APPENDIX M

TRAVEL DEMAND FORECAST REPORT

Spadina Subway Extension Environmental Assessment Downsview to Steeles Avenue

Demand Forecasting for the Comparison of Route Alternatives

August, 2005

Prepared by: Demand Forecasting Technical Sub-group

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1 INTRODUCTION

This report presents the analysis prepared by the Demand Forecasting Technical Sub-Group. The purpose of this group has been to produce travel demand forecasts for different subway route alignments between Downsview station and a transit terminal station on Steeles Avenue, west of Keele Street. These forecasts are intended to be used to help identify a preferred route for the subway extension and provide input into the evaluation process for routing alignments.

The forecast year is 2021 and is intended to provide demand estimates for a 5 year +/- post-construction period. This document details the assumed transportation network (road and transit), major transit routing and fare structure, and land use expected to be in place in that year. The document provides a discussion of the processes used to gather all the necessary information for the forecasting model, preparation and analysis of model runs, refinement procedures for station-level analysis and demand forecasts for all subway route alignments.

2 APPROACH

The City of Toronto's GTA Model[1] has been used to generate the travel forecasts for 2021. It is an EMME/2-based model. The GTA Model contains a GTA-wide transportation network (transit and road), and is based on 2001 and 1996 Transportation for Tomorrow Survey[2] data. The Model has been used extensively by the City in many transportation planning, transportation environmental assessments and in the preparation of the Council-approved Official Plan[3].

A flowchart of the demand forecasting work plan is shown in Exhibit 1. The work was divided into three components:

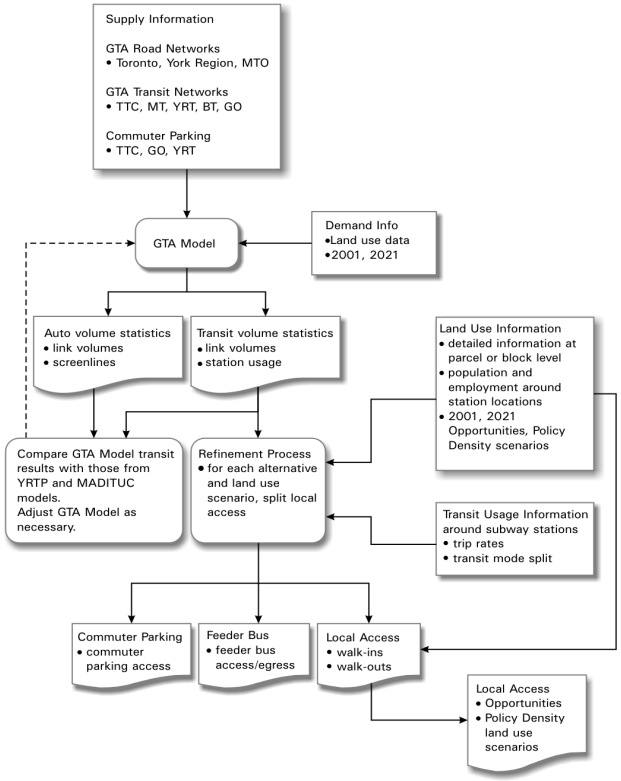
1) GTA Model Work – Update and Validation
2) Refinement Process; and
3) Opportunities and Policy Density – Land Use Scenarios

The first step in the process required the update of the GTA Model to produce the forecasts for the possible subway routes using 2021 transportation networks (transit and roads) and 2021 population and employment forecasts for the GTA[4]. Validation of the model within the study area for the base year (2001) was required in order to ensure that the allocation of travel demands between modes was within acceptable limits.

Because the GTA Model is traffic zone-based (traffic zones cover relatively large areas) and the study is evaluating route alternatives within a relatively small area, refinements to the model results were done to better reflect station walk-ins and walk-outs as well as transfers to/from local transit services. Forecasts for walk access to/from station locations were also produced using two additional land use scenarios, namely, Opportunities (increased population potential) and Policy Density land use which are described in more detail in section 5.1. Appendix A provides a more detailed description of the work undertaken.

[1] GTA Model is a customized modeling framework that the City of Toronto uses for travel demand forecasting. The modeling framework uses EMME/2 travel demand forecasting software as a platform for completing calculations and performing various tasks to complete a four-stage travel demand forecasting procedure.
[2] The Transportation for Tomorrow Survey (TTS) is a comprehensive GTA-wide telephone interview survey conducted every 5 years, in parallel with the Census, which collects detailed information on travel habits and behaviours for weekday travel.
[3] The City of Toronto Official Plan was approved by City Council in December 2002.
[4] Sources of the population and employment forecasts vary from municipality to municipality. More detail on the sources is found in Section 5.

Exhibit 1 – Flowchart of Demand Forecasting Work



3 MODEL VALIDATION

The purpose of the model validation exercise was to confirm that the GTA Model adequately simulates actual observed transit and auto driver trips. The GTA Model was validated by comparing the model's estimates for 2001 (based on the four-stage modeling process) to adjusted 2001 Cordon Count[5] data and TTC station usage data for 2001.

Table 1 shows the comparison between 2001 cordon count data for transit trips crossing a section of the Steeles Avenue screenline and the corresponding figure generated by the GTA model. The Steeles Avenue screenline extends from Richmond Hill GO Line, east of Yonge Street, to Jane Street. The screenline was extended further to the east, compared to previous work, so that the forecasting sub-group could assess the impact and relationship of the subway extension demands to improvements to both the Bradford and Richmond Hill GO services.

Table 1 - Southbound Cordon - North of Steeles between Jane St and Richmond Hill GO

MODE	Adjusted Cordon Count AM peak hour	Simulated GTA model AM peak hour	% Difference
	2001	2001+	
Transit Persons	7,100	7,600	7.0%
Auto Persons	15,000	15,300	2.0%
TOTAL	22,100	22,900	3.6%

The results of Table 1 show that the cordon north of Steeles Avenue covering the Study Area is accurately represented by the GTA Model. Table 2, below, shows the comparison between 2001 station usage counts and the corresponding figures generated by the GTA Model.

Table 2 - 2001 AM Peak Period Boardings and Alightings by Station

Station	Observed[a] Boardings	Simulated[b] Boardings	Observed[a] Alightings	Simulated[b] Alightings	Sim/Obs Boardings	Sim/Obs Alightings
Eglinton West	4,050	4,190	665	1,010	3.5%	51.9%
Glencairn	1,245	945	135	275	-24.1%	103.7%
Lawrence West	2,630	2,725	1,485	1,285	3.6%	-13.5%
Yorkdale	3,115	4,685	885	1,055	50.4%	19.2%
Wilson	4,875	3,785	1,390	1,260	-22.4%	-9.4%
Downsview	4,530	3,165	3,630	3,635	-30.1%	0.1%
Total	20,445	19,495	8,190	8,520	-4.6%	4.0%

[a]Observed station usage information is from 2001 TTC Station Usage Count report.
[b]Simulated station usage is from the GTA Model

Table 2 results show that while there are variations in the accuracy of the model's simulation of individual station usage, on an aggregate basis the estimates are well within accepted limits for a regional modeling exercise.

[5] Cordon Count data is collected across the GTA every 3 years (scheduled to coincide with TTS and Census). Travel usage data (auto, truck, transit) is collected on prescribed roads at specific cordons across the GTA including Steeles Avenue at the York/Toronto boundary and includes the capture of occupancy data in passenger vehicles. The transit cordon count was adjusted by a factor of 1.34 to account for an under-representation of transit trips crossing southbound over the entire Steeles boundary between York Region and Toronto. This factor is the ratio of 2001 TTS AM peak transit trips to the 2001 Cordon count AM peak transit trips crossing the Steeles boundary.

4 FUTURE NETWORKS

The assumptions for the 2021 road network, transit network, and commuter parking changes are listed in Appendix B. All planned road and transit changes for 2021 were coded in the GTA Model networks. Exhibit 2 shows a map of the changes in surface transit routes assumed for the subway extension. City staff assembled all road and transit network information with the cooperation of staff from the Ministry of Transportation Ontario (MTO), GO Transit, York Region, Peel Region, City of Toronto, and TTC. The subway routes studied are shown in Exhibits 3a-3h.

Fare structures are assumed to remain as they currently exist including the local transit zone fare boundary at Steeles Avenue. However, it should be noted that within the timeframe examined in this analysis, fare structures may change significantly and if, as a result, the zone fare boundary at Steeles is modified or eliminated, transit ridership could increase above the levels forecast here.

Exhibit 2 - Map of Possible Surface Transit Routes Connecting to Subway Extension

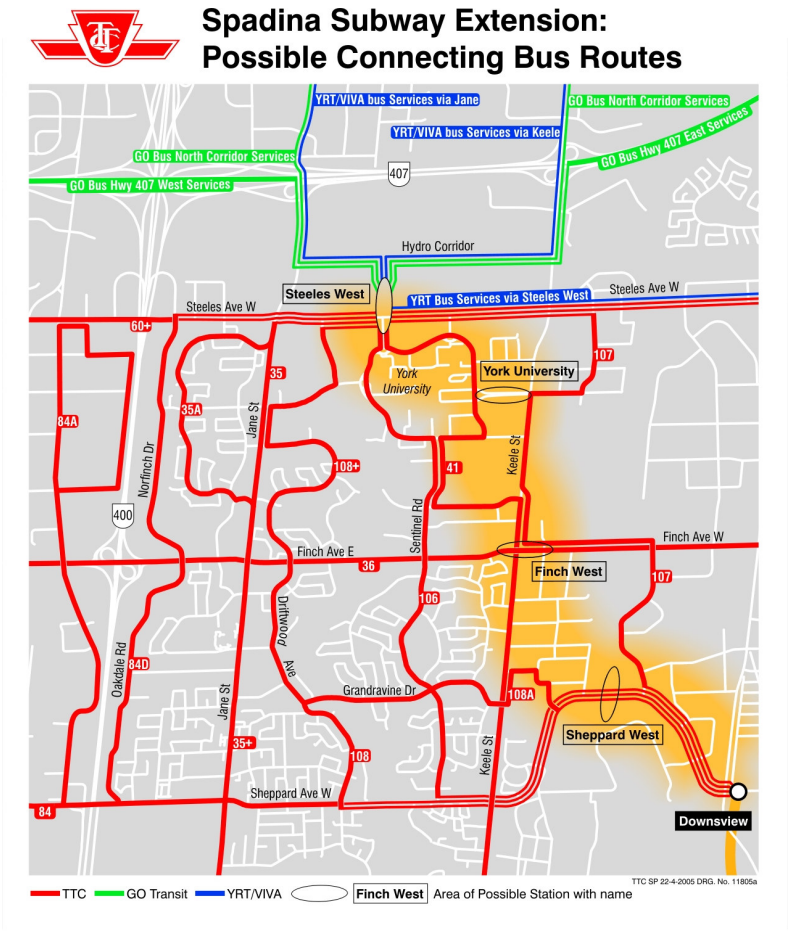
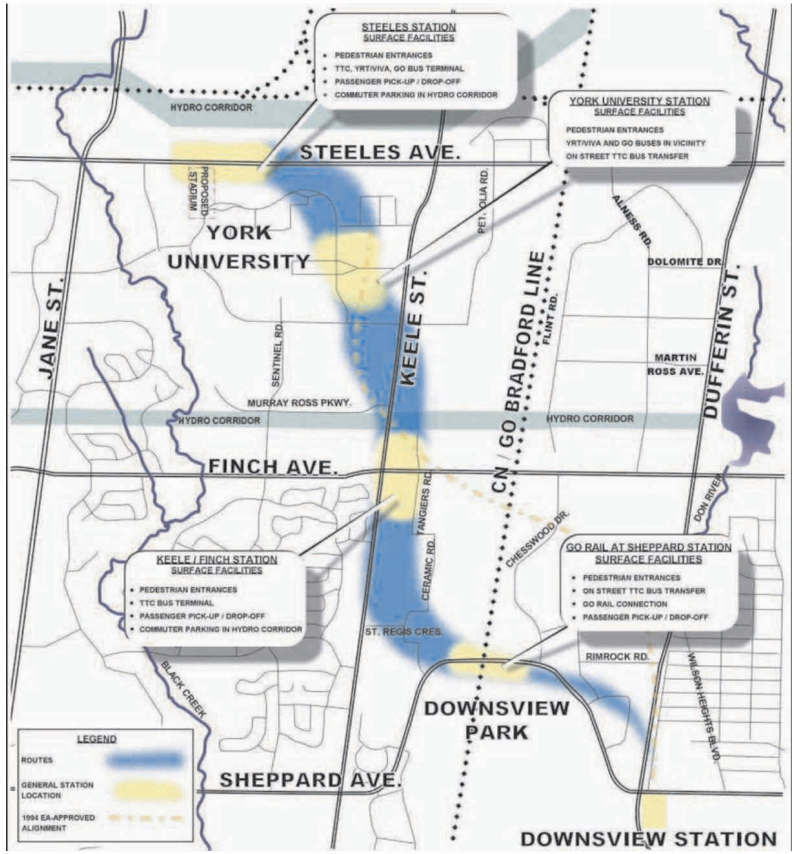


Exhibit 3a

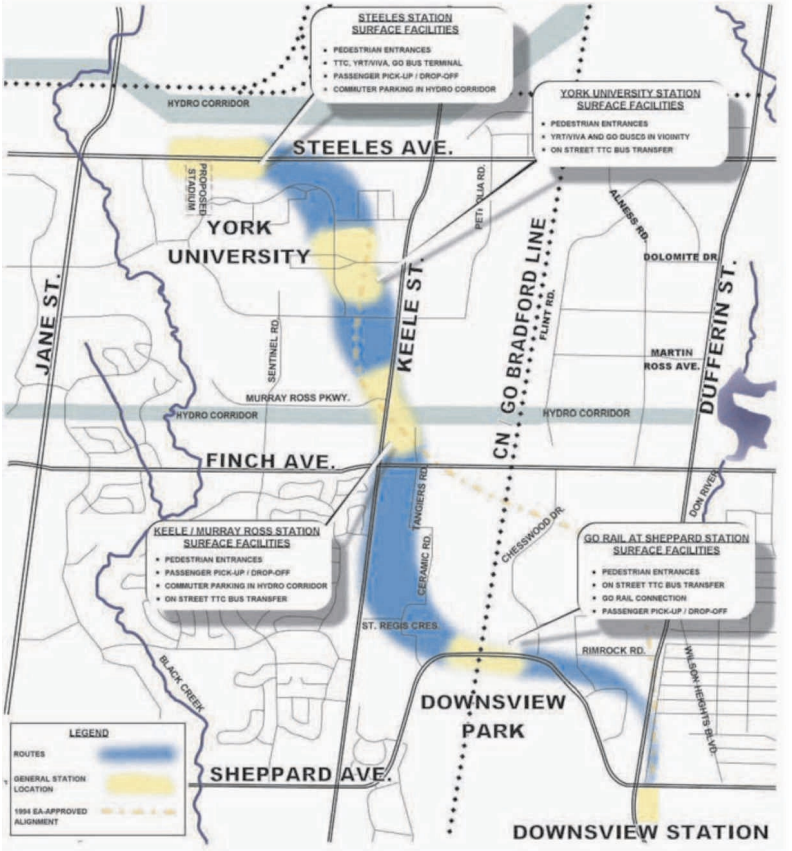
Route 1



TTC SP 06-06-2005 DRG. No. 11811a

Exhibit 3b

Route 2



TTC SP 06-06-2005 DRG. No. 11811b

Exhibit 3c

Route 3

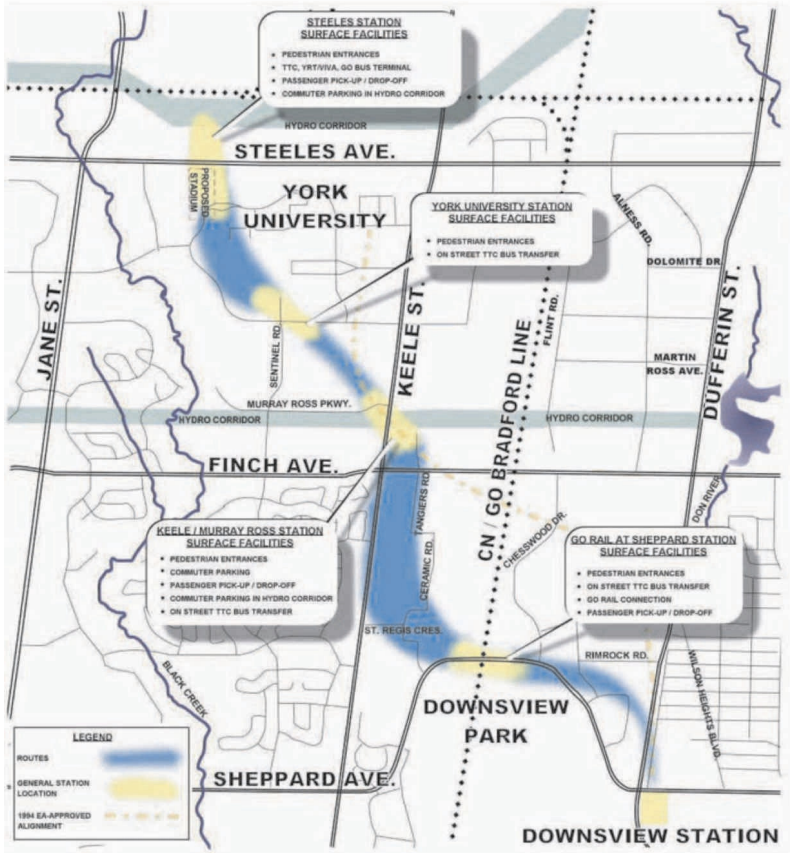


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Exhibit 3d

Route 4

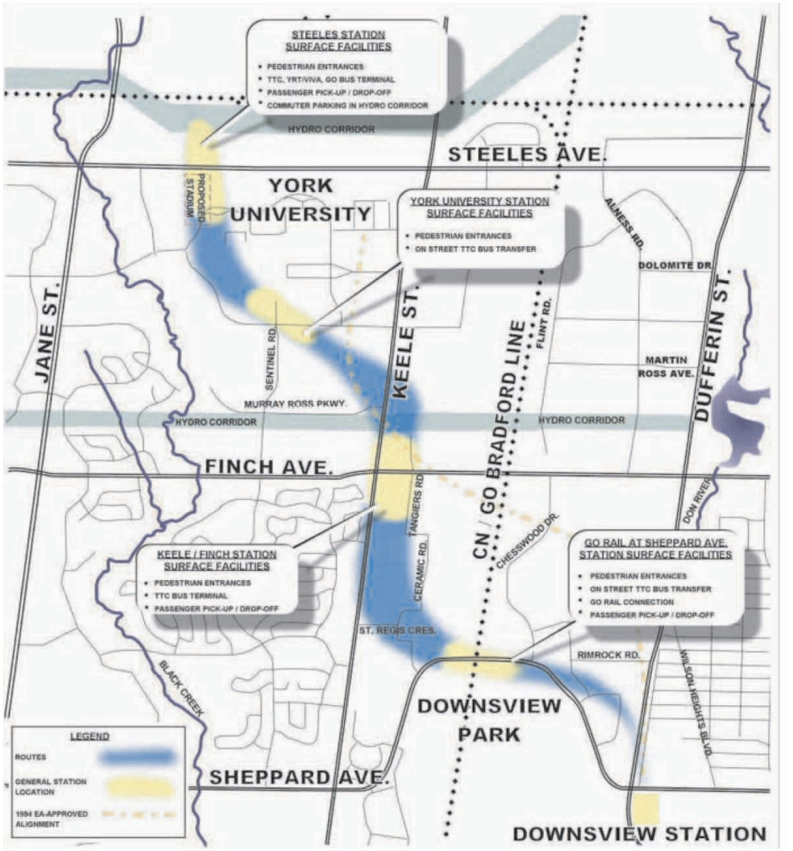

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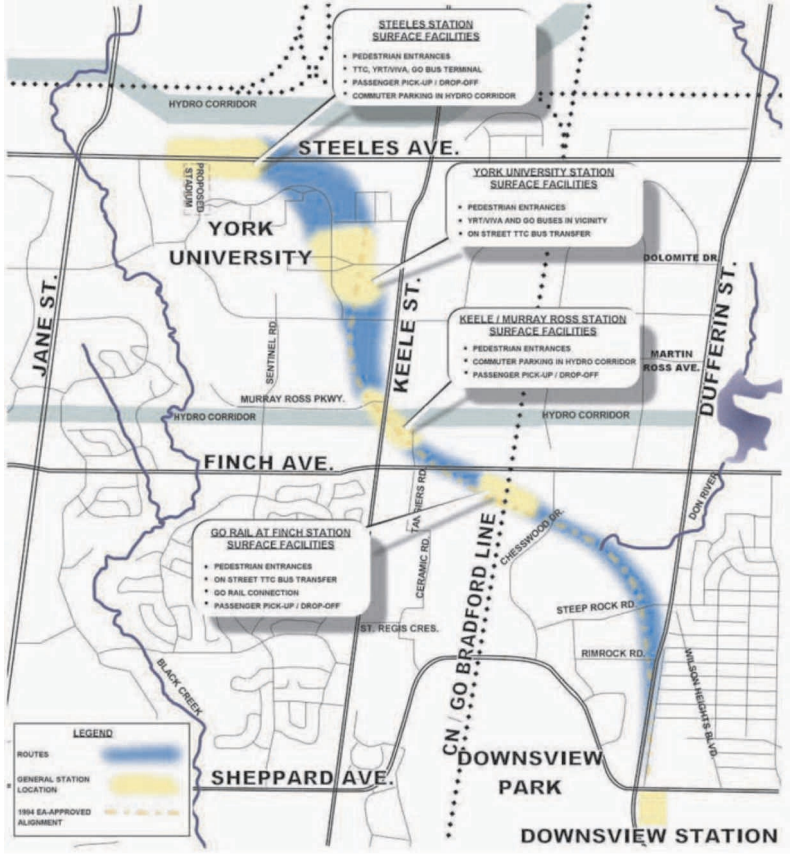
Exhibit 3e

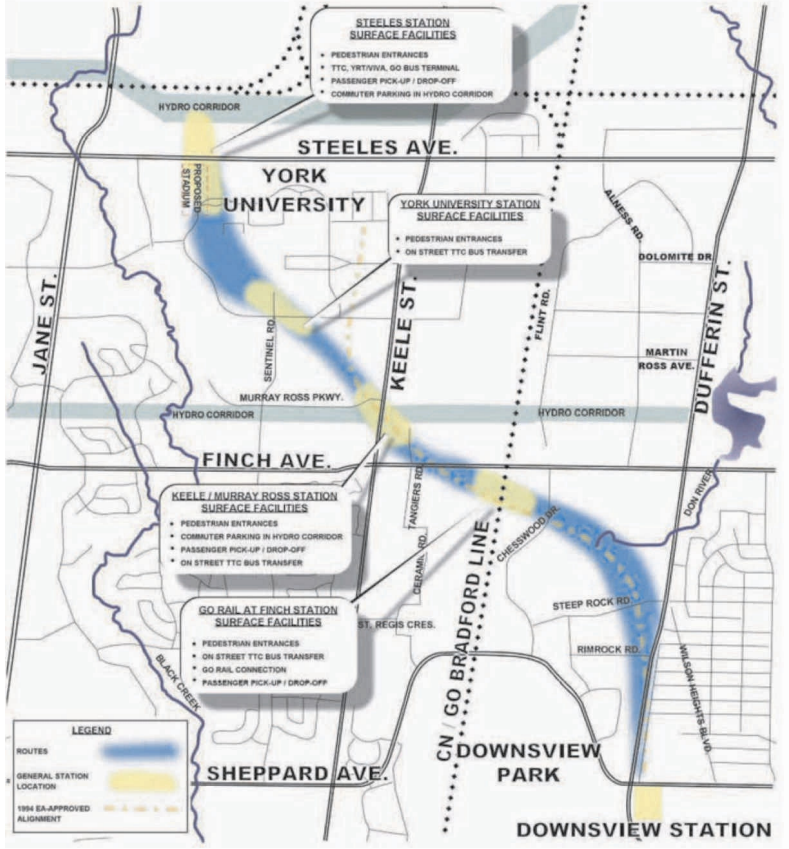
Route 5



TTC SP 06-06-2005 DRG. No. 11811e

Exhibit 3f

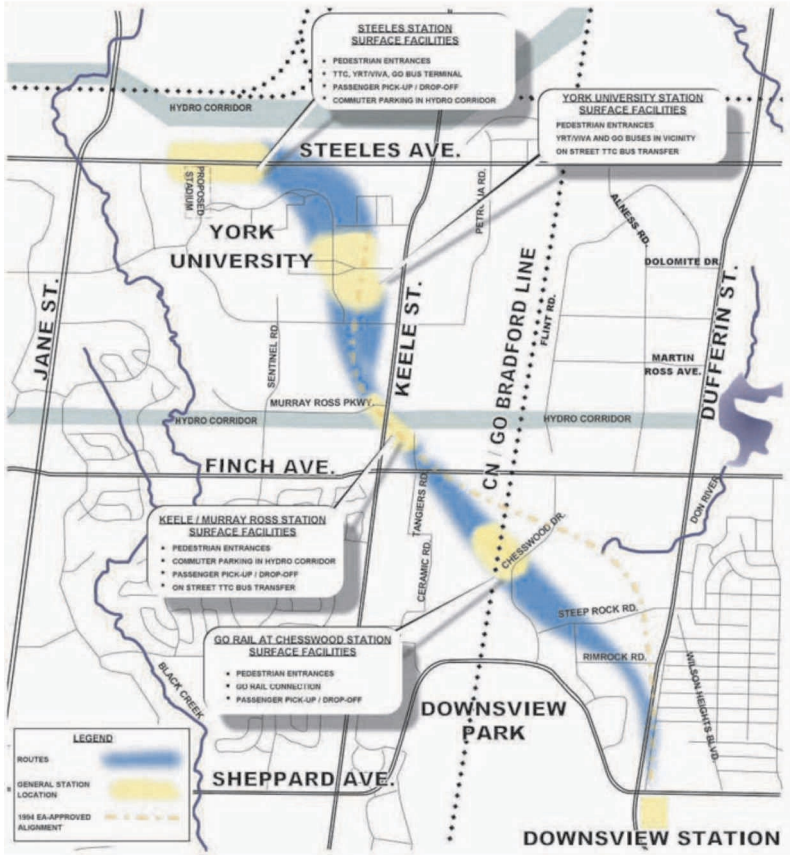
Route 6



TTC SP 06-06-2005 DRG. No. 11811f

Exhibit 3g

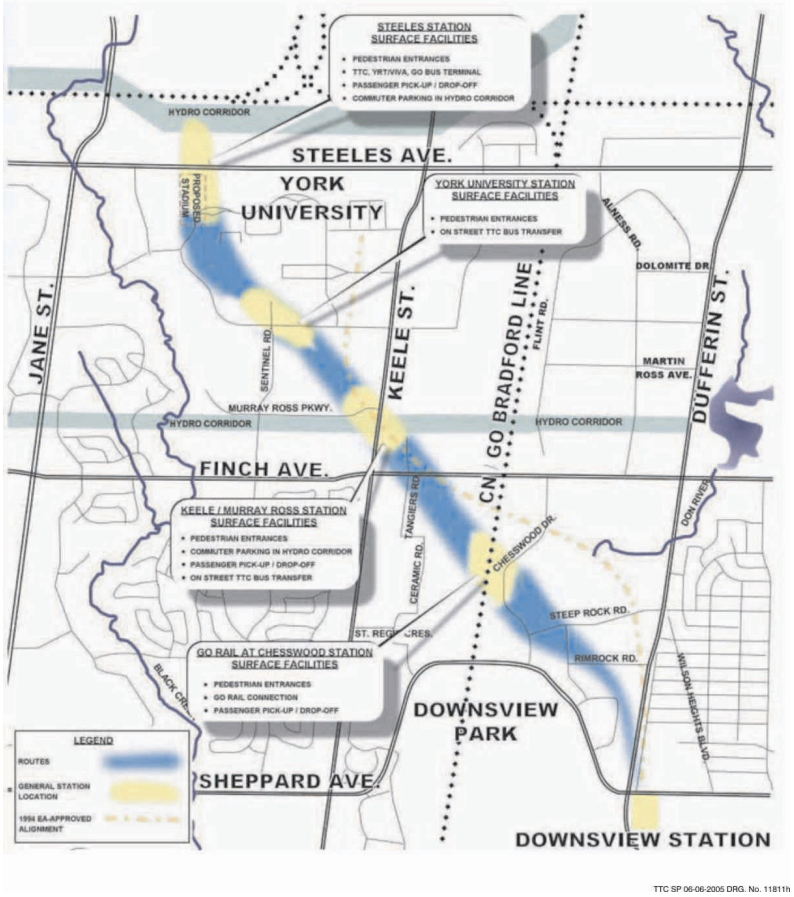
Route 7



TTC SP 06-06-2005 DRG. No. 11811g

Exhibit 3h

Route 8



TTC SP 06-06-2005 DRG. No. 11811h

5 LAND USE

Table 3 contains the regional 2021 population and employment control totals used in the GTA model. Each region provided this information at a regional and traffic zone level.

Table 3 - Regional Land Use Assumptions

Region	Source	2001 POP	2001 EMP	2021 POP	2021 EMP
Toronto	Official Plan	2,450,750	1,453,650	2,800,050	1,718,950
Durham	Development Charges study	527,050	166,350	849,750	311,000
York	York Region Official Plan (September 2004 update)	772,000	386,000	1,272,000	721,200
Peel	Peel Region Official Plan (August 2003 update)	981,650	517,750	1,394,900	761,400
Halton	Halton Region Official Plan (June 2003 update)	389,250	169,000	592,300	308,000
Hamilton	1999-2001 TMP	498,100	192,350	566,800	229,650
TOTAL		5,618,800	2,885,100	7,475,800	4,050,200

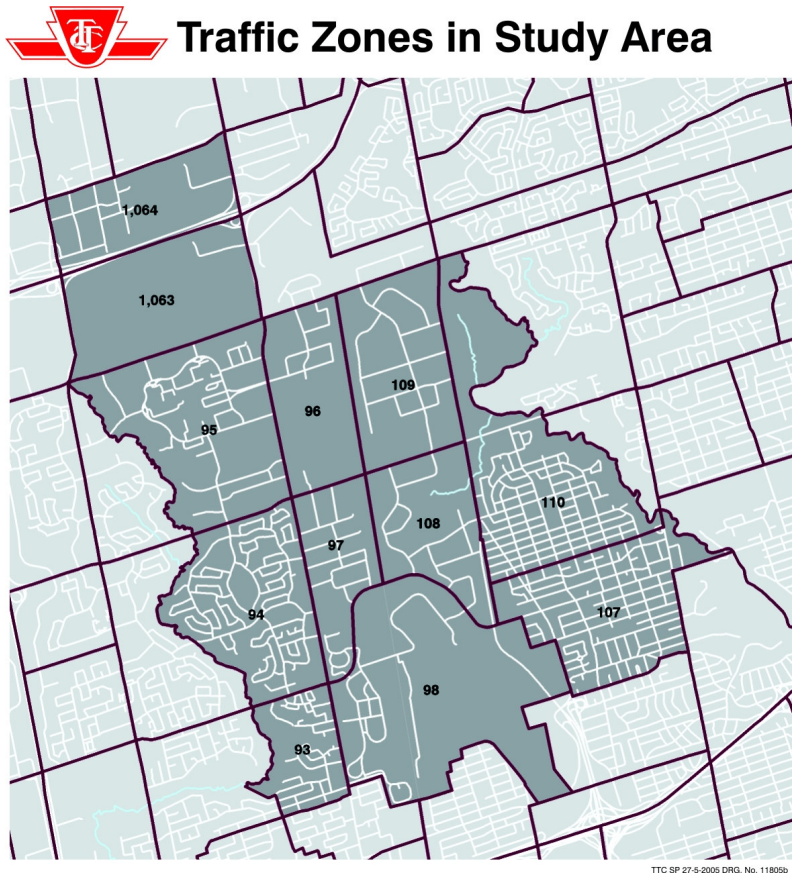
Table 4 shows the 2001 and 2021 land use for the traffic zones in the study area (Exhibit 4). The source of this information is a traffic zone level breakdown of the City of Toronto and York Region Official Plans' forecasts.

Table 4 - Study Area Land Use Assumptions by Traffic Zone

96 Traffic Zone	2001 POP	2001 EMP	2021 POP	2021 EMP
93	5,500	650	6,400	800
94	16,850	1,700	17,100	2,050
95	8,850	7,200	10,950	9,550
96	-	4,600	1,550	4,700
97	350	5,750	2,500	5,850
98	950	1,050	3,550	1,150
107	11,400	2,450	12,200	3,050
108	-	7,350	-	7,900
109	-	12,900	700	13,950
110	8,450	2,900	8,350	3,400
1063	-	3,350	-	4,050
1064	-	4,300	1,850	5,500
Study Area Totals	52,350	54,200	65,150	61,950

Source: City of Toronto, City Planning, Policy & Research Section
(Zones 93-98 and 107-110)

Exhibit 4 – Traffic Zones in Study Area



5.1 Land Use Scenarios

A total of three different land use scenarios were developed for the potential subway station areas:

- Base land use (Official Plan)
- Opportunities land use
- Policy Density land use

In order to assess the impact of land use in the vicinity of stations on subway ridership, land use scenarios were developed for the land area within a 500 metre radius of each potential station. Exhibit 5 shows the identified stations and their 500 metre catchment areas in relation to land use potential and opportunities identified in the City's Official Plan.

Research has shown that the likelihood of a transit customer walking to a rapid transit station decreases significantly once the walk distance exceeds 500 metres. At this point, the customer is likely to choose to walk to a nearby bus stop and then use surface transit to reach a rapid transit station. The forecasts of transit customers walking into and walking out of rapid transit stations are based on the total population and employment within a 500 metre radius of the station.

Base Land Use Scenario

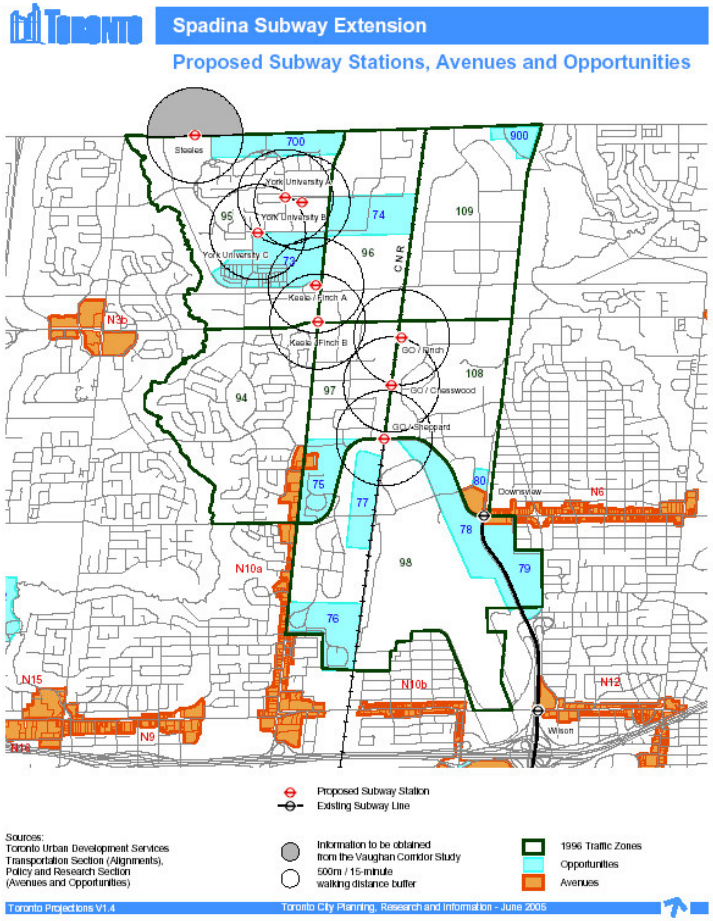
The 2021 population and employment forecasts from Official Plans were used as a basis for estimating travel demands for the base land use scenario using the GTA Model. Since Official Plan land use forecasts are done to a traffic zone level only, which is much larger than the 500 metre station area radius, more detailed estimates were needed for the station areas. City Planning staff provided the Base Land use forecasts for the 500 metre radius around potential stations as shown in Table 5.

Opportunities Land Use Scenario

The second land use scenario used Opportunities[6] for residential development in the vicinity of potential future subway stations. The Opportunities scenario has the same employment forecast as the Base scenario. The source of this information is the background research to the City of Toronto's Official Plan. The Opportunities scenario assumes development in identified "opportunity" areas being built out to their assumed densities within the 500 metre walking distance of the potential subway station by the 2021 horizon year. The "opportunity" areas were assessed during the Official Plan process without consideration of a potential Spadina subway extension. This is the scenario that has been used in the evaluation of route and alignment alternatives.

[6] The identification of Opportunities for additional residential development beyond the base Official Plan forecasts are discussed in the Official Plan background report: Flashforward: Projecting Population and Employment to 2031 in a Mature Urban Area, City of Toronto, June 2002.

Exhibit 5 - Land Uses Around Potential Stations



In order to assess station locations, and potential ridership, from a policy perspective, a third land use scenario was developed. This scenario assumed a target density for development in the vicinity of potential future subway stations. A target density of 100 persons per hectare within 500 metres of a rapid transit station is used as the policy density. This density was used in the Rapid Transit Expansion Study (August 2001)[7] which lists land use guidelines for successful rapid transit in a corridor. One of the guidelines states:

> ***"population and employment densities in excess of 100 are necessary to achieve transit modal splits which are favourable to the implementation of rapid transit. At densities below 100, the success of rapid transit cannot be assured and the operational performance of a line may not be affordable."***

City and TTC staff reviewed the potential station locations and determined if those locations, based on Official Plan policies and objectives, would be either mixed-use or entirely employment based. For those stations identified as mixed use, the split between population and employment was estimated to be 65/35. This split was estimated based on review of comparable existing subway stations in the City.

Table 5 lists the 2021 population and employment within 500 metres of the subway extension station locations for the Base (Official Plan) land use, Opportunities, and Policy Density scenarios. Not all stations will have estimates for all three scenarios since the Opportunities scenario applies only to those stations that have the potential for residential development within a 500-metre radius. For example, the Finch West station at GO will have predominantly employment in its vicinity and, therefore, no population values for the Opportunities scenario. The Policy Density population and employment were estimated for only those stations south of York University station. Some stations have a mix of population and employment while others are mainly employment.

[7] Toronto Transit Commission, August 2001.

Table 5 - 2021 Base, Opportunities and Policy Density Forecasts within 500m of Possible Station Locations

Possible Station	Base (OP) Pop	Base (OP) Emp	Opportunities Pop	Opportunities Emp[c]	Policy Density Pop	Policy Density Emp
Steeles West[a]	1,300	900	1,900	900	na	Na
York University at Sentinel	2,600	1,800	3,800	1,800	na	Na
York University at east end of Common	2,300	1,800	3,500	1,800	na	Na
York University at west end of Common	2,600	1,800	3,800	1,800	na	Na
Finch West at Keele	2,400	2,000	3,900	2,000	5,000	2,700
Keele / Murray Ross	1,900	1,900	3,200	1,900	5,000	2,700
Finch West at GO[b]	negligible	3,400	negligible	3,400	negligible	7,700
GO / Chesswood[b]	negligible	3,500	negligible	3,500	negligible	7,700
Sheppard West	700	2,000	2,200	2,000	5,000	2,700

Source: City of Toronto, City Planning, Policy & Research Section

[a]Figures do not include the land use just north of Steeles that, at the time of writing, is going through the secondary plan approval process. If approved, there would an additional 10,355 population and 4,600 employment of which a population of 6,640 and employment of 2200 would be within 500m of the Steeles station. As the proposed Steeles West station is common to all routing alternatives, changes to the land use assumptions at this station will not affect the selection of a preferred subway route.

[b]It is expected that the land use in the vicinity of these stations will remain predominantly employment-based.

[c]Opportunities were not estimated for employment. Therefore, employment forecasts were assumed to be the same as the base employment forecasts.

More details on total population and employment within 500 metres of each potential subway station for the years 2001 and 2021 for each subway route alternative are shown in tables in Appendix C.

6 RIDERSHIP FORECAST RESULTS

As discussed earlier in this document, ridership forecasts were prepared for two levels of analysis; namely, overall subway extension volumes by route and individual station usage including boardings and alightings by mode (walk-in, transfer, commuter parking). The results discussed below were prepared as part of the subway route evaluation process and have been incorporated into the detailed evaluation of the route options. The ridership forecasts presented here reflect the most detailed estimates available for station level analysis and will also form part of the analysis for station location phase of the study.

6.1 Screenline Volumes

Overall screenline volumes, at three separate screenlines between Downsview Station and Steeles Avenue, do not vary significantly between the route options tested using the GTA Model. Therefore, a single series of numbers is shown below that represents the overall allocation of travel by mode to each screenline. Some adjustments have been made to the raw model results, the details of which can be found in Appendix D.

These screenline volumes only include trips generated from the 2021 land use as listed in Table 3. It thus excludes the additional land use just north of Steeles Avenue that is going through a secondary plan approval process.

Table 6 - 2021 AM Peak Period Screenline Volumes with Subway Extension - Corridor between Jane St. and Richmond Hill GO

		Model Volume (person-trips) – AM peak period					
		Rapid Transit	GO Rail	Surface Transit	Total Transit	Total Auto	TOTAL
South of Steeles	SB	4,800	10,000	37,200	52,000	44,300	96,300
	NB	1,200	5	15,300	16,505	21,500	38,010
South of Finch	SB	49,800	11,200	700	61,700	39,100	100,800
	NB	13,800	10	8,500	22,310	35,300	57,610
South of Sheppard	SB	65,400	11,100	1,300	77,800	46,900	124,700
	NB	22,200	70	8,500	30,770	36,900	67,670

Table 7 - 2001+ AM Peak Period Screenline Volumes - Corridor between Jane St. and Richmond Hill GO

		Model Volume (person-trips) – AM peak period					
		Rapid Transit	GO Rail	Surface Transit	Total Transit	Total Auto	TOTAL
South of Steeles	SB	-	5,200	12,800	18,000	36,100	54,100
	NB	-	-	8,200	8,200	14,600	22,800
South of Finch	SB	23,200	6,100	4,100	33,400	32,100	65,500
	NB	6,200	-	10,000	16,200	24,600	40,800
South of Sheppard	SB	36,400	6,100	3,200	45,600	36,700	82,300
	NB	15,800	-	7,800	23,600	30,600	54,200

6.2 Forecasting Transit Trips to York University

A more manual process was used to forecast trips using the subway to go to York University. This process involved applying transit mode split and direction of travel factors to university employees and students. Employment at the university is expected to remain constant at approximately 5,300 employees while the student enrolment is expected to increase from 50,000 in 2004 (including the double cohort)[8] to 52,000 in 2021.

[8] In 2003, the province phased out the 5-year high school program and completed phasing in a 4-year program that resulted in two groups of students graduating in a single year, the 'double-cohort'. The

For work trips to the university, the 2001 transit mode split is 10% for the AM peak period [2001 TTS]. The work trip transit mode split to York University was doubled to 20% for the forecasting exercise. TTS also indicates that that 74% of all transit work trips going to the university occur during the AM peak period, and that approximately 75% of these trips originate from locations in Toronto. These have been assumed to stay constant in 2021.

For student trips to the university, an AM peak period transit mode split of 55% was assumed. The 2001 TTS figure was 40%. TTS data also indicates that approximately 70% of all student trips made by transit originate from locations in Toronto.

Completing the calculations using these assumptions results in approximately 5,500 AM peak period transit trips travelling northbound on the Spadina subway extension and alighting at York University station. Those transit trips coming from the north, 2300, were assumed to walk to the university from the Steeles station or be dropped off by buses from the north circulating through the university. If changes to fare arrangements can be made to permit travel between non-TTC buses and the subway on a single fare there would likely be some customers who would travel the short subway ride between Steeles and York University stations.

6.3 Commuter Parking

There are three locations in the Spadina Subway Extension corridor that are identified for commuter parking:

- Steeles Avenue terminal
- Keele/Hydro Corridor
- Downsview Station

In order to prepare a complete analysis of station utilization for each routing option, the following assumptions were made for stations in the vicinity of these three locations:

Table 8 - Commuter Parking Assumptions

Station	Commuter Parking Location	# Spaces
Steeles Terminal	Steeles/hydro corridor	3000
York U - Sentinel	Keele/Hydro corridor	400
Keele/Murray Ross	Keele/Hydro corridor	400
Keele/Finch	Keele/Hydro corridor	400
Downsview	SE quadrant Sheppard/Allen	640

The commuter parking facilities listed above were used both in the GTA Model and for the station level usage forecasts.

6.4 Station Usage Forecasts

Table 9 lists the number of AM peak period customers forecast to use each of the possible stations identified in the eight subway route alternatives. Appendix D has more detail on these figures and lists any refinements made to the unrefined GTA Model results.

Table 9 - Total Boardings and Alightings - 2021 AM Peak Period

increased demand for university programs in the period after this 'double cohort' of students is still reflected in the student population for 2004.

	Land Use Scenario		
Station	**Official Plan - Base**	**Opportunities**	**Policy Density**
Steeles West combined with York U	21,250	21,250	21,250
Keele / Murray Ross	1,550	1,700	2,000
Finch West at Keele	3,000	3,200	3,500
Finch West at GO	1,750	1,750	2,050
GO / Chesswood	250	250	550
Sheppard West	2,650	2,950	3,750

The usage results for Steeles West and York University stations assumed the same level of land use and student enrolment for all three land use scenarios. All forecasts include the additional land use just north of Steeles Avenue that is going through a secondary plan approval process. The above figures were derived from the subway route alignments modeled in the GTA Model. In each of the subway route alignments, the differences in the station usage forecasts for Steeles West and York University stations were negligible, thus the average was used.

GO / Chesswood station was not included in the original set of subway route scenarios run through the GTA Model. The station usage is based solely on the population and employment within 500m of the station. In fact, the area is and will most likely remain predominantly as industrial and commercial land. Thus, the GO / Chesswood figures in the above table represent mostly AM peak period walk-outs to the employment destinations. There is no opportunity at this location for any transfers to other modes of public transit except for that of GO train. The GTA Model results indicated that the number of customers transferring at this station between GO train and the subway is very small (less than 50 total boardings and alightings in the AM peak period). The Finch West station at the GO line is in the same land use category as GO / Chesswood, however, transfers between Finch West buses and the subway would be possible at this location.

The above station usage results indicate that, of all the possible stations located south of York University, the highest ridership levels are achieved with Routes 1 and 4. This can be clearly shown in Table 10 which uses the Official Plan – Opportunities Land Use scenario AM peak period forecast results applied to all eight identified subway route alternatives. Table 11 expands these figures to an all-day basis.

Table 10 - Total Boardings and Alightings - 2021 Opportunities Land Use - AM Peak Period

Station	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8
Steeles West and York U	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400
Keele / Murray Ross		1,700	1,700		1,700	1,700	1,700	1,700
Finch West at Keele	3,200			3,200				
Finch West at GO / Finch					1,750	1,750		
GO / Chesswood							250	250
Sheppard West	2,950	2,950	2,950	2,950				
Totals	27,550	26,050	26,050	27,550	24,850	24,850	23,350	23,350

Table 11 - Total Boardings and Alightings - 2021 Opportunities Land Use - All Day[a]

Station	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8
Steeles West and York U	81,000	81,000	81,000	81,000	81,000	81,000	81,000	81,000
Keele / Murray Ross		5,900	5,900		5,900	5,900	5,900	5,900
Finch West at Keele	11,050			11,050				
Finch West at GO					6,050	6,050		
GO / Chesswood							850	850
Sheppard West	10,150	10,150	10,150	10,150				
Totals	102,200	97,050	97,050	102,200	92,950	92,950	87,750	87,750

[a]All day forecast assumed to be 3.45 times the AM peak period forecast. For student trips to/from York University, this factor is 5.0. For employment trips to/from York University, this factor is 2.7.

The evaluation matrix for the routing options contains the indicator of transfer activity to/from the subway at stations on Finch Avenue West. The evaluation matrix also includes the indicator of the AM peak period subway volume southbound, heading into Downsview station. The subway volume represents the maximum load point for the subway extension. The transfer activity and subway link volume figures are shown in Table 12 and Table 13.

Table 12 - Transfer Activity at Stations on Finch Ave W - 2021 Opportunities Land Use - AM Peak Period

	Route 1[a]	Route 2	Route 3	Route 4[a]	Route 5[b]	Route 6[b]	Route 7	Route 8
AM Peak Subway Transfers at Keele / Finch area	1075	0	0	1075	1075	1075	0	0

[a]transfers occur at the Finch West station at Keele
[b]transfers occur at the Finch West station at GO

Table 13 - Subway Link Volumes – 2021 Opportunities Land Use - AM Peak Period

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8
AM ***Peak Period*** Link Volume - SB to Downsview	17,105	16,050	16,050	17,105	15,525	15,525	14,375	14,375

6.5 Detailed Forecasts for Preferred Route Alternative

At the time of writing this report, the overall evaluation process indicated that Route 1 is the preferred alternative. Table 14 contains more details for the stations that were identified as part of Route 1. It also contains the AM peak period volumes that are forecast to be on each link of the subway extension.

Table 14 - Route 1 Station Usage and Link Volume Forecasts - 2021 Opportunities Land Use - AM Peak Period

Station	Park & Ride TO station	walk-ins TO station	bus transfers TO station	walk-outs FROM station	bus transfers FROM station	NB volume TO station	SB volume FROM station
Steeles West and York U	1,550	1,150	10,450	5,850	2,400	8,250	13,150
Finch West at Keele	400	900	1,100	400	450	8,950	15,350
Sheppard West	NA	450	1,400	600	550	9,850	17,100

7 CONCLUSIONS

This report has documented the process and data used in the forecasting of ridership on the possible Spadina subway route extensions. The forecasts are to be used to help identify a preferred route for the subway extension and provide input into the evaluation process for routing alignments. The forecasting results contained in this report indicates that, of all the eight subway route options, Route1 and Route 4 will result in the highest ridership levels with approximately 100,000 daily trips and an annual figure of approximately 30 million trips.

Appendix A – Description of Work

The forecasting work was divided into three components:

1) GTA Model Work
2) Validation and Refinement Process; and
3) Maximum Opportunity and Policy – Land Use

Each component is described below. A flowchart of the demand forecasting work is shown in Exhibit A1.

1. GTA Model Work

1.1 Assemble supply information required by the GTA model
- road networks for 2001, 2021
- transit networks for 2001, 2021
- commuter parking facilities for 2001, 2021

1.2 Assemble demand information required by the GTA model
- traffic zone level population and employment for GTA for 2001, 2021

1.3 Confirm base scenarios to be run on GTA model with Technical Group
- AM peak networks and assignments

Network	2001 Land Use	2021 Land Use
Base 2001 network	✓	
2021 network with EA-approved alignment		✓
2021 network with alignment to Steeles via GO/Sheppard		✓
2021 network with alignment to Steeles via GO/Finch		✓

1.4 Confirm model assumptions with Demand Forecasting Sub-Group
- confirm network assumptions
- confirm land use assumptions

1.5 Complete GTA model runs and assemble output statistics
- reasonableness check of the model results
- compare to York Region Transit Plan 2021 ridership forecasts
- compare to TTC's MADITUC model transit assignments for 2021

1.6 Present results to Demand Forecasting Sub-Group

1.7 Document results

2. Validation and Refinement Process

2.1 Use York Region Model 2021 results for comparison
- refer to York Region Transit Plan reports
- review networks and land use to determine if comparisons are applicable
- if applicable, review and compare subway link volumes and station boardings
- if applicable, review and compare auto/transit screen lines

2.2 Compare transit forecasts of the GTA model with those produced by TTC's MADITUC model
- compare station usage: 2001 network and 2001 demand, 2021 network and 2021 demand
- refine/adjust GTA network in study area as necessary
- refine/adjust zone centroid connectors in study area as necessary

2.3 Confirm evaluation criteria with Demand Forecasting Sub-Group
- auto screenlines in study area
- transit screenlines in study area
- station usage - boardings, alightings, feeder bus, commuter parking
- link volumes on subway extension

2.4 Confirm refinement approach with Demand Forecasting Sub-Group
- adjust subway station access/egress figures by forecasting walk-ins and walk-outs using the GTA model station usage results as a control total
- this forecasting is done by applying trip rates and mode split factors to the population and employment within 500 metres of each proposed station location

2.5 Assemble land use data for possible station locations
- identify all possible station locations
- summarise land use (population and employment) for 500m catchment area around each station location

2.6 Derive trip rates and mode splits around possible station locations
- identify comparable existing subway stations
- calculate trip rates and mode splits from 2001 TTS

2.7 Forecast walk-in and walk-out 2021 demand for each possible station location

2.8 Adjust forecasts in GTA model station usage results
- refinement will produce statistics for walk-ins, walk-outs, feeder bus volumes and commuter parking for 2021 land use

2.9 Assemble results into subway route scenarios as defined by project team
- assemble 2021 forecast results for each subway route alternative

2.10 Present results to Demand Forecasting Sub-Group

2.11 Document results

3. Opportunities and Policy Density – Land Use Scenarios

3.1 Confirm approach/policy regarding development around rapid transit stations
- confirm city policies
- how best to assemble maximum opportunity and policy land use data around potential station locations

3.2 Assemble maximum opportunity and policy land use data in study area at detailed level

3.3 Forecast walk-in and walk-out maximum opportunity demand and policy demand for each possible station location

3.4 Present results to Demand Forecasting Sub-Group

3.5 Document results

Appendix B – 2021 Network Assumptions in the GTA Model

The following provides a description of the road and transit network assumptions that are included in the City of Toronto's future 2021 GTA-wide emme/2 networks.

Road Network

Where available, each region in the GTA submitted expected 2021 road improvements.

GTA-wide highway improvements for 2021 were not provided by the Ministry of Transportation as they are currently undertaking a review of highway improvements and will not have a priority list, by horizon year, completed until the Spring of 2005 (approximate). However, the widening of Highway 404, which is already underway, is included between Highway 7 and Highway 401 as an HOV lane.

Transit Network

The 2021 transit network assumptions are listed below:

TTC

Replace the future York University BRT, (interim to Spadina Subway extension; routes T196A, T196B) with Spadina Subway extension to Steeles Avenue with a 3000-car capacity park-and-ride station on the north side Steeles Avenue. (Steeles gateway station)

Incorporated several bus routing changes for the Spadina extension as recommended by TTC. Added two new York Region bus services along Jane St and Keele St from Major Mackenzie Dr. to the Steeles gateway station. See Exhibit 2 in the report.

York Region Transit

Updated York Region's Quick Start program to reflect improved headways and faster travel speeds (based on 'York Region Rapid Transit Plan – Network Configuration Report', September 2003) including the following services:

1. Finch-Richmond Hill-Newmarket
2. Finch-Richmond Hill
3. Highway 7
4. Vaughan North-South Link
5. Markham North-South Link
6. Finch-Richmond Hill-Markham

York Region Transit changes to feeder buses directly impacting the Steeles gateway station or York University (based on letter dated December 8, 2004 from YRT) include the following:

1. 'Jane-Concord' route providing a convenient and direct transit link to the York University Campus
2. 'YRT Replacement route for TTC 35 (Jane North)'. York agrees in principle that the TTC's preliminary recommendation that the current route 35 should be assumed by YRT in the context of a subway extension to York University/Steeles gateway station.
3. 'YRT Replacement Route for TTC 107 (Keele North)'.York agrees in principal that the TTC's preliminary recommendation that the current route 107 should be

assumed by YRT in the context of a subway extension to York University/Steeles gateway station.

4. 'YRT Route 3 (Thornhill-York University)' service connecting Thornhill to the Steeles gateway station.

Added the following Park and Ride stations consistent to the 'York Region Rapid Transit Plan – Network Configuration Report', September 2003 report:

1. Hwy 7 and Hwy 400
2. Yonge St and Bloomington Rd
3. Yonge St and Gamble Rd
4. Hwy 7 and Markham Stouffville Hospital
5. Hwy 7 and Bayview Ave
6. Hwy 7 and Hwy 27
7. Warden Ave and Hwy 407
8. Hwy 7 and Hwy 404
9. Hwy 7 and Hwy 50
10. Yonge St and Aurora
11. Davis Dr and Leslie St

GO Bus

GO Transit's BRT plan to double today's (2004) service for only those Hwy 407 routes servicing York University. Other routes to remain unchanged. The modified routes are:

1. Hamilton to Pickering
2. Oakville to Mount Joy
3. Square One to York University
4. Meadowvale to York University

GO Bus routes from the north, west and east that currently terminate at Yorkdale have been recoded to terminate at the new Steeles gateway station.

Table B1 lists the bus route serving Steeles and York University Stations.

Table B1 – GO Bus and YRT/VIVA Routes Serving Steeles and York University Stations

				Corridor of Operation			
Route ID	**Route Description**	**Station Served**	**Service change for 2021**	**407 West**	**Jane/Keele**	**407 East**	**Steeles**
GO 55	Bramalea - York U	York U	Improved 2004 headways by doubling service	X			
GO 53	Streetsville - York U	York U		X			
GO 46a	Oakville - York U	York U		X			
GO 47a	Hamilton - York U	York U		X			
GO 48a	Meadowvale - York U	York U		X			
GO 65B	Barrie-Maple TM(400)	York U	Extended to York U		X		
GO 66A	Newmarket-StlsGtwy EX1	Steeles	Rerouted from Yorkdale to Steeles Station		X		
GO 68C	Bradford-StlsGtwy	Steeles			X		
GO 14b	Oshawa BT - York U	York U	Improved 2004 headways by doubling service			X	
GO 44b	MtJoy - York U	York U				X	
GO 49b	Pickering - York U	York U				X	
GO 49d	STC - York U	York U				X	
GO 33A	Georgetown-StlsGtwy	Steeles	Rerouted from Yorkdale to Steeles Station	X			
GO 33B	Brampton BT-StlsGtwy	Steeles		X			
GO 33C	York Mills-Guelph	Steeles		X			
GO 33D	StlsGtwy-Brampton R	Steeles		X			
GO 33F	Guelph-StlsGtwy	Steeles		X			
GO 34B	Bramalea-StlsGtwy EX427	Steeles		X			
GO 34C	StlsGtwy-Brampton27	Steeles		X			
GO 34E	StlsGtwy-Bramalea27	Steeles		X			
GO 34F	Brampton-StlsGtwy EX427	Steeles		X			
GO 34G	Brampton-StlsGtwy(27)	Steeles		X			
GO 34H	Bramalea-StlsGtwy(27)	Steeles		X			
GO 42	Bolton-York U	Steeles		X			
YRT 3	Thornhill-StlsGtwy	Steeles	Improved headways for VIVA routes; added/modified as per YRT				X
YRT 20	Jane - Concord	Steeles and York U			X		
VIVA	Vaughan N/S Link	Steeles and York U			X		
VIVA	Hwy 7	Steeles and York U			X		
YRT 35	Jane North - York U	Steeles and York U			X		
YRT 107	Keele North - Steeles	Steeles			X		

GO Rail

Increased GO Rail frequencies on all GO Rail lines as described below: (additional trains up from 2001)

1. Lakeshore West – additional 6 peak period trains
2. Milton – additional 7 peak period trains
3. Georgetown - additional 4 peak period trains
4. Bradford - additional 4 peak period trains

5. Richmond Hill - additional 3 peak period trains
6. Stouffville - additional 4 peak period trains
7. Lakeshore East - additional 6 peak period trains

Added new GO Rail stations as identified by GO Transit:

1. Kennedy on the Stouffville Line (already complete)
2. Centennial on the Stouffville Line (already complete)
3. Bloomington/Vandorf on the Richmond Hill Line
4. Sheppard/GO on the Bradford Line
5. Pleasant on the Georgetown Line
6. Lisgar on the Milton Line

Updated GO Rail's network to include morning peak period two-way service on the following GO Rail Lines:

1. Milton
2. Georgetown
3. Bradford
4. Richmond Hill

Appendix C – Land Use Tables

Table C1 – 2001 Population and Employment within 500m

Station	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8
Steeles West	90	90	90	90	90	90	90	90
York U	excluded	excluded	excluded	excluded	Excluded	excluded	excluded	excluded
Keele / Murray Ross		3472	3472		3472	3472	3472	3472
Finch West at Keele	5368			5368				
Finch West at GO					2768	2768		
GO / Chesswood							3757	3757
Sheppard West	1632	1632	1632	1632				
Totals	7090	5194	5194	7090	6330	6330	7319	7319

Table C2 – 2021 Population and Employment within 500m – Opportunities Land Use Scenario

Station	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8
Steeles West[a]	11593	11593	11593	11593	11593	11593	11593	11593
York U	excluded	excluded	excluded	excluded	Excluded	excluded	excluded	excluded
Keele / Murray Ross		5156	5156		5156	5156	5156	5156
Finch West at Keele	5899			5899				
Finch West at GO					3439	3439		
GO / Chesswood							3452	3452
Sheppard West	4125	4125	4125	4125				
Totals	21617	20874	20874	21617	20188	20188	20201	20201

[a]Includes the 6,640 population and 2,200 employment just north of Steeles station. The proposed land use is going through the secondary plan approval process.

Appendix D - Forecast Refinements – More Detailed Notes

Refinements to Screenlines

2021 AM peak period Steeles southbound screenline was adjusted to account for the GTA model's over-assignment of transit trips on surface transit southbound on Yonge Street approaching Steeles Avenue. This was noticed during the validation of the model using 2001 networks and demand. During this validation process, it was observed that the model under-simulated trips on GO Rail and over-simulated trips on surface transit crossing the north Toronto boundary.

By analysing those southbound trips on the Yonge Street road segment, approximately 4,940 AM peak period transit trips were re-allocated from surface transit to the three GO Rail services from York Region and to the Spadina subway extension. These 4,940 transit trips are all destined to downtown core locations south of College and Carlton Streets.

The following table shows the adjustments that were made to the original set of south of Steeles southbound screenline results from the GTA model.

Table D1 – 2021 AM Peak Period Screenline Volumes
Steeles Screenline Southbound – Summary of Re-allocation

		Model Volume (person-trips) – AM peak period					
		Rapid Transit	GO Rail	Surface Transit	Total Transit	Total Auto	TOTAL
Original Volumes		4,631	5,892	42,144	52,667	44,317	96,984
Adjustments		+200	+4,101	-4,939			
Final Volumes		4,831	9,993	37,205	52,029	44,317	96,346

Since these trips are all destined to the downtown, these adjustments were also applied to the southbound screenlines for Finch and Sheppard Avenues, the results of which are shown in Section 6.1.

Refinements to GTA Model Results

The following table shows the migration of station usage figures from the GTA model to the refined figures for Route 1.

Sheppard West station

		GTA Model	Base	Opp.	Policy
Boarding on subway					
- walk in		219	145	431	1001
- transfer		1327	1401	1401	1401
- commuter parking		0	0	0	0
	Totals	1546	1546[a]	1832	2402
Alighting from subway					
- walk out		1078	591	591	809
- transfer		37	524	524	524
- commuter parking		0	0	0	0
	Totals	1115	1115[a]	1115	1333
Total board & alight - AM peak		2661	2661	2947	3735
Total board & alight - All day		9180	9180	10169	12885

[a] GTA model control totals are maintained in the base land use scenario

Finch West station

		GTA model	Base	Opp.	Policy
Boarding on subway					
- walk in		0	660[a]	888	1058
- transfer		1547	1077[b]	1077	1077
- commuter parking		721	400[c]	400	400
	Totals	2268	2136	2365	2535
Alighting from subway					
- walk out		44	405	405	539
- transfer		797	436	436	436
- commuter parking		0	0	0	0
	Totals	841	841	841	975
Total board & alight - AM peak		3109	2977	3206	3509
Total board & alight - All day		10726	10272	11060	12107

[a] Walk ins are 75% of the 500m forecast; also includes half of the 614 modelled to walk to York U stn which are in the southern area of zone 95
[b] Number of GTA model transfers reduced by 500m base walk-in forecast
[c] Commuter parking capacity is 400, thus 321 moved to Steeles and control total adjusted down 321

York University Common station					
		GTA model	New Base	Added to New Base	Modified Base
Boarding on subway					
- walk in		614	307[a]		307
- transfer		6322	6322		6322
- commuter parking		0	0		0
	Totals	6936	6629		6629
Alighting from subway					
- walk out		2974	5516		5516
- transfer		1576	1576		1576
- commuter parking		0	0		0
	Totals	4550	7092		7092
Total board & alight - AM peak		11486	13721	0	13721
Total board & alight - All day		na	54335	0	54535

[a] 307 (or half) of the 614 of the original walk-in forecast is assumed to be walking to York University station from residential development in the southern part of the campus while the remainder will walk to Finch West station.

Steeles West station					
		GTA model	New Base	Added to New Base	Modified Base
Boarding on subway					
- walk in		0	865[a]		865
- transfer		3664	3907	200[b]	4107
- commuter parking		967	1210	321[c]	1531
	Totals	4631	5982	521	6503
Alighting from subway					
- walk out		88	330		330
- transfer		1070	828		828
- commuter parking		0	0		0
	Totals	1158	1158		1158
Total board & alight - AM peak		5789	7140	521	7661
Total board & alight - All day		19972	24634	1797	26432

[a] Hand computed trips due to new development north of Steeles; results added to the GTA model boarding figures.
[b] Additional 200 transfers from Steeles screenline reallocation –
[c] Additional 321 commuter parkers from overflow at Finch West lot

Some refinements had to be made to the original GTA model results to arrive at the above figures. The refinements to station usage mainly consist of the following.

- The station walk-ins and walk-outs are recomputed using the population and employment within 500m of the station and applying transit trip rates. The bus-to-subway and subway-to-bus transfers are adjusted to retain to-station and from-station control totals.
- Commuter parking figures are adjusted if the model allocates more commuter parkers to a commuter parking lot than its capacity. The over-allocation is assigned to a nearby commuter parking lot.

- As mentioned in section 6.2, the number of transit customers walking out of the station at York University was estimated outside of the GTA model.
- Transit trips from a proposed land use were added to the boardings at Steeles West station. This land use with just over an expected 10,400 population is located in the vicinity of the Steeles West station just north of Steeles Avenue. This information was not initially included in York Region's Official Plan information and thus not included in the original model runs.

Appendix E - Comparison of Results to Other Work

The GTA model 2021 forecasts were compared to those generated simultaneously by the TTC's MADITUC transit assignment model. Forecasts have also been compared to those in the York Rapid Transit Plan (December 2003 report "YRTP 2021 Ridership Forecasts").

The forecast figures are summarised below.

	GTA Model[a]	MADITUC Model	YRTP Model
AM peak Steeles southbound screenline – Jane to Richmond Hill GO	53,000	44,000	38,000[b]
AM peak boardings and alightings on subway extension	23,000	26,000	Not available
AM peak subway volume SB to Downsview station	15,000	12,200	7,200[c]

[a] Pre-refinement figures
[b] YRTP reported a screenline volume of 33,000 between Jane and Bayview, thus the estimated forecast of Richmond Hill GO Train AM peak volume of 5,000 was added to make the screenlines comparable
[c] A factor of 2.0 was applied to YRTP AM peak hour forecast of 3,600 to estimate AM peak period figure

The purpose of the MADITUC model run was to do an independent analysis to see if the results of the assignment of transit trips in the GTA model were reasonable. The results indicate that there are significant differences between the two models in the screenline volumes, however, the station usage and subway link volume are comparable in both models. The subway link volume results from the YRTP model is significantly lower than those forecast in the other models. This can be explained by the fact that, as part of the YRTP study, the scenario of extending the subway to York University was a late request, thus the surface network was not as well represented as in the other two models.

As a result of the comparison of model results, the network was checked and, even with minor network adjustments, the results did not change significantly.

Appendix F – Glossary of Terms

Density	The average number of individuals or units per space unit
EA	Environmental Assessment
Gateway	Intermodal transfer facility where people can move from cars to transit or from buses to rapid transit, where services which cater to commuters can be located
GTA	Greater Toronto Area.
GTA Model	An EMME/2-based travel demand forecasting model that can be used to forecast automobile and transit trips on road and transit networks
Headway	The time separation between two vehicles, both travelling in the same direction
Link	A connection between points within a transportation network
Mode Split	Percent of trips made on transit (vs. private means of transport)
Peak Hour	Maximum hour of travel demand during a time period
Peak Period	Defined period of maximum travel demand, generally the three hour period during a weekday
Screenline	Definable boundary section across which trip volumes are measured or estimated
Trip Rate	The average number of trips made per individual over a period of time
TTS	Transportation Tomorrow Survey – A comprehensive travel demand survey that contains detailed demographic information on all members of a surveyed household and a ledger of travel information over an entire weekday

Credits: Yonge-Spadina Subway Loop EA Draft Report, McCormick Rankin, 1992