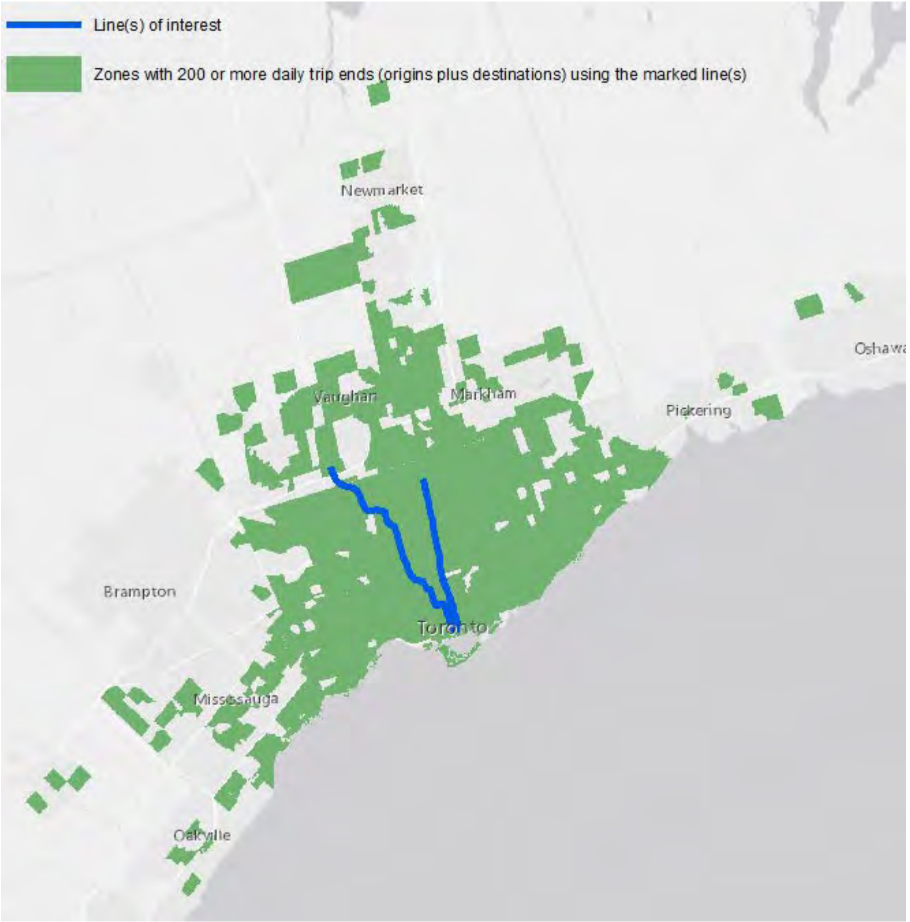


Figure 4.6: 24-Hour 2031 Yonge-University-Spadina (YUS) Catchment Area*

* No SmartTrack; Low population/Medium employment land use.

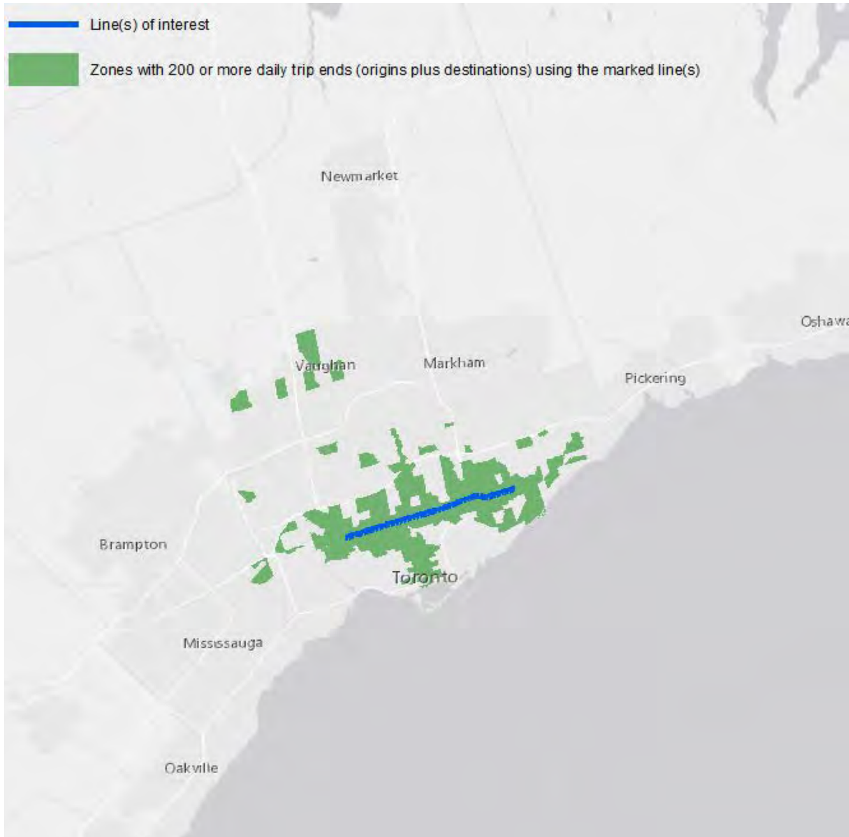


Figure 4.7: 24-Hour 2031 Eglinton Crosstown Catchment Area*
* No SmartTrack; Low population/Medium employment land use; Mount-Dennis – Kennedy base alignment.

Table 4.7: 2031 Catchment Area Summary Statistics, Selected Rail Transit Lines

Run	Land Use	Catchment	Population	Area (Ha)	Total Trips	Total Transit Trips	Total Trips on Line(s)*
2031 5 minute SmartTrack with Crosstown Phase 2	Low Pop, Medium Emp	SmartTrack and Crosstown Phase 2	2,962,400	55,000	7,378,200	2,120,400	315,300
2031 5 minute SmartTrack with Crosstown Phase 2	Low Pop, Medium Emp	SmartTrack only	2,433,300	41,600	6,226,300	1,958,900	254,100
2031 Base	Low Pop, Medium Emp	Eglinton Crosstown	1,321,000	18,800	4,437,700	1,672,300	123,000
2031 Base	Low Pop, Medium Emp	Yonge-University-Spadina Line	4,662,400	97,000	9,465,600	2,304,300	982,200

*From or to catchment zone(s)

4.3.7 SmartTrack Travel Time Savings

A standard, major measure of the benefit of any transportation infrastructure investment is the travel time savings that it induces for trip-makers. A successful transit line should result in travel time savings for both transit riders and auto users, since some former auto users shift to transit, thereby reducing congestion and delay at least somewhat within the road system.[26]

By comparing O-D travel times for various SmartTrack options relative to the base case travel times, travel time savings can be computed. Figure 4.8, for example, displays the without- and with-SmartTrack 2031 morning peak period O-D travel time frequency distributions, while Figure 4.9 plots the frequency distribution of travel time savings for this SmartTrack scenario. These distributions are constructed by weighting the travel time frequencies by the number of trips being made by the given mode within the given travel time bin. SmartTrack clearly generates travel time savings for large numbers of transit riders. It also results in small increases in travel times for some riders, principally due to increased congestion of some local transit lines feeding SmartTrack, as well as for some long-distance GO Rail riders who experience slightly slower travel times in SmartTrack corridors

The travel times shown in Figures 4.8 and 4.9 are based on the "perceived" average travel times as computed within the Emme network model. In deciding to use transit rather than another mode, as well as in choosing one path through the transit system relative to another, trip-makers value or weight different components of their travel times differently. Specifically, they consistently find "out-of-vehicle" travel time components – walking to/from transit, waiting and transferring – more onerous on a per-minute basis that the "in-vehicle" travel time spent. This differential weighting of transit travel time components is accounted for in GTAModel V4.0 in its calculations of travellers' mode and route choices.

[26] Auto time savings due to a transit improvement are often not as large as one might naively expect, since as drivers are attracted off the road and onto transit, this frees up road space, thereby generating a "rebound" effect, in which some trip-makers are attracted back to driving. An equilibrium always exists between auto and transit usage, given the relative travel times and costs on the two modes.

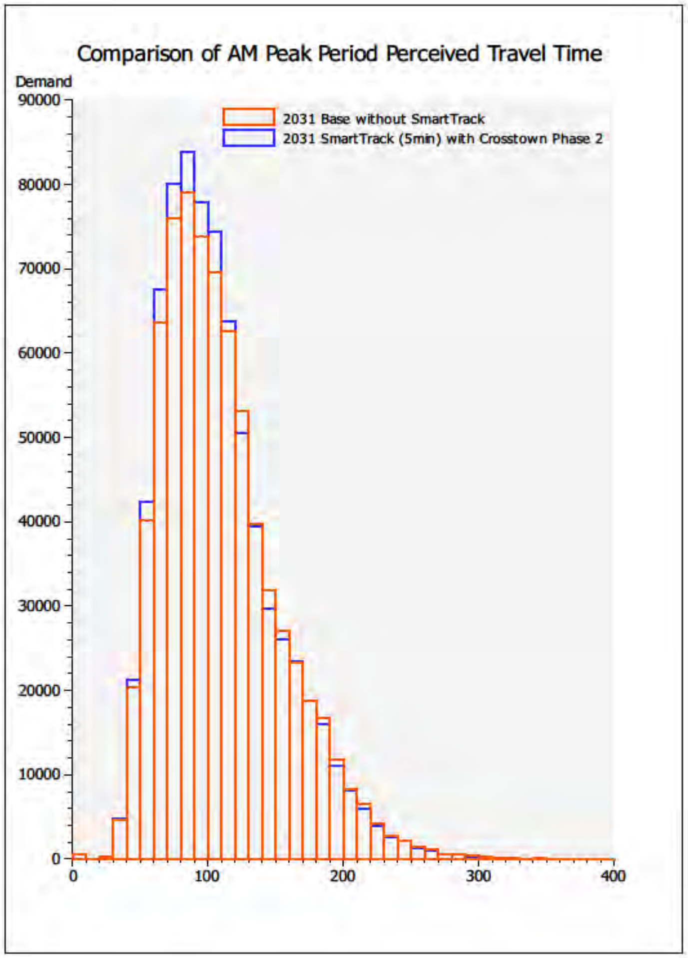


Figure 4.8: 2031 Morning Peak-Period Transit Travel Time Distributions, with & without SmartTrack*

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; 5-minute headway; Eglinton Crosstown Phase 2 western alignment

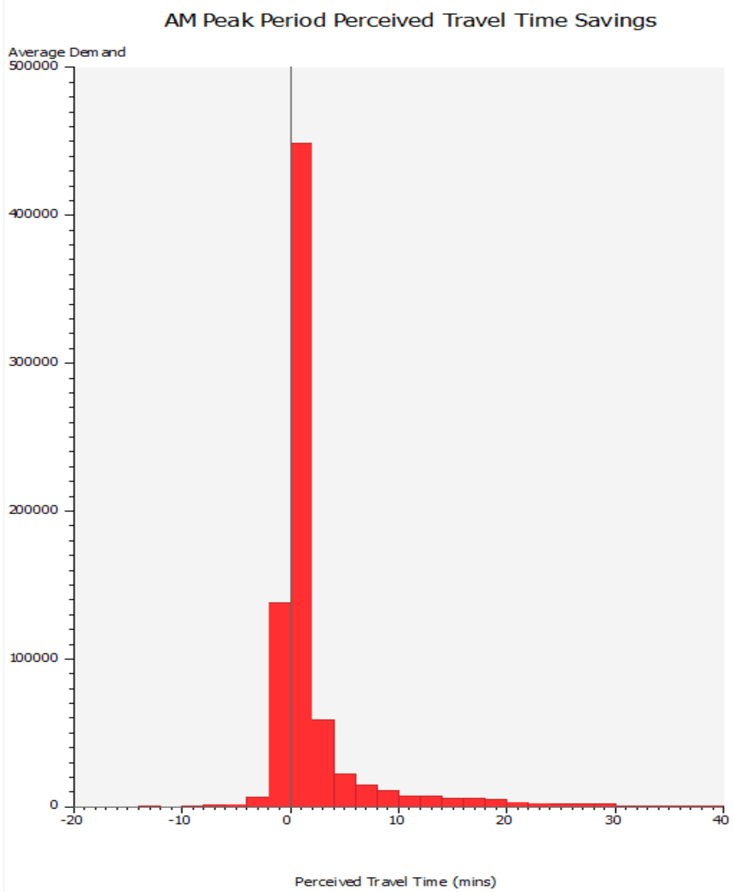


Figure 4.9: 2031 Morning Peak-Period Transit Travel Time Savings with SmartTrack*

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; 5-minute headway; Eglinton Crosstown Phase 2 western alignment

Table 4.8 summarizes 2031 total daily hours saved by both transit and auto users for a variety of SmartTrack headways. "Transit time savings" are based on the perceived travel times experienced by transit users. "Transit fare savings" are the user fare savings derived from the SmartTrack policy of charging TTC fares on the line, expressed in equivalent minutes of travel time. "Auto time savings" are the savings in auto travel times resulting from somewhat less congested roads due to diversion of former auto trip-makers to transit due to implementation of the SmartTrack service. These are, as expected, less than the transit time savings since, despite the significant impact of SmartTrack, major congestion still remains on the future year road networks. In general, these transit and auto travel time savings are a very significant user and economic benefit, and are large compared to any of the other projects examined in this study.

Table 4.8: Transit & Auto Daily Travel Time Savings by SmartTrack Scenario

SmartTrack Headway	Transit Time Savings	Transit Fare Savings	Auto Time Savings
	Total Hours Saved per Day	Total Hours (Equivalent) Saved per Day	Total Hours Saved per Day
15 min	11,300	9,300	3,200
10 min	29,400	10,600	4,500
5 min	55,900	12,200	8,300

* Assumes Low population/Medium employment with SmartTrack influence land use
* Assumes TTC fare on SmartTrack.
* 5-minute headway; Eglinton Crosstown Phase 2 western alignment

In order to further understand travel time savings, it is common in the evaluation of alternative transportation investments to convert travel time savings into dollar terms through the assumption of a "value of time" (VoT) that expresses how much a trip-maker is willing to pay to save a minute or an hour of travel time. In its economic evaluations Metrolinx assumes a VoT of $16/hour. Based on this VoT, Table 4.9 can be readily constructed from Table 4.8 to provide an estimate of SmartTrack daily travel time saving benefits expressed in dollar terms. If one further assumes that, accounting for holidays and weekends, that there are approximately 310 "equivalent weekdays" within a year, these daily travel time savings can be expanded to yearly totals, as is also shown in the table.[27]

[27] 310 days is the factor that the TTC uses to factor daily trips up to annual trips. Loosely speaking, this can be interpreted as assuming 250 "normal weekdays" (50 weeks x 5 days/week) and that the remaining weekend, holiday and vacation days each represent approximately half of a normal weekday in terms of transit ridership generated. Different assumptions, of course, can be made, but this one is a reasonable one for present purposes and is consistent with standard practice.

Table 4.9: Summary of 2031 Travel Time Savings, Transit Expressed in Monetary Terms, Daily & Annual*

SmartTrack Headway	Transit Time Savings		Transit Fare Savings		Auto Time Savings	
	Daily	Annual	Daily	Annual	Daily	Annual
15 min	$180,800	$56 million	$148,800	$46.1 million	$51,200	$15.9million
10 min	$470,400	$145.8 million	$169,600	$ 52.6 million	$72,000	$22.3 million
5 min	$894,400	$277.3 million	$195,200	$60.5 million	$132,800	$41.2 million

SmartTrack Headway	Total Savings	
	Daily	Annual
15 min	$380,800	$118 million
10 min	$712,000	$220.7 million
5 min	$1,222,400	$378.9 million

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway; Eglinton Crosstown Phase 2 western alignment

As shown in Table 4.9, the monetary value of travel time savings due to SmartTrack are very large: in the order of $1.2 million per day and nearly $380 million annually for the 5-minute headway case. These are very large numbers. The City of Toronto is undertaking a Business Case Analysis (BCA) of SmartTrack in parallel to this study, which will deal with this issue in much greater detail. But it is clear that SmartTrack's potential for generating major economic benefit (in addition to its ridership benefits) is very high.

4.3.8 Auto VKT & GHG Emissions Savings Due to SmartTrack

Two other common measures of transit investment impact are reductions in the system-wide total distance travelled by cars (commonly referred to as vehicle-kilometres –travelled – VKT) and total greenhouse gas (GHG) emissions. VKT is a useful aggregate measure of the load on the road system (congestion) and is closely correlated with GHG emissions. The transportation sector is the single biggest source of GHG emissions in Ontario, and reducing these emissions needs to be an objective of any transportation infrastructure investment. VKT is computed directly within the road network modelling process; GHG emissions are computed from VKT based on an assumed average exhaust emission of 270.3 gCO_2e.per kilometre travelled (EPA, 2013).

Table 4.10 presents 2031 daily VKT and GHG emissions for the base, no-SmartTrack case and various SmartTrack scenarios, as well as the reductions in these measures for each SmartTrack scenario. Again using the conversion factor of 310 weekday equivalents per year, the table also shows estimated annual savings for both measures for each SmartTrack scenario. These reductions are quite significant in magnitude, reaching up to 50 $ktCO_2e$ annually with a 5 min SmartTrack headway.

Table 4.10: Daily & Annual 2031 VKT and GHG Emission Reductions, Various SmartTrack Scenarios*

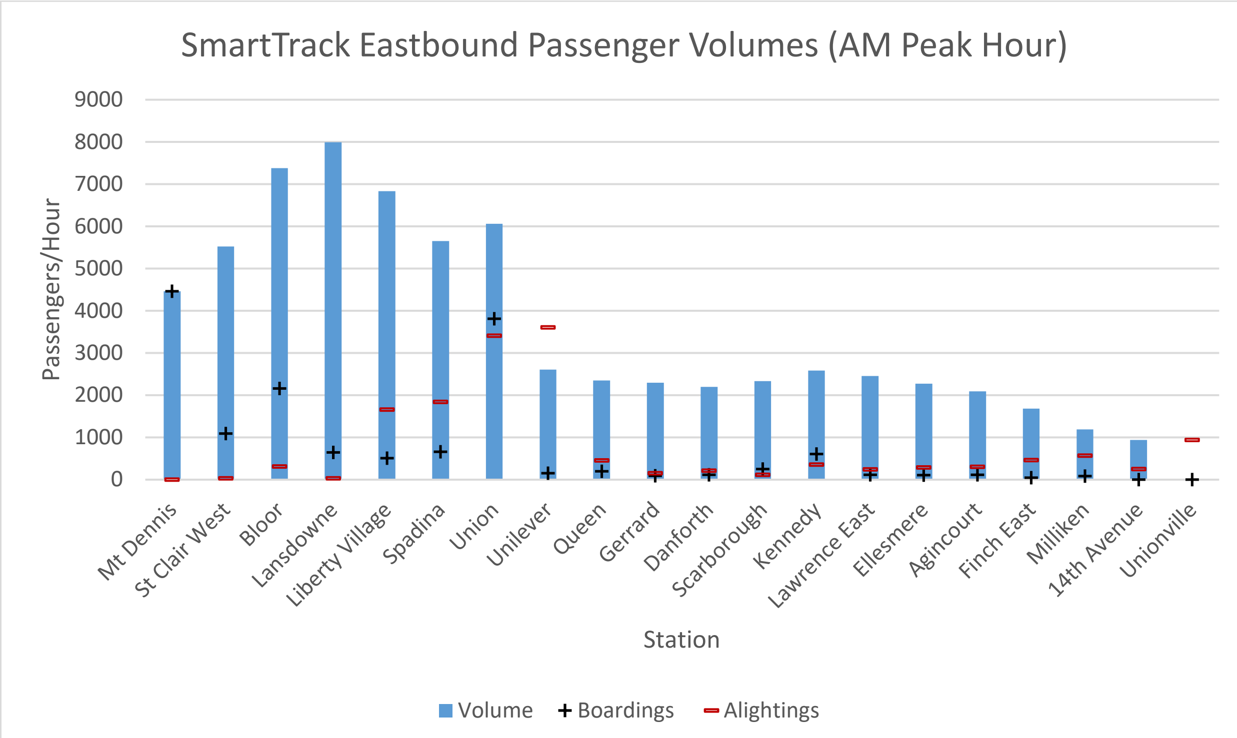
SmartTrack Headway	VKT Reductions		GHG Reductions	
	Daily	Annual	Daily	Annual
15 min	450,200	140 million	121,700 kgCO_2e	38 ktCO_2e
10 min	512,700	159 million	138,600 kgCO_2e	43 ktCO_2e
5 min	592,500	184 million	160,200 kgCO_2e	50 ktCO_2e

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway; Eglinton Crosstown Phase 2 western alignment

4.3.9 Peak-Load Points & "Reverse Flows"

Figure 4.10 shows 2031 AM peak hour flows on SmartTrack by line segment for a 5-minute headway scenario. Peak load points are located at Lansdowne station eastbound and Gerrard station westbound.

One hypothesis associated with the SmartTrack concept is that connecting to major suburban employment centres in Markham and Mississauga would generate significant "reverse flow" into and out of these centres during the morning and afternoon peak periods, respectively. That is, that the line would generate considerable "two-way flow" rather than just "one-way flow" into the Toronto downtown in the morning and out of it in the evening. As indicated in Figure 4.10 these flows are projected to be modest given the scenarios examined. This likely indicates that more needs to be done to solve the "last mile" problem of connecting suburban employment centres to higher-order transit than has been represented in these model system runs.



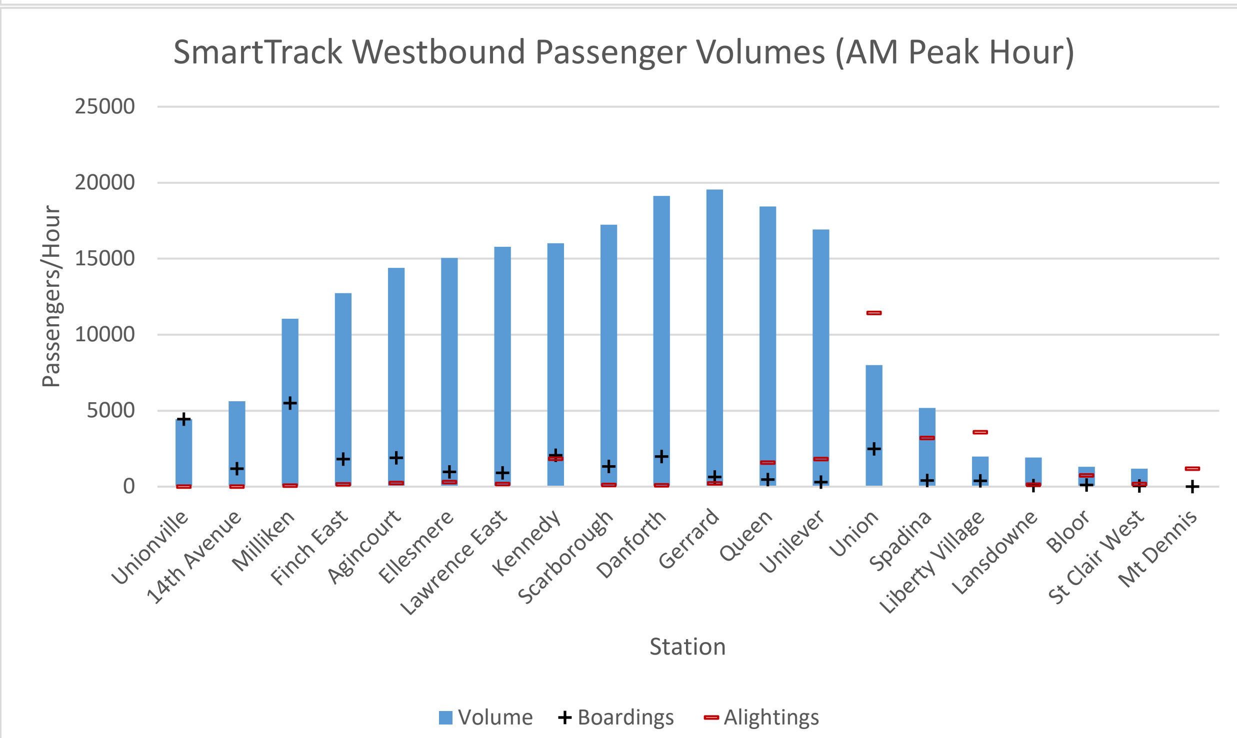


Figure 4.10: 2031 AM Peak Hour SmartTrack Loading by Line Segment*

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway, Eglinton Crosstown Phase 2 western alignment.

4.3.10 Network Interactions

Any transit line is a piece within an overall network which collectively provides the connectivity between points in space needed to serve a complex origin-destination travel pattern. A productive new line should not only attract riders to itself but also make the overall network more productive. Table 4.11 lists total daily riders on selected TTC rail lines[28] that run parallel to or intersect with the proposed SmartTrack alignment, with and without the implementation of SmartTrack. Points to note from this table include:

- In addition to relieving ridership on the YUS subway (as has been previously discussed), SmartTrack provides some relief to other over-burdened lines, notably the downtown streetcar routes and the Bloor-Danforth subway, thereby freeing up some capacity on these lines and providing a somewhat better quality of service on these lines.
- The addition of SmartTrack boosts ridership on Eglinton Crosstown and the Sheppard LRT. Note that the ridership increase includes riders boarding on the Eglinton West LRT extension.
- SmartTrack's daily ridership is only exceeded by the ridership on the YUS and Bloor-Danforth subway lines, again reinforcing the importance of this line to increasing the productive capacity of Toronto's transit system.

Table 4.11: 2031 Daily Ridership, TTC Rail Lines, with & without SmartTrack*

Line	Daily Boardings without SmartTrack	Daily Boardings with SmartTrack
Queen (incl. Kingston Rd, Downtowner) Streetcar	72,500	67,300
King Streetcar	88,400	76,200
Dundas Streetcar	13,400	11,200
Carlton Streetcar	31,400	28,700
Harbourfront Streetcar	7,100	7,400
Spadina Streetcar	11,300	8,800
Bathurst Streetcar	7,100	6,300
St Clair Streetcar	22,600	21,200
Eglinton LRT	124,800	171,700
Finch West LRT	33,000	30,500
Sheppard LRT	41,100	42,600
Yonge-University-Spadina Subway	991,800	933,400
Bloor-Danforth Subway	621,000	549,200
Sheppard Subway	52,400	47,800

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway; Eglinton Crosstown Phase 2 western alignment. Note that Eglinton LRT includes the western extension in the SmartTrack case.

[28] SmartTrack impacts on Metrolinx RER/GO Rail lines is discussed in Section 4.3.12, below.

Figure 4.11 shows how these SmartTrack riders load onto the overall transit network for the 2013 morning peak-hour case. This figure underscores the large geographic "reach" of the SmartTrack line as it loops through the City of Toronto. Figure 4.12 provides the same overall view, but shows loading on SmartTrack itself.

Figure 4.11: 2031 Morning Peak Hour Transit Line Loadings by SmartTrack Riders*
* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway with Eglinton Crosstown Phase 2 western alignment. Note that this figure does **not** show riders on the SmartTrack line itself, just the ridership on lines connecting to SmartTrack.

Figure 4.12: 2031 Morning Peak Hour Loadings on SmartTrack*
* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; 5-minute headway with Eglinton Crosstown Phase 2 western alignment

Chapter 5: ANALYSIS OF OTHER LINES

5.1 INTRODUCTION

In addition to the analysis of SmartTrack ridership described in the previous chapter, this study was also tasked with the analysis of specified options for the proposed Relief Line and Scarborough Subway Extension services, with and without SmartTrack. The results for these two lines for the 2031 forecast year are presented in Sections 5.2 and 5.4, respectively. The corresponding 2041 results are provided in Appendices D and E. Section 5.3 then presents a simple, high-level analysis of the implications of implementation of the Yonge Subway Extension (YSE) for peak loads on the Yonge line and the potential for both SmartTrack and the Relief Line to provide sufficient relief for the Yonge line with the addition of YSE in both 2031 and 2041.

5.2 2031 RELIEF LINE (RL) RIDERSHIP ANALYSIS

5.2.1 Introduction

Section 5.2.2 presents results from this study's initial analysis of "Little-J" corridors described in Chapter 3. Subsequent to this analysis, a very preliminary analysis of a few "Big-J" options was undertaken, the results of which are shown in Section 5.2.3.

5.2.2 "Little-J" RL Ridership Results

Table 5.1 shows projected 2031 RL boardings for each of the six "Little-J" corridors considered for AM peak hour; AM peak, and all-day, as well as the AM peak hour peak loading point for each line. In general, the RL options attract significant ridership, with between 87,000 and 187,000 all-day daily boardings, 14,300 and 30,200 AM peak-hour boardings, and AM peak-load point volumes of 9,400 to 16,300 passengers, depending on the corridor.

Table 5.1: 2031 RL Boardings by Time of Day and Corridor, without SmartTrack*

		RL Boardings			Peak Point - Peak Direction	
Corridor #	Corridor Description	AM Peak Hour Boardings	AM Peak Period Boardings	All Day Boardings	Location & Direction	Peak Hour Volume
A3	Broadview via Queen	14,300	29,100	86,800	WB out of Sumach/Dundas	9,400
B1	Pape via Queen	25,500	52,000	148,000	WB out of Sumach/Queen	15,100
B2	Pape via Queen (with Unilever Stop)	22,600	46,100	137,400	WB out of King/Cherry	10,800
C	Broadview via King	27,900	56,900	168,500	WB out of Front/Cherry	14,800
D1	Pape via King	26,600	54,300	165,700	WB out of King/Cherry	15,000
D2	Pape via King (with Unilever Stop)	30,200	61,700	186,800	WB out of Front/Cherry	16,300

* Assumes Low population/Medium employment without SmartTrack influence land use (except for base)

Table 5.2 shows the impact of SmartTrack with 15-minute and 5-minute headways on RL boardings for the Pape alignments.[29] Interestingly, RL boardings actually increase slightly with inclusion of a 15-minute SmartTrack service. It appears that some SmartTrack riders find it attractive under the 15-minute headway assumption to transfer to the Bloor-Danforth line and then to the RL for their journey downtown, rather than to stay on SmartTrack for the entire journey. Or, in the case of inclusion of a Unilever stop on the RL, they transfer directly from SmartTrack to the RL at this stop. Note that the RL increases are larger for the two Unilever corridor options, which is consistent with this hypothesis. Also, note that the addition of SmartTrack causes the assumed employment scenario to switch from “medium employment without SmartTrack influence” to “medium employment with SmartTrack influence”. This change in the employment distribution may also contribute to the slight increase in projected RL ridership due to shifts in employment and associated work trip patterns associated with this change in assumption.

The 5-minute headway option for SmartTrack does reduce RL boardings relative to the non-SmartTrack case, indicating that at this service level SmartTrack provides better service to the downtown than the RL for some trips diverting from the Bloor-Danforth line. These reductions in RL ridership range from 2,100 to 5,200 AM peak hour boardings and 7,400 to 27,200 total daily boardings, depending on the RL under consideration. The resulting RL boardings are still significant, both in the AM peak and over the course of the entire day.

[29] At the time of preparation of this report, Pape appears to be the preferred RL terminal on the Danforth line.

Table 5.2: 2031 RL Boardings by Time of Day and Corridor, with SmartTrack*

		(a) RL Boardings, with 15-minute Headway SmartTrack Service			Peak Point - Peak Direction	
Corridor #	**Corridor Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
B1	Pape via Queen	27,700	56,400	158,700	WB out of Gerrard/Carlaw	14,600
B2	Pape via Queen (with Unilever Stop)	25,700	52,300	154,600	WB out of Queen/Pape	10,300
D1	Pape via King	29,300	59,800	177,200	WB out of Gerrard/Carlaw	14,500
D2	Pape via King (with Unilever Stop)	33,500	68,400	204,400	WB out of Front/Cherry	15,300

		(b) RL Boardings, with 5-minute Headway SmartTrack Service			Peak Point - Peak Direction	
Corridor #	**Corridor Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
B1	Pape via Queen	20,200	41,300	121,000	WB out of Sumach/Queen	10,600
B2	Pape via Queen (with Unilever Stop)	20,500	41,800	129,900	WB out of Unilever	8,100
D1	Pape via King	22,400	45,600	138,500	WB out of King/Cherry	11,200
D2	Pape via King (with Unilever Stop)	27,800	56,700	174,100	WB out of Front/Cherry	12,700

* Low population/Medium employment (with SmartTrack influence)

Table 5.3 shows the impact of the RL with and without SmartTrack on reducing the AM peak load on the Yonge subway line running southbound from Bloor station. The RL-only reductions do not vary much by corridor, ranging from 2,600 to 4,600 peak-hour riders. These reductions generally bring the projected 2031 Yonge peak hour ridership close to the capacity of the line, which the TTC estimates will be approximately 36,000 riders per hour by 2031 due to signal upgrades and other operational improvements designed to increase the line's capacity.[30]

[30] In many cases with the introduction of the RL, the Yonge subway southbound AM peak-load point actually shifts to just north of Bloor station, where the loadings are slightly higher than the south of Bloor values. The south of Bloor numbers are shown here for the sake of consistency and given that this been the traditional focus of Yonge line capacity concerns.

The RL reductions are larger than the SmartTrack 15-minute reduction of 1,100 riders, but significantly less than the SmartTrack 5-minute reduction of 5,600 AM peak hour riders. The combined effect of RL and SmartTrack further increases the diversion from the Yonge line. In particular, in the case of the 5-minute headway SmartTrack service combined with the RL, the Yonge line ridership southbound from Bloor is reduced substantially below the assumed 36,000 passenger/hour capacity. In general, it appears that **both** the RL and higher-frequency SmartTrack services will be required to provide significant relief to the Yonge line by 2031.

Table 5.3: 2031 Yonge Line Relief, RL & SmartTrack Combinations*

RL Corridor #	RL Corridor Description	SmartTrack Frequency	Volume, Southbound from Bloor (AM Peak Hour)	Volume Change, Southbound from Bloor (AM Peak Hour)	
				Attributable to RL	Total
2031 Low-Med Base			**40,100**	*** Acts as Base**	
A3	Broadview via Queen	None	37,300	-2,800	-2,800
B1	Pape via Queen	None	35,500	-4,600	-4,600
B2	Pape via Queen (with Unilever Stop)	None	37,500	-2,600	-2,600
C	Broadview via King	None	36,400	-3,700	-3,700
D1	Pape via King	None	35,700	-4,400	-4,400
D2	Pape via King (with Unilever Stop)	None	36,200	-3,900	-3,900
2031 Low-Med 15 min SmartTrack without RL			**39,100**	*** Acts as Base**	**-1,100**
B1	Pape via Queen	15 min	34,300	-4,700	-5,800
B2	Pape via Queen (with Unilever Stop)	15 min	36,400	-2,600	-3,700
D1	Pape via King	15 min	34,800	-4,200	-5,300
D2	Pape via King (with Unilever Stop)	15 min	35,200	-3,800	-4,900
2031 Low-Med 5 min SmartTrack without RL			**34,500**	*** Acts as Base**	**-5,600**
B1	Pape via Queen	5 min	31,400	-3,100	-8,700
B2	Pape via Queen (with Unilever Stop)	5 min	32,800	-1,700	-7,300
D1	Pape via Queen	5 min	31,900	-2,600	-8,200
D2	Pape via King (with Unilever Stop)	5 min	32,100	-2,400	-8,000

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

This issue of transfers between the Bloor-Danforth line and the Yonge line at Bloor station is explored further in Table 5.4. As shown in the table, both the RL and SmartTrack very significantly reduce the number of peak hour transfers from the westbound Bloor-Danforth line to the southbound Yonge line at Bloor station. For the RL, these reductions range from 2,500 to 4,700 (24-45%), depending on the alignment. SmartTrack alone generates reductions of 600 to

3,500 (6-34%) as headways range from 15 to 5 minutes. Combined, the two lines further reduce these transfers by up to 6,400 (62%). Thus, both lines individually and in combination have the potential to greatly reduce the problem of excessive transfers at Boor station. Yonge line crowding remains a concern, however, due to the heavy volumes boarding the line from the north. The "Little-J" RL options cannot address this problem. SmartTrack diverts some of this traffic, particularly at lower headways, but ideally more should still be done to keep the loading of the Yonge line during peak periods under capacity.

Table 5.4: 2031 AM Peak Westbound Bloor to Southbound Yonge Transfers*

RL Corridor #	RL Corridor Description	SmartTrack Frequency	WB BD-SB YUS Transfers at Bloor-Yonge (AM Peak Hour)	Change from Base	
				Attributable to RL	Total
	2031 Low-Med Base		**10,300**	***Acts as Base**	
A3	Broadview via Queen	None	7,500	-2,800	-2,800
B1	Pape via Queen	None	5,600	-4,700	-4,700
B2	Pape via Queen (with Unilever Stop)	None	7,800	-2,500	-2,500
C	Broadview via King	None	6,700	-3,600	-3,600
D1	Pape via King	None	6,300	-4,000	-4,000
D2	Pape via King (with Unilever Stop)	None	6,400	-3,900	-3,900
	2031 Low-Med 15 min SmartTrack without RL		**9,700**	***Acts as Base**	**-600**
B1	Pape via Queen	15 min	5,200	-4,500	-5,100
B2	Pape via Queen (with Unilever Stop)	15 min	7,300	-2,400	-3,000
D1	Pape via King	15 min	5,800	-3,900	-4,500
D2	Pape via King (with Unilever Stop)	15 min	6,100	-3,600	-4,200
	2031 Low-Med 5 min SmartTrack without RL		**6,800**	***Acts as Base**	**-3,500**
B1	Pape via Queen	5 min	3,900	-2,900	-6,400
B2	Pape via Queen (with Unilever Stop)	5 min	5,200	-1,600	-5,100
D1	Pape via King	5 min	4,600	-2,200	-5,700
D2	Pape via King (with Unilever Stop)	5 min	4,800	-2,000	-5,500

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Table 5.5 presents the daily net new riders generated by the RL, with and without SmartTrack. The RL net new daily riders are modest relative to the much more extensive SmartTrack service. As with RL boardings, the combination of a 15-minute SmartTrack and RL service increases the number of net riders attributable to the RL, especially for RL options involving the Unilever stop, again indicating the synergies between the two lines at this service level for SmartTrack.[31] Again, this effect reverses with a 5-minute SmartTrack headway, in which case the SmartTrack service clearly is the dominant attractor of new riders, thereby reducing the new ridership

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[31] The construction of SmartTrack also is assumed to increase employment at the Unilever site, which might also contribute to increased RL ridership.

attributable to the RL somewhat. These decreases, however, are relatively minor, again indicating that SmartTrack and the RL are not serious competitors with one another for ridership.

Table 5.5: 2031 Daily Net New System Riders Generated by the Relief Line*

RL Corridor #	RL Corridor Description	SmartTrack	Daily New Net Transit Riders (System Wide)	
			Attributable to RL	Total
	2031 Low-Med Base		***Acts as Base**	
A3	Broadview via Queen	None	5,700	5,700
B1	Pape via Queen	None	8,900	8,900
B2	Pape via Queen (with Unilever Stop)	None	10,900	10,900
C	Broadview via King	None	16,300	16,300
D1	Pape via King	None	11,800	11,800
D2	Pape via King (with Unilever Stop)	None	19,600	19,600
	2031 Low-Med 15 min SmartTrack without RL		***Acts as Base**	**26,200**
B1	Pape via Queen	15 min	10,700	36,900
B2	Pape via Queen (with Unilever Stop)	15 min	13,800	40,000
D1	Pape via King	15 min	12,900	39,100
D2	Pape via King (with Unilever Stop)	15 min	22,900	49,100
	2031 Low-Med 5 min SmartTrack without RL		***Acts as Base**	**52,000**
B1	Pape via Queen	5 min	6,600	58,600
B2	Pape via Queen (with Unilever Stop)	5 min	8,800	60,800
D1	Pape via Queen	5 min	8,400	60,500
D2	Pape via King (with Unilever Stop)	5 min	17,000	69,000

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Figures 5.1 and 5.2 display the 2031 catchment area for the Pape-Queen RL corridor using the same procedure as is used to define the SmartTrack catchment area in Chapter 4. Note that Figure 5.2 excludes those trips transferring at Pape Station to or from the Bloor-Danforth Line east of Pape (i.e., it indicates RL riders that do not use the Bloor-Danforth line, illustrating the relatively limited "local" catchment area for the line). Figures 5.3 and 5.4 display 2031 morning peak hour RL ridership by segment and overall transit network flows for RL riders, respectively, assuming the Pape-Queen alignment. Note that the southbound flow on the University subway line reflects "counter-flow" trips from the Toronto downtown accessing east-end destinations via the RL, providing another example of the network effects that can be generated by new rail lines.

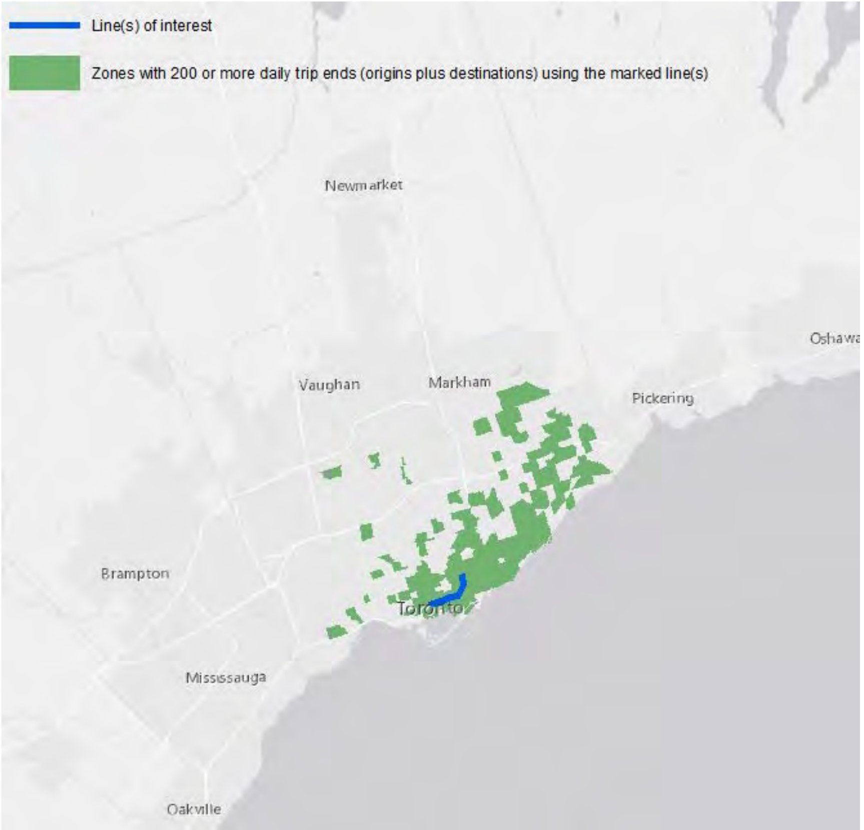

Figure 5.1: 2031 RL Catchment Area, Pape-Queen Alignment (B1)
* Assumes Low population/Medium employment.

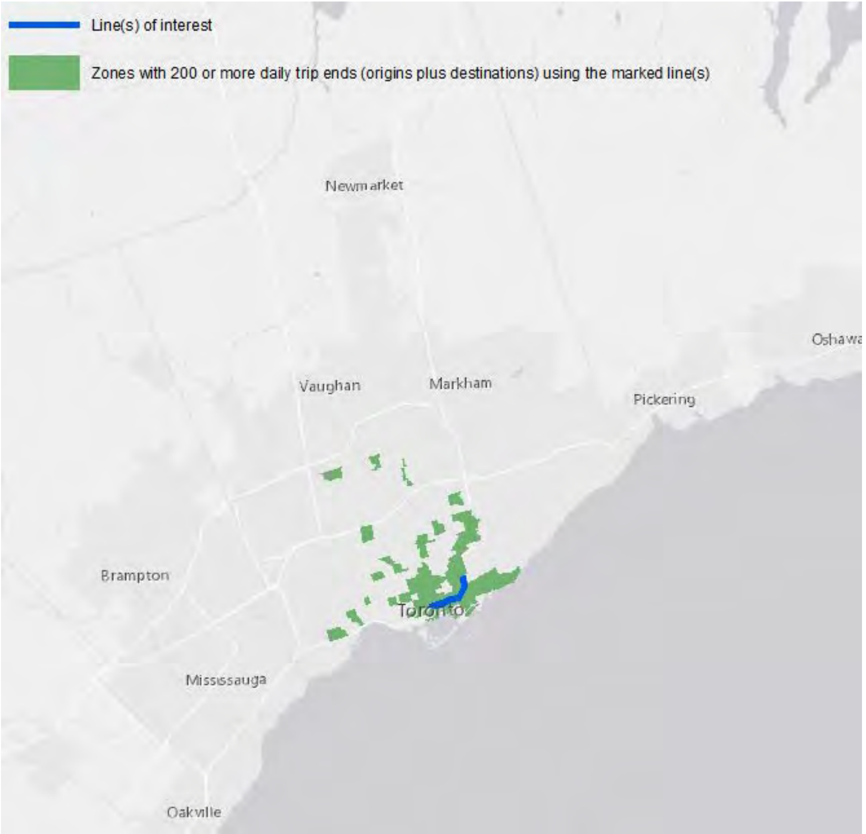

Figure 5.2: 2031 RL Catchment Area (without BD transfers), Pape-Queen Alignment (B1)
* Assumes Low population/Medium employment; Excludes trips transferring at Pape Station to/from the Bloor-Danforth Line east of Pape.

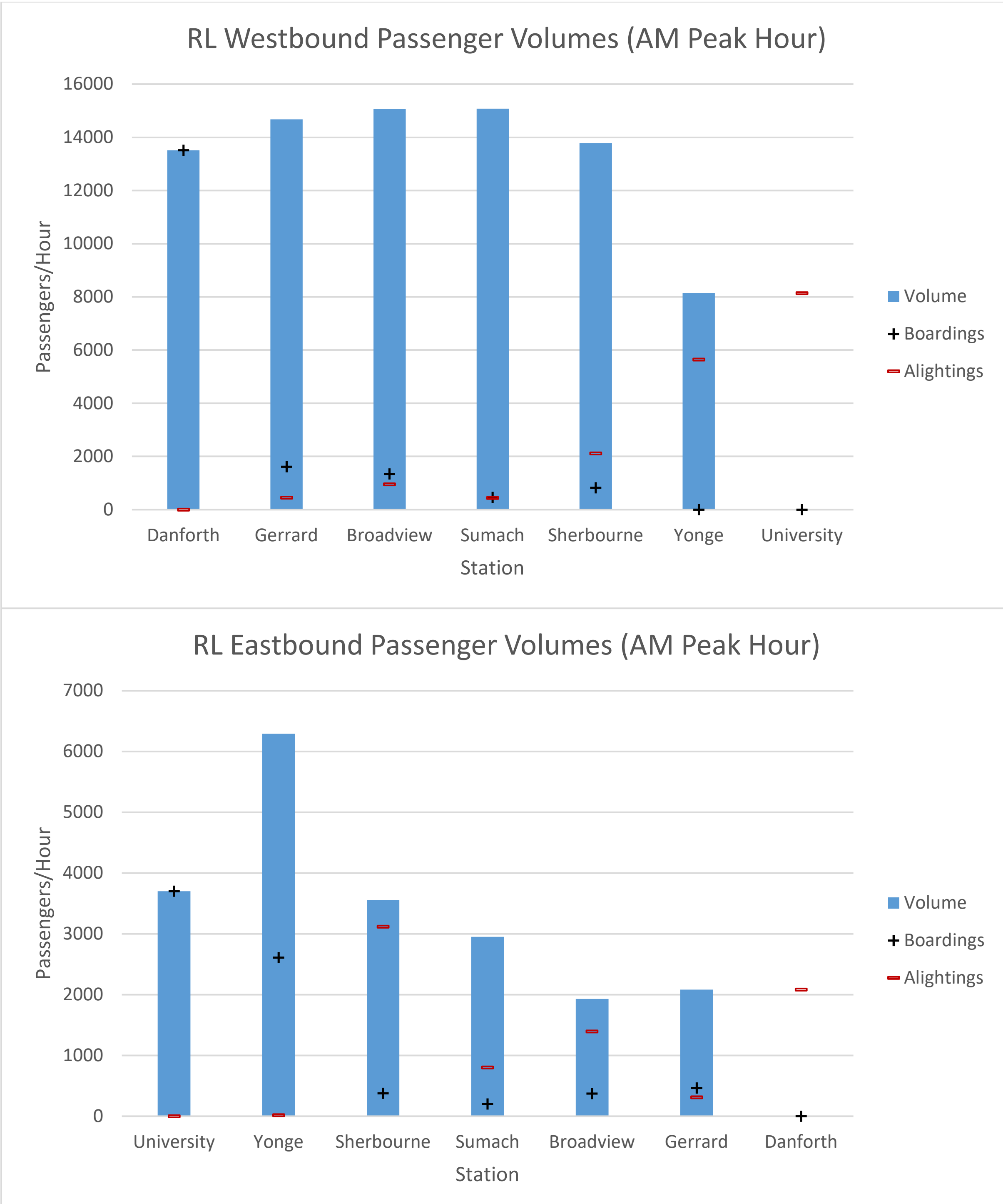

Figure 5.3: 2031 RL Morning Peak Hour Ridership by Line Segment, Pape-Queen Alignment (B1)

* Assumes Low population/Medium employment.

Figure 5.4: 2031 Morning Peak Hour Transit Network Loadings by RL Riders, Pape-Queen Alignment (B1)

* Assumes Low population/Medium employment.

5.2.3 Relief Line (RL) "Big-J" Analysis

In addition to the "Little-J" RL corridors discussed in the previous section, preliminary "Big-J" alignments have been tested in which the "Little-J" Pape via Queen and King corridors are extended north of Danforth Avenue to Sheppard Avenue, as illustrated in Figure B.10 in Appendix B. These options were tested with and without the standard SmartTrack option with 15- and 5-minute headways, with TTC fares, for 2041.[32]

Table 5.6 presents the RL "Big-J" 2041 ridership estimates without SmartTrack, in which significant peak-period and all-day ridership is projected, with all-day ridership increasing in the order of 110,000 riders per day relative to the "Little-J" case (Table D.1).

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[32] While most results presented in the main body of this report have been for 2031, it is assumed here that the "Big-J" extension of the RL north of Danforth certainly will not happen by 2031. Hence only 2041 projections are presented here.

Table 5.6: 2041 RL Boardings by Time of Day and Corridor, without SmartTrack*

		RL Boardings			Peak Point - Peak Direction	
Corridor #	**Corridor Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	43,600	89,000	268,700	WB out of Gerrard/Carlaw	22,600
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	41,900	85,500	262,600	WB out of Gerrard/Pape	18,700
D1 to Sheppard	Pape via King – Extended to Sheppard	46,400	94,600	289,800	WB out of Broadview/Queen	23,500
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	51,100	104,200	320,200	WB out of Front/Cherry	23,800

* Assumes Low population/Medium employment without SmartTrack influence land use.

Table 5.7 presents “Big-J” RL ridership estimates given implementation of SmartTrack for both 15-minute and 5-minute SmartTrack headway cases. As in the “Little-J” case examined above, the 15-minute SmartTrack service generates slight increases in RL ridership, while the more attractive 5-minute service reduces RL ridership somewhat.

Tables 5.8 and 5.9 explore Yonge line relief of the “Big-J” RL with and without SmartTrack. The “Big-J” RL, with or without the 15-minute SmartTrack options have very similar impacts on net Yonge line relief, generating Yonge volumes southbound from Bloor station in the morning the peak hour that are at or slightly below capacity. The “Big-J” RL plus the 5-minute SmartTrack option yield peak-hour volumes south of Bloor that are comfortably below capacity. Hence, the 2041 results for the “Big-J” are qualitatively similar to those found for the 2031 “Little-J” case: both the RL and a high-frequency SmartTrack service will be required to provide significant relief to Yonge line operations.

Table 5.7: 2041 RL Boardings by Time of Day and Corridor, with SmartTrack*

		(a) RL Boardings, with 15-minute Headway SmartTrack Service			Peak Point - Peak Direction	
Corridor #	**Corridor Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	49,300	100,500	297,000	WB out of Gerrard/Carlaw	22,900
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	48,600	99,200	300,200	WB out of Gerrard/Pape	20,100
D1 to Sheppard	Pape via King – Extended to Sheppard	52,600	107,300	320,400	WB out of Gerrard/Carlaw	24,500
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	58,400	119,200	359,700	WB out of Gerrard/Pape	24,500

		(b) RL Boardings, with 5-minute Headway SmartTrack Service			Peak Point - Peak Direction	
Corridor #	**Corridor Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	39,000	79,600	242,000	WB out of Gerrard/Carlaw	18,600
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	40,500	82,600	257,900	WB out of Gerrard/Pape	15,800
D1 to Sheppard	Pape via King – Extended to Sheppard	42,100	85,800	262,600	WB out of Gerrard/Carlaw	19,000
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	49,600	101,100	313,400	WB out of Gerrard/Pape	19,200

* Low population/Medium employment (with SmartTrack influence).

Table 5.8: 2041 Yonge Line Relief, RL & SmartTrack Combinations*

RL Corridor #	RL Corridor Description	SmartTrack Frequency	Volume, Southbound from Bloor (AM Peak Hour)	Volume Change, Southbound from Bloor (AM Peak Hour) Attributable to RL	Volume Change, Southbound from Bloor (AM Peak Hour) Total
2041 Low-Med Base			**42,600**	*** Acts as Base**	
B1 to Sheppard	Pape via Queen – Extended to Sheppard	None	34,800	-7,800	-7,800
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	None	36,400	-6,200	-6,200
D1 to Sheppard	Pape via King – Extended to Sheppard	None	34,300	-8,300	-8,300
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	None	34,700	-7,900	-7,900
2041 Low-Med 15 min SmartTrack without RL			**41,400**	*** Acts as Base**	**-1,200**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	15 min	34,000	-7,400	-8,600
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	15 min	36,500	-4,900	-6,100
D1 to Sheppard	Pape via King – Extended to Sheppard	15 min	33,200	-8,200	-9,400
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	15 min	33,800	-7,600	-8,800
2041 Low-Med 5 min SmartTrack without RL			**36,800**	*** Acts as Base**	**-5,800**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	5 min	30,600	-6,200	-12,000
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	5 min	32,100	-4,700	-10,500
D1 to Sheppard	Pape via King – Extended to Sheppard	5 min	30,900	-5,900	-11,700
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	5 min	31,200	-5,600	-11,400

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Table 5.9: 2041 AM Peak Westbound Bloor to Southbound Yonge Transfers*

RL Corridor #	RL Corridor Description	SmartTrack Frequency	WB BD-SB YUS Transfers at Bloor-Yonge (AM Peak Hour)	Change from Base	
				Attributable to RL	Total
2041 Low-Med Base			**10,400**	***Acts as Base**	
B1 to Sheppard	Pape via Queen – Extended to Sheppard	None	6,900	-3,500	-3,500
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	None	8,900	-1,500	-1,500
D1 to Sheppard	Pape via King – Extended to Sheppard	None	6,500	-3,900	-3,900
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	None	6,700	-3,700	-3,700
2041 Low-Med 15 min SmartTrack without RL			**10,200**	***Acts as Base**	**-200**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	15 min	6,900	-3,300	-3,500
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	15 min	8,800	-1,400	-1,600
D1 to Sheppard	Pape via King – Extended to Sheppard	15 min	6,200	-4,000	-4,200
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	15 min	6,400	-3,800	-4,000
2041 Low-Med 5 min SmartTrack without RL			**7,200**	***Acts as Base**	**-3,200**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	5 min	4,200	-3,000	-6,200
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	5 min	5,600	-1,600	-4,800
D1 to Sheppard	Pape via King – Extended to Sheppard	5 min	4,600	-2,600	-5,800
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	5 min	4,700	-2,500	-5,700

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Finally, Table 5.10 presents estimated 2041 net new riders associated with the "Big-J" RL, with and without SmartTrack. Similar to the "Little-J" case, the “Big-J” RL is expected to generate non-negligible new ridership, but less than SmartTrack is expected to do. Again, the RL’s main contributions are expected to be Yonge line relief, an improved path into the downtown for trip makers in it service corridor, and additional network redundancy, rather than tapping a major new market for transit riders.

Table 5.10: 2041 Daily Net New System Riders Generated by the Relief Line*

RL Corridor #	RL Corridor Description	SmartTrack	Daily New Net Transit Riders (System Wide) Attributable to RL	Daily New Net Transit Riders (System Wide) Total
	2041 Low-Med Base		***Acts as Base**	
B1 to Sheppard	Pape via Queen – Extended to Sheppard	None	22,800	22,800
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	None	24,900	24,900
D1 to Sheppard	Pape via King – Extended to Sheppard	None	26,800	26,800
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	None	37,200	37,200
	2041 Low-Med 15 min SmartTrack without RL		***Acts as Base**	**52,800**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	15 min	28,900	81,700
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	15 min	33,900	86,700
D1 to Sheppard	Pape via King – Extended to Sheppard	15 min	31,600	84,400
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	15 min	46,300	99,200
	2041 Low-Med 5 min SmartTrack without RL		***Acts as Base**	**84,000**
B1 to Sheppard	Pape via Queen – Extended to Sheppard	5 min	20,400	104,400
B2 to Sheppard	Pape via Queen (with Unilever Stop) – Extended to Sheppard	5 min	25,500	109,400
D1 to Sheppard	Pape via King – Extended to Sheppard	5 min	22,900	106,800
D2 to Sheppard	Pape via King (with Unilever Stop) – Extended to Sheppard	5 min	36,700	120,700

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

5.3 YONGE SUBWAY EXTENSION (YSE) RIDERSHIP ANALYSIS

2031 and 2041 ridership forecasts have been generated for the YSE for the following four scenarios:

- YSE alone (no Relief Line or SmartTrack).
- YSE, with "Little-J" RL.
- YSE, with SmartTrack.
- YSE with both "Little-J" RL and SmartTrack.
- YSE with both "Big J" RL and SmartTrack (2041 only)

The focus of this analysis is not on the YSE per se but to understand the impact of both SmartTrack and the "Little-J" RL on relief of Yonge line ridership if/when the YSE is built. Table 5.11 shows AM peak hour volumes southbound from Bloor Station for the scenarios being considered.

Table 5.11: Yonge Subway 2031 AM Peak Hour Data with YSE*

Scenario	SmartTrack Headway	Volume	Transfers, WB BD to SB YUS
Base: No YSE, Relief Line or SmartTrack		40,100	10,300
YSE, No Relief Line or SmartTrack		43,700	10,100
YSE with "Little J" Relief Line Only		38,800	5,700
YSE with SmartTrack Only	*15* *5*	42,400 38,100	9,500 6,700
YSE with both "Little J" Relief Line and SmartTrack	*15* *5*	37,800 34,800	5,300 3,900

* Assumes Low population/Medium employment (with SmartTrack influence land use in cases with SmartTrack); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment; Relief Line refers to "Little-J" corridor B1.

Points to note from this table include:

- The YSE adds approximately 3,600 additional riders to the "south of Bloor" AM peak hour ridership, above the base of 40,100. The total projected peak-hour ridership of 43,700 is far in excess of the current or expected future capacity of the line. These projections reinforce concerns about the impact of the YSE on Yonge line overcrowding.
- The reductions in Yonge ridership generated by either the RL ("Little-J" corridor option B1) or SmartTrack individually are consistent with those generated in the no-YSE case (Table 5.3). Assuming an approximate capacity of the Yonge line in the order of 36,000 passengers/hour, then neither line alone will bring the Yonge line 2031 AM peak hour ridership below this capacity threshold.

- The RL plus a 5-minute headway SmartTrack service is the only alternative examined that generates Yonge ridership southbound from Bloor station that does not exceed the line's capacity.

Table 5.12 shows comparable results for the 2041 forecast year. As is seen in this table, it is projected that by 2041 the Yonge line with the YSE we will be over capacity under all "Little-J" RL scenarios, including the 5-minute SmartTrack scenario. The "Big-J" RL plus 5-minute SmartTrack scenario does reduce the Yonge ridership below the capacity threshold – indicating that both lines will be required by 2041 to keep the Yonge line peak ridership under capacity.

Table 5.12: Yonge Subway 2041 AM Peak Hour Data with YSE*

Scenario	SmartTrack Headway	Volume	Transfers, WB BD to SB YUS
Base: No YSE, Relief Line or SmartTrack		42,600	10,400
YSE, No Relief Line or SmartTrack		45,800	10,100
YSE with "Little J" Relief Line Only		41,200	5,900
YSE with SmartTrack Only	*15*	44,800	9,900
	5	40,200	6,800
YSE with both "Little J" Relief Line and SmartTrack	*15*	40,500	5,700
	5	37,100	4,100
YSE with both "Big J" Relief Line and SmartTrack	*15*	38,100	6,700
	5	34,400	4,100

* Assumes Low population/Medium employment (with SmartTrack influence land use in cases with SmartTrack); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment; Relief Line refers to corridor B1.

5.4 SCARBOROUGH SUBWAY EXTENSION (SSE) RIDERSHIP ANALYSIS

5.4.1 Introduction

Sub-section 5.4.2 presents base 2031 forecast results for SSE options with and without SmartTrack using base assumptions of the "low population / medium employment land-use" scenario, and the base headway assumption of headways equal to the main Bloor-Danforth line. Sub-section 5.4.3 conducts sensitivity tests with respect to both the land-use and headway assumptions. Sub-section 5.4.4 then presents additional analyses of the 2031 base case. 2041 ridership numbers are presented in Appendix E.

5.4.2 2031 Base Forecast Results

Table 5.13 shows projected 2031 SSE boardings for each of the four options considered. These results all assume the base low population / medium employment scenario and Table 3.2 SSE headways. AM peak hour peak loading point volumes are shown for each option, which in all cases occurs at Kennedy station, in both directions.

Table 5.13: 2031 SSE Users by Time of Day and Alignment, without SmartTrack*

		SSE Users without SmartTrack			Into Kennedy		Out of Kennedy	
Alignment #	**Alignment Description**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Direction**	**Peak Hour Volume**	**Location & Direction**	**Peak Hour Volume**
McCowan4	McCowan with 4 stops	23,300	47,600	145,900	WB into Kennedy	17,300	WB out of Kennedy	19,400
McCowan3	McCowan with 3 stops	18,500	37,800	116,000	WB into Kennedy	13,600	WB out of Kennedy	18,900
Midland	Midland with 3 stops	19,900	40,600	125,200	WB into Kennedy	14,400	WB out of Kennedy	19,100
Bellamy	Bellamy with 4 stops	23,600	48,100	146,700	WB into Kennedy	17,600	WB out of Kennedy	20,100

* Assumes Low population/Medium employment.

The McCowan4 and Bellamy options attract the most ridership, with both having AM peak hour and all-day ridership in the order of 23,000 and 146,000 riders, respectively. The relatively strong performance of the Bellamy alignment presumably is due to its more eastern alignment, which allows it to reduce bus access times to the subway for potential riders coming from further east. It also has a transfer connection with the GO RER line. This result, of course, comes at the cost of a more expensive alignment due to its additional length.

Table 5.14 shows the impact of SmartTrack with 15, 10 and 5 minute headways on SSE riders for the McCowan3 alignment. This alignment was selected as being representative of the four options considered for the purpose of this analysis. As indicated in the table, SmartTrack reduces SSE ridership by 900 – 4,200 riders in the AM peak hour and by 5,500-26,700 daily riders depending on the SmartTrack headway. In particular, the 15-minute minute SmartTrack service has a very minor impact on SSE ridership, whereas the impact of the 5-minute service is more significant.

Table 5.14: 2031 SSE Users by Time of Day and Alignment, with SmartTrack*

		SSE Users with SmartTrack			Into Kennedy		Out of Kennedy	
Alignment #	**SmartTrack Frequency**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Directio n**	**Peak Hour Volume**	**Location & Directio n**	**Peak Hour Volume**
McCowan 3	5 min	14,300	29,200	89,300	WB into Kennedy	9,800	WB out of Kennedy	13,900
McCowan 3	10 min	16,400	33,500	102,600	WB into Kennedy	11,600	WB out of Kennedy	16,300
McCowan 3	15 min	17,600	35,900	110,500	WB into Kennedy	12,600	WB out of Kennedy	17,600

* Assumes Low population/Medium employment with SmartTrack influence land; TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Table 5.15 shows the impact of the SSE with and without SmartTrack on reducing the AM peak load on the Yonge subway line running southbound from Bloor station. As shown in this table, the SSE has almost no effect on Yonge line relief, but to the extent that there is an effect, it makes over-crowding only marginally worse. This is not surprising given that the SSE is simply an extension of the Bloor-Danforth line and so any growth in ridership due to the SSE inevitably results in some additional riders arriving at Bloor station looking to try to transfer to the southbound Yonge line.

Table 5.15: 2031 Yonge Line Relief, SSE & SmartTrack Combinations*

SSE Alignment	SSE Alignment Description	SmartTrack	Volume Southbound @ South of Bloor (Peak Hour)
	2031 Low-Med Base with SRT		**39,900**
McCowan4	McCowan with 4 stops	None	40,000
McCowan3	McCowan with 3 stops	None	40,000
Midland	Midland with 3 stops	None	40,000
Bellamy	Bellamy with 4 stops	None	40,000

* Assumes Low population/Medium employment with SmartTrack influence land use; TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Table 5.16 presents the daily net new riders generated by the SSE in the absence of SmartTrack. In this test the without-SSE base is assumed to include the existing Scarborough RT line. As indicated in the table, the SSE is expected to generate moderate net new daily ridership.

Table 5.16: 2031 Daily Net Riders Generated by the SSE*

SSE Alignment	SSE Alignment Description	SmartTrack	Net New Riders (Daily)
	2031 Low-Med Base with SRT		***Acts as Base**
McCowan4	McCowan with 4 stops	None	9,100
McCowan3	McCowan with 3 stops	None	8,600
Midland	Midland with 3 stops	None	9,400
Bellamy	Bellamy with 4 stops	None	8,300

* Assumes Low population/Medium employment;

5.4.3 2031 Sensitivity Tests

The sensitivity of the results presented in the previous section to population/employment and service frequency assumptions was tested. Three scenarios (all without SmartTrack) were tested and compared to the base results presented in the previous section, which assumed the McCowan 3 stop option:

1. Assumption of the low population / low employment land use scenario.
2. Approximately doubling the SSE headway by turning back every second eastbound Bloor-Danforth train at Kennedy. The low population / medium employment land use scenario is assumed.
3. The combination of low population / low employment and doubled headway assumptions.

Table 5.17 presents the SSE ridership estimates for each of these three scenarios and compares them to the base case results presented in Sub-Section 5.4.2. As shown in Table 5.17(a), assumption of more conservative employment growth has little impact on projected SSE ridership. Increasing the SSE headway (i.e., reducing its service frequency) has a greater impact. Ridership is more sensitive to frequency, with 17% and 7% reductions in AM Peak and all-day

SSE ridership resulting from the 50% reduction in service frequency (Table 5.17 (b)). Table 5.17 (c) further illustrates the relative lack of sensitivity to land use assumptions, with only modest further decreases in SSE ridership when the more conservative employment scenario is combined with the frequency reduction.

5.4.4 Additional SSE Analysis

Figure 5.5 presents the 2031 catchment area for the McCowan3 SSE alignment, while Figure 5.6 presents the peak-hour loadings by segment for this alignment.

Table 5.17: 2031 SSE Sensitivity Test Results*

(a) 2031 SSE Sensitivity Test Results (Low-Low)

		Low/Low Land Use: SSE Users without SmartTrack			Into Kennedy		Out of Kennedy	
Alignment #	**Alignment Description**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Direction**	**Peak Hour Volume**	**Location & Direction**	**Peak Hour Volume**
McCowan 4	McCowan with 4 stops	22,700	46,200	142,000	WB into Kennedy	16,600	WB out of Kennedy	18,800
McCowan 3	McCowan with 3 stops	18,000	36,800	112,700	WB into Kennedy	13,200	WB out of Kennedy	18,300
Midland	Midland with 3 stops	19,400	39,500	121,900	WB into Kennedy	13,900	WB out of Kennedy	18,600
Bellamy	Bellamy with 4 stops	23,100	47,000	143,200	WB into Kennedy	16,900	WB out of Kennedy	19,500

(b) 2031 SSE Sensitivity Test Results (Low-Med, Half Frequency)

		Low/Med with Halved Frequency: Users on the SSE			Into Kennedy		Out of Kennedy	
Alignment #	**Alignment Description**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Direction**	**Peak Hour Volume**	**Location & Direction**	**Peak Hour Volume**
McCowan 4	McCowan with 4 stops	19,500	39,700	136,100	WB into Kennedy	14,700	WB out of Kennedy	17,500
McCowan 3	McCowan with 3 stops	15,500	31,700	108,400	WB into Kennedy	11,700	WB out of Kennedy	17,500
Midland	Midland with 3 stops	16,500	33,700	116,700	WB into Kennedy	12,200	WB out of Kennedy	17,600
Bellamy	Bellamy with 4 stops	19,600	40,100	137,000	WB into Kennedy	14,800	WB out of Kennedy	17,800

(c) 2031 SSE Sensitivity Test Results (Low-Low, Half Frequency)

		Low/Low with Halved Frequency: Users on the SSE			Into Kennedy		Out of Kennedy	
Alignment #	**Alignment Description**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Direction**	**Peak Hour Volume**	**Location & Direction**	**Peak Hour Volume**
McCowan 4	McCowan with 4 stops	18,800	38,400	132,400	WB into Kennedy	14,100	WB out of Kennedy	16,900
McCowan 3	McCowan with 3 stops	15,000	30,700	105,200	WB into Kennedy	11,200	WB out of Kennedy	16,900
Midland	Midland with 3 stops	16,000	32,600	113,400	WB into Kennedy	11,700	WB out of Kennedy	17,000
Bellamy	Bellamy with 4 stops	19,100	38,900	133,400	WB into Kennedy	14,200	WB out of Kennedy	17,200

* Assumes TTC fare on SmartTrack;

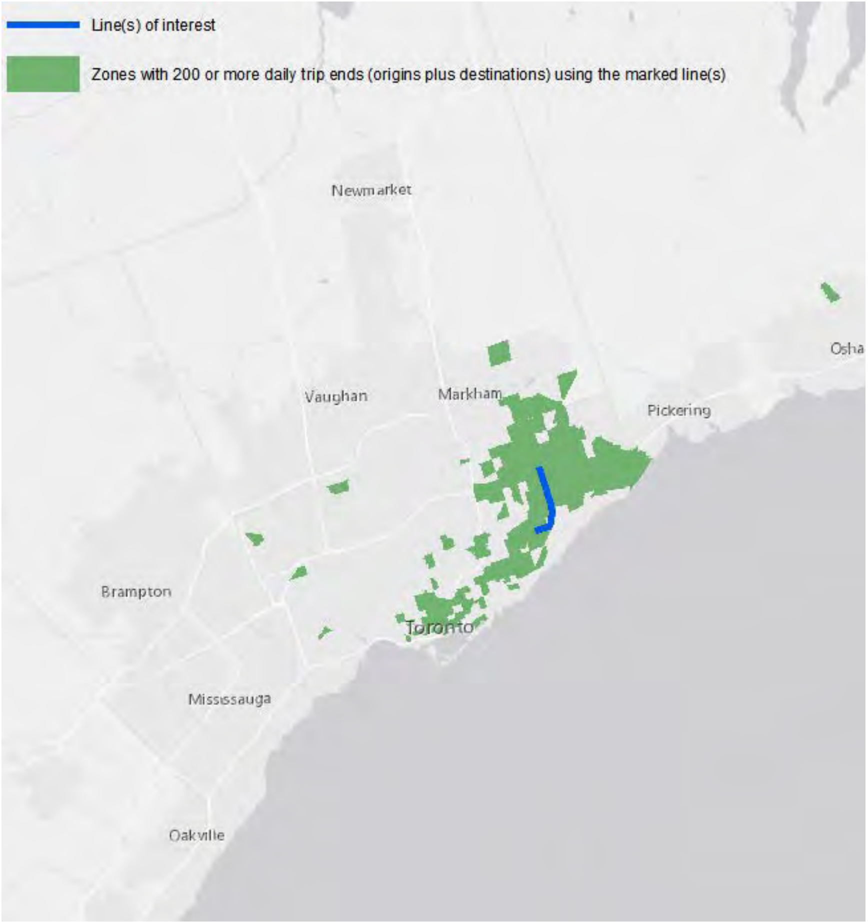

Figure 5.5: 2031 SSE Catchment Area, McCowan3 Alignment*

* Assumes Low population/Medium employment

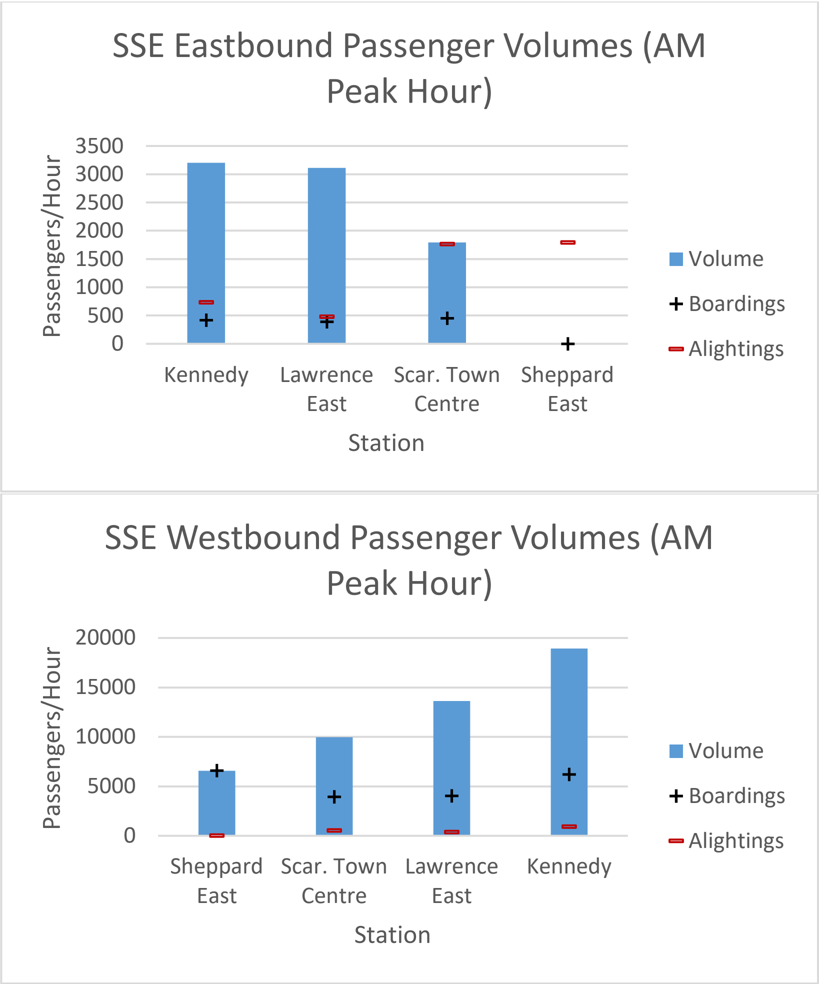

Figure 5.6: 2031 SSE Morning Peak Hour Ridership by Line Segment, McCowan3 Alignment*

* Assumes Low population/Medium employment.

Chapter 6: INTEGRATED RER/SMARTTRACK SERVICE CONCEPT ANALYSIS

6.1 INTRODUCTION

All results presented in Chapters 4 and 5 assume a full set of SmartTrack stations as defined in Figures B.1 – B.3 in Appendix B. It is possible that not all of these stations will be included in the final design of a SmartTrack service,[33] depending on a number of factors, most notably their contributions to the line's overall ridership/revenue on the one hand and capital and operating costs on the other. Operational impacts of more rather than less stations on overall line speeds and the interactions between SmartTrack and longer-distance RER trains using the same tracks are also of concern. Put very simply, additional stations increase network connectivity but slow the trains down somewhat (due to the additional stops) and add to the line's capital and operating costs.

This study is not tasked with investigating operating and costing issues, but it is concerned with ridership impacts. The net impact of more as opposed to fewer stations and the associated increased connectivity versus slower speeds on ridership can only be determined by testing different station scenarios within the ridership forecasting model. A full "optimization" of stations is well beyond the scope of this study, since this must involve joint assessment of ridership, cost and operational factors. In this study, several illustrative station options have been tested as a first step in terms of exploring the ridership trade-offs among various options.

Subsequent to the analysis of the "full" SmartTrack concept described in Chapter 3 and the ridership analyses based on this concept presented in Chapters 4 and 5, City Council at the March 31 council meeting authorized two specific scenarios to be investigated. These are Options "C" and "D" from City Staff report EX13.3, Appendix 2, as shown in Figures 6.1 and 6.2. These options vary from the SmartTrack concept assumed to this point in this report in important ways. Section 6.2 discusses the Option C and D assumptions and compares them in detail to the base SmartTrack concept described in Chapter 3. Section 6.3 then presents and discusses the 2031 ridership forecast results for a number of variants of Options C and D (where these variants represent different combinations of stations and SmartTrack frequencies) and compares these to Chapter 4 base results.

Several alternatives of the Relief Line (RL) and Scarborough Subway Extension (SSE), relative to those described in Chapter 3 and analyzed in Chapter 5, that emerged during the course of this study are also briefly examined in Sections 6.4 and 6.5, respectively, within the context of the integrated RER/SmartTrack service concept "Option C".

[33] Or, at least, in a first-phase implementation.

6.2 SMARTTRACK OPTIONS "C" & "D"

As discussed in greater detail in Chapter 3, the SmartTrack ridership estimates presented in Chapters 4 and 5 are based on the following key assumptions:

- SmartTrack is treated as a separate service from GO RER for modelling and analysis purposes.[34] That is, SmartTrack is treated as a separate service that shares the same corridor (and, implicitly, track) as the Stouffville and Kitchener GO RER services. This approach facilitated explicitly identifying SmartTrack ridership impacts. Reported SmartTrack ridership does not include Stouffville or Kitchener RER riders, and the SmartTrack headways exclude the RER trains sharing the SmartTrack corridor.
- GO RER trains are assumed to not stop at the new SmartTrack stations; they only stop at their RER Service Concept (base case) stations.
- Under the TTC fare scenarios any rider boarding a SmartTrack train between Unionville Station and the MACC pays a TTC fare. Riders boarding a GO RER train pay a standard GO fare, even if boarding a GO RER station within the City of Toronto.
- Similar assumptions hold for the portion of the Lakeshore East GO RER which shares the corridor with SmartTrack and the Stouffville GO RER line.

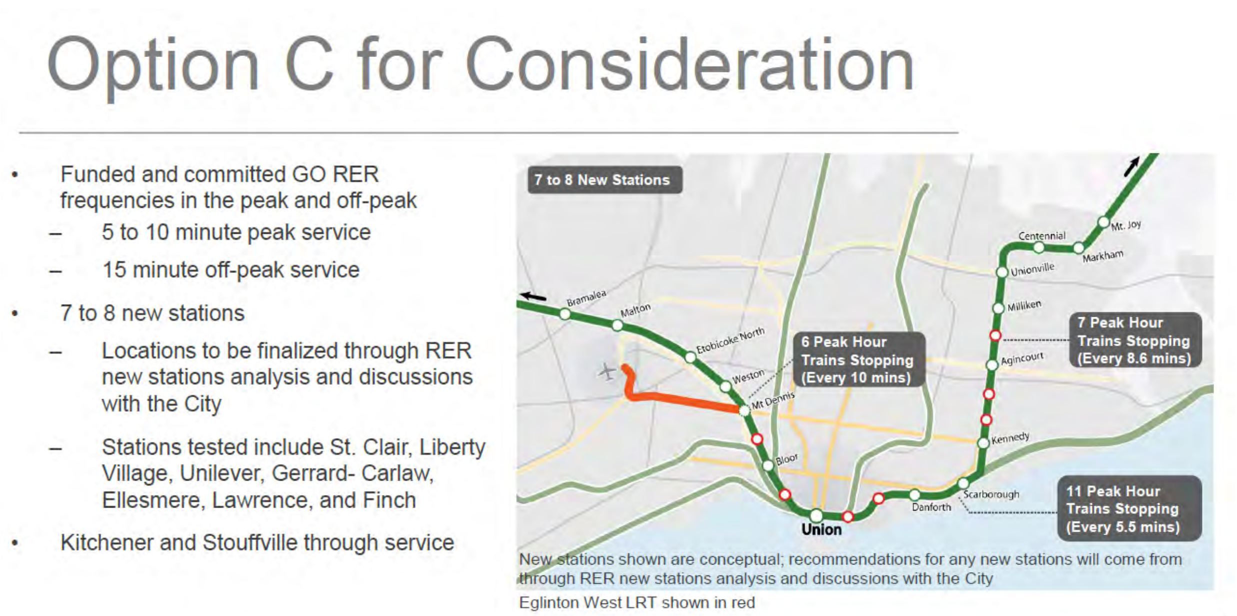

Figure 6.1: Proposed Integrated SmartTrack & RER Option C
Source: City Staff Report EX13.3, Appendix 2 (2016)

[34] I.e., no judgement is intended by this assumption as to the operator of this service or the extent of service integration between SmartTrack or GO RER.

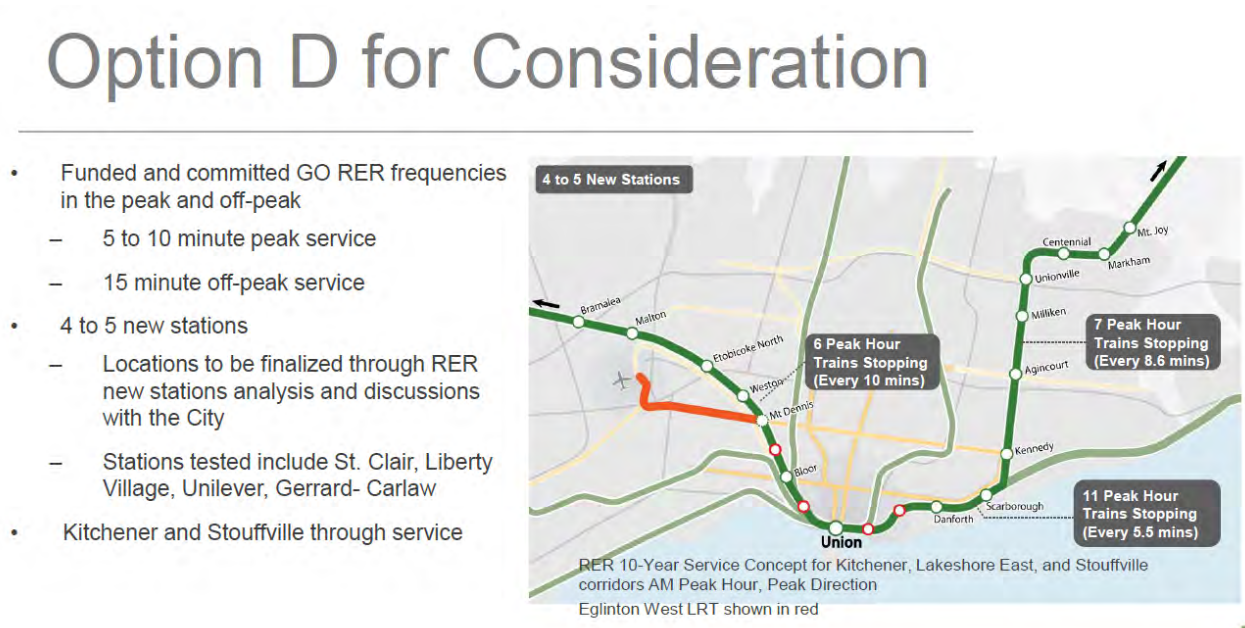

Figure 6.2: Proposed Integrated SmartTrack & RER Option D
Source: City Staff Report EX13.3, Appendix 2 (2016)

The intent of Options C and D is for SmartTrack and GO RER services to be treated in a more integrated way. The key differences between these new options and the base SmartTrack option just described are:

- GO RER trains (except for those operating in a limited-stop pattern) stop at all stations along the line, including any new station created as part of the SmartTrack project. This includes any new stations through which Lakeshore East trains pass.
- The "SmartTrack" corridor includes all stations on the Kitchener, Stouffville and Lakeshore East lines between Milliken and Mt. Dennis stations, inclusive. "SmartTrack" headway is explicitly defined herein as the combined headway on this "SmartTrack" corridor. [35,36].
- TTC fares are charged to any rider boarding any train at a station located within the "SmartTrack" corridor providing that the rider's egress station is also within that corridor.
- Riders on these three lines who board and/or alight at a GO RER station outside the "SmartTrack" corridor pay a standard GO fare. Note that this <u>includes</u> riders boarding/alighting at Unionville, who were previously allowed to pay a TTC fare if the

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[35] The Eglinton Crosstown Phase 2 alignment from Mt. Dennis to the MACC and Pearson Airport is assumed throughout this analysis. Frequencies and stations discussed in this chapter are for the Unionville-Union-Mt. Dennis heavy rail corridor. Different from the analysis presented in Chapters 4 and 5, Eglinton Crosstown Phase 2 ridership is *not* included in the ridership numbers presented in this chapter, since this line segment is constant across all options discussed herein.

[36] Assuming the Eglinton Crosstown Phase 2 service, it is conceivable that the SmartTrack service concept could be extended beyond Mt. Dennis along the Kitchener corridor to additional stations to the north-west of Mt. Dennis, perhaps as far as Bramalea or even Brampton. This option is not explored in this report, but could well be the subject of future investigations.

other end of their trip alighted/boarded at a SmartTrack station within the City of Toronto.[37]

- As in the original concept, note that "SmartTrack" trains provide through service at Union Station.

This new concept represented by Options C and D is henceforth referred to in this report as an *integrated service concept* (ISC). Note that it is consistent with the SmartTrack service concept presented in Chapter 3 in that it still involves mixing long-distance, lower-frequency “commuter” (GO RER) trains with somewhat shorter-distance, higher-frequency “urban metro” (SmartTrack) trains. Different fares for the two services are also maintained. The key difference is that now all trains stop at all stations along the line and, as a result, the “SmartTrack” service frequency experienced at any station with the SmartTrack (“urban metro”) service area is the combined frequency of the SmartTrack and GO RER trains.[38]

This explicit integration of the SmartTrack and GO RER services makes assessing the ridership impacts of various SmartTrack service options more difficult. The simplest but also the most consistent approach to dealing with this problem is to use the total combined ridership in each of the three corridors (Kitchener, Stouffville and Lakeshore East). Any changes (plus or minus) from the base (no SmartTrack) should be attributable to the SmartTrack scenario being tested (stations, SmartTrack frequency, etc.) since this is the only change between scenarios.

In order to provide a base against which Option C & D alternatives can be compared, Table 6.1 presents combined SmartTrack and GO RER results from Chapter 4 for the TTC fare, Eglinton Crosstown Phase 2 western alignment, low population – medium employment (with SmartTrack influence) scenarios for the range of SmartTrack headways examined. These results are taken as the base SmartTrack scenario against which the ISC Options C & D are compared. Table 6.1 presents the AM peak hour and total daily ridership by line and for the sum of the three corridors for the no-SmartTrack and 15-, 10- and 5-minute headway SmartTrack options.[39] The absolute numbers in these tables are larger than those presented in Chapter 4 due to the inclusion of the longer-distance GO RER riders, but the overall impact of the introduction of a high-frequency SmartTrack service is exactly the same. The 15-minute SmartTrack service results in a relatively modest increase in riders on the three lines relative to the Base RER Service Concept since it is in many respects simply a replacement of the 15-minute Unionville – Mt. Dennis Base RER Service Concept trains, along with through service at Union and the assumption of TTC fares. A 10-minute headway service however, adds 97,000 daily riders on top of the Base RER service, while a 5-minute headway service adds 231,000 daily riders relative to the Base RER service.

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[37] Note that riders boarding/alighting on at an Eglinton Crosstown Phase 2 station located within the City of Mississauga are assumed to pay a standard TTC fare. This is the same assumption as in the base SmartTrack Chapters 4 and 5 analyses.

[38] Previously, SmartTrack riders only “saw” the SmartTrack train frequency, while GO RER riders only “saw” the GO RER train frequency.

[39] Because of the “inter-lining” of the Stouffville and Kitchener lines due to the through-service at Union Station, it is difficult to separate Stouffville riders from Kitchener riders given limitations of the Emme network modelling software being used for this analysis. Thus, only total ridership for the two lines combined is shown.

Table 6.1: Base (Original Concept; Chapter 4) 2031 Combined SmartTrack & GO RER Ridership Forecasts*

a) Base 2031 Combined SmartTrack & GO RER Ridership Forecasts (AM Peak Hour)*

Scenario	RER Services		Total	Compared to Base, RER
	Kitchener-Stouffville Lines	Lakeshore East Line		
Base, No RER	8,300	12,100	20,400	-13,800
Base, RER Service Concept	18,700	15,400	34,100	0
SmartTrack, 15-minute headway	23,400	15,400	38,800	4,700
SmartTrack, 10-minute headway	33,700	15,400	49,100	15,000
SmartTrack, 5-minute headway	55,500	15,300	70,700	36,600

b) Base 2031 Combined SmartTrack & GO RER Ridership Forecasts (all day)*

Scenario	RER Services		Total	Compared to Base, RER
	Kitchener-Stouffville Lines	Lakeshore East Line		
Base, No RER	40,800	58,100	98,900	-65,400
Base, RER Service Concept	88,900	75,400	164,300	0
SmartTrack, 15-minute headway	125,600	75,100	200,700	36,400
SmartTrack, 10-minute headway	186,200	75,100	261,300	97,000
SmartTrack, 5-minute headway	321,200	74,600	395,800	231,500

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); Assumes TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Appendix G presents AM peak hour and total daily boardings and alightings at SmartTrack and GO RER stations for the same scenarios presented in Table 6.1. These can be compared to the corresponding station boardings and alightings for the various C and D scenarios analyzed in the next section.

ISC Options C and D only differ by the number of new stations (relative to the Metrolinx base RER Service Concept). The more restricted of the two, Option D assumes 4-5 new stations, while Option C assumes 7-8 new stations. This can be compared to the base SmartTrack service concept of 11 new stations. In the analysis presented herein, the station sets described in Table 6.2 are tested (and compared to the base, full-station SmartTrack scenario):

Table 6.2: Integrated Service Concept (ISC) Station Sets Tested

Station Set ID	Description
C0	Option C/D service pattern with new stations at St Clair, Liberty Village, Unilever, Gerrard-Carlaw, Lawrence, Ellesmere, Finch
C1	C0 plus Woodbine station
C2	C0 plus Lansdowne station
C3	C0 plus 14th Avenue station
D0	Option C/D service pattern with new stations at St Clair West, Liberty Village, Unilever, Gerrard-Carlaw
D1	D0 plus Lawrence station
D2	D0 plus Ellesmere station
D3	D0 plus Finch Station

Both Options C and D assume the following morning peak period headways:

- 3 trains per hour from Lincolnville to Union Station on the Stouffville line.
- 4 trains per hour from Oshawa to Union Station on the Lakeshore East line.
- 2 trains per hour from Mt Pleasant to Union Station on the Kitchener line.
- 4 trains per hour from Unionville to Bramalea on the Stouffville and Kitchener Lines, with through-service at Union Station.
- Additional limited-stop trains on the Kitchener and Lakeshore East corridors. With the exception of Union Station, these do not stop at stations in the Integrated Service Concept station sets.

This results in the following combined AM peak period frequencies by line segment as follows (note that these combined frequencies do not include limited-stop trains):

- 3 trains per hour Lincolnville-Unionville (20-minute headway).
- 4 trains per hour Oshawa-Scarborough Station (15-minute headway).
- 7 trains per hour Unionville-Scarborough Station (8.6-minute headway).
- 11 trains per hour Scarborough Station-Union (5.5-minute headway)
- 6 trains per hour Union-Bramalea (10-minute headway).

It must be stressed that, the number of new stations and fare policy aside, this is simply the Metrolinx RER Service Concept. The only “SmartTrack elements” are the inclusion of a limited number of new stations and adoption of TTC fares for trips made wholly within the City of

Toronto. The base case for this basic ISC scenario is the "Base with RER" case (the second row) in Tables 6.3 and 6.4.

Regardless of the station set assumed for a given scenario, in addition to this base 4 trains/hour (15-minute headway) assumption for the Unionville-Union-Mt. Dennis "SmartTrack" corridor, 12 trains/hour (5-minute headway) services are also tested so as to continue to explore the critical issue of service frequency on transit ridership.

6.3 2031 RIDERSHIP FORECASTS, OPTIONS "C' & "D"

Table 6.3 presents 2031 AM peak hour ridership results for the 16 station scenarios described above for the 15-minute (base) and 5-minute SmartTrack corridor service cases. Table 6.4 presents similar results for the 2031 all-day case. Appendix F presents similar forecasts for the 2041 case. Points to note from these two tables include:

- All "C" and "D" options produce more ridership, both in the AM peak hour and on a daily basis, relative to the Base RER Service Concept. They thus are preferred on a ridership basis to the Base RER Service Concept. As with previous findings, this represents a validation of the SmartTrack "urban metro" service concept involving reduced fares, additional stations and higher service frequency. The Base RER service concept clearly does not maximize ridership in these corridors, even when one accounts for impacts on the long-distance, 905-based commuter components of the service.
- Also consistent with the Chapter 4 analysis, there is very significant market potential that can be tapped as SmartTrack service frequencies are increased. All "C" and "D" options as specified in Figures 6.1 and 6.2 generate significantly less ridership both in the AM peak period and over the full day than the 5-minute headway option within the SmartTrack portion of these corridors. The base "C" and "D" options definitely do not represent "optimized" options from a ridership perspective: they "leave on the table" in the order of 133,000 daily riders that could be using this service under the 5-minute headway case.
- The various permutations of intermediate stations assumed generates very small changes in both AM peak-period and daily ridership. This may imply that the choice of intermediate stations to include in the first phase implementation of the service might be driven more by cost or other considerations. This is not to say that additional stations in the long run will not be needed, and certainly no design decisions should be taken that would preclude the addition of more stations.
- The overall ridership generated by the various 5-minute headway scenarios examined in this analysis relative to that generated by the scenarios considered in the Chapter 4 analysis is virtually identical. It is difficult at this time to sort out the impact of the reduced number of stations relative to the Chapter 4 analysis (which will reduce local access somewhat but also speed up the trains somewhat) relative to changes in fare, overall frequency assumptions and increased number of stops for the long-distance "RER" commuters. Further sensitivity testing of restoring additional intermediate stations would be useful, but beyond the resources of this study.

Table 6.3: 2031 ISC AM Peak Hour Ridership, Alternative Station Sets & Service Frequencies*

Scenario	ISC Services		Total	Compared to Base, RER	Compared to SmartTrack, 5 minute headway
	Kitchener-Stouffville Lines	Lakeshore East Line			
Option C0 – 15 min	32,900	17,800	50,700	16,500	-20,000
Option C1 – 15 min	32,800	17,700	50,600	16,400	-20,200
Option C2 – 15 min	32,600	17,800	50,300	16,200	-20,400
Option C3 – 15 min	32,800	17,800	50,500	16,400	-20,200
Option D0 – 15 min	33,100	17,900	50,900	16,800	-19,800
Option D1 – 15 min	32,900	17,800	50,700	16,500	-20,100
Option D2 – 15 min	33,200	17,800	50,900	16,800	-19,800
Option D3 – 15 min	33,500	17,800	51,300	17,200	-19,400
Option C0 – 5 min	59,600	17,100	76,700	42,600	6,000
Option C1 – 5 min	59,500	17,000	76,600	42,400	5,800
Option C2 – 5 min	58,300	17,000	75,300	41,200	4,600
Option C3 – 5 min	59,400	17,100	76,500	42,300	5,700
Option D0 – 5 min	58,000	17,100	75,100	41,000	4,400
Option D1 – 5 min	58,100	17,100	75,200	41,100	4,500
Option D2 – 5 min	58,600	17,100	75,700	41,600	5,000
Option D3 – 5 min	59,200	17,100	76,300	42,200	5,600

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Table 6.4: 2031 ISC All Day Ridership, Alternative Station Sets & Service Frequencies*

Scenario	ISC Services		Total	Compared to Base, RER	Compared to SmartTrack, 5 minute headway
	Kitchener-Stouffville Lines	Lakeshore East Line			
Option C0 – 15 min	173,200	89,700	262,900	98,600	-132,900
Option C1 – 15 min	172,800	89,500	262,300	98,000	-133,500
Option C2 – 15 min	172,300	89,700	262,000	97,700	-133,800
Option C3 – 15 min	172,800	89,800	262,600	98,300	-133,200
Option D0 – 15 min	170,500	90,200	260,700	96,400	-135,100
Option D1 – 15 min	170,700	89,800	260,500	96,200	-135,300
Option D2 – 15 min	171,600	89,800	261,400	97,100	-134,400
Option D3 – 15 min	173,900	89,900	263,800	99,500	-132,000
Option C0 – 5 min	329,300	86,100	415,400	251,100	19,700
Option C1 – 5 min	329,400	85,900	415,300	251,000	19,500
Option C2 – 5 min	324,400	85,800	410,200	245,800	14,400
Option C3 – 5 min	328,700	86,200	414,900	250,600	19,100
Option D0 – 5 min	312,800	86,300	399,100	234,800	3,300
Option D1 – 5 min	315,900	86,100	402,100	237,800	6,300
Option D2 – 5 min	318,400	86,200	404,700	240,400	8,900
Option D3 – 5 min	321,400	86,200	407,600	243,300	11,900

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

2031 station boardings and alightings for the AM peak hour and 24-hour time periods for the station sets and frequency combinations tested are presented in Appendix G. The tables in Appendix G indicate that, in general, the introduction of the SmartTrack service has very little impact on RER station boardings/alightings outside the City of Toronto. They remain essentially constant across SmartTrack frequency assumptions for the outer-most stations of Lincolnville and Stouffville (Stouffville line), Malton, Bramalea and stations north-west of Bramalea

(Kitchener line) and the Lakeshore East stations east of Scarborough station. Stations closer to the City boundaries (and the commencement of the SmartTrack service) decline somewhat as SmartTrack frequency increases, but these declines are generally compensated by significant increases in boardings at Unionville, Mt. Dennis, Scarborough and Danforth stations. Hence, the concern that adding SmartTrack trains within the RER corridors would have detrimental impacts on longer-distance commuters seems to be largely unfounded. This holds regardless of the ISC station set assumed.

Tables 6.5 and 6.6 present 2031 travel time savings for the station sets and frequency combinations tested. Comparable numbers for 2041 can be found in Appendix H. As in the case of ridership, travel time savings do not vary much among the base "C" and "D" options. Extending the SmartTrack service to 5-minute headways more than doubles the resulting travel time savings, yet again indicating the importance of low headways (high frequency) on maximizing the benefits generated by the line.

Table 6.5: 2031 ISC Transit & Auto Daily Travel Time Savings by SmartTrack Scenario*

ISC Option	Transit Time Savings	Transit Fare Savings	Auto Time Savings
	Total Hours Saved per Day	Total Hours (Equivalent) Saved per Day	Total Hours Saved per Day
Option C0 – 15 min	20,900	5,700	2,600
Option C1 – 15 min	20,500	5,400	5,100
Option C2 – 15 min	20,100	5,700	3,800
Option C3 – 15 min	20,300	5,400	3,500
Option D0 – 15 min	22,200	5,800	5,400
Option D1 – 15 min	21,200	5,700	4,400
Option D2 – 15 min	21,500	5,600	5,400
Option D3 – 15 min	22,400	5,700	4,400
Option C0 – 5min	56,900	4,900	7,400
Option C1 – 5min	56,000	4,600	8,500
Option C2 – 5min	57,500	4,900	6,700
Option C3 – 5min	57,100	4,700	6,900
Option D0 – 5min	56,300	5,200	7,200
Option D1 – 5min	55,200	5,100	8,200
Option D2 – 5min	55,900	5,100	8,200
Option D3 – 5min	57,400	5,100	6,500

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment

Table 6.6: 2031 ISC Summary of 2031 Travel Time Savings, Transit Expressed in Monetary Terms, Daily & Annual*

ISC Option	Transit Time Savings		Transit Fare Savings		Auto Time Savings	
	Daily	Annual	Daily	Annual	Daily	Annual
Option C0	$334,400	$103.7 mil	$91,200	$28.3 mil	$41,600	$12.9 mil
Option C1	$328,000	$101.7 mil	$86,400	$26.8 mil	$81,600	$25.3 mil
Option C2	$321,600	$99 mil	$91,200	$28.1 mil	$60,800	$18.7 mil
Option C3	$324,800	$100.7 mil	$86,400	$26.8 mil	$56,000	$17.4 mil
Option D0	$355,200	$110.1 mil	$92,800	$28.8 mil	$86,400	$26.8 mil
Option D1	$339,200	$105.2 mil	$91,200	$28.3 mil	$70,400	$21.8 mil
Option D2	$344,000	$106.6 mil	$89,600	$27.8 mil	$86,400	$26.8 mil
Option D3	$358,400	$111.1 mil	$91,200	$28.3 mil	$70,400	$21.8 mil
Option C0 – 5min	$910,400	$282.2 mil	$78,400	$24.3 mil	$118,400	$36.7 mil
Option C1 – 5min	$896,000	$277.8 mil	$73,600	$22.8 mil	$136,000	$42.2 mil
Option C2 – 5min	$920,000	$283.4 mil	$78,400	$24.1 mil	$107,200	$33 mil
Option C3 – 5min	$913,600	$283.2 mil	$75,200	$23.3 mil	$110,400	$34.2 mil
Option D0 – 5min	$900,800	$279.2 mil	$83,200	$25.8 mil	$115,200	$35.7 mil
Option D1 – 5min	$883,200	$273.8 mil	$81,600	$25.3 mil	$131,200	$40.7 mil
Option D2 – 5min	$894,400	$277.3 mil	$81,600	$25.3 mil	$131,200	$40.7 mil
Option D3 – 5min	$918,400	$284.7 mil	$81,600	$25.3 mil	$104,000	$32.2 mil

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

6.4 ONE-STOP EXPRESS SSE & EGLINTON CROSSTOWN EAST EXTENSION ANALYSIS

Subsequent to the analysis of various multi-stop SSE alignments discussed in Chapter 5, City Planning is preparing an initial Business Case for the project has narrowed the SSE options to the original McCowan 3-stop (which extends from Sheppard to Kennedy and has two statins in-between (see Figure B.9, Appendix B), and an “express” or “1-stop” option, which provides an express connection between the Scarborough City Centre and Kennedy Station (see Figure B.11, Appendix B). In addition, it is proposed to package the "1-stop" option with an Eglinton Crosstown extension eastward from Kennedy station to the University of Toronto Scarborough campus (UTSC), called the Eglinton East LRT (see Figure B.12, Appendix B).

These SSE options were tested with the integrated SmartTrack “Option C0” service concept described above. Overall 2031 ridership estimates for these three SSE options are shown in Table 6.7 below. Points to note include:

- Reducing the SSE from three to one stops reduces peak hour ridership on the line by approximately one-third (from 11,100 to 7,300 and daily ridership by 38% (63,800 versus for the 3-stop case of 103,000).
- Net new riders goes up marginally with the one-stop alignment.
- Implementation of the Eglinton East LRT has a very marginal impact on the SSE, since it is largely serving a somewhat different catchment area.

Table 6.7: 2031 Ridership Estimates, SSE Options*

RER/SmartTrack Scenario	Scarborough Subway Scenario	Daily SSE Users	AM Peak Hour, Peak Point Ridership	Daily Net New Riders**
Option C (7 stations)	McCowan 3-Stop	103,000	11,100	3,100
Option C (7 stations)	Express without Eglinton East LRT	63,800	7,300	4,500
Option C (7 stations)	Express with Eglinton East LRT to UTSC	62,100	7,150	2,500

*All scenarios use Low/Medium Pop/Emp with SmartTrack Influence.
** Daily Net New Riders calculated by comparing to a base with Option C and the current SRT in place.

The Eglinton East LRT itself is another large transit project that requires an initial Business Case analysis. For this project, City Planning has made the choice to focus on two different LRT options, one ending at UTSC (as per above), and another continuing north from UTSC to Sheppard (Figure B.13, Appendix B). Ridership estimates for these two options can be seen in Table 6.8 below. Please note that these are preliminary ridership numbers and further refinement on the service concept and the surrounding feeder bus network may be required. Total ridership estimates for the two alignments within this very preliminary analysis are essentially identical.

Table 6.8: 2031 Ridership Estimates, Eglinton East LRT Options

RER/SmartTrack Scenario	Eglinton East LRT Scenario	Daily Users of Eglinton LRT East	AM Peak Hour, Peak Point Ridership on LRT East	Daily Net New Riders
Option C with SSE Express	Eglinton East LRT to UTSC	37,600	4,800	-2,000
Option C with SSE Express	Eglinton East LRT to Sheppard	38,400	4,800	-2,000

* All scenarios use Low/Medium Pop/Emp with SmartTrack Influence.
** Daily Net New Riders calculated by comparing to a base with Option C and the SSE Express in place.

6.5 RELIEF LINE ALIGNMENT ADDITIONAL ANALYSIS

6.5.1 Introduction

Similar to the SSE case, work has continued within City Planning on refining the RL "Little-J" and "Big-J" alignments since the analysis presented in Chapter 5 was prepared in support of preparing an initial Business Case for the RL. Two "Little-J" alignments have been the focus of this analysis:

- From Pape Station on Line 2 to downtown via Queen (labelled "AQ").
- From Pape Station on Line 2 to downtown via Eastern then Queen (labelled "EQ").

Changes in service assumptions introduce by City Planning and the TTC relative to those used in Chapter 5 are:

- Updated, refined alignment speeds that differ from (and are slightly slower than) the corridor speeds assumed in the Chapter 5 analysis.
- Headways are now assumed to be 2 min (peak) and 3 min (off-peak) relative to the previously assumed 3 (peak) / 4.5 (off-peak) min headways previously assumed. These new headways are more consistent with the anticipated future headways on the Bloor-Danforth and Yonge-University-Spadina lines.

These revised assumptions for the RL were tested with and without the integrated SmartTrack service concept (ISC) scenario C0. 2031 and 2041 ridership estimates for the "Little-J" options are presented in Section 6.5.2 and Appendix H, respectively. 2041 ridership estimates for the "Big-J" options are presented in Section 6.5.3. All results shown assume TTC fares on SmartTrack and the low population / medium employment with SmartTrack influence land use scenario for runs involving SmartTrack.

6.5.2 2031 Revised "Little-J" RL Ridership Estimates

Table 6.9 presents AM peak-hour, AM peak-period and all-day "Little-J" RL ridership without SmartTrack. These ridership estimates are consistent with, but slightly larger than, those generated by the previously assumed RL operating characteristics (cf. Table 5.1). This indicates that the reduced headways assumed more than compensate for the slightly slower in-vehicle travel times, again indicating the importance of service frequency in attracting ridership. Note that, as in the previous Chapter 5 analysis, the Unilever stop option (EQ) generates slightly lower ridership than the shorter AQ alignment that does not "detour" to hit the Unilever site. The slower travel time from Pape station to the downtown provided by the Unilever option to trip-makers results in fewer people transferring from the Bloor-Danforth line to the RL. Also note, however, that the land use scenario used in these tests do not include possible development impacts of the RL on the Unilever site.

Table 6.9: 2031 RL Boardings by Time of Day and Alignment, without ISC Option C0*

		RL Boardings			Peak Point - Peak Direction	
Alignment	**Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
AQ	Pape via Queen	28,700	58,500	177,100	Westbound leaving Queen/Sumach	17,200
EQ	Pape via Queen (with Unilever Stop)	26,800	54,600	165,500	Westbound leaving King/Cherry	13,400

* Assumes Low population/Medium employment without SmartTrack influence land use

Table 6.10 presents RL ridership with implementation of the SmartTrack ISC Option C0. RL alignment AQ ridership goes down by 3,100 in the AM peak hour and 8,900 over the day, while alignment EQ daily ridership increases by 10,400. This slight increases most likely largely reflects the increased development assumed at the Unilever site due to the SmartTrack influence.

Table 6.10: 2031 RL Boardings by Time of Day and Alignment, with ISC Option C0*

		(a) RL Boardings, with Option C			Peak Point - Peak Direction	
Alignment	**Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
AQ	Pape via Queen	25,600	52,100	168,400	Westbound leaving Queen/Sumach	13,100
EQ	Pape via Queen (with Unilever Stop)	27,000	55,000	175,900	Westbound leaving King/Cherry	11,200

* Assumes Low population/Medium employment with SmartTrack influence land use

Tables 6.11 and 6.12 explore the impacts of both the revised RL and SmartTrack ISC C0 lines on Yonge line relief. Comparing these results to those generated in the Chapter 5 analysis (Tables 5.3 and 5.4), the impacts are similar, but somewhat greater. Note that, as in the Chapter 5 analysis, the EQ (Unilever stop) alignment results in 2,500 more AM peak hour riders on the Yonge line southbound from Bloor and diverts 2,700 fewer transfers at Bloor station than the AQ (no-Unilever) option. Again, this reflects the slower Pape-to-downtown travel time provided by the EQ option, making it somewhat less effective as relief for the Yonge line.

Finally, Table 6.13 shows 2031 net new riders for the revised "Little-J" RL with and without the SmartTrack ISC Option C0. Again, RL numbers increase somewhat with the new operating assumptions, but the general result is the same: the "Little-J" RL is expected to generated limited new ridership, with its primary function being relief for the Yonge line by providing an alternative path into the downtown for transit riders travelling from the east.

Table 6.11: 2031 Yonge Line Relief, RL & SmartTrack Combinations*

Alignment	Description	SmartTrack	Volume, Southbound from Bloor (AM Peak Hour)	Volume Change, Southbound from Bloor (AM Peak Hour) Attributable to RL	Total
	2031 Low-Med Base		**40,100**	*** Acts as Base**	
AQ	Pape via Queen	None	34,200	-5,900	-5,900
EQ	Pape via Queen (with Unilever Stop)	None	36,700	-3,400	-3,400
	2031 Option C without RL		**36,000**	*** Acts as Base**	**-4,100**
AQ	Pape via Queen	Option C	31,900	-4,100	-8,200
EQ	Pape via Queen (with Unilever Stop)	Option C	33,700	-2,300	-6,400

* Assumes Low population/Medium employment SmartTrack influence land use when Option C is included.

Table 6.12: 2031 AM Peak Westbound Bloor to Southbound Yonge Transfers*

Alignment	Description	SmartTrack	WB BD-SB YUS Transfers at Bloor-Yonge (AM Peak Hour)	Change from Base Attributable to RL	Total
	2031 Low-Med Base		**10,300**	***Acts as Base**	
AQ	Pape via Queen	None	4,600	-5,700	-5,700
EQ	Pape via Queen (with Unilever Stop)	None	7,300	-3,000	-3,000
	2031 Option C without RL		**7,500**	***Acts as Base**	**-2,800**
AQ	Pape via Queen	Option C	3,800	-3,700	-6,500
EQ	Pape via Queen (with Unilever Stop)	Option C	5,400	-2,100	-4,900

* Assumes Low population/Medium employment SmartTrack influence land use when Option C is included.

Table 6.13: Table 6.13: 2031 Daily Net New System Riders Generated by the Relief Line*

Alignment	Description	SmartTrack	Daily New Net Transit Riders (System Wide) Attributable to RL	Total
	2031 Low-Med Base		***Acts as Base**	
AQ	Pape via Queen	None	10,800	10,800
EQ	Pape via Queen (with Unilever Stop)	None	13,400	13,400
	2031 Option C without RL		***Acts as Base**	**27,500**
AQ	Pape via Queen	Option C	10,300	37,700
EQ	Pape via Queen (with Unilever Stop)	Option C	15,600	43,100

* Assumes Low population/Medium employment SmartTrack influence land use when Option C is included.

6.5.3 6.5.3 2041 "Big-J" RL Ridership

Tables 6.14 and 6.15 show revised 2041 "Big-J" RL ridership with and without the SmartTrack ISC Option C0. The no-SmartTrack AM peak hour riders are estimated to be 7,200 and 7,700 higher than the Chapter 5 estimates (cf. Table 5.6) for the AQ and EQ options, respectively, while the all-day increases are 49,500 and 41,800, respectively. The with-ISC C0 SmartTrack option results are very similar to the full-SmartTrack, 15-minute headway results (cf. Table 5.7), with very little difference in ridership being seen between the two RL options.

Table 6.14: 2041 "Big-J" RL Boardings by Time of Day and Alignment, without ISC Option C*

		RL Boardings			Peak Point - Peak Direction	
Alignment	**Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	50,800	103,600	314,200	Westbound leaving Pape/Gerrard	26,200
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	48,200	98,300	304,400	Westbound leaving Pape/Gerrard	21,200

* Assumes Low population/Medium employment without SmartTrack influence land use

Table 6.15: 2041 "Big-J" RL Boardings by Time of Day and Corridor, with ISC Option C*

		(a) RL Boardings, with Option C			Peak Point - Peak Direction	
Alignment	**Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	49,300	100,600	318,000	Westbound leaving Pape/Gerrard	23,100
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	52,100	106,300	336,400	Westbound leaving Pape/Gerrard	19,300

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base).

Tables 6.16 and 6.17 examine the impact of the "Big-J" RL on Yonge line relief in 2041, with and without the ISC Option C0 SmartTrack. The AQ option reduces the loading on the Yonge line southbound from Bloor station in the AM peak to below its projected capacity of 36,000 passengers/hour, while the EQ option approximately meets the capacity target. With the addition of the SmartTrack ISC Option C0 both "Big-J" RL options result in under-capacity peak-hour flows on the Yonge line.

Table 6.16: 2041 Yonge Line Relief, "Big J" RL & SmartTrack Combinations*

Alignment	Description	SmartTrack	Volume, Southbound from Bloor (AM Peak Hour)	Volume Change, Southbound from Bloor (AM Peak Hour) Attributable to RL	Total
	2041 Low-Med Base		**42,600**	*** Acts as Base**	
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	None	32,700	-9,900	-9,900
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	None	36,100	-6,500	-6,500
	2041 Option C without RL		**38,600**	*** Acts as Base**	**-4,000**
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	Option C	30,700	-7,900	-11,900
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	Option C	32,600	-6,000	-10,000

* Assumes Low population/Medium employment SmartTrack influence land use when Option C is included.

Table 6.17: 2041 AM Peak Westbound Bloor to Southbound Yonge Transfers*

Alignment	Description	SmartTrack	WB BD-SB YUS Transfers at Bloor-Yonge (AM Peak Hour)	Change from Base Attributable to RL	Total
	2041 Low-Med Base		**10,400**	***Acts as Base**	
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	None	5,100	-5,300	-5,300
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	None	8,400	-2,000	-2,000
	2041 Option C without RL		**7,800**	***Acts as Base**	**-2,600**
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	Option C	3,900	-3,900	-6,500
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	Option C	5,900	-1,900	-4,500

* Assumes Low population/Medium employment SmartTrack influence land use when Option C is included.

Finally, Table 6.18 presents estimated net new 2041 riders for the Big-J RL options, with and without the ISC Option C0 SmartTrack.

Table 6.18: 2031 Daily Net New System Riders Generated by the "Big J" Relief Line*

Alignment	Description	SmartTrack	Daily New Net Transit Riders (System Wide)	
			Attributable to RL	Total
	2041 Low-Med Base		*Acts as Base	
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	None	26,500	26,500
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	None	30,400	30,400
	2041 Option C without RL		***Acts as Base**	**59,600**
AQ extended to Sheppard	Pape via Queen extended to Sheppard Ave	Option C	26,500	86,100
EQ extended to Sheppard	Pape via Queen (with Unilever Stop) extended to Sheppard Ave	Option C	35,500	95,100

* Assumes Low population/Medium employment SmartTrack influence land use when Option C is included.

6.5.4 Revised Yonge Subway Extension (YSE) Ridership Estimates

Tables 6.19 and 6.20 present revised Yonge line AM peak hour ridership south of Bloor and the AM peak hour transfers from Bloor-Danforth westbound to Yonge southbound for the case of implementation of the YSE, for 2031 and 2041 forecast years, with and with Relief Line (RL) and the SmartTrack C0 option. These tables can be compared to the results in Tables 5.11 and 5.12 for the original SmartTrack cases examined.

Table 6.19: Yonge Subway 2031 AM Peak Hour Data with YSE and EQ Relief Line Option*

Scenario	Southbound Volume, South of Bloor	Transfers, WB BD to SB YUS
Base: No YSE, Relief Line or SmartTrack	40,100	10,300
YSE, No Relief Line or SmartTrack	43,700	10,100
YSE with "Little J" EQ Relief Line Only	40,100	7,000
YSE with Option C0 Only	39,700	7,500
YSE with both "Little J" EQ Relief Line and Option C0	37,100	5,300

* Assumes Low population/Medium employment (with SmartTrack influence land use in cases with SmartTrack); Option C0; Relief Line refers to “Little-J” alignment EQ.

As shown in Table 6.19, no combination of Relief Line with the SmartTrack C0 option reduces the 2031 Yonge line ridership south of Bloor to below capacity. In 2041, only the combination of the "Big J" RL and the C0 SmartTrack option barely achieves the Yonge line capacity threshold, leaving no margin for variations in flow or operating conditions. As indicated in the Chapter 5 analysis, higher frequency SmartTrack options than the C0 option tested here will be required to reduce Yonge line ridership below capacity in both the 2031 and 2041 cases.

Table 6.20: Yonge Subway 2041 AM Peak Hour Data with YSE and EQ Relief Line Option*

Scenario	Volume	Transfers, WB BD to SB YUS
Base: No YSE, Relief Line or SmartTrack	42,600	10,400
YSE, No Relief Line or SmartTrack	45,800	10,100
YSE with "Little J" EQ Relief Line Only	42,300	7,200
YSE with Option C0 Only	41,900	7,900
YSE with both "Little J" EQ Relief Line and Option C0	39,600	5,700
YSE with both "Big J" EQ Relief Line and Option C0	36,000	5,400

* Assumes Low population/Medium employment (with SmartTrack influence land use in cases with SmartTrack); Option C0; Relief Line refers to alignment EQ.

Table 6.21 and 6.22 below present similar data, with the only difference being the AQ Relief Line alignment is assumed instead of the EQ alignment. Comparing Table 6.19 to Table 6.21 and Table 6.20 to Table 6.22, respectively, it is seen that the AQ alignment generates more relief to the Yonge line than the EQ alignment. As can be seen in Table 6.21, the combination of the AQ Relief Line and Option C0 reduces the 2031 Yonge line ridership south of Bloor to just below capacity. In 2041, only the combination of the "Big J" AQ RL and the C0 SmartTrack option reduces the Yonge line ridership south of Bloor to below capacity.

Table 6.21: Yonge Subway 2031 AM Peak Hour Data with YSE and AQ Relief Line Option*

Scenario	Southbound Volume, South of Bloor	Transfers, WB BD to SB YUS
Base: No YSE, Relief Line or SmartTrack	40,100	10,300
YSE, No Relief Line or SmartTrack	43,700	10,100
YSE with "Little J" AQ Relief Line Only	37,200	3,900
YSE with Option C0 Only	39,700	7,500
YSE with both "Little J" AQ Relief Line and Option C0	35,200	3,200

* Assumes Low population/Medium employment (with SmartTrack influence land use in cases with SmartTrack); Option C0; Relief Line refers to alignment EQ.

Table 6.22: Yonge Subway 2041 AM Peak Hour Data with YSE and AQ Relief Line Option*

Scenario	Southbound Volume, South of Bloor	Transfers, WB BD to SB YUS
Base: No YSE, Relief Line or SmartTrack	42,600	10,400
YSE, No Relief Line or SmartTrack	45,800	10,100
YSE with "Little J" AQ Relief Line Only	39,690	4,400
YSE with Option C0 Only	41,900	7,900
YSE with both "Little J" AQ Relief Line and Option C0	37,800	3,500
YSE with both "Big J" AQ Relief Line and Option C0	34,800	3,700

* Assumes Low population/Medium employment (with SmartTrack influence land use in cases with SmartTrack); Option C0; Relief Line refers to alignment EQ.

Chapter 7: STUDY SUMMARY & KEY FINDINGS

7.1 STUDY SUMMARY

The purpose of this study was to provide transit ridership estimates and other key network performance measures for alternative configurations for the proposed SmartTrack service using the City of Toronto's new regional travel demand model system, GTAModel V4.0. This work included:

- Confirming the integrated RER and SmartTrack Service Concept to be modelled.
- Completion and validation of a new travel demand model system to be used by the City of Toronto in this and similar studies of transit ridership and travel demand.
- Development and review of forecasting assumptions that provide key inputs into the transit ridership forecasts.
- Generating transit ridership forecasts for the identified range of future year networks and input scenarios.
- Analysis and comparison of ridership forecast results.
- Documentation and reporting of all work and results.

The study did not deal with:

- Detailed engineering design considerations of route alignments and stations.
- Capital and operating costs of alternative network designs.
- Financing mechanisms to pay for the construction and operation of network additions.

While the primary focus of this analysis was on options for the proposed SmartTrack line, this line cannot be considered in isolation of the overall Greater Toronto-Hamilton Area (GTHA) transit network and, in particular, other major transit infrastructure proposed investments, notably GO RER plans, Scarborough Subway Extension (SSE) options, and Relief Line (RL) options (formerly often referred to as the Downtown Relief Line). Similarly, the future is a very uncertain place, and so ranges of estimated ridership need to be generated across a variety of possible future year growth scenarios and other assumptions. Given this, a wide range of combinations of network investment and growth scenarios are generated in this study and results were compared in detail.

The transit ridership forecasts were generated using a large computer simulation model system called GTAModel V4.0. This model system simulates all trips made by all persons in the GTHA by all modes for all trip purposes over the course of a "typical" 24-hour weekday

The ridership analysis consisted of three major parts:

1. Analysis of a wide range of SmartTrack options compared to a base future network case. Alternative service frequencies, fares and alignments were examined.
2. Analysis of the interaction of SmartTrack with the proposed Relief Line and Scarborough Subway Extension, for various options for each of these lines. The focus of this analysis was not to provide a detailed examination of these lines, but primarily to understand the likely interaction between them and SmartTrack

3. Analysis of a number station options within an integrated RER/SmartTrack service concept, labelled in this report the ISC – Integrated Service Concept.

7.2 KEY FINDINGS

7.2.1 SmartTrack

Key findings of this study with respect to SmartTrack include the following:[40]

- The ridership analysis in Chapter 4 clearly demonstrates a very significant market potential for SmartTrack, in the order of 300,000 riders per day with a 5-minute service headway in 2031. This far exceeds any other rail project under current consideration by the City of Toronto (including the under-construction Eglinton Crosstown LRT and the proposed GO RER system) and is only exceeded by the Yonge-University-Spadina and Bloor-Danforth subway lines within the existing TTC network.
- Ridership is very sensitive to both fares and service headway (frequency). Maximization of ridership requires high frequency service and is significantly enhanced if TTC rather than GO fares are applied to the system. Considerable latent demand for transit appears to exist within the system that can be realized if attractive transit services are provided that tap into the natural spatial pattern of this demand. SmartTrack clearly does this when operated at higher frequency levels.
- The attractiveness of through-service between the Stouffville and Kitchener lines at Union Station is validated, with significant through movements occurring in both directions at Union Station, especially at higher service frequencies.
- Further, emerging/planned nodes at both Liberty Village to the west of the downtown core and the Unilever site to the east represent important new transit and development nodes that are very well served by SmartTrack. SmartTrack provides the ability to "seamlessly" extend the traditional downtown into attractive new development areas.
- SmartTrack clearly outperforms the Base RER Service Concept from a ridership perspective, even at higher headways, regardless of design scenario considered. The SmartTrack concept is one of an "urban metro" (subway) in which a greater number of stops, significantly higher frequency, and all-day, two-way service much better meets the needs of not just commuters (short- as well as long-distance) but a much wider range of trip-makers in general. As clearly shown by the ridership analysis, it is this style of service that is required to divert auto users to transit (on the one hand) and to provide enhanced transit service to beleaguered current transit riders (on the other). As noted above, such a service is capable of tapping into the latent demand for transit that exists, providing that the service concept is fully implemented.
- Largely based on cost and constructability considerations, the City of Toronto has elected to proceed on the assumption that the Eglinton Crosstown LRT will be extended west from Mt. Dennis, rather than the originally proposed continuation of the heavy-rail line

[40] Note that these findings generally are for the case in which TTC fares are applied to SmartTrack, in keeping with the SmartTrack design concept as an "urban metro" and as integrated, key component of the overall Toronto transit network. Ridership as found in this study to be very sensitive to fares. Application of higher fares (such as current GO fares) would reduce ridership considerably.

branching from the Kitchener line at that point. From the ridership analysis undertaken in this study, there is relatively little difference among these alternative alignments.

- The "reverse flow" outbound in the morning and inbound in the afternoon to/from the termini of SmartTrack at the Mississauga Airport Corporate Centre (MACC) in the west and Unionville/Markham in the north-east that had been hypothesized by some to be potentially large does not materialize in this analysis to any significant degree. This, however, may well reflect the current lack of good "last mile" solutions for getting commuters from the suburban train stations to their actual workplaces. This is a common challenge facing all rail lines (including the Base RER Service Concept) in attracting significant "reverse flow" into lower density suburban areas.
- Providing that key stations are included in the system (notably Liberty Village and Unilever) overall ridership does not appear to vary dramatically with the inclusion or exclusion of some of the more minor "intermediate" stations along the alignment. Thus, a "Phase 1" system with less than the full build-out is certainly conceivable and should be successful. This does not imply, however, that additional stations will not be required so as to maximize the full potential over time. Provision for the full suite of stations over the longer term should certainly be made in designing the line, and more detailed analysis of the ridership opportunities (and overall benefit-cost trade-offs) should be undertaken.
- The currently proposed "Options C and D" presented to Council in March 2016 both represent improvements over the Base RER Service Concept with respect to ridership. It is clear, however, that they do not represent optimal designs with respect to ridership maximization, which requires higher service frequencies.
- SmartTrack offers significant "relief" to the over-crowded Yonge line, especially when it is run at higher frequencies. It can both divert people travelling from the east away from using the Bloor-Danforth line (thereby reducing the number of transfers occurring at the critical Bloor-Yonge interchange station) and people travelling from the north away from the Yonge line altogether. As discussed below, none of the Relief Line "Little-J" corridors will provide adequate long-term relief to Yonge and SmartTrack is seen to be an important element in addressing this chronic, long-term challenge. The potential extension of the Relief Line to Sheppard Avenue, however, offers the prospect of more significant long-term (2041) relief to the over-crowded Yonge line. It does not, however, replace the need for SmartTrack.
- SmartTrack's catchment area – the spatial extent of the trip origins and destinations using the line – is very large. The five-minute headway catchment area covers 55,000 hectares and serves a total 2031 travel market of nearly 3 million people and 7.4 million total daily trips. Comparable numbers for the Eglinton Crosstown, for example are 18,800 hectares, 1.3 million people and 4.4 million total daily trips.
- SmartTrack provides enhanced transit network connectivity throughout much of the City of Toronto, linking with many major east-west transit routes. It makes these routes more productive, while at the same time reducing over-crowding on both the Yonge and the Bloor-Danforth subway lines. In particular, the Stouffville portion of the line provides a new "transit spine", analogous to the Yonge line, upon which a significantly improved Scarborough transit network can be built

7.2.2 Relief Line

Analysis of the interaction of SmartTrack with the proposed Relief Line (RL), for various RL corridors, was also undertaken. The focus of this analysis was not to provide a detailed examination of the RL, but primarily to understand the likely interaction between it and SmartTrack. Notable findings from the Relief Line corridor analysis, presented in Chapter 5, include the following:

- Depending on the corridor, ridership on the "Little-J" RL (which links the Bloor-Danforth line from a station east of the Don River with the downtown core) is projected to range from 14,300 to 30,200 trips in the peak hour and from 86,800 to 186,800 on a daily basis. This is almost entirely existing ridership that is diverted to a less crowded and/or faster route by using the RL.
- SmartTrack is not a major competitor to the RL. A 5-minute SmartTrack service does reduce RL ridership somewhat, but not excessively.
- A primary rationale for the RL is to provide "relief" to the Yonge subway line by diverting riders (particularly in peak periods) to the RL. Findings with respect to this issue include:
    - The "Little-J" RL alone will at best bring the 2031 Yonge line ridership south of Bloor in the AM peak (the critical point in the system) to approximately the assumed line capacity of 36,000 passengers/hour.
    - This capacity shortfall becomes worse if the Yonge Subway is extended to Richmond Hill (the Yonge Subway Extension or YSE),
    - This capacity shortfall is also worse in 2041, regardless of whether the YSE is built or not.
    - The combination of the "Little-J" RL and a 15-minute SmartTrack service reduces the Yonge AM peak ridership to somewhat below capacity in 2031.
    - Much more significant reductions below the Yonge capacity is obtained with both the "Little-J" RL and a 5-minute SmartTrack service in 2031, a clearly very desirable state to achieve for a variety of reasons.
- RL corridors that include a stop at Unilever generate less relief of the Yonge line due to the more circuitous, slower route from the Danforth line into the downtown.
- From a ridership perspective, the various King corridors out-perform the Queen corridors.
- The catchment area and overall impact on network operations of the RL are much smaller than that projected for SmartTrack.
- The "Big-J" RL corridors investigated (select "Little-J" corridors extended northward from the Bloor-Danforth line to Sheppard Avenue) provide enhanced relief for the Yonge line and, in general, attract significant ridership in the 2041 forecast year,
- Based on this ridership analysis, both the RL and SmartTrack are attractive additions to the Toronto transit network, providing significant new capacity into the downtown and significant relief to the Yonge subway line.[41] For both the 2031 "Little-J" RL and the 2041 "Big-J" RL cases examined, it appears that <u>both</u> the RL and a high-frequency

[41] They also both provide much-needed redundancy within the network in terms of alternative routes in and out of the downtown when the Yonge and/or University line downtown segments are temporarily shut down for one reason or another.

SmartTrack service will be required to provide adequate Yonge line relief, as well as to meet other objectives for enhanced transit capacity into the Toronto downtown.

Subsequent to the analysis of the various RL corridors discussed in Chapter 5, City Planning has undertaken a more refined analysis, including updated service assumptions, of two alternative alignments within the Queen" corridor in support of preparing an initial Business Case for the RL. These two "Little-J" alignments are referred to as option "AQ" (Pape to downtown via Queen Street) and option "EQ" (Pape to Eastern Avenue, with a stop at the Unilever site, then on to downtown via Queen Street). These options were also examined in conjunction with the prototype integrated SmartTrack/RER service concept "Option C".

Notable findings of the refined analysis, presented in Chapter 6, include the following:

- Depending on the alignment, the projected peak hour ridership ranges between 26,800 and 28,700 and between 165,500 to 177,100 riders on a daily basis.
- The integrated SmartTrack/RER "Option C "service concept is not a major competitor to the RL. In terms of providing "relief" to the Yonge subway line, findings include:
    - The "Little J" RL will bring the 2031 AM peak hour Yonge Line ridership south of Bloor to below capacity (alignment AQ) or just above capacity (alignment EQ).
    - The combination of the "Little J" RL and the integrated SmartTrack/RER Service "Option C" reduces the Yonge AM peak hour ridership to comfortably below capacity in 2031.
    - By 2041, the "Little J" RL alone will not be able to reduce the Yonge AM peak ridership below capacity. The combination of integrated SmartTrack/RER Service "Option C" and the "Little J" RL will bring the Yonge AM Peak hour ridership to capacity (alignment EQ), or just below capacity (alignment AQ).
    - The combination of the "Big J" RL (extended to Sheppard Avenue) and the integrated SmartTrack/RER Service "Option C" that reduces the Yonge AM Peak hour ridership comfortably below capacity in 2041.
- The extended "Big J" versions of the alignments attract significant ridership and provide enhanced relief to the Yonge Line.
- The extension of the Yonge subway to Richmond Hill (the Yonge Subway Extension or YSE) was also analyzed with RL option EQ. This analysis shows that:
    - The capacity shortfall (at Yonge south of Bloor) is worsened due to the addition of the YSE.
    - The combination of integrated SmartTrack Service "Option C" and the "Little J" Relief Line alignment EQ does not provide enough relief to reduce the Yonge AM peak hour ridership to capacity.
    - By 2041, the capacity shortfall due to the addition of the YSE is further worsened. The only combination that is able to reduce the Yonge AM peak hour ridership to capacity is that of the "Big J" Relief Line alignment EQ and the integrated SmartTrack/RER Service "Option C".

7.2.3 Scarborough Subway Extension

Various options for the Scarborough Subway Extension (SSE) were examined in relationship to SmartTrack. Initially, several three and four stop alternative alignments were considered, generating the following key findings:

- The projected ridership for the multi-stop SSE options examined is not out of range from what one might expect for the end stations of long line running into a suburban region.
- The introduction of SmartTrack does reduce SSE ridership, as expected. Somewhat analogous to the RL – SmartTrack case, the SSE and SmartTrack are primarily designed to address different markets: the motivation for the SSE is specifically to provide a high-quality connection between the Scarborough City Centre and the rest of the TTC network; while SmartTrack provides a major new north-south "transit spine" for the entire Scarborough transit network, as well as significantly enhanced connectivity for Scarborough and Markham into the Toronto downtown. Thus, as in the RL case, it is not a question of "either/or" between SSE and SmartTrack but rather what the best design for each might be so that each best contributes to overall transit service within the City of Toronto (and beyond).

During the course of this study the concept of a "one-stop" SSE option that would provide an "express" service from Kennedy Station to the Scarborough City Centre was introduced by City Planning. This option was briefly examined within this study in conjunction with the prototype integrated SmartTrack/RER service concept "Option C". Findings from this analysis include:

- Reducing the SSE from three to one stops reduces peak hour ridership on the line by approximately one-third (from 11,100 to 7,300 and daily ridership by 38% (63,800 versus for the 3-stop case of 103,000).
- Implementation of the Eglinton East LRT has a very marginal impact on the SSE, since it is largely serving a somewhat different catchment area.

Based on the very preliminary analysis undertaken to date, the Eglinton East LRT may attract in the order of 38,000 riders per day in the 2031 horizon year.

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Appendix A: POPULATION & EMPLOYMENT SCENARIO DEFINITIONS

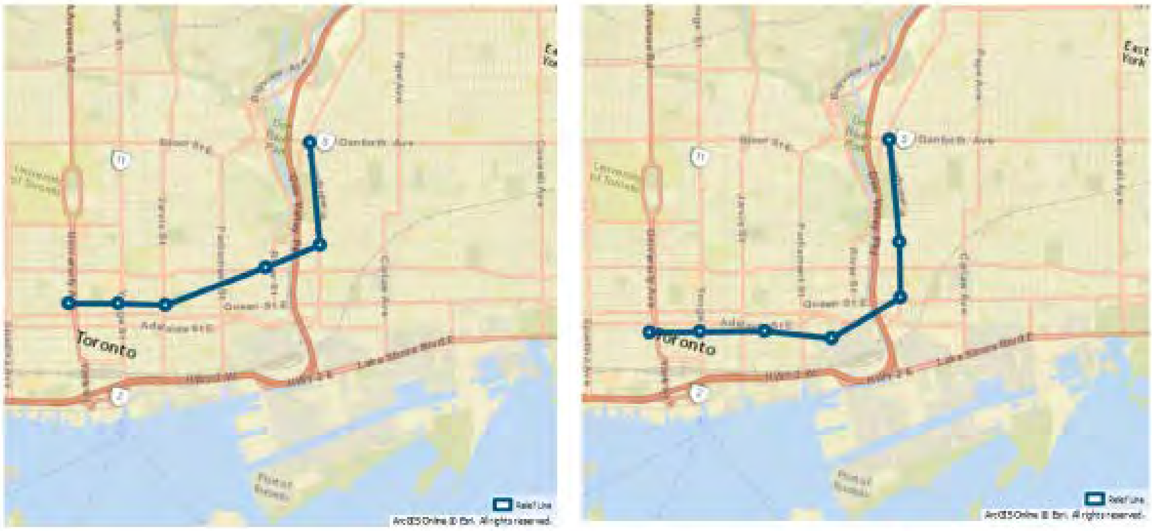
Population/Employment Scenario	**Definition**
Low population / Low employment without SmartTrack influence	A scenario that is based on the Provincial Growth Plan regional control totals.
Low population / Medium employment without SmartTrack influence	Relative to the low population/low employment scenario, this scenario maintains the GTA-wide control total for employment but redirects some of the employment growth identified for the non-Toronto portions of the GTA in the Provincial Growth Plan regional control totals to the City of Toronto. The population distribution is unchanged.
Low population / Medium employment with SmartTrack influence	This scenario uses the same regional totals as the low population/medium employment without SmartTrack influence scenario but redistributes some of the growth within individual regions to reflect shifts which are expected as a result of the introduction of SmartTrack. This has the effect of shifting growth towards the SmartTrack corridor.
High population / High employment with SmartTrack influence	Relative to the low population/medium employment scenarios, this scenario redirects some of the population growth and more of the employment growth identified for the non-Toronto portions of the GTA in the Provincial Growth Plan regional control totals to the City of Toronto. This scenario also includes SmartTrack influence, directing additional growth to the SmartTrack corridor.
Additional Regional Growth	This scenario is a variation on the low population/medium employment with SmartTrack influence. It assumes there will be 10% more population and employment growth in the GTA after 2021 as a result of the introduction of SmartTrack.

Appendix B: NETWORK ALIGNMENTS

Figure B.1: Base SmartTrack Alignment

Figure B.2: Alternative SmartTrack Western Alignment: Northern Alignment

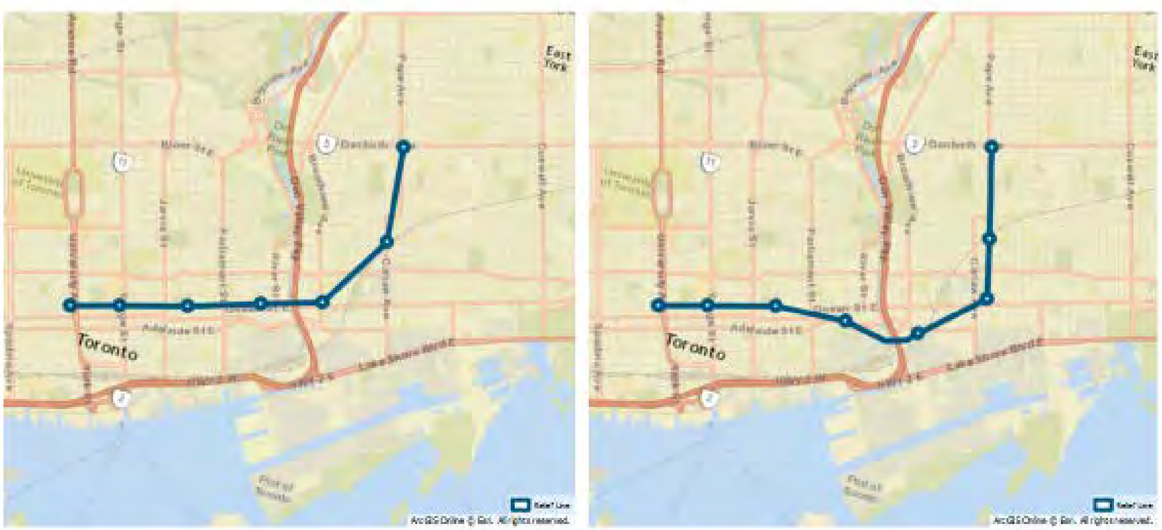
Figure B.3: Alternative SmartTrack Western Alignment: Eglinton Crosstown Extension



DRAFT – A3 Relief Line. Broadview-Queen.

DRAFT – C Relief Line. Broadview-King.

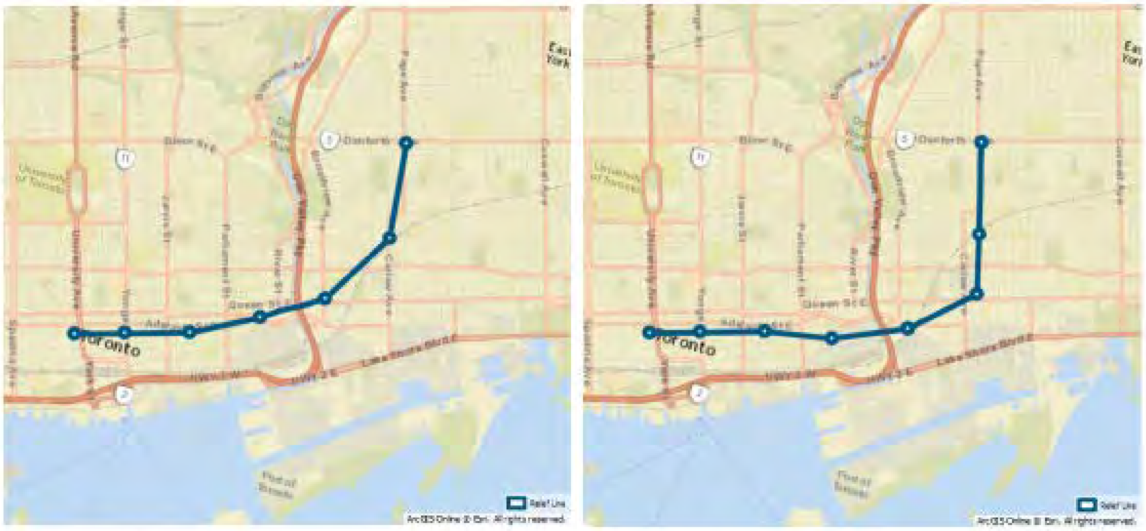
Figure B.4: Relief Line Broadview Options



DRAFT – B1 Relief Line. Pape-Queen.

DRAFT – B2 Relief Line. Pape-Queen via Unilever site.

Figure B.5: Relief Line Pape-Queen Options



DRAFT – D1 Relief Line. Pape-King. DRAFT – D2 Relief Line. Pape-King via Unilever site.

Figure B.6: Relief Line Pape-King Options

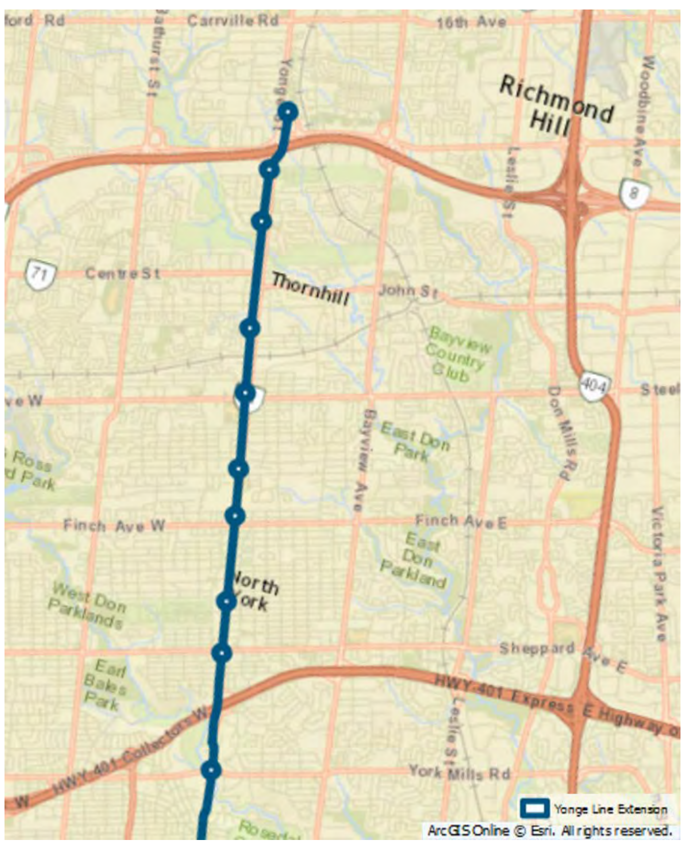


Figure B.7: Yonge Subway Extension (YSE) Alignment

DRAFT – SSE Midland

DRAFT – SSE Bellamy

Figure B.8: Scarborough Subway Extension (SSE) Midland & Bellamy Options

DRAFT – SSE McCowan3

DRAFT – SSE McCowan4

Figure B.9: Scarborough Subway Extension (SSE) "McCowan3" & "McCowan4" Options

Figure B.10: "Big-J" RL Extension from Pape Station to Sheppard Avenue

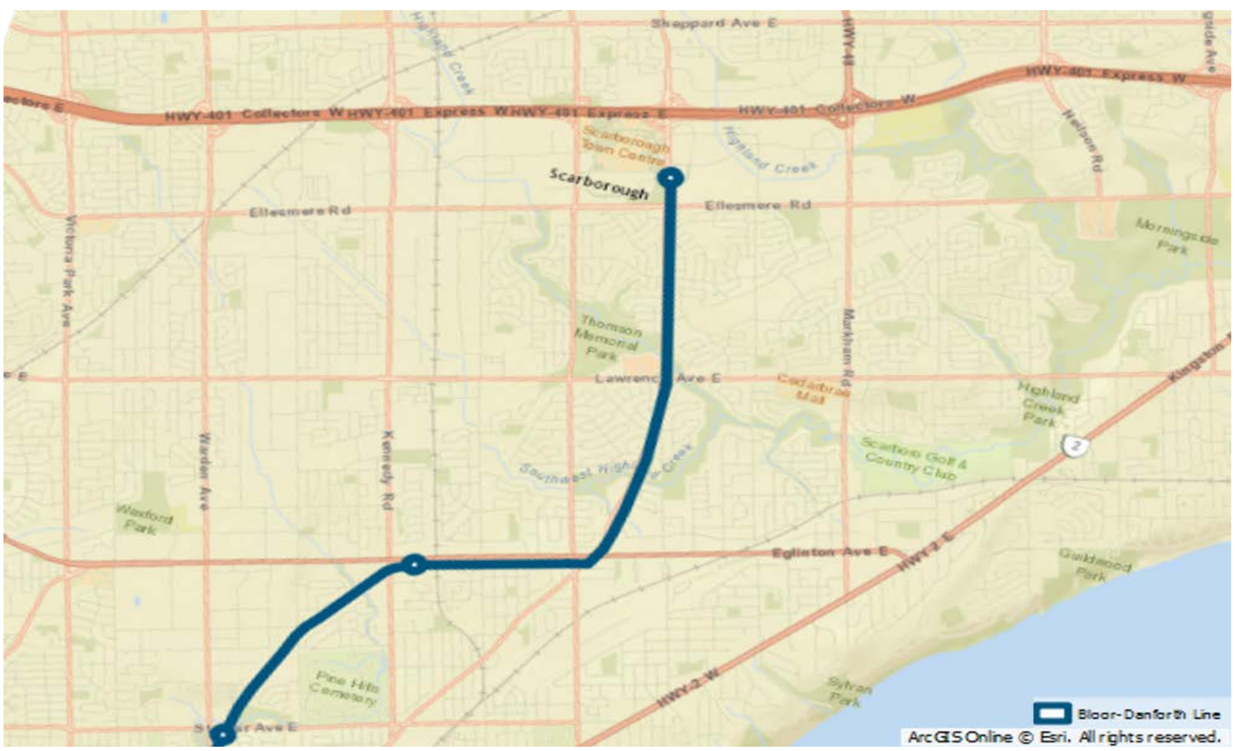


Figure B.11: One-Stop "Express" SSE Alignment

Figure B.12: Eglinton Crosstown East Extension, with One-Stop SSE

Figure B.13: Eglinton Crosstown East Extension (to Sheppard), with One-Stop SSE

Appendix C: 2041 SMARTTRACK RIDERSHIP FORECASTS

Table C.1: 2041 SmartTrack All Day Transit Boardings by Headway and Fare*

SmartTrack Headway	2041 TTC Fare Scenario	2041 GO Fare Scenario
15 min	89,900	50,400
5 min	360,100	133,000

* Assume Low pop/ Med emp with SmartTrack Influence

* Standard SmartTrack

SmartTrack Headway	2041 TTC Fare Scenario	2041 GO Fare Scenario
	compared to RER base case	compared to RER base case
15 min	47,200	40,700
5 min	82,100	49,100

* Assume Low pop/ Med emp with SmartTrack Influence

* Standard SmartTrack

Table C.2: 2041 All Day SmartTrack Boardings and Net New Riders*

Land Use Scenario	SmartTrack Headway	All Day Boardings on SmartTrack	Net New System Riders
Low Pop / Low Emp	*15*	62,300	9,100
	5	284,300	34,600
Low Pop / Med Emp without ST Influence	*15*	66,200	9,900
	5	298,300	36,700
Low Pop / Med Emp with ST Influence	*15*	89,900	47,200
	5	360,100	82,100
High Pop / High Emp	*15*	93,800	^ No Base Exists
	5	371,700	^ No Base Exists
ABR	*15*	94,400	^ No Base Exists
	5	369,300	^ No Base Exists

^ Cannot be calculated as no base exists for this Land Use Scenario

* Assumes TTC Fare

* Standard SmartTrack

Table C.3: 2041 Forecast Summary, Alternative SmartTrack Western Alignments*

Western Alignment	SmartTrack Headway	All Day Boardings on SmartTrack	Net New System Riders
Continuous On Eglinton	*15*	89,900	47,200
	5	360,100	82,100
Northern Alignment	*15*	92,700	47,500
	5	366,600	88,700
Eglinton Crosstown Phase 2	*15*	144,100	54,100
	5	369,800	83,700

* Assumes Low population/Medium employment with SmartTrack influence land use and TTC fare on SmartTrack

Table C.4: 2041 AM-Peak-Hour Yonge Line Riders, South of Bloor by SmartTrack Headway.

SmartTrack Headway	Riders	Change (Absolute)	Change (%)
Base Network without SmartTrack	42,600		
15 min	41,300	-1,300	-3%
5 min	35,700	-6,900	-16%

* Assume Low pop/ Med emp with SmartTrack Influence (except in the base)
* Assume TTC fare on SmartTrack
* Standard SmartTrack

Table C.5: 2041 AM-Peak-Hour Westbound Bloor to Southbound Yonge Transfers*

SmartTrack Headway	Transfers	Change (Absolute)	Change (%)
Base Network without SmartTrack	10,300		
15 min	10,100	-200	-2%
5 min	6,900	-3,400	-33%

* Assume Low pop/ Med emp with SmartTrack Influence (except in the base)
* Assume TTC fare on SmartTrack
* Standard SmartTrack

Appendix D: 2041 RELIEF LINE RIDERSHIP FORECASTS

Table D.1: 2041 RL Boardings by Time of Day and Alignment, without SmartTrack

		RL Boardings			Peak Point - Peak Direction	
Alignment #	Alignment Description	AM Peak Hour Boardings	AM Peak Period Boardings	All Day Boardings	Location & Direction	Peak Hour Volume
A3	Broadview via Queen	15,300	31,200	91,600	WB out of Sumach/Dundas	10,200
B1	Pape via Queen	27,900	57,000	161,600	WB out of Broadview/Queen	16,000
B2	Pape via Queen (with Unilever Stop)	26,000	53,100	156,500	WB out of Unilever	11,800
C	Broadview via King	32,000	65,200	191,900	WB out of Front/Cherry	15,700
D1	Pape via King	29,900	61,000	182,800	WB out of Broadview/Queen	16,100
D2	Pape via King (with Unilever Stop)	35,000	71,400	214,700	WB out of Front/Cherry	17,500

Table D.2: 2041 RL Boardings by Time of Day and Alignment, with SmartTrack

		(a) RL Boardings, with 15-minute Headway SmartTrack Service			Peak Point - Peak Direction	
Alignment #	Alignment Description	AM Peak Hour Boardings	AM Peak Period Boardings	All Day Boardings	Location & Direction	Peak Hour Volume
B1	Pape via Queen	33,600	68,600	189,600	WB out of Gerrard/Carlaw	17,100
B2	Pape via Queen (with Unilever Stop)	33,000	67,200	195,600	EB out of Queen/Yonge	13,200
D1	Pape via King	36,100	73,600	212,600	WB out of Gerrard/Carlaw	16,900
D2	Pape via King (with Unilever Stop)	42,400	86,400	255,200	WB out of Gerrard/Pape	17,200

		(b) RL Boardings, with 5-minute Headway SmartTrack Service			Peak Point - Peak Direction	
Alignment #	**Alignment Description**	**AM Peak Hour Boardings**	**AM Peak Period Boardings**	**All Day Boardings**	**Location & Direction**	**Peak Hour Volume**
B1	Pape via Queen	22,600	46,100	135,600	WB out of Gerrard/Carlaw	11,200
B2	Pape via Queen (with Unilever Stop)	25,000	51,100	157,400	EB out of Queen/Yonge	8,800
D1	Pape via King	25,600	52,200	157,400	WB out of King/Cherry	11,500
D2	Pape via King (with Unilever Stop)	33,800	69,000	211,900	WB out of Front/Cherry	13,400

Table D.3: 2041 Yonge Line Relief, RL & SmartTrack Combinations

RL Alignment #	RL Alignment Description	SmartTrack Frequency	Volume, Southbound from Bloor (AM Peak Hour)	Volume Change, Southbound from Bloor (AM Peak Hour)	
				Attributable to RL	**Total**
2041 Low-Med Base			**42,600**	*** Acts as Base**	
A3	Broadview via Queen	None	39,500	-3,100	-3,100
B1	Pape via Queen	None	37,600	-5,000	-5,000
B2	Pape via Queen (with Unilever Stop)	None	39,600	-3,000	-3,000
C	Broadview via King	None	38,800	-3,800	-3,800
D1	Pape via King	None	38,200	-4,400	-4,400
D2	Pape via King (with Unilever Stop)	None	38,300	-4,300	-4,300
2041 Low-Med 15 min SmartTrack without RL			**41,400**	*** Acts as Base**	**-1,200**
B1	Pape via Queen	15 min	37,100	-4,300	-5,500
B2	Pape via Queen (with Unilever Stop)	15 min	39,100	-2,300	-3,500
D1	Pape via King	15 min	37,300	-4,100	-5,300
D2	Pape via King (with Unilever Stop)	15 min	37,800	-3,600	-4,800
2041 Low-Med 5 min SmartTrack without RL			**36,800**	*** Acts as Base**	**-5,800**
B1	Pape via Queen	5 min	33,800	-3,000	-8,800
B2	Pape via Queen (with Unilever Stop)	5 min	35,500	-1,300	-7,100
D1	Pape via Queen	5 min	34,300	-2,500	-8,300
D2	Pape via King (with Unilever Stop)	5 min	34,900	-1,900	-7,700

Table D.4: 2041 AM Peak Westbound Bloor to Southbound Yonge Transfers

RL Alignment #	RL Alignment Description	SmartTrack Frequency	WB BD-SB YUS Transfers at Bloor-Yonge (AM Peak Hour)	Change from Base	
				Attributable to RL	Total
	2041 Low-Med Base		**10,400**	***Acts as Base**	
A3	Broadview via Queen	None	7,400	-3,000	-3,000
B1	Pape via Queen	None	5,900	-4,500	-4,500
B2	Pape via Queen (with Unilever Stop)	None	7,900	-2,500	-2,500
C	Broadview via King	None	7,000	-3,400	-3,400
D1	Pape via King	None	6,600	-3,800	-3,800
D2	Pape via King (with Unilever Stop)	None	6,600	-3,800	-3,800
	2041 Low-Med 15 min SmartTrack without RL		**10,200**	***Acts as Base**	**-200**
B1	Pape via Queen	15 min	5,600	-4,600	-4,800
B2	Pape via Queen (with Unilever Stop)	15 min	7,800	-2,400	-2,600
D1	Pape via King	15 min	6,200	-4,000	-4,200
D2	Pape via King (with Unilever Stop)	15 min	6,400	-3,800	-4,000
	2041 Low-Med 5 min SmartTrack without RL		**7,200**	***Acts as Base**	**-3,200**
B1	Pape via Queen	5 min	4,100	-3,100	-6,300
B2	Pape via Queen (with Unilever Stop)	5 min	5,600	-1,600	-4,800
D1	Pape via King	5 min	4,900	-2,300	-5,500
D2	Pape via King (with Unilever Stop)	5 min	5,000	-2,200	-5,400

Table D.5: 2041 Daily Net Riders Generated by the Relief Line

RL Alignment #	RL Alignment Description	SmartTrack	Daily New Net Transit Riders (System Wide)	
			Attributable to RL	Total
	2041 Low-Med Base		***Acts as Base**	
A3	Broadview via Queen	None	5,300	5,300
B1	Pape via Queen	None	9,600	9,600
B2	Pape via Queen (with Unilever Stop)	None	12,800	12,800
C	Broadview via King	None	19,100	19,100
D1	Pape via King	None	13,000	13,000
D2	Pape via King (with Unilever Stop)	None	23,600	23,600
	2041 Low-Med 15 min SmartTrack without RL		***Acts as Base**	**52,800**
B1	Pape via Queen	15 min	13,600	66,400
B2	Pape via Queen (with Unilever Stop)	15 min	18,800	71,600
D1	Pape via King	15 min	18,400	71,200
D2	Pape via King (with Unilever Stop)	15 min	29,600	82,500
	2041 Low-Med 5 min SmartTrack without RL		***Acts as Base**	**84,000**
B1	Pape via Queen	5 min	7,400	91,300
B2	Pape via Queen (with Unilever Stop)	5 min	11,300	95,200
D1	Pape via Queen	5 min	9,800	93,800
D2	Pape via King (with Unilever Stop)	5 min	22,200	106,100

Appendix E: 2041 SCARBOROUGH SUBWAY EXTENSION RIDERSHIP FORECASTS

Table E.1: 2041 SSE Users by Time of Day and Alignment, without SmartTrack

		SSE Users without SmartTrack			Into Kennedy		Out of Kennedy	
Alignment #	Alignment Description	AM Peak Hour Users	AM Peak Period Users	All Day Users	Location & Direction	Peak Hour Volume	Location & Direction	Peak Hour Volume
McCowan 4	McCowan with 4 stops	25,400	51,900	157,800	WB into Kennedy	19,200	WB out of Kennedy	21,500
McCowan 3	McCowan with 3 stops	20,200	41,200	125,200	WB into Kennedy	15,200	WB out of Kennedy	21,000
Midland	Midland with 3 stops	21,400	43,700	134,700	WB into Kennedy	15,900	WB out of Kennedy	21,200
Bellamy	Bellamy with 4 stops	26,200	53,300	160,200	WB into Kennedy	19,800	WB out of Kennedy	22,400

Table E.2: 2041 SSE Users by Time of Day and Alignment, with SmartTrack

		SSE Users with SmartTrack			Into Kennedy		Out of Kennedy	
Alignment #	SmartTrack Frequency	AM Peak Hour Users	AM Peak Period Users	All Day Users	Location & Direction	Peak Hour Volume	Location & Direction	Peak Hour Volume
McCowan 3	5 min	15,200	30,900	94,500	WB into Kennedy	10,600	WB out of Kennedy	15,200
McCowan 3	15 min	19,200	39,100	119,700	WB into Kennedy	13,900	WB out of Kennedy	19,600

Table E.3: 2041 Yonge Line Relief, SSE & SmartTrack Combinations

SSE Alignment	SSE Alignment Description	SmartTrack	Volume Southbound @ South of Bloor (Peak Hour)
2031 Low-Med Base with SRT			**42,000**
McCowan4	McCowan with 4 stops	None	42,200
McCowan3	McCowan with 3 stops	None	42,600
Midland	Midland with 3 stops	None	42,600
Bellamy	Bellamy with 4 stops	None	42,300

Table E.4: 2041 Daily Net Riders Generated by the SSE

SSE Alignment	SSE Alignment Description	SmartTrack	Net New Riders (Daily)
2041 Low-Med Base with SRT			***Acts as Base**
McCowan4	McCowan with 4 stops	None	13,400
McCowan3	McCowan with 3 stops	None	12,400
Midland	Midland with 3 stops	None	12,800
Bellamy	Bellamy with 4 stops	None	13,100

Table E.5: 2041 SSE Sensitivity Test Results

(a) 2041 SSE Sensitivity Test Results (Low/Low)

		Low/Low Land Use: SSE Users without SmartTrack			Into Kennedy		Out of Kennedy	
Alignment #	**Alignment Description**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Direction**	**Peak Hour Volume**	**Location & Direction**	**Peak Hour Volume**
McCowan4	McCowan with 4 stops	24,300	49,600	151,300	WB into Kennedy	18,200	WB out of Kennedy	20,600
McCowan3	McCowan with 3 stops	19,200	39,100	119,900	WB into Kennedy	14,400	WB out of Kennedy	20,100
Midland	Midland with 3 stops	20,400	41,600	128,900	WB into Kennedy	15,100	WB out of Kennedy	20,300
Bellamy	Bellamy with 4 stops	25,100	51,100	153,900	WB into Kennedy	18,700	WB out of Kennedy	21,300

(b) 2041 SSE Sensitivity Test Results (Low/Med, Half Frequency)

		Low/Med with Halved Frequency: Users on the SSE			Into Kennedy		Out of Kennedy	
Alignment #	**Alignment Description**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Directio n**	**Peak Hour Volume**	**Location & Directio n**	**Peak Hour Volume**
McCowan 4	McCowan with 4 stops	21,400	43,600	147,400	WB into Kennedy	16,400	WB out of Kennedy	19,500
McCowan 3	McCowan with 3 stops	16,900	34,400	117,100	WB into Kennedy	13,000	WB out of Kennedy	19,400
Midland	Midland with 3 stops	17,900	36,600	125,800	WB into Kennedy	13,500	WB out of Kennedy	19,400
Bellamy	Bellamy with 4 stops	21,700	44,400	149,300	WB into Kennedy	16,600	WB out of Kennedy	19,900

(c) 2041 SSE Sensitivity Test Results (Low/Low, Half Frequency)

		Low/Low with Halved Frequency: Users on the SSE			Into Kennedy		Out of Kennedy	
Alignment #	**Alignment Description**	**AM Peak Hour Users**	**AM Peak Period Users**	**All Day Users**	**Location & Directio n**	**Peak Hour Volume**	**Location & Directio n**	**Peak Hour Volume**
McCowan 4	McCowan with 4 stops	20,500	41,700	141,500	WB into Kennedy	15,600	WB out of Kennedy	18,700
McCowan 3	McCowan with 3 stops	16,000	32,700	112,000	WB into Kennedy	12,200	WB out of Kennedy	18,500
Midland	Midland with 3 stops	17,100	34,800	120,500	WB into Kennedy	12,800	WB out of Kennedy	18,700
Bellamy	Bellamy with 4 stops	21,000	42,700	143,700	WB into Kennedy	15,800	WB out of Kennedy	19,000

Appendix F: 2041 STATION SET TEST RESULTS

Table F.1: Base 2041 Combined SmartTrack & GO RER Ridership Forecasts

(a) Base 2041 Combined SmartTrack & GO RER Ridership Forecasts (AM Peak Hour)*

Scenario	RER Services		Total	Compared to Base, RER
	Kitchener-Stouffville Lines	Lakeshore East Line		
Base, No RER	8,900	14,600	23,400	-16,400
Base, RER Service Concept	20,000	19,800	39,800	0
SmartTrack, 15-minute headway	26,900	19,900	46,800	7,000
SmartTrack, 5-minute headway	66,400	19,600	86,000	46,200

* TTC fare; Low population-medium employment (with SmartTrack influences); Eglinton Crosstown Phase 2 western alignment.

(b) Base 2041 Combined SmartTrack & GO RER Ridership Forecasts (all day)*

Scenario	RER Services		Total	Compared to Base, RER
	Kitchener-Stouffville Lines	Lakeshore East Line		
Base, No RER	44,300	73,000	117,200	-75,800
Base, RER Service Concept	95,900	97,100	193,000	0
SmartTrack, 15-minute headway	148,100	96,800	244,900	51,900
SmartTrack, 5-minute headway	377,700	95,800	473,500	280,500

* TTC fare; Low population-medium employment (with SmartTrack influences); Eglinton Crosstown Phase 2 western alignment.

Table F.2: 2041 ISC AM Peak Hour Ridership, Alternative Station Sets & Service Frequencies*

Scenario	ISC Services	Total		

	Kitchener-Stouffville Lines	Lakeshore East Line		Compared to Base, RER	Compared to SmartTrack, 5 minute headway
Option C0	39,200	23,500	62,700	22,800	-23,400
Option C1	39,000	23,600	62,600	22,800	-23,500
Option C2	38,600	23,600	62,100	22,300	-23,900
Option C3	39,000	23,500	62,500	22,600	-23,600
Option D0	39,300	23,600	62,900	23,000	-23,200
Option D1	39,000	23,600	62,600	22,700	-23,500
Option D2	39,400	23,500	62,900	23,000	-23,200
Option D3	39,500	23,500	63,000	23,200	-23,000
Option C0 – 5 min	69,800	22,300	92,100	52,300	6,100
Option C1 – 5 min	69,700	22,300	92,000	52,100	5,900
Option C2 – 5 min	68,400	22,300	90,700	50,800	4,600
Option C3 – 5 min	69,700	22,300	91,900	52,100	5,900
Option D0 – 5 min	68,300	22,300	90,700	50,800	4,600
Option D1 – 5 min	68,100	22,400	90,500	50,700	4,400
Option D2 – 5 min	69,100	22,300	91,400	51,500	5,300
Option D3 – 5 min	69,400	22,300	91,700	51,900	5,700

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Table F.3: 2041 ISC Daily Ridership, Alternative Station Sets & Service Frequencies*

Scenario	ISC Services		Total		

	Kitchener-Stouffville Lines	Lakeshore East Line		Compared to Base, RER	Compared to SmartTrack, 5 minute headway
Option C0	203,100	117,700	320,800	127,800	-152,700
Option C1	202,800	117,900	320,600	127,600	-152,800
Option C2	200,900	118,300	319,200	126,200	-154,200
Option C3	202,600	117,900	320,500	127,500	-152,900
Option D0	200,500	118,500	319,000	126,000	-154,400
Option D1	200,200	118,500	318,800	125,700	-154,700
Option D2	202,100	117,700	319,800	126,800	-153,700
Option D3	203,200	117,800	321,000	128,000	-152,500
Option C0 – 5 min	381,000	112,100	493,000	300,000	19,600
Option C1 – 5 min	381,000	111,700	492,700	299,700	19,200
Option C2 – 5 min	375,400	112,000	487,300	294,300	13,900
Option C3 – 5 min	380,800	112,000	492,800	299,700	19,300
Option D0 – 5 min	363,800	112,000	475,900	282,800	2,400
Option D1 – 5 min	365,900	112,100	478,000	284,900	4,500
Option D2 – 5 min	371,500	112,200	483,700	290,700	10,200
Option D3 – 5 min	371,600	112,000	483,600	290,500	10,100

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Table F.4: 2041 ISC Transit & Auto Daily Travel Time Savings by SmartTrack Scenario *

ISC Option	Transit Time Savings	Transit Fare Savings	Auto Time Savings
	Total Hours Saved per Day	Total Hours (Equivalent) Saved per Day	Total Hours Saved per Day
Option C0	33,800	7,300	4,500
Option C1	31,300	7,300	3,600
Option C2	29,500	7,000	5,500
Option C3	33,300	7,200	4,700
Option D0	31,700	7,200	4,200
Option D1	31,600	7,200	7,500
Option D2	33,100	7,300	3,400
Option D3	35,700	7,400	4,100
Option C0 – 5min	71,400	5,800	7,800
Option C1 – 5min	77,000	5,700	9,900
Option C2 – 5min	71,600	6,000	9,100
Option C3 – 5min	72,200	5,600	9,900
Option D0 – 5min	71,900	6,200	9,600
Option D1 – 5min	72,300	6,200	8,600
Option D2 – 5min	71,400	6,100	9,600
Option D3 – 5min	72,400	6,200	6,200

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Table F.5: 2041 ISC Summary of 2041 Travel Time Savings, Transit Expressed in Monetary Terms, Daily & Annual*

ISC Option	Transit Time Savings		Transit Fare Savings		Auto Time Savings	
	Daily	Annual	Daily	Annual	Daily	Annual
Option C0	$540,800	$166.6 mil	$116,800	$36.2 mil	$72,000	$22.2 mil
Option C1	$500,800	$155.3 mil	$116,800	$36.2 mil	$57,600	$17.9 mil
Option C2	$507,200	$157.2 mil	$115,200	$35.7 mil	$88,000	$27.3 mil
Option C3	$532,800	$165.2 mil	$115,200	$35.7 mil	$75,200	$23.3 mil
Option D0	$507,200	$157.2 mil	$115,200	$35.7 mil	$67,200	$20.7 mil
Option D1	$505,600	$156.7 mil	$115,200	$35.7 mil	$120,000	$37.2 mil
Option D2	$529,600	$164.2 mil	$116,800	$36.2 mil	$54,400	$16.9 mil
Option D3	$571,200	$177.1 mil	$118,400	$36.7 mil	$65,600	$ 20.3 mil
Option C0 – 5min	$1.14 mil	$351.9 mil	$92,800	$28.6 mil	$124,800	$38.4 mil
Option C1 – 5min	$1.23 mil	$379.5 mil	$91,200	$28.1 mil	$158,400	$48.8 mil
Option C2 – 5min	$1.15 mil	$352.8 mil	$96,000	$29.6 mil	$145,600	$44.8 mil
Option C3 – 5min	$1.16 mil	$355.8 mil	$89,600	$27.6 mil	$158,400	$48.8 mil
Option D0 – 5min	$1.15 mil	$354.3 mil	$99,200	$30.6 mil	$153,600	$47.3 mil
Option D1 – 5min	$1.16 mil	$356.3 mil	$99,200	$30.6 mil	$137,600	$42.4 mil
Option D2 – 5min	$1.14 mil	$351.9 mil	$97,600	$30.1 mil	$153,600	$47.3 mil
Option D3 – 5min	$1.16 mil	$356.8 mil	$99,200	$30.6 mil	$99,200	$30.5 mil

* Assumes Low population/Medium employment with SmartTrack influence land use (except for base); TTC fare on SmartTrack; Eglinton Crosstown Phase 2 western alignment.

Appendix G: 2031 STATION BOARDINGS & ALIGHTINGS, ALTERNATIVE SERVICE CONCEPTS

Table G.1: Base 2031 GO RER Station Boardings (AM Peak Hour)*

Station	Scenario			
	Base	SmartTrack, 15 minute	SmartTrack, 10 minute	SmartTrack, 5 minute
Lincolnville	380	370	380	380
Stouffville	880	860	870	870
Mount Joy	1,330	1,310	1,190	950
Markham	620	490	430	340
Centennial	490	390	270	150
Unionville	2,240	2,920	3,560	4,440
14^{th} Avenue	0	530	870	1,190
Milliken	1,500	2,650	3,880	5,590
Finch	0	280	820	1,870
Agincourt	220	460	920	2,020
Ellesmere	0	190	500	1,070
Lawrence East	0	130	450	1,010
Kennedy	100	280	810	2,670
Scarborough	40	290	850	1,710
Danforth	380	470	800	2,310
Gerrard	0	60	240	740
Queen	0	50	180	660
Unilever	0	60	170	450
Union	4,040	3,830	6,330	9,760
Spadina	0	140	350	1,070
Liberty Village	0	90	280	880
Lansdowne	0	40	250	720
Bloor	250	270	610	2,420
St. Clair West	0	150	480	1,140
Mt. Dennis	60	490	1,600	4,540
Weston	200	120	100	70
Etobicoke North	200	160	160	150
Woodbine	0	0	0	0
Malton	650	620	630	630
Bramalea	2,770	2,810	2,820	2,820
Other Lakeshore East Line Stations	14,420	14,470	14,430	14,310
Other Kitchener Line Stations	6,050	6,190	6,200	6,160

* TTC fare; Low population-medium employment (with SmartTrack influences); Eglinton Crosstown Phase 2 western alignment.

Table G.2: Base 2031 GO RER Station Alightings (AM Peak Hour)*

Station	Scenario			
	Base	SmartTrack, 15 minute	SmartTrack, 10 minute	SmartTrack, 5 minute
Lincolnville	0	0	0	0
Stouffville	0	0	0	0
Mount Joy	10	0	0	10
Markham	0	0	0	0
Centennial	0	0	0	0
Unionville	220	540	780	970
14th Avenue	0	130	180	260
Milliken	70	210	460	980
Finch	0	60	210	610
Agincourt	130	160	320	600
Ellesmere	0	90	220	590
Lawrence East	0	30	120	410
Kennedy	960	1,010	1,340	2,640
Scarborough	40	100	190	380
Danforth	610	740	790	1,060
Gerrard	0	70	160	370
Queen	0	550	970	2,040
Unilever	0	1,230	3,520	5,420
Union	64,260	63,930	66,520	73,070
Spadina	0	1,110	2,180	5,050
Liberty Village	0	900	2,680	5,240
Lansdowne	0	20	60	160
Bloor	970	1,150	1,120	1,900
St. Clair West	0	30	80	200
Mt. Dennis	260	400	840	1,950
Weston	80	70	70	70
Etobicoke North	110	100	100	100
Woodbine	0	0	0	0
Malton	180	150	150	140
Bramalea	1,050	990	990	990
Other Lakeshore East Line Stations	1,580	1,530	1,540	1,540
Other Kitchener Line Stations	190	190	190	190

* TTC fare; Low population-medium employment (with SmartTrack influences); Eglinton Crosstown Phase 2 western alignment.

Table G.3: Base 2031 GO RER Station Boardings (all day)*

Station	Scenario			
	Base	SmartTrack, 15 minute	SmartTrack, 10 minute	SmartTrack, 5 minute
Lincolnville	780	750	770	770
Stouffville	1,810	1,750	1,770	1,770
Mount Joy	2,760	2,720	2,460	1,950
Markham	1,320	1,050	900	690
Centennial	1,020	800	550	320
Unionville	5,870	8,380	11,040	14,570
14th Avenue	0	1,890	3,130	4,420
Milliken	3,730	6,710	10,740	17,140
Finch	0	1,250	3,410	7,610
Agincourt	1,320	2,040	3,970	8,650
Ellesmere	0	1,130	2,610	6,570
Lawrence East	0	700	2,060	5,470
Kennedy	3,000	3,640	6,180	14,920
Scarborough	320	1,650	3,970	7,570
Danforth	3,270	3,270	4,320	9,400
Gerrard	0	790	1,980	4,450
Queen	0	1,270	3,220	6,470
Unilever	0	8,600	14,200	21,370
Union	150,320	152,520	168,140	203,170
Spadina	0	3,480	7,510	18,100
Liberty Village	0	5,220	9,450	17,720
Lansdowne	0	360	1,400	3,550
Bloor	3,130	3,530	5,170	14,620
St. Clair West	0	620	1,850	4,480
Mt. Dennis	1,470	3,250	7,280	17,860
Weston	1,110	910	880	760
Etobicoke North	1,320	1,180	1,160	1,110
Woodbine	0	0	0	0
Malton	2,570	2,390	2,410	2,380
Bramalea	10,490	10,490	10,550	10,540
Other Lakeshore East Line Stations	40,370	40,130	39,960	39,600
Other Kitchener Line Stations	13,770	14,090	14,130	14,070

* TTC fare; Low population-medium employment (with SmartTrack influences); Eglinton Crosstown Phase 2 western alignment.

Table G.4: Base 2031 GO RER Station Alightings (all day)*

Station	Scenario			
	Base	SmartTrack, 15 minute	SmartTrack, 10 minute	SmartTrack, 5 minute
Lincolnville	700	680	690	700
Stouffville	1,800	1,750	1,760	1,760
Mount Joy	3,270	2,790	2,270	1,840
Markham	1,290	1,010	830	600
Centennial	1,260	690	460	130
Unionville	6,600	11,510	15,300	19,550
14^{th} Avenue	0	1,850	2,750	3,820
Milliken	2,720	6,290	10,470	16,720
Finch	0	1,190	3,460	8,260
Agincourt	990	1,920	4,100	8,580
Ellesmere	0	1,030	2,450	6,180
Lawrence East	0	820	2,350	5,830
Kennedy	2,480	3,400	6,010	15,560
Scarborough	290	1,740	4,330	7,740
Danforth	3,120	3,840	4,890	10,370
Gerrard	0	830	2,140	4,670
Queen	0	1,400	3,090	7,860
Unilever	0	3,220	9,200	16,210
Union	153,100	156,870	169,280	198,340
Spadina	0	3,200	7,510	19,140
Liberty Village	0	2,490	7,490	17,360
Lansdowne	0	430	1,680	3,820
Bloor	3,260	4,750	6,210	14,290
St. Clair West	0	660	1,870	4,400
Mt. Dennis	1,130	3,580	7,810	18,550
Weston	1,020	750	700	590
Etobicoke North	1,400	1,280	1,250	1,220
Woodbine	0	0	0	0
Malton	2,540	2,430	2,450	2,450
Bramalea	10,840	10,850	10,910	10,920
Other Lakeshore East Line Stations	40,590	40,530	40,470	40,220
Other Kitchener Line Stations	14,130	14,470	14,510	14,490

* TTC fare; Low population-medium employment (with SmartTrack influences); Eglinton Crosstown Phase 2 western alignment.

Table G.5: 2031 ISC AM Peak Hour Station Boardings, Alternative Station Sets & Service Frequencies*

Station	Scenario							
	Option C0	Option C1	Option C2	Option C3	Option D0	Option D1	Option D2	Option D3
Lincolnville	360	360	360	360	380	370	370	370
Stouffville	800	820	810	780	840	830	840	840
Mount Joy	900	890	900	840	1,090	1,110	1,110	1,110
Markham	290	280	290	280	390	370	380	380
Centennial	320	310	320	290	330	340	330	320
Unionville	2,150	2,180	2,160	1,990	2,370	2,310	2,340	2,320
14th Avenue	0	0	0	120	0	0	0	0
Milliken	5,070	5,080	5,080	5,050	6,330	5,980	5,980	5,560
Finch	1,170	1,180	1,160	1,170	0	0	0	1,460
Agincourt	1,280	1,280	1,290	1,280	1,680	1,510	1,500	1,600
Ellesmere	640	640	640	650	0	0	730	0
Lawrence East	550	550	550	550	0	560	0	0
Kennedy	810	810	820	820	1,010	920	960	940
Scarborough	1,490	1,490	1,500	1,500	1,500	1,490	1,490	1,500
Danforth	2,100	2,090	2,100	2,090	2,200	2,170	2,160	2,170
Gerrard	730	740	730	740	730	740	730	730
Queen	0	0	0	0	0	0	0	0
Unilever	430	430	430	440	440	440	440	440
Union	5,910	5,910	5,870	5,920	5,870	5,880	5,900	5,900
Spadina	0	0	0	0	0	0	0	0
Liberty Village	270	270	250	280	270	270	270	280
Lansdowne	0	0	270	0	0	0	0	0
Bloor	770	770	550	770	790	770	770	780
St. Clair West	640	640	580	640	640	640	640	640
Mt. Dennis	1,930	1,910	1,740	1,920	1,920	1,930	1,930	1,930
Weston	110	110	110	120	110	120	120	120
Etobicoke North	150	150	140	150	150	150	150	150
Woodbine	0	50	0	0	0	0	0	0
Malton	630	590	610	630	620	630	620	620
Bramalea	3,040	2,970	2,990	3,040	3,030	3,030	3,040	3,030
Other Lakeshore East Line Stations	14,280	14,220	14,280	14,290	14,370	14,290	14,280	14,270
Other Kitchener Line Stations	6,180	6,150	6,140	6,190	6,170	6,180	6,170	6,180

Station	Scenario							
	Option C0 – 5min	Option C1 – 5min	Option C2 – 5min	Option C3 – 5min	Option D0 – 5min	Option D1 – 5min	Option D2 – 5min	Option D3 – 5min
Lincolnville	370	370	370	360	380	380	380	380
Stouffville	830	820	810	800	850	840	840	830
Mount Joy	810	810	810	750	1,030	980	980	970
Markham	260	260	260	240	320	310	300	300
Centennial	240	240	240	210	270	270	260	260
Unionville	2,900	2,890	2,900	2,700	3,040	2,980	2,980	2,970
14th Avenue	0	0	0	190	0	0	0	0
Milliken	8,130	8,140	8,150	8,000	9,450	9,180	9,230	8,540
Finch	2,110	2,110	2,100	2,110	0	0	0	2,380
Agincourt	2,310	2,320	2,320	2,310	3,170	2,850	2,820	2,920
Ellesmere	1,250	1,250	1,250	1,250	0	0	1,380	0
Lawrence East	1,240	1,240	1,230	1,240	0	1,200	0	0
Kennedy	2,980	2,990	3,000	3,000	3,400	3,090	3,300	3,480
Scarborough	2,130	2,130	2,110	2,140	2,080	2,080	2,080	2,090
Danforth	3,610	3,600	3,580	3,590	3,840	3,730	3,740	3,790
Gerrard	1,080	1,080	1,070	1,080	1,060	1,060	1,070	1,070
Queen	0	0	0	0	0	0	0	0
Unilever	860	850	840	850	830	840	840	850
Union	9,810	9,800	9,610	9,790	9,690	9,740	9,720	9,720
Spadina	0	0	0	0	0	0	0	0
Liberty Village	1,450	1,450	1,360	1,450	1,450	1,440	1,450	1,460
Lansdowne	0	0	780	0	0	0	0	0
Bloor	4,220	4,220	3,270	4,240	4,150	4,160	4,190	4,160
St. Clair West	1,340	1,340	1,250	1,330	1,330	1,330	1,330	1,330
Mt. Dennis	5,420	5,420	4,910	5,410	5,400	5,410	5,420	5,440
Weston	200	190	190	200	200	200	200	200
Etobicoke North	300	300	280	310	300	310	310	300
Woodbine	0	100	0	0	0	0	0	0
Malton	1,020	950	970	1,000	1,010	1,010	1,020	1,000
Bramalea	3,830	3,710	3,750	3,830	3,810	3,830	3,820	3,820
Other Lakeshore East Line Stations	14,220	14,160	14,130	14,210	14,180	14,170	14,180	14,200
Other Kitchener Line Stations	6,130	6,100	6,100	6,120	6,130	6,130	6,120	6,130

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Table G.6: 2031 ISC AM Peak Hour Station Alightings, Alternative Station Sets & Service Frequencies*

Station	Scenario							
	Option C0	Option C1	Option C2	Option C3	Option D0	Option D1	Option D2	Option D3
Lincolnville	0	0	0	0	0	0	0	0
Stouffville	0	0	0	0	0	0	0	0
Mount Joy	0	10	0	10	0	0	0	0
Markham	0	0	0	0	0	0	0	0
Centennial	0	0	0	0	0	0	0	0
Unionville	220	220	220	200	250	240	250	240
14th Avenue	0	0	0	50	0	0	0	0
Milliken	300	310	300	280	410	390	380	350
Finch	110	110	110	100	0	0	0	130
Agincourt	180	180	180	170	240	250	210	210
Ellesmere	170	170	170	170	0	0	200	0
Lawrence East	90	100	100	90	0	90	0	0
Kennedy	1,380	1,380	1,370	1,330	1,710	1,550	1,570	1,630
Scarborough	220	220	220	220	210	200	210	220
Danforth	800	790	790	800	800	810	800	820
Gerrard	550	550	550	560	550	550	550	560
Queen	0	0	0	0	0	0	0	0
Unilever	5,300	5,300	5,310	5,310	5,350	5,320	5,340	5,330
Union	70,790	71,070	70,630	71,090	70,650	70,730	70,960	71,060
Spadina	0	0	0	0	0	0	0	0
Liberty Village	2,750	2,720	2,580	2,730	2,750	2,740	2,740	2,760
Lansdowne	0	0	40	0	0	0	0	0
Bloor	940	910	1,030	940	930	930	930	960
St. Clair West	40	40	40	40	50	50	50	50
Mt. Dennis	340	330	330	340	350	340	350	350
Weston	120	110	110	120	120	120	120	120
Etobicoke North	110	70	110	110	110	110	110	110
Woodbine	0	120	0	0	0	0	0	0
Malton	150	140	150	150	150	150	150	150
Bramalea	1,170	1,130	1,150	1,180	1,170	1,180	1,180	1,180
Other Lakeshore East Line Stations	1,550	1,560	1,560	1,550	1,550	1,540	1,550	1,560
Other Kitchener Line Stations	190	190	190	190	190	190	190	190

Station	Scenario							
	Option C0 – 5min	Option C1 – 5min	Option C2 – 5min	Option C3 – 5min	Option D0 – 5min	Option D1 – 5min	Option D2 – 5min	Option D3 – 5min
Lincolnville	0	0	0	0	0	0	0	0
Stouffville	0	0	0	0	0	0	0	0
Mount Joy	0	0	0	0	0	0	0	0
Markham	0	0	0	0	0	0	0	0
Centennial	0	0	0	0	0	0	0	0
Unionville	480	480	480	430	520	510	520	500
14th Avenue	0	0	0	100	0	0	0	0
Milliken	2,190	2,180	2,190	2,060	2,520	2,440	2,440	2,320
Finch	610	610	620	620	0	0	0	680
Agincourt	540	540	540	540	720	690	640	670
Ellesmere	630	630	620	630	0	0	680	0
Lawrence East	460	460	460	460	0	400	0	0
Kennedy	2,300	2,300	2,300	2,260	2,550	2,340	2,440	2,570
Scarborough	530	530	510	540	520	520	530	510
Danforth	1,200	1,200	1,190	1,190	1,150	1,150	1,160	1,210
Gerrard	1,040	1,040	1,040	1,040	1,020	1,030	1,010	1,040
Queen	0	0	0	0	0	0	0	0
Unilever	6,590	6,560	6,530	6,570	6,600	6,600	6,600	6,600
Union	81,220	81,280	80,450	81,140	80,520	80,830	80,700	81,310
Spadina	0	0	0	0	0	0	0	0
Liberty Village	6,460	6,460	6,280	6,460	6,450	6,430	6,470	6,480
Lansdowne	0	0	170	0	0	0	0	0
Bloor	2,370	2,300	2,100	2,360	2,280	2,280	2,300	2,340
St. Clair West	240	240	230	240	230	240	240	240
Mt. Dennis	1,850	1,790	1,690	1,830	1,840	1,840	1,830	1,840
Weston	130	120	130	130	130	130	130	130
Etobicoke North	240	130	240	240	240	240	240	240
Woodbine	0	250	0	0	0	0	0	0
Malton	280	260	270	280	280	280	280	280
Bramalea	1,900	1,780	1,860	1,900	1,890	1,910	1,900	1,910
Other Lakeshore East Line Stations	1,560	1,560	1,560	1,560	1,560	1,560	1,570	1,570
Other Kitchener Line Stations	190	190	190	190	190	190	190	190

Table G.7: 2031 ISC Daily Station Boardings, Alternative Station Sets & Service Frequencies*

Station	Scenario							
	Option C0	Option C1	Option C2	Option C3	Option D0	Option D1	Option D2	Option D3
Lincolnville	740	740	730	730	780	750	750	750
Stouffville	1,630	1,670	1,650	1,600	1,710	1,690	1,710	1,720
Mount Joy	1,970	1,940	1,970	1,830	2,350	2,380	2,410	2,400
Markham	750	740	750	720	980	910	960	940
Centennial	700	690	690	630	720	730	710	700
Unionville	5,620	5,670	5,650	5,000	6,130	6,000	6,060	5,980
14th Avenue	0	0	0	720	0	0	0	0
Milliken	12,870	12,900	12,860	12,680	16,220	15,360	15,310	14,260
Finch	3,440	3,450	3,410	3,430	0	0	0	4,230
Agincourt	4,010	4,010	4,010	4,020	5,270	4,790	4,580	4,980
Ellesmere	2,540	2,550	2,530	2,550	0	0	2,910	0
Lawrence East	2,070	2,070	2,080	2,070	0	2,090	0	0
Kennedy	5,410	5,420	5,520	5,330	6,520	5,900	6,100	6,430
Scarborough	5,340	5,360	5,350	5,410	5,160	5,100	5,250	5,310
Danforth	7,710	7,700	7,740	7,700	7,930	7,910	7,860	7,930
Gerrard	4,550	4,560	4,550	4,570	4,520	4,510	4,530	4,570
Queen	0	0	0	0	0	0	0	0
Unilever	18,570	18,600	18,570	18,610	18,670	18,590	18,640	18,660
Union	177,180	176,930	176,610	177,190	175,430	175,820	175,790	176,920
Spadina	0	0	0	0	0	0	0	0
Liberty Village	10,870	10,800	10,240	10,860	10,830	10,850	10,790	10,900
Lansdowne	0	0	1,510	0	0	0	0	0
Bloor	4,820	4,720	4,500	4,820	4,860	4,800	4,830	4,840
St. Clair West	2,310	2,330	2,110	2,330	2,300	2,300	2,290	2,320
Mt. Dennis	6,780	6,670	6,260	6,750	6,740	6,770	6,750	6,740
Weston	860	820	840	870	860	870	870	870
Etobicoke North	1,280	1,160	1,250	1,300	1,300	1,300	1,300	1,290
Woodbine	0	640	0	0	0	0	0	0
Malton	2,450	2,280	2,350	2,430	2,430	2,430	2,430	2,430
Bramalea	11,070	10,740	10,970	11,090	11,080	11,050	11,090	11,070
Other Lakeshore East Line Stations	39,650	39,520	39,630	39,660	39,880	39,690	39,660	39,680
Other Kitchener Line Stations	14,090	13,990	13,990	14,100	14,080	14,100	14,080	14,090

Station	Scenario							
	Option C0 – 5min	Option C1 – 5min	Option C2 – 5min	Option C3 – 5min	Option D0 – 5min	Option D1 – 5min	Option D2 – 5min	Option D3 – 5min
Lincolnville	750	750	750	730	770	780	770	770
Stouffville	1,690	1,670	1,680	1,640	1,730	1,710	1,720	1,700
Mount Joy	1,810	1,820	1,840	1,670	2,280	2,170	2,170	2,160
Markham	750	750	750	710	890	850	860	850
Centennial	540	550	570	490	640	620	620	610
Unionville	8,400	8,410	8,400	7,540	8,750	8,590	8,650	8,590
14th Avenue	0	0	0	1,210	0	0	0	0
Milliken	26,480	26,470	26,520	25,970	30,270	29,490	29,740	27,410
Finch	8,090	8,090	8,100	8,090	0	0	0	8,830
Agincourt	9,030	9,050	9,020	9,040	11,520	10,760	10,320	10,830
Ellesmere	7,060	7,070	7,020	7,080	0	0	7,270	0
Lawrence East	6,160	6,130	6,130	6,160	0	5,630	0	0
Kennedy	13,500	13,500	13,530	13,540	15,420	13,800	14,880	15,870
Scarborough	9,450	9,470	9,350	9,510	8,590	8,860	8,890	8,870
Danforth	13,220	13,220	13,200	13,160	13,790	13,550	13,510	13,730
Gerrard	6,830	6,820	6,750	6,840	6,690	6,710	6,710	6,780
Queen	0	0	0	0	0	0	0	0
Unilever	24,130	24,120	23,940	24,120	24,100	24,130	24,120	24,140
Union	219,260	219,890	218,020	219,250	216,250	217,040	216,770	218,390
Spadina	0	0	0	0	0	0	0	0
Liberty Village	22,510	22,530	21,590	22,480	22,390	22,350	22,410	22,500
Lansdowne	0	0	3,820	0	0	0	0	0
Bloor	20,620	20,530	16,210	20,660	20,110	20,200	20,260	20,380
St. Clair West	5,290	5,270	5,000	5,250	5,250	5,260	5,260	5,270
Mt. Dennis	19,640	19,580	16,980	19,590	19,440	19,450	19,480	19,620
Weston	1,230	1,180	1,030	1,230	1,250	1,240	1,240	1,240
Etobicoke North	2,220	1,850	2,010	2,250	2,230	2,240	2,220	2,230
Woodbine	0	1,300	0	0	0	0	0	0
Malton	3,990	3,740	3,730	3,970	3,970	3,980	4,000	3,980
Bramalea	16,390	15,820	13,980	16,400	16,340	16,390	16,380	16,370
Other Lakeshore East Line Stations	39,430	39,320	39,260	39,410	39,480	39,330	39,430	39,510
Other Kitchener Line Stations	13,900	13,830	10,470	13,900	13,900	13,910	13,900	13,900

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Table G.8: 2031 ISC Daily Station Alightings, Alternative Station Sets & Service Frequencies*

Station	Scenario							
	Option C0	Option C1	Option C2	Option C3	Option D0	Option D1	Option D2	Option D3
Lincolnville	680	690	680	670	710	680	700	680
Stouffville	1,700	1,720	1,710	1,690	1,720	1,720	1,720	1,750
Mount Joy	2,920	2,840	2,920	2,770	3,120	3,060	3,070	3,060
Markham	1,080	1,080	1,080	1,070	1,170	1,120	1,150	1,130
Centennial	980	970	980	950	1,040	1,020	1,020	1,020
Unionville	7,010	7,040	7,040	6,200	7,470	7,280	7,360	7,330
14th Avenue	0	0	0	1,170	0	0	0	0
Milliken	12,400	12,430	12,400	12,100	14,840	14,280	14,260	13,560
Finch	3,740	3,750	3,760	3,710	0	0	0	4,390
Agincourt	4,150	4,150	4,160	4,180	5,250	4,910	4,790	4,950
Ellesmere	2,320	2,330	2,320	2,310	0	0	2,680	0
Lawrence East	2,360	2,370	2,370	2,360	0	2,400	0	0
Kennedy	6,080	6,090	6,070	5,990	7,520	6,850	6,990	7,180
Scarborough	5,440	5,440	5,430	5,500	5,190	5,160	5,300	5,390
Danforth	8,970	8,970	8,930	8,970	9,210	9,120	9,120	9,200
Gerrard	4,770	4,780	4,780	4,780	4,780	4,760	4,770	4,820
Queen	0	0	0	0	0	0	0	0
Unilever	12,890	12,870	12,890	12,900	12,970	12,910	12,970	12,930
Union	177,600	178,200	177,350	178,220	177,240	177,360	177,810	178,180
Spadina	0	0	0	0	0	0	0	0
Liberty Village	8,830	8,750	8,340	8,780	8,790	8,780	8,780	8,820
Lansdowne	0	0	2,080	0	0	0	0	0
Bloor	5,820	5,690	5,270	5,810	5,870	5,820	5,830	5,890
St. Clair West	2,330	2,350	2,170	2,330	2,320	2,310	2,310	2,340
Mt. Dennis	7,840	7,770	6,810	7,830	7,830	7,850	7,860	7,840
Weston	820	790	790	830	820	830	830	820
Etobicoke North	1,350	1,250	1,340	1,370	1,370	1,360	1,370	1,380
Woodbine	0	600	0	0	0	0	0	0
Malton	2,450	2,300	2,370	2,440	2,420	2,430	2,420	2,420
Bramalea	11,410	11,110	11,270	11,450	11,420	11,400	11,450	11,420
Other Lakeshore East Line Stations	40,170	40,060	40,180	40,210	40,430	40,240	40,190	40,250
Other Kitchener Line Stations	14,300	14,190	14,210	14,320	14,320	14,330	14,300	14,300

Station	Scenario							
	Option C0 – 5min	Option C1 – 5min	Option C2 – 5min	Option C3 – 5min	Option D0 – 5min	Option D1 – 5min	Option D2 – 5min	Option D3 – 5min
Lincolnville	690	690	690	670	710	710	710	700
Stouffville	1,760	1,740	1,730	1,710	1,760	1,750	1,770	1,740
Mount Joy	2,680	2,710	2,690	2,590	2,930	2,850	2,860	2,840
Markham	990	1,000	990	950	1,070	1,040	1,050	1,040
Centennial	740	750	750	730	830	810	820	810
Unionville	10,370	10,340	10,380	9,150	11,060	10,740	10,870	10,800
14th Avenue	0	0	0	1,910	0	0	0	0
Milliken	24,910	24,940	24,890	24,200	28,760	27,770	28,030	26,360
Finch	8,800	8,810	8,810	8,830	0	0	0	9,150
Agincourt	9,040	9,050	9,010	9,040	11,400	10,430	10,290	10,760
Ellesmere	6,520	6,520	6,490	6,510	0	0	6,640	0
Lawrence East	6,440	6,430	6,380	6,430	0	6,070	0	0
Kennedy	16,110	16,110	16,120	16,020	18,080	16,710	17,650	18,070
Scarborough	9,790	9,790	9,670	9,860	8,820	9,190	9,250	9,100
Danforth	13,330	13,360	13,300	13,310	13,390	13,250	13,380	13,480
Gerrard	7,640	7,640	7,630	7,660	7,480	7,510	7,520	7,580
Queen	0	0	0	0	0	0	0	0
Unilever	17,230	17,200	17,080	17,210	17,230	17,250	17,250	17,260
Union	217,840	218,170	215,510	217,660	215,510	216,410	216,110	217,570
Spadina	0	0	0	0	0	0	0	0
Liberty Village	22,400	22,400	21,700	22,410	22,340	22,310	22,420	22,450
Lansdowne	0	0	3,990	0	0	0	0	0
Bloor	20,290	20,130	17,160	20,330	19,890	19,990	20,110	20,160
St. Clair West	5,470	5,460	5,200	5,450	5,430	5,450	5,440	5,460
Mt. Dennis	20,350	20,180	18,790	20,280	20,130	20,100	20,180	20,260
Weston	1,160	1,120	1,120	1,160	1,170	1,170	1,160	1,160
Etobicoke North	2,140	1,820	2,080	2,160	2,140	2,150	2,150	2,140
Woodbine	0	1,280	0	0	0	0	0	0
Malton	3,690	3,520	3,570	3,680	3,670	3,670	3,690	3,670
Bramalea	17,130	16,580	16,800	17,130	17,070	17,120	17,110	17,120
Other Lakeshore East Line Stations	40,250	40,120	40,040	40,230	40,240	40,160	40,230	40,260
Other Kitchener Line Stations	14,250	14,150	14,150	14,240	14,230	14,250	14,240	14,240

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Table G.9: 2031 ISC Daily Net New System Ridership*

Scenario	New Net System Riders (Relative to 2031 Base, RER)
Option C0	27,700
Option C1	27,500
Option C2	27,500
Option C3	27,800
Option D0	29,200
Option D1	28,400
Option D2	29,000
Option D3	29,200
Option C0 – 5 min	45,100
Option C1 – 5 min	44,300
Option C2 – 5 min	44,200
Option C3 – 5 min	44,900
Option D0 – 5 min	44,000
Option D1 – 5 min	44,500
Option D2 – 5 min	44,400
Option D3 – 5 min	45,400

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Table G.10: 2041 ISC Daily Net New System Ridership*

Scenario	New Net System Riders (Relative to 2041 Base, RER)
Option C0	59,300
Option C1	59,400
Option C2	59,200
Option C3	58,600
Option D0	61,700
Option D1	60,700
Option D2	61,000
Option D3	60,400
Option C0 – 5 min	78,600
Option C1 – 5 min	77,400
Option C2 – 5 min	77,800
Option C3 – 5 min	78,200
Option D0 – 5 min	78,500
Option D1 – 5 min	78,300
Option D2 – 5 min	78,100
Option D3 – 5 min	78,300

* Eglinton Crosstown Phase 2 western alignment; Low population – medium employment (with SmartTrack influence).

Appendix H: 2041 RELIEF LINE ALIGNMENT ANALYSIS

Table H.1: 2041 RL Boardings by Time of Day and Corridor, without ISC Option C*

		RL Boardings			Peak Point - Peak Direction	
Alignment	Description	AM Peak Hour Boardings	AM Peak Period Boardings	All Day Boardings	Location & Direction	Peak Hour Volume
AQ	Pape via Queen	32,000	65,200	193,900	Westbound leaving Queen/Broadview	18,300
EQ	Pape via Queen (with Unilever Stop)	30,400	61,900	186,400	Westbound leaving Unilever	14,300

* Assumes Low population/Medium employment without SmartTrack influence land use

Table H.2: 2041 RL Boardings by Time of Day and Corridor, with ISC Option C

		(a) RL Boardings, with Option C			Peak Point - Peak Direction	
Alignment	Description	AM Peak Hour Boardings	AM Peak Period Boardings	All Day Boardings	Location & Direction	Peak Hour Volume
AQ	Pape via Queen	29,800	60,800	194,500	Westbound leaving Pape/Gerrard	14,400
EQ	Pape via Queen (with Unilever Stop)	33,500	68,300	215,500	Eastbound leaving Queen/Yonge	13,100

* Assumes Low population/Medium employment with SmartTrack influence land use

Table H.3: 2041 Yonge Line Relief, RL & SmartTrack Combinations

Alignment	Description	SmartTrack	Volume, Southbound from Bloor (AM Peak Hour)	Volume Change, Southbound from Bloor (AM Peak Hour) Attributable to RL	Volume Change, Southbound from Bloor (AM Peak Hour) Total
	2041 Low-Med Base		**42,600**	*** Acts as Base**	
AQ	Pape via Queen	None	36,600	-6,000	-6,000
EQ	Pape via Queen (with Unilever Stop)	None	39,200	-3,400	-3,400
	2041 Option C without RL		**38,600**	*** Acts as Base**	**-4,000**
AQ	Pape via Queen	Option C	34,700	-3,900	-7,900
EQ	Pape via Queen (with Unilever Stop)	Option C	36,000	-2,600	-6,600

Table H.4: 2041 AM Peak Westbound Bloor to Southbound Yonge Transfers

Alignment	Description	SmartTrack	WB BD-SB YUS Transfers at Bloor-Yonge (AM Peak Hour)	Change from Base	
				Attributable to RL	Total
	2031 Low-Med Base		**10,400**	***Acts as Base**	
AQ	Pape via Queen	None	4,700	-5,700	-5,700
EQ	Pape via Queen (with Unilever Stop)	None	7,600	-2,800	-2,800
	2031 Option C without RL		**7,800**	***Acts as Base**	**-2,600**
AQ	Pape via Queen	Option C	4,100	-3,700	-6,300
EQ	Pape via Queen (with Unilever Stop)	Option C	5,800	-2,000	-4,600

Table H.5: 2041 Daily Net New System Riders Generated by the Relief Line

Alignment	Description	SmartTrack	Daily New Net Transit Riders (System Wide)	
			Attributable to RL	Total
	2031 Low-Med Base		***Acts as Base**	
AQ	Pape via Queen	None	11,400	11,400
EQ	Pape via Queen (with Unilever Stop)	None	15,400	15,400
	2031 Option C without RL		***Acts as Base**	**59,600**
AQ	Pape via Queen	Option C	12,300	71,900
EQ	Pape via Queen (with Unilever Stop)	Option C	20,000	79,600