

## **APPENDIX 6:**

### **Transportation Modelling Considerations City of Toronto, February 2014**

#### **Transportation and Infrastructure**

The future of the elevated Gardiner Expressway east of Jarvis Street forms part of a larger discussion about the transportation and transit networks that serve one of North America's fastest-growing regions. Transportation is also one of the four lenses considered in the evaluation of the Gardiner options, and includes all modes for moving people and goods. The transportation scope of work carried out by the City included travel demand forecasting, land use and transportation analysis, transit sensitivity testing of future scenarios, congestion cost analysis, and the coordination of a transportation model peer review. Dillon Consulting ("Dillon") assisted the City in the transportation assessment.

#### **Transportation Modelling**

The City of Toronto uses a well-recognized computer model (EMME/2) for predicting future travel demand patterns. The model explicitly represents travel for several purposes including work, school and "other" trips, and also by auto, transit and "other" modes. Although the basic form of the model is traditional, the model is quite advanced and represents industry best-practice. The City's model (commonly referred to as GTAModel) covers all of the Greater Toronto and Hamilton Area (GTHA) and is represented by over 1,700 traffic zones of which 463 are in the City of Toronto.

The time period represented in the model is the three-hour A.M. peak period. Modelling the peak period is an industry standard as it is meant to represent the greatest demand for travel and so is the most likely period for congestion to occur. Traditionally in Toronto, the peak demand for travel in the A.M. peak period is greater than that in the P.M. and so has been chosen as the basis for the City's travel demand model. For analysis purposes the auto network assignment is done using just the A.M. peak hour. Results can be converted between the peak period and peak hour through use of a "peak hour factor".

The model is calibrated using data from the Transportation Tomorrow Survey (TTS) ([www.transportationtomorrow.on.ca](http://www.transportationtomorrow.on.ca)) funded by the Ministry of Transportation. This survey is undertaken every five years through a cooperative effort by the various agencies responsible for planning transportation systems in the Greater Toronto Area and beyond.

Further transportation analysis was conducted by Dillon using a more detailed micro-simulation package called Paramics, and based on input received from the EMME/2 model. The Paramics study area is Spadina to Woodbine, and Dundas south to the lake.

## **Population and Employment Assumptions**

The EMME/2 model inputs for projections include the population and employment distributions for the year which is being modelled – 2031 in this case. These projections are produced by each region through intensive procedures to match control totals which are set periodically by provincial policy.

Area	Population			Employment		
	Current	2031 Forecast	Growth	Current	2031 Forecast	Growth
<b>GTHA</b>	6.57 M	8.61 M	31 %	3.26 M	4.52 M	39 %
<b>Toronto</b>	2.61 M	3.07 M	17.6 %	1.27 M	1.83 M	44 %

## **Transportation Network Assumptions**

The 2031 study area road network coded in the EMME/2 model includes: the extension of Bremner Boulevard from Spadina Avenue to Bathurst Street; the extension of Queens Quay from Parliament to Cherry Street; and the new road network included in the West Don Lands redevelopment (Bayview Avenue extension, Front Street reconfiguration, Mill Street and the River Street extension south of King Street East). The Paramics modelling analysis also includes the proposed Richmond-Adelaide cycle track between Parliament Street and Bathurst Street. This is a separated cycling lane (westbound on Richmond and eastbound on Adelaide), which reduces the number of lanes on both streets from four to three.

## **Mode Split Assumptions**

The existing auto/transit mode splits for morning peak hour trips into the detailed study area (Spadina to Woodbine and Dundas to the lake) are approximately 31% auto/60% transit, and the 2031 forecast by the EMME/2 model is 28% auto/66% transit. The most recent available data (2011), however, indicates that the EMME/2 forecast mode splits are already being achieved.

Dillon conducted further research and analysis to refine the mode split assumptions to capture travel behaviour changes and emerging trends not accounted for in the regional forecasting model. Travel behaviour changes include: people travelling less times per week by car; traveling at other times outside of the peak hour; increased trip sharing; use of technology to reduce trips (telephone and video conferencing, work from home, webinars, etc.); and additional mode shift away from auto use. As a result of this work, the modal split in the Paramics model was adjusted as follows: Maintain, Improve and Replace options – 22% auto/71% transit; and Remove – 20% auto/73% transit. The Remove mode split for autos is lower to reflect reduced overall capacity of the new Lake Shore Boulevard.

## **Transportation and Land Use Trends**

The historical population, employment and transportation trends in the central area of the city (Bathurst Street to the Don Valley Parkway and Dupont Street to the lake) were analyzed in order to better understand the role of the Gardiner over time. Since 1985 the central area population has grown from 120,500 to 199,300 (65% increase), and is anticipated to increase to 258,100 (a further 29.5% increase) by 2031. Employment has increased since 1985 from 352,000 to 442,000 (25.5% increase), and is forecast to grow to 571,000 by 2031 (a further 29% increase).

A key factor in the population-employment relationship is that the ratio of residents to jobs has increased from approximately 1:3 in 1985 to 1:2.2 in the present, and the current ratio is estimated to be maintained into the future. This is an important trend since it illustrates the live-work policy direction of the City, which results in more downtown jobs being filled by downtown residents, and helps to reduce the number of commuting trips and increase walking and cycling trips in particular. It is also worth noting that waterfront redevelopment outside the central area, particularly in the Port Lands, also accounts for a significant amount of population and employment growth.

In terms of the movement of people and goods into the central area during the morning peak hour, there has been a wide range of trends among the various modes of travel. Since 1985, automobiles trips have increased by 19% but have decreased as a percentage of the overall mode of travel, and while truck traffic has been constant in terms of actual volumes, trucks as a percentage of automobile traffic have decreased from 3% to 2.6%. Traffic on the entire downtown section of the Gardiner has also remained fairly constant as a percentage of inbound trips to the central area, with about 4% entering from the west end at Bathurst and 3% from the east at the Don Valley Parkway. Traffic volumes on the eastern leg of the Gardiner west of the DVP are about 120,000 per day (combined for both directions) including Lake Shore Boulevard, and, comparatively speaking, this is about 60% of the corresponding volumes at Bathurst Street in the west end.

Dillon Consulting conducted a survey (applying Bluetooth technology) of vehicle travel patterns using the Gardiner, DVP and Lake Shore Blvd corridors in November 2009. The key findings of the analysis indicate that:

- 22% of eastbound vehicles on the Gardiner from west of Bathurst travel straight through the downtown and do not exit
- 17% of westbound vehicles on the Gardiner from the DVP/Lake Shore travel straight through the downtown and do not exit
- 40% of southbound vehicles on the DVP exit at Richmond Street
- the majority of trips in both directions are destined to the Yonge-Bay-York and Spadina off-ramps.

Over time, TTC trips have risen and fallen – generally accounting for about 45-50% of downtown inbound trips. GO Transit has accounted for the most significant growth since 1985 (85%), which reflects the fact that service and the network have both been

expanding. The success of GO has been a key factor in accommodating the growth in the downtown, and in employment in particular. New transit capacity is required to accommodate Toronto's future population and employment growth regardless of whether the Gardiner East is maintained, improved, replaced or removed. Without it, all the options for the future of the eastern Gardiner face an increase in traffic congestion and travel time for both auto drivers/passengers and transit users.

In the future, inbound trips to the central area are estimated to increase by approximately 50%, and the majority will be accommodated by transit. Automobile traffic to the central area is estimated to grow by approximately 15% but the decline in the portion of the overall mode of travel will continue. Transit service into the central area, as previously indicated, is expected to increase for both the TTC and GO Transit, and will facilitate the growth in trips on both services (61% for TTC and 95% for GO).

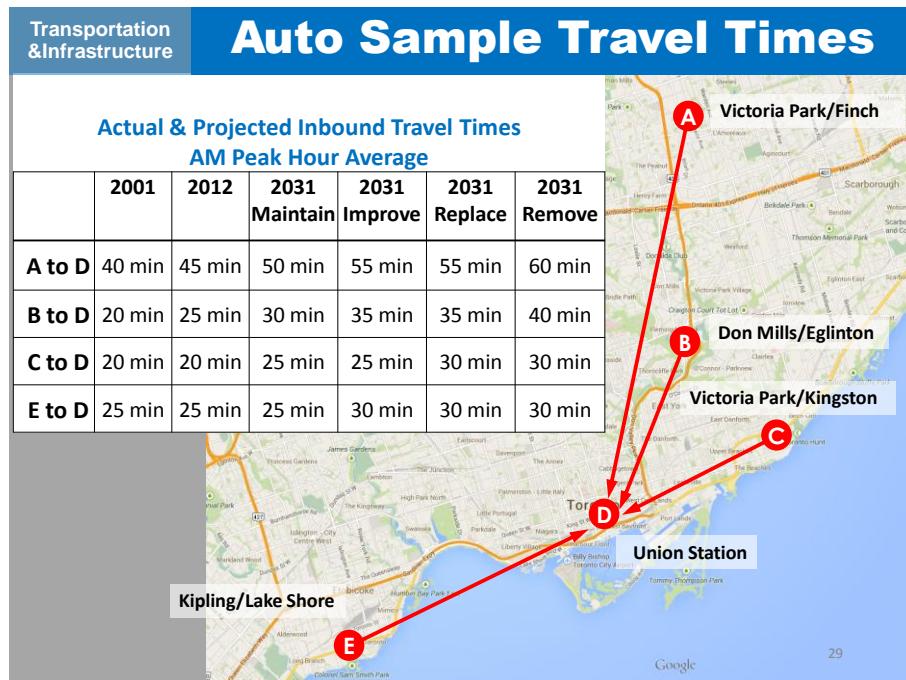
### **Transportation Model Output and Findings**

EMME/2 travel demand runs were completed for existing conditions, and for the future Maintain and Remove options. The results were provided to Dillon for further assessment using a micro simulation model (Paramics) for the project study area bounded by Spadina Avenue in the west, Dundas Street to the north, Woodbine Avenue in the east and the lake to the south. The Paramics model was also used to assess the Improve and Replace options, and key travel data from the model were used in the comparative evaluation of the options, including average vehicle travel time, vehicle kilometres travelled, vehicle hours, average speed and the number of vehicles using the network.

The EMME/2 model was also used as part of a two-stage process with Dillon's Paramics model to estimate existing and future travel times beyond the project study area for the four Gardiner options. This process first analysed the origins and destinations of vehicles using the Gardiner (select link analysis) in the model. Based on the density of the trip patterns, specific origin points were selected and the intersection of Bay Street and Front Street was selected to represent a downtown destination for comparing travel times. The origin points for the analysis are Victoria Park/Finch, Don Mills/Eglinton, Victoria Park/Kingston, and Kipling/Lake Shore in the west end.

The analysis of travel times is included in the comparative evaluation analysis by Dillon. It must be emphasized that travel times for 2031 are best estimates and there may be variations subject to a number of factors (e.g., weather, major incidents, construction, special events). Travel times can also vary on a daily basis under existing conditions. The figure below summarizes the findings of the travel time analysis.

## Auto Sample Travel Times



The findings indicate that if the current Gardiner/Lake Shore network is maintained, the projected travel times from the present to 2031 will increase by approximately 5 minutes for trips from the east, and negligible change is anticipated for the west end trip from Kipling/Lake Shore. One of the key evaluation findings, as shown in the Figure above, is that the average A.M. peak hour auto travel time among various O/D pairs is forecast to increase by 10 to 20% (5-10 minutes) depending on the EA option over the future 2031 Maintain condition. The difference in the travel time between the Maintain option, and the Improve and Replace options is an additional 5 minutes for all of the origin points except the trip from Victoria Park/Kingston, which does not change. For the Remove option, travel time is estimated to increase by 5-10 minutes over the Maintain option. Specifically, the travel time from Victoria Park/Finch increases by 10 minutes, the trip from Don Mills/Eglinton increases by 5 minutes, and the other two trip times remain the same. Additional information on travel time comparisons is included in Dillon's report.

## Transit Assumptions

The assumptions included in the EMME/2 model reflect the importance of future transit improvements as key factors in managing transportation congestion, facilitating growth and supporting new jobs.

The anticipated provincial investment in the Greater Toronto Hamilton Area (GTHA), through Metrolinx, identifies key transit priorities as a means of reducing transportation congestion, facilitating growth and creating jobs. Among the projects identified in the first phase are the Eglinton Crosstown LRT, the Finch West LRT, Bloor-Danforth Subway Extension from Kennedy Station to the Scarborough City Centre and on to

Sheppard Avenue, the Sheppard East LRT, and the Toronto-York Spadina Subway Extension. The Gardiner East EA assumes all of these planned or under construction projects are in place by 2031, as well as Union Station improvements, GO Transit service improvements on all corridors, the Relief Line between the Danforth subway line and the Yonge-University subway lines, the Waterfront East LRT, the Cherry Street LRT south of King Street, and the extension of Broadview transit service south into the Port Lands. The Union-Pearson air-rail link will be completed in 2015, but is not included in the model assumptions.

It is estimated that as much as \$200 to \$300 million per year, or 25% of Metrolinx funds raised each year, could potentially accrue to Toronto. The City's current five-year Official Plan review and the Feeling Congested campaign are intended to provide Council with tools for prioritizing transportation and transit enhancements, subject to available funding.

“Feeling Congested” is the transportation component of the City’s five-year Official Plan review, and is the basis for identifying future transit improvements. The Feeling Congested campaign began in 2013, and is expected to be completed in 2015. Once completed, it will provide direction to City Council to prioritize future transit investments, and, among other items, will also address “complete” streets and provide a bicycle framework policy.

The Feeling Congested initiative identified a total of 24 rapid transit projects for review. Of these, five are currently funded by Metrolinx and are included in the model. The five projects are listed below and, where available, estimated completion years are identified for these and other projects discussed in this section:

- Eglinton Crosstown LRT (2020);
- Finch West LRT (2020);
- Bloor-Danforth Subway Extension from Kennedy Station to the Scarborough City Centre and on to Sheppard Avenue;
- Sheppard LRT (2021); and
- Toronto-York Spadina Subway Extension (2016).

In addition to the funded projects, the Gardiner EA also assumed the following unfunded projects from the list of 24:

- Relief Line (subway) between the Danforth subway line and the Yonge-University line (2021);
- Waterfront East LRT – Union Station to Leslie (Phase 1 to Parliament – 2020);
- Yonge North Subway Extension.

The Relief Line study is being conducted by the City in coordination with Metrolinx, and is one in a number of potential measures aimed at providing relief in the Yonge Subway corridor. The length of the line is estimated to be just over 5 kilometres, depending on where it connects to the Bloor-Danforth Subway.

There are other waterfront-specific projects included in the model, although they are not part of the list of 24 projects:

- Cherry Street LRT south of King Street East (2015 completion for the extension to Mill Street/rail corridor);
- Broadview Avenue transit extension south of Queen Street into the Port Lands (pre-2031);
- Union Station Improvement Plan (2016); and
- GO Transit improvements, including frequency, reverse commute and off-peak service improvements.

It should also be noted that certain operational transit improvements are also being undertaken, but are not reflected in the model as the exact service impacts are still to be determined. They include the following:

- New subway vehicles on the full system network (in progress); and
- New higher capacity streetcars (roll-out beginning in 2014).

Finally, two other special projects are worth noting, although they are also not included in the modelling assumptions – Metrolinx Yonge Relief Network Study and the Union-Pearson (UP) air/rail link. The UP link is a high speed connection between Union Station and Pearson Airport with intermediate stops at Bloor/Dundas and in Weston at Lawrence. This is a special transit service with a yet to be determined fare pricing. It is not considered to be a typical commuter transit facility, but it could potentially provide an alternative for some trips using the Gardiner. The UP line is scheduled to begin service in 2015. The Yonge Relief Network Study is on-going and will consider a number of local and regional initiatives aimed at relieving congestion on the Yonge Subway line.

Of all the projects listed above, four in particular fall within the boundaries of the Gardiner study area – GO Transit service upgrades on the East Corridor, the Relief line between the Danforth and the Yonge/University subway lines, the Waterfront East LRT extension, and an extension of Broadview Avenue transit service between Queen Street East and the Port Lands. These improvements, with the exception of the Broadview Avenue extension, could potentially increase the transit capacity crossing the Don Valley corridor between Bloor Street East and the lake by approximately 42% in the future.

The results of the transportation modelling analysis indicate that the additional transit services are required to meet the future travel needs generated by new growth and by employment growth in particular. This is consistently the case no matter which option for the Gardiner is considered. For all the EA options, no additional transit service is identified to accommodate a potential increase in transit trips – above and beyond the new transit services already noted.

A sensitivity analysis was also conducted to measure the impacts to the network without the new transit lines. The results indicate that this would place additional pressure on the

existing TTC and GO Transit services beyond their capacities. The analysis also indicated that additional pressure would be placed on the road network, especially for automobile trips on the Don Valley Parkway to the Port Lands. It is clear from the analysis that new transit service and network improvements are essential to accommodating future populations and the creation of new job opportunities in the study area, the downtown, the City as a whole and the region beyond.

### **Transportation Modelling Peer Review**

Given the importance of this major environmental assessment undertaking, Waterfront Toronto in collaboration with the City of Toronto commissioned the consultant ARUP to perform a peer review of the modelling process in fall 2013. The objective of the peer review was twofold: to confirm that the modelling process undertaken was reasonable and was performed to industry standard levels; and to confirm the appropriateness of the assumptions and the reliability of the output and conclusions drawn from the process.

The peer review provided a detailed examination of the modelling process used for the transportation analysis, including its assumptions and suggested recommendations for improvement where applicable. Although the peer review identified some minor issues, they were deemed to have minimal potential impact to the final analysis results. The conclusion of the peer review was that the overall modelling process and assumptions used in the analysis were sound and met industry-standard practices.