

Appendix 1, Attachment 1

SmartTrack Ridership Forecast



Memorandum

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January 18, 2016

To: John Livey, Deputy City Manager
From: Jennifer Keesmaat, Chief Planner and Executive Director
Re: **SmartTrack Ridership Forecasts, Release 1, Summary Report**

I am pleased to send you the *SmartTrack Ridership Forecasts, Release 1, Summary Report*.

This is an important milestone that represents the culmination of a year's hard work developing a state-of-the-art demand forecasting model which can now be used by the City of Toronto on all future transportation planning projects. Its first application has been to assess the ridership potential for SmartTrack.

The SmartTrack work program provided the impetus to accelerate the completion of the new model by the University of Toronto. GTAModel Version 4 replaces the City's previous model which has been in use since 2001. The new model includes numerous advancements relative to the previous model that make it the best tool available within the Greater Toronto and Hamilton Area (GTHA) to undertake this analysis. In summary, its greater functionality includes:

1. Calibration using the most recent comprehensive region-wide travel behaviour survey data available (i.e. the 2011 Transportation Tomorrow Survey);
2. Capability to simulate full day (24 hour) travel demand instead of just the busiest (AM peak) period, given that peak travel mode is often influenced by trips made at other times in the day;
3. Improved representation of counter-peak commuter flows;
4. Greater flexibility to model alternative fare structures; and
5. Introduction of capacity constraints on the transit network.

Appendix 1: Attachment 1 - SmartTrack Ridership Forecasts Report

The ridership numbers prepared through this process and summarized in this report have informed the SmartTrack Western Corridor Feasibility Review. The consultant, HDR, was asked to undertake an independent, high level assessment of options for extending a heavy rail corridor between Mount Dennis and the Mississauga Airport Corporate Centre (MACC). Council directed staff to assess two heavy rail corridors: the Eglinton corridor, and a second corridor that extends further north on the Kitchener GO corridor and turns south past Pearson Airport to the MACC. The approved extension of the Eglinton Crosstown LRT (furthermore referred to as Crosstown West) forms the base reference case for the review.

A range of service frequencies for SmartTrack have been tested (5, 10 and 15 minute headways), assuming alternative fares (GO fare versus a standard TTC fare), five alternative population and employment forecasts, and two alternative horizon years (2031 and 2041). These attributes have been applied to the base SmartTrack network scenario.

The base SmartTrack network scenario consists of the full alignment from Unionville in the north-east, running along the Stouffville GO corridor, with through service at Union Station continuing along the Kitchener GO corridor to the Mississauga Airport Corporate Centre (MACC) in the north-west. At Mount Dennis this base alignment is assumed to leave the existing Kitchener GO corridor to continue to the MACC on a new alignment along Eglinton Avenue West. This base SmartTrack scenario is assumed to have 23 stations.

These ridership forecasts show that:

- SmartTrack is capable of capturing significant ridership assuming a TTC fare and five minute service, regardless of the growth scenario or the horizon year. For example, using the base case scenario, forecasts for 2031 indicate daily boardings ranging from 282,990 to 321,436.
- SmartTrack assists in providing congestion relief on the Yonge Subway at the critical point south of Bloor. For the base SmartTrack network scenario this is currently calculated at 17% in both 2031 and 2041 with 5 minutes headways (see Table 3.1 and Appendix Table I.5 in the Summary Report).

These forecasts represent a moment in time; they will change and evolve as the SmartTrack service concept is refined in collaboration with Metrolinx. I cannot stress enough that the material herein represents the base SmartTrack scenario that has already evolved as a result of the HDR Western Corridor Feasibility Review. However, they do give us an indication of the opportunities associated with the SmartTrack proposal.

As a result of the findings in this Summary Report and the Western Corridor Feasibility Review, the revised SmartTrack concept makes full use of existing heavy rail infrastructure, with LRT along Eglinton Avenue West. This has important implications with respect to timing, making it more viable to deliver within an expedited timeline, in partnership with Metrolinx.

Appendix 1: Attachment 1 - SmartTrack Ridership Forecasts Report

Over the course of the next two weeks, two similar reports will be generated, one summarizing Relief Line ridership forecasts (with and without SmartTrack) and one summarizing Scarborough Subway Extension forecasts (with and without SmartTrack).

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Chief Planner & Executive Director
City Planning Division



MEMORANDUM

To: City of Toronto Planning
From: Eric J. Miller, Ph.D.
Subject: SmartTrack Ridership Forecasts, Release 1, Summary Report
Date: January 18, 2016

1. INTRODUCTION

This memorandum presents a first high-level summary of “Release 1” SmartTrack ridership forecasts prepared by UTTRI in collaboration with City of Toronto Planning staff using the GTAModel V4.0 travel demand forecasting system. Full documentation of the demand model system, its base year validation and its assessment by an independent peer review panel will be provided in other reports.

Forecasts have been prepared for two future years: 2031 and 2041. In each case a base year forecast has been prepared which includes known committed major transit¹ and “RER” upgrades to the GO Rail system as defined by the Metrolinx RER Service Concept. The impacts of SmartTrack implementation relative to this base case are then estimated using the model system.

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 Station² 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 alignment along Eglinton Avenue. This base SmartTrack configuration is assumed to have 24 stations. See Figure 1.1.

Forecasts have been generated for a wide combination of scenarios concerning fares, frequencies, etc. Specifically, the following dimensions have been tested:

- Alternative SmartTrack service headways (15, 10 and 5 minutes).
- Alternative SmartTrack fares (TTC; GO).
- Alternative “western alignments” of SmartTrack beyond Mount Dennis (“continuous”, “northern alignment”, “Eglinton Crosstown Phase 2”); see Figures 1.2 and 1.3).
- Alternative population and employment scenarios. Five population/employment scenarios have been tested, as summarized in Table 1.1. The “low population / medium

¹ These include: Eglinton Crosstown, Finch West LRT, Sheppard East LRT, Toronto-York Spadina Subway Extension and the Scarborough Subway Extension.

² I.e., trains run through Union Station, connecting the Stouffville and Kitchener lines.

employment with SmartTrack influence” has been taken as the “base” forecast for most runs.



Figure 1.1: Base SmartTrack Alignment

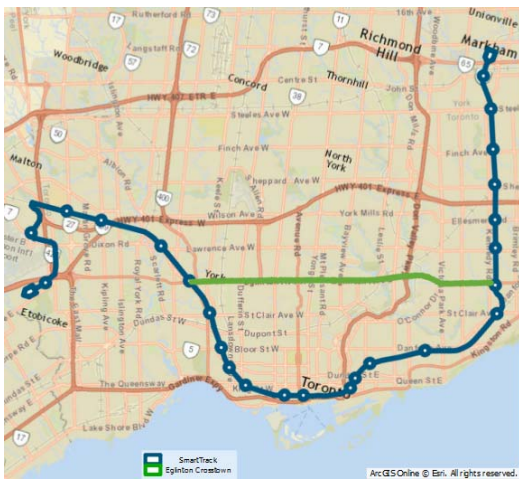


Figure 1.2: Alternative SmartTrack Western Alignment: northern alignment



Figure 1.3: Alternative SmartTrack Western Alignment: Eglinton Crosstown LRT extension

Table 1.1: Population & Employment Scenario Definitions

Population/Employment Scenario	Definition
<i>Low population / Low employment without SmartTrack influence</i>	A scenario that is based on the Provincial Growth Plan regional control totals.
<i>Low population / Medium employment without SmartTrack influence</i>	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.
<i>Low population / Medium employment with SmartTrack influence</i>	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.
<i>High population / High employment with SmartTrack influence</i>	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.
<i>Additional Regional Growth</i>	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.

In addition to SmartTrack scenarios a variety of Relief Line (RL) and Scarborough Subway Extension (SSE) scenarios have been tested, with and without SmartTrack. The results from these runs will be summarized in separate reports.

GTAModel V4.0 generates a wealth of detailed information concerning the spatial pattern of travel by all modes (auto, transit, etc.) over a typical 24-hour weekday time period within both the City of Toronto and the entire Greater Toronto-Hamilton Area (GTHA). In particular, with respect to transit ridership, estimates of boardings for every transit line in the region and boardings/alightings at every higher-order transit station are generated. The origin-destination patterns of transit users under different scenarios can be mapped. Changes in travel times and congestion levels by mode, etc. are also generated. Subsequent reports will provide examples of more detailed information concerning the impact of SmartTrack and other transit investment options that should be of interest to planners and decision-makers.

This first summary report, however, simply provides a first-cut summary of key results across combinations of the options described above. These results are presented in three parts. Section 2 provides a very high-level comparison of the overall impact of the SmartTrack options investigated on SmartTrack usage and transit ridership for the 2031 forecast year. Section 3 and Appendix II provide a bit more detail for a few key aspects of the SmartTrack service, also for the 2031 forecast year. In both Sections, all results are shown for the base, “continuous” western alignment option (Figure 1.1). Section 4 then presents a comparison of high-level 2031 results across the three western alignments. Finally, Appendix I provides data comparable to the 2031 data presented in Sections 2, 3 and 4 for the 2041 forecast year, which display the same general trends as the 2031 case.

Note that all numbers presented in this preliminary report are “raw” numbers as generated by the model system. In final versions of reports, these numbers will be rounded (e.g., to the nearest 100), reflecting a more appropriate level of numerical precision.

2. SUMMARY OF 2031 SMARTTRACK RIDERSHIP FORECASTS

2.1 Definition of Terms

In this and subsequent reports the term “boarding” refers to a transit rider using a particular transit line such as SmartTrack (i.e., it literally is a count of how many riders board/use a given line). The term “ridership” refers to the number of persons making a transit trip (i.e., the number of riders using the transit system). Boardings exceed ridership since trip-makers often transfer from one transit line to another in the course of their journey. Thus a transit trip involving one transfer generates two boardings. On average in the 2011 base case, there are about 1.77 boardings per transit trip in the TTC system. Both the usage of a given transit line (boardings) and the overall level of transit ridership are of interest, and both are reported herein.

“Net new riders” measures the increase in the number of transit riders that occur due to a service change (e.g., implementation of SmartTrack) relative to the base case. It is not possible within the current model system to precisely identify the number of net new riders using a specific transit line, and so this number is always presented at the overall system level. While most of these new riders might be expected to be using the new service as part of their trip, it is possible that the new service might result in new riders using other lines as well. That is, by attracting existing riders from a parallel line and thereby relieving congestion on this line it might enable that line to attract new riders to its improved service. In particular it is possible that both SmartTrack and the RL might attract current users of the Yonge Subway to use these new services, thereby “freeing up” capacity on the Yonge line that, in turn, attracts new riders to the Yonge line.

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

Table 2.1 presents 2031 total daily SmartTrack boardings 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 most of the scenarios investigated to date.

With respect to headway, it is clear in all the scenarios investigated that moving beyond 15 minute headways to 10 or 5 minute headways 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 2.1: 2031 SmartTrack All-Day Transit Boardings by Headway & Fare*

SmartTrack Headway	2031 TTC Fare Scenario	2031 GO Fare Scenario
15 min	76,617	37,680
10 min	154,296	61,358
5 min	314,567	108,014

* Assumes Low population/Medium employment with SmartTrack influence

Table 2.2 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 2.2: 2031 All-Day Net New System Ridership by SmartTrack Headway & Fare*

SmartTrack Headway	2031 TTC Fare Scenario	2031 GO Fare Scenario
15 min	20,124	14,452
10 min	30,769	17,875
5 min	48,332	22,369

* Assumes Low population/Medium employment with SmartTrack influence

Table 2.3: 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	Net New System Riders
<i>Low population / Low employment without SmartTrack influence</i>	15	66,738	8,771
	10	135,021	17,741
	5	286,476	35,633
<i>Low population / Medium employment without SmartTrack influence</i>	15	64,061	6,542
	10	131,711	15,012
	5	282,990	30,815
<i>Low population / Medium employment with SmartTrack influence</i>	15	76,617	20,124
	10	154,296	30,769
	5	314,567	48,332
<i>High population / High employment with SmartTrack influence</i>	15	78,252	**
	10	157,531	**
	5	321,436	**
<i>Additional Regional Growth</i>	15	79,660	**
	10	158,863	**
	5	320,907	**

*Assumes TTC Fare

**The base (no SmartTrack) case for this land use scenario has not yet been run and so new riders have not yet been calculated.

Table 2.3 compares the 2031 total daily SmartTrack boardings and net new system ridership for the “base” SmartTrack system for the five population/employment scenarios considered 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. This is arguably a good result in that it indicates that the forecasts are relatively robust across land use scenarios, which are known to have a fair amount of uncertainty associated with them

3. A FEW KEY DETAILED RESULTS

The previous section summarized system-wide, all-day ridership results. This section provides a few selected more detailed results, typically for the morning peak period or peak hour that help further illustrate some key SmartTrack impacts.

Table 3.1 presents the 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. Note that the “Base” scenario is the no-SmartTrack case. As can be seen SmartTrack does provide relief for the Yonge line, especially at the 5-minute headway level.

Table 3.1: 2031 AM-Peak-Hour Yonge Line Riders, South of Bloor by SmartTrack Headway*

SmartTrack Headway	Riders
Base	38,752
15 min	37,451
10 min	35,378
5 min	32,090

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

Figure 3.1 provides information on the estimated 2031 AM peak-hour flows into and through Union Station, indicating that significant “cross traffic” between the west and east through Union exists.

Additional information concerning 2031 AM-peak-hour peak load points on the SmartTrack system is provided in Appendix II.

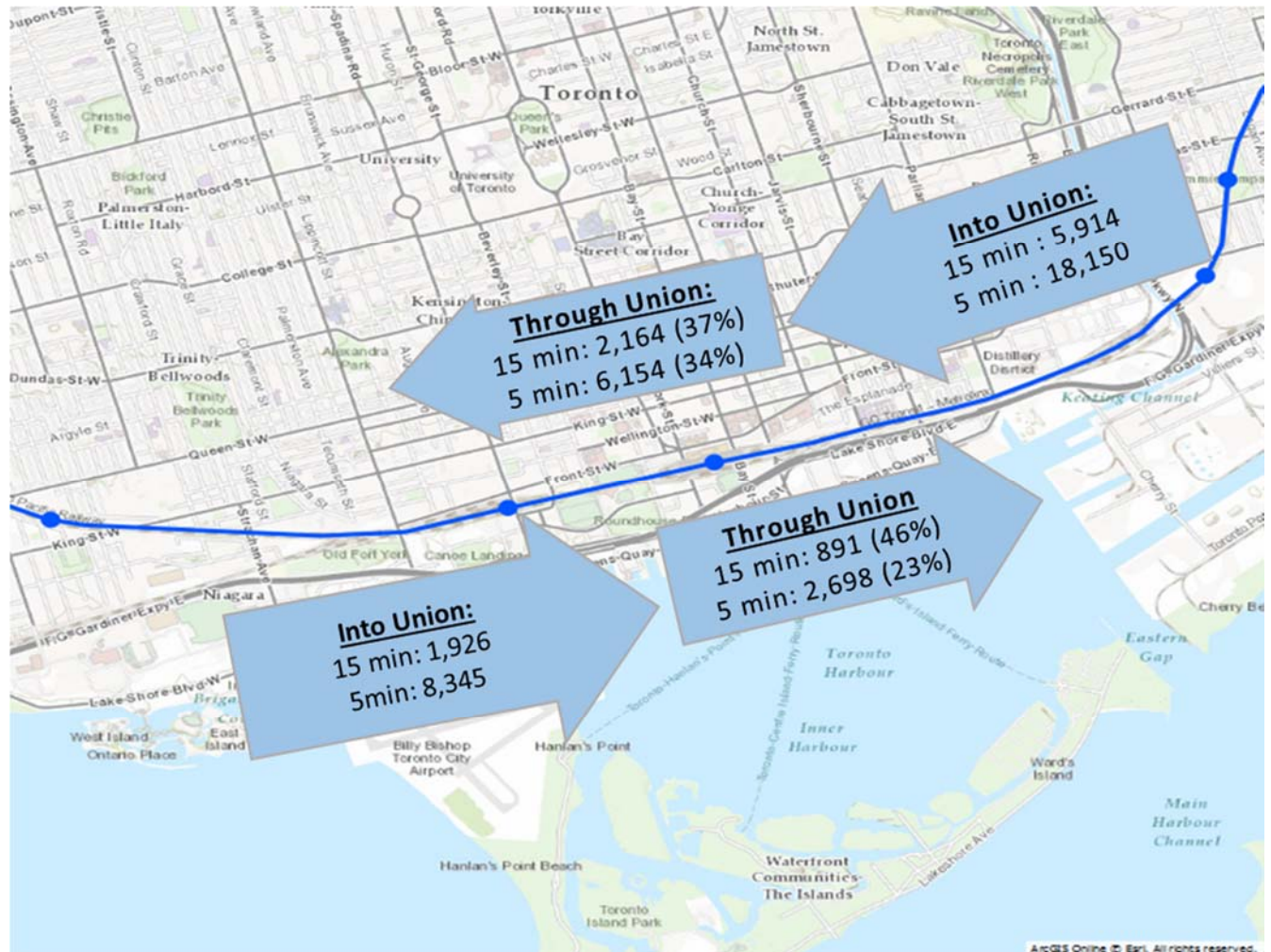


Figure 3.1: 2031 AM-Peak-Hour SmartTrack Flows through Union Station

4. COMPARISON OF WESTERN ALIGNMENT OPTIONS

The previous two sections have 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 1.1), thereby providing “continuous” (transfer-free) travel between this corridor segment and the rest of the SmartTrack service corridor (most notably downtown Toronto).

As introduced in Section 1, and as shown in Figure 1.2, two other alignments are currently under consideration 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 into Pearson Airport. 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).

Table 4.1 summarizes the differences in 2031 SmartTrack corridor boardings and net new system ridership of the three proposed western alignments. As indicated by this table, the Eglinton Crosstown option generates the largest number of daily boardings of the three alignments. The longer Northern Alignment (with more stations) generates the most net new riders and total boardings that are quite similar to the Eglinton Crosstown boardings for the 10- and 5-minute headway cases. The base SmartTrack “Continuous on Eglinton” alignment generates the least total boardings and net new riders of the three scenarios.

Table 4.1 2031 Forecast Summary, Alternative SmartTrack Western Alignments*

Western Alignment	SmartTrack Headway	All Day Boardings on SmartTrack**	Net New System Riders
Continuous on Eglinton (heavy rail)	15	76,617	20,124
	10	154,296	30,769
	5	314,567	48,332
Northern Alignment (heavy rail)	15	86,886	24,934
	10	170,166	36,623
	5	335,118	58,155
Eglinton Crosstown Phase 2 (heavy rail+LRT)	15	105,331	25,746
	10	177,347	35,655
	5	336,702	54,283

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

**For the Eglinton Crosstown Phase 2 case, these include boardings on the Crosstown portion between Mount Dennis and MACC, so as to be comparable to the "Continuous on Eglinton" base SmartTrack case.

APPENDIX I: ADDITIONAL 2041 RESULTS

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

SmartTrack Headway	2041 TTC Fare Scenario	2041 GO Fare Scenario
15 min	97,942	52,865
5 min	377,783	138,749

* Assumes Low population/Medium employment with SmartTrack influence

Table I.2 2041 SmartTrack All Day Net New System Riders by Headway and Fare*

SmartTrack Headway	2041 TTC Fare Scenario	2041 GO Fare Scenario
15 min	50,134	38,061
5 min	84,955	52,735

* Assumes Low population/Medium employment with SmartTrack influence

Table I.3 2041 All Day SmartTrack Boardings and Net New Riders*

Land Use Scenario	SmartTrack Headway	All Day Boardings on SmartTrack	Net New System Riders
<i>Low population / Low employment without SmartTrack influence</i>	15	68,895	9,665
	5	300,637	36,757
<i>Low population / Medium employment without SmartTrack influence</i>	15	73,299	9,892
	5	314,902	36,056
<i>Low population / Medium employment with SmartTrack influence</i>	15	97,942	50,134
	5	377,783	84,955
<i>High population / High employment with SmartTrack influence</i>	15	101,867	**
	5	389,930	**
<i>Additional Regional Growth</i>	15	102,097	**
	5	386,852	**

*Assumes TTC Fare

**The base (no SmartTrack) case for this land use scenario has not yet been run and so new riders have not yet been calculated.

Table I.4 2041 Forecast Summary, Alternative SmartTrack Western Alignments*

Western Alignment	SmartTrack Headway	All Day Boardings on SmartTrack**	Net New System Riders
Continuous on Eglinton (heavy rail)	15	97,942	50,134
	5	377,783	84,955
Northern Alignment (heavy rail)	15	107,955	51,669
	5	401,865	88,922
Eglinton Crosstown Phase 2 (heavy rail+LRT)	15	127,615	55,703
	5	393,844	86,668

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

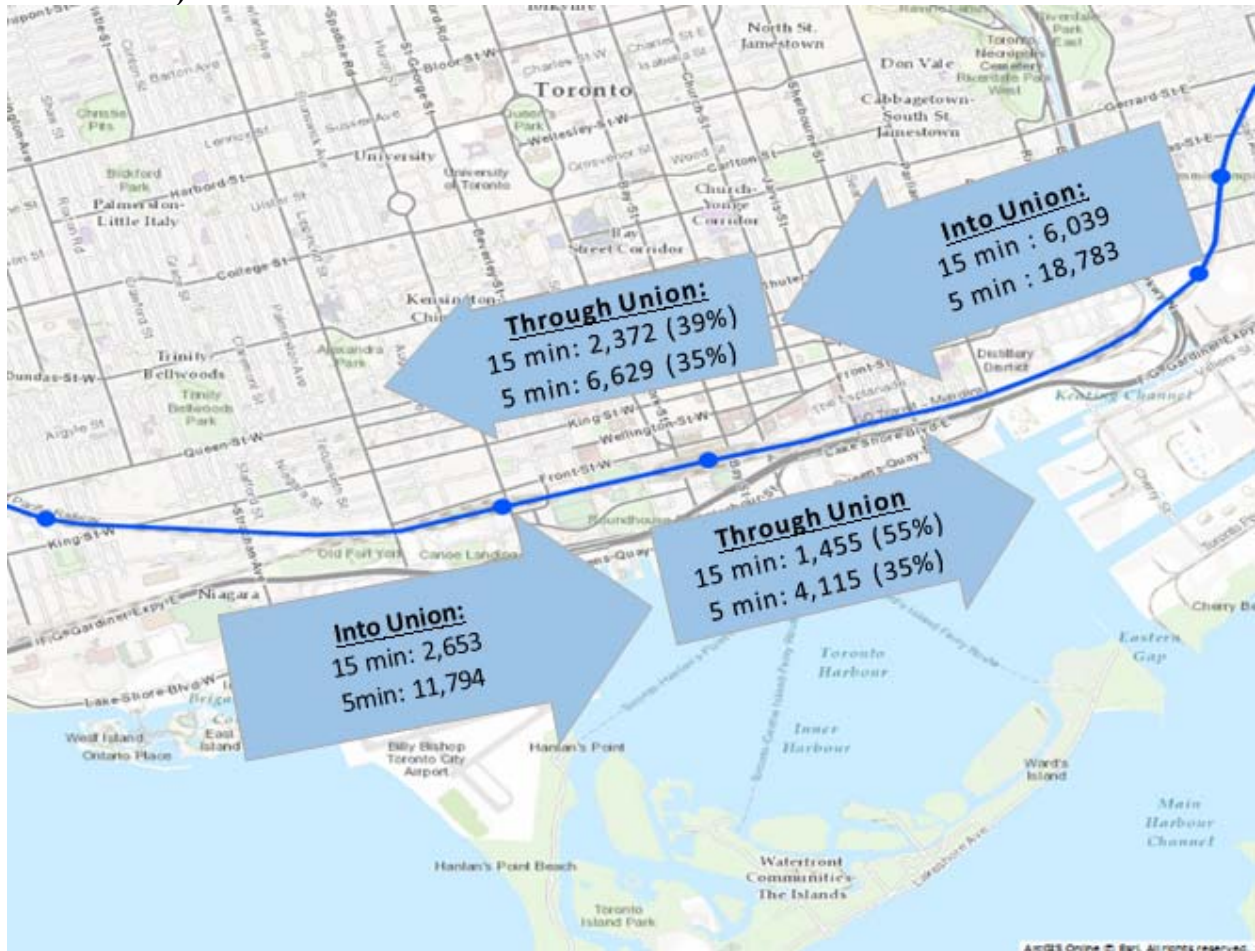
**For the Eglinton Crosstown Phase 2 case, these include boardings on the Crosstown portion between Mount Dennis and MACC, so as to be comparable to the "Continuous on Eglinton" base SmartTrack case.

Table I.5: 2041 AM-Peak-Hour Yonge Line Riders, South of Bloor by SmartTrack Headway*

SmartTrack Headway	Riders
Base	41,761
15 min	40,668
5 min	34,869

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

Figure I.1: 2041 AM-Peak-Hour SmartTrack Flows through Union Station (assumes Low population/Medium employment with SmartTrack influence land use and TTC fare on SmartTrack)



APPENDIX II: 2031 AM-PEAK-HOUR PEAK LOAD POINTS

Figure II.1: 2031 AM-Peak-Hour, Peak Direction Volume: West Portion (assumes Low population/Medium employment with SmartTrack influence land use and TTC fare on SmartTrack)



Figure II.2: 2031 AM-Peak-Hour, Peak Direction Volume: East Portion (assumes Low population/Medium employment with SmartTrack influence land use and TTC fare on SmartTrack)

