Transportation Addendum to the Technical Briefing Report

Gardiner/Lake Shore Corridor

December 2004

Toronto Waterfront Revitalization Corporation

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1.0 INTRODUCTION

This report is a transportation addendum to the July 2004 Technical Briefing Report and provides an overview of the work undertaken in the GSA – Variation 1- Construction Staging Plan and Traffic Disruption Report and the Microsimulation of the Toronto Waterfront Revitalization Plan Report.

As the Great Street Approach (GSA) – Variation 1 evolved as the preferred basis for an Environmental Assessment (documented in the July 2004 Technical Briefing), a study was undertaken to answer the following questions:

1. Can this approach be built?
2. How long will it take?
3. How much will it cost? and
4. How disruptive will it be?

The GSA – Variation 1 Construction Staging Plan and Traffic Disruption Report was completed in November 2004 jointly by Marshall Macklin Monaghan, BA Group, and Morrison Hershfield. Based on the conceptual construction staging plan that was developed, the proposed configuration of the GSA- Variation 1 at Spadina was modified. The modification involved the way in which the elevated Gardiner structure and the at-grade Lake Shore Boulevard merged into the new Great Street in the area of Spadina Avenue. The modified configuration was assessed using the same Paramics model that was used in assessing the Replacement and Transformation Approaches, which have not changed since the Technical Briefing.

The GSA – Variation 1 was further tested to investigate the feasibility of reducing the cross-section of the Great Street. Two additional scenarios were tested. In one scenario, the Great Street was reduced from 10 to 8 lanes from Jarvis east to Don Roadway. In the other scenario, the Great Street was reduced to four lanes per direction from Spadina to Don Roadway. The entire Waterfront modelling work is contained in the Microsimulation of the Toronto Waterfront Revitalization Plan Report completed by IntelliCAN Transportation in December of 2004.

2.0 GARDINER / LAKE SHORE CORRIDOR APPROACHES

The three approaches considered for revitalizing the Gardiner / Lake Shore Corridor (GLC) are briefly described below.

2.1 Replacement Approach

The idea behind this scheme is to replace the existing structure with roads on the surface, underground, and on the railway embankment, and to do so in a way that retains and if possible enhances traffic performance. East of the Front Street interchange, a four-lane express road runs underground to the north of Fort York from Strachan to Spadina. Similarly, to the east of the central area, a four-lane express road runs on the railway embankment between Jarvis and Cherry, with Lake Shore (at grade) beside it. In the central area between Spadina and Jarvis, there are two five-lane one-way streets: eastbound on the surface and westbound partly on the surface and partly below grade;

2.2 Transformation Approach

The idea behind this scheme is to reduce the barrier effect of the expressway without removing the upper structure, which after all does not physically restrict pedestrian movement at grade, but to remove some of the ramps, which do. Secondly, to attend to the current anti-pedestrian environment below and adjacent to the structure by relocating Lake Shore Boulevard and building beneath the structure, thereby providing frontage to adjacent streets and treating the Gardiner as series of buildings and spaces with a roof carrying traffic. For most of its length, Lake Shore is beside rather than under the Gardiner, and has regular building frontage on one side and building frontage under the Gardiner on the other. Finally, the aesthetic problems are addressed by various architectural enhancements and cladding of the structure; and

2.3 Great Streets Approach (GSA)

The desire to further improve the quality of the place, and reduce the cost, led to explorations based on the “place-making first” philosophy and the desire to make a “Great Street” which would act as an orientation spine in a streets-and-blocks framework for a Precinct Plan for the Central Waterfront, rather than simply a more normal set of roads. A continuous Lake Shore Drive from Humber Bay to Ashbridges Bay helps to create a scheme based on simplicity, ease of comprehension, and economy.

First Variation

In the first of these schemes studied, the heavier traffic load west of Spadina is accommodated through retention of the existing Gardiner. The rest is accommodate on a ten-lane surface street with wide sidewalks and generous median between Spadina and Cherry, diverging into two fine-lane, one-way streets in the central section between Simcoe and Jarvis.

This variation is recommended as the starting point to the Environmental Assessment.

Second Variation

A variation is to construct an underground route west of Spadina rather than retaining the existing elevated expressway in that portion. This particularly benefits Fort York, its adjacent neighbourhood, the railway lands community park and west Harbourfront. It brings a full surface street solution for the whole extent of the waterfront, except for ramp portal structures just east of Spadina.

Third Variation

A third variation consists of a continuous eight-lane Lake Shore Drive across the full extent of the central waterfront between Jameson and the Don River. Its width is similar to University Avenue. Street crossings by pedestrians would be shorter than with other variations.

3.0 CONSTRUCTION STAGING AND TRAFFIC DISRUPTION STUDY FOR THE GREAT STREETS APPROACH – VARIATION 1

The Construction Staging and Traffic Disruption Report outlines a detailed construction staging plan for the "Great Street" Approach (GSA) Variation 1 to address the question - can this approach be built? Using the staging plan, the duration and costs of construction are estimated to address the questions - how long will it take? And how much will it cost? The impacts for traffic operations during the various stages of construction were also assessed to address the question - How disruptive will it be?

This study represents a preliminary exploration of an approach to construction for this particular option and may be subject to change as the preferred approach evolves. This study was completed jointly between Marshall Macklin Monaghan, BA Group and Morrison Hershfield.

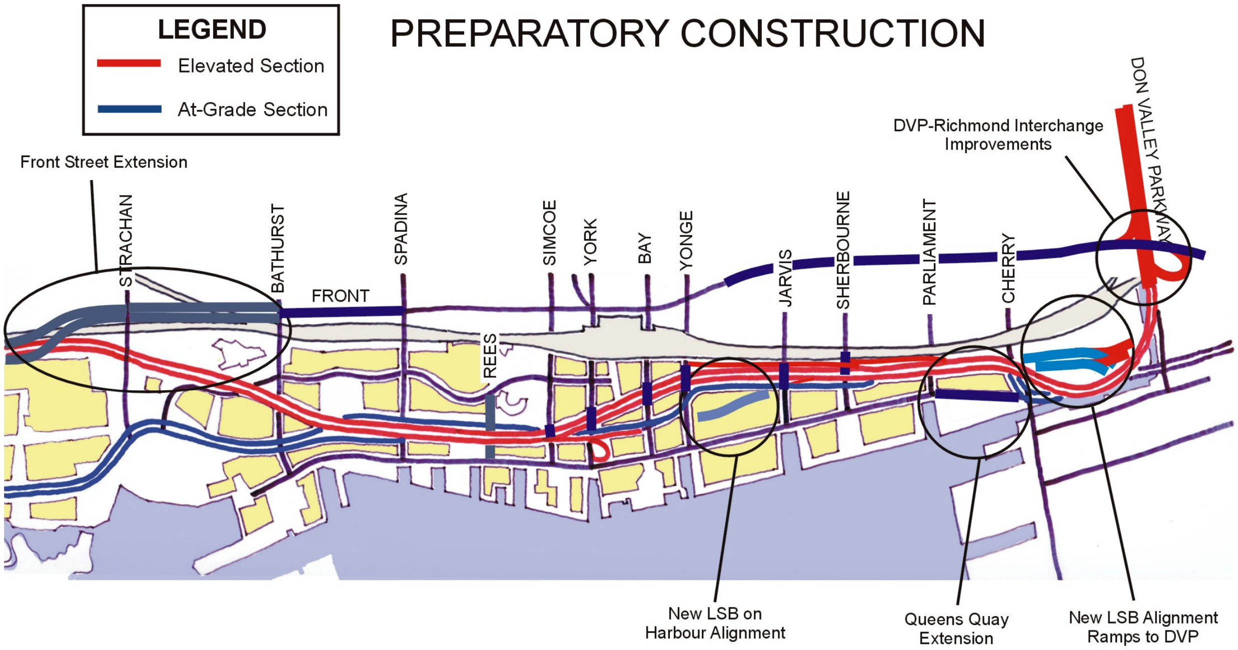
3.1 Construction Staging

The overall principles of the detailed construction phasing are summarized as follows:

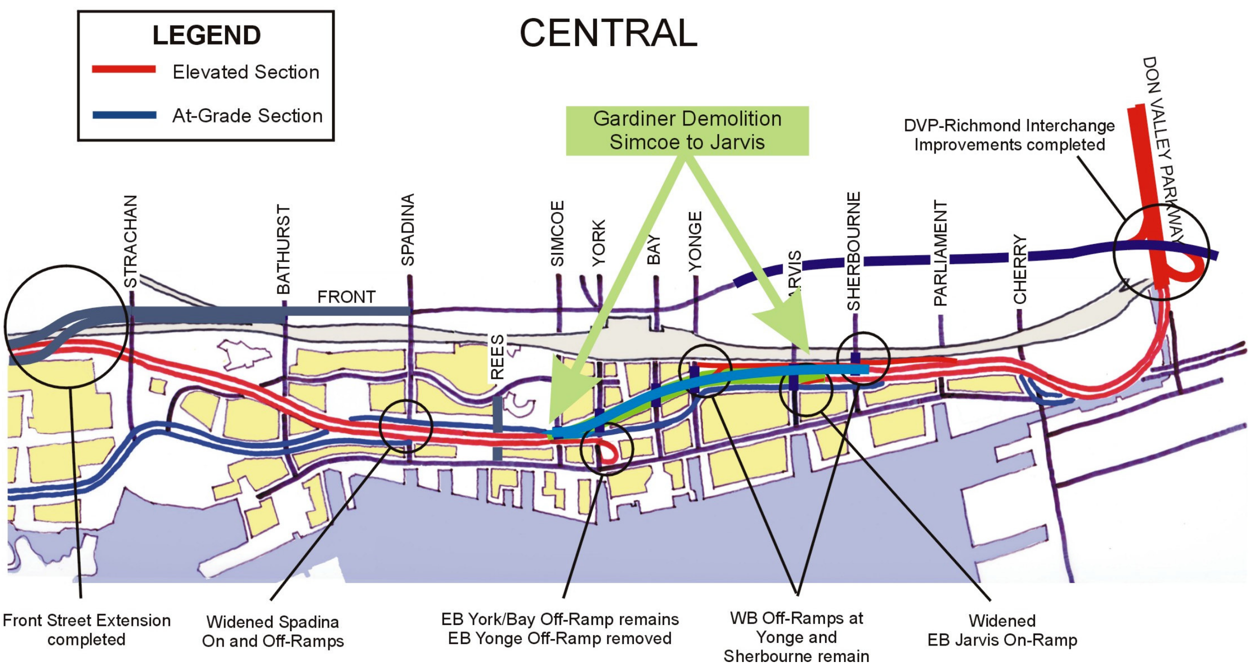
- Build as much of the future road network as possible without significantly impacting existing traffic operations as part of the Preparatory Construction Stage. This includes new roads that exist outside of the existing right-of-way, widening of existing surface roads where possible, and construction of new structures that do not interfere with existing traffic operations;
- Build temporary network structures that are designed to increase the capacity of the GLC road to minimize the impacts of construction on traffic operations. Structures include the temporary widening of existing ramps to facilitate traffic operations once sections of the elevated structure are closed to traffic. These temporary structures are not part of the ultimate road design but are imperative to ensure an acceptable level of traffic capacity is maintained; and
- Dismantle the Gardiner structure in three phases and transition traffic to the "improved" road network. Improvements include a combination of permanent and temporary measures. The staging plan has the demonstrable benefit of removing the elevated Gardiner structure in the central section, the area with the highest visibility and highest potential for revitalization, within the early stages of the construction process. The central section could be removed within two years from the start of construction.

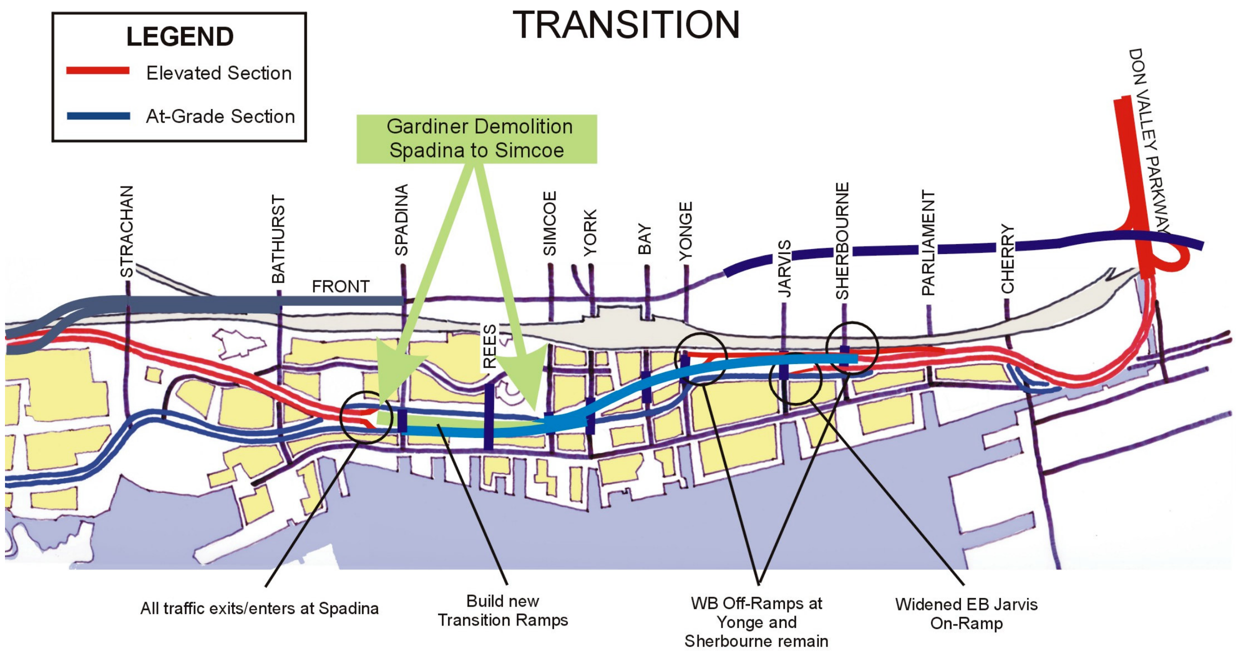
An overview of the proposed construction staging plan for the Preparatory Construction, Central, Transition and Eastern sections is summarized in the following figures.

PREPARATORY CONSTRUCTION



CENTRAL




TRANSITION
LEGEND
Elevated Section
At-Grade Section
Gardiner Demolition
Spadina to Simcoe
STRACHAN
BATHURST
FRONT
SPADINA
REES
SIMCOE
YORK
BAY
YONGE
JARVIS
SHERBOURNE
PARLIAMENT
CHERRY
DON VALLEY PARKWAY
All traffic exits/enters at Spadina
Build new
Transition Ramps
WB Off-Ramps at
Yonge and
Sherbourne remain
Widened EB Jarvis
On-Ramp


EASTERN
LEGEND
Elevated Section
At-Grade Section
Gardiner Demolition
Jarvis to DVP
STRACHAN
BATHURST
FRONT
SPADINA
REES
SIMCOE
YORK
BAY
YONGE
JARVIS
PARLIAMENT
CHERRY
DON VALLEY PARKWAY
New Transition ramps
in operation at Spadina
Stage construction
of DVP Ramps

More details with respect to the specific steps involved within each of the stages can be found in the Construction Staging and Traffic Disruption Report. The report also includes detailed drawings of the various construction stages.

3.2 Construction Duration and Cost Estimate

Before the GSA – Variation 1 can be constructed, the projects associated with the Preparatory Construction stage must be completed. Major projects and their estimated completion time, assuming a start date in 2005, are as follows:

- Environmental Assessment – 3 to 4 years (completion by 2008)
- Front Street Extension – 4 years (completion by 2009)
- Richmond/Adelaide Improvements – 1 to 2 years (completion by 2009)
- Pre-build contracts – 2 years (completion by 2010)

The principal work associated with construction of the GSA – Variation 1 would take approximately six to seven years to complete. Assuming construction could begin as early as 2009, the GSA – Variation 1 could be in place by 2015 or 2016.

The construction duration and cost estimates included in the original report are presented in a stage-by-stage and modular format, enabling adjustments to be made without having to revisit the entire project.

A summary of the results is shown in **Table 3.1**.

TABLE 3.1: CONSTRUCTION COSTS AND SCHEDULE

ELEMENT	DURATION	COST PER YEAR	TOTAL COST
Central Section	2 years	$50 Million	$100 Million
Transition Section	2 years	$53 Million	$106 Million
Eastern Section	3 years	$80 Million	$240 Million
Richmond/ DVP	1 to 2 years	Preparatory Construction	$46 Million
Front Street Extension	4 years	Preparatory Construction	Not Included
TOTAL	7 years		$492 Million

The cost estimate is based on the following assumptions:

- Construction crews work 36 weeks/year and 7 days/week;
- 800 to 900 construction workers at the peak of construction;
- Costs approximately $70 to $80 million per year for 6 to 7 years; and

- Costs approximately $280 to $320 thousand per day.

3.3 Traffic Disruption

The original report strategically assesses traffic operations at each stage of the proposed construction staging plan. A summary of the assessment is provided below.

As construction proceeds over the six to seven year construction period, there will be some disruption to traffic. The construction staging plan has been designed to maximize traffic capacity to the extent possible throughout the construction process. Temporary improvements to increase the capacity of the road network are planned including widening and reconfiguring different ramps. Operational simplifications along the GLC would also be implemented to increase the through movement capacity. Simplifications would include removing traffic signals and restricting movements to right-in/right-out only at key intersections.

It is expected that the construction road network can accommodate approximately 80 to 90 percent of existing traffic volumes to and from the west during the critical stage. The critical stage is expected to occur during construction of the Transition section, with the Gardiner (east of Spadina) closed and all traffic entering and exiting at the temporarily widened Spadina ramps. Existing traffic volumes to and from the east are expected to be accommodated at a reasonable Level of Service throughout the construction staging. There is expected to be heavy reliance on parallel routes such as Front Street, Bremner Boulevard and Queens Quay during various stages of construction. Any road closures would be scheduled to occur during off-peak times.

4.0 UPDATED PARAMICS MODELLING

As discussed in the Technical Briefing Report, the study team had access to one of the world's most advanced traffic analytical capabilities in the University of Toronto's Intelligent Transportation System Centre and a team of researchers (IntelliCAN) using state-of-the-art simulation software. Using te PARAMICS software, a virtual reality or simulation model was built of the road network bounded by Dundas Street, the Humber River, Lake Ontario, and Woodbine Avenue. A complete copy of the Paramics modelling work completed by IntelliCAN is attached as Appendix B.

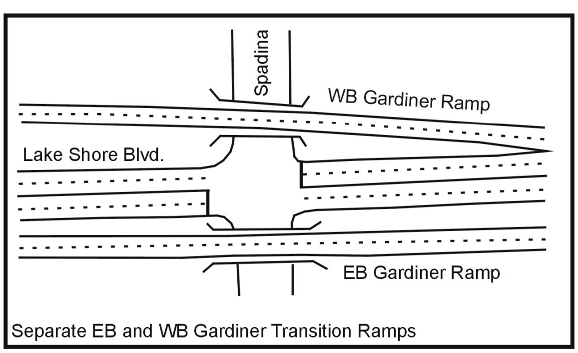
4.1 Configuration Modification for GSA – Variation 1

As a result of the detailed construction staging plan, as discussed in Section 3.0 of this report, the proposed configuration of the GSA- Variation 1 at Spadina was modified. The initial concept had the EB and WB transition ramps separated by Lake Shore Boulevard (LSB), which would operate at-grade between to the two ramps. This concept had the benefit of creating a more typical at-grade intersection for Spadina at LSB. However, the existing WB Lake Shore structure and the Gardiner off-ramp to Spadina complicated the staging of the construction of the separate transition ramp structures since there is not enough space to construct the new ramps without removing the existing structures. This created a conflict for the staging plan, which required the transition ramps to be built and accommodating traffic before removal of the WB Lake Shore structure or the Spadina off-ramp.

To address this, the transition ramps were modified from two ramps separated by Lake Shore in the middle, to one central transition ramp with EB and WB Lake Shore Boulevard separated. This modification allowed the transition ramps to be constructed and in operation before the Spadina off-ramp and WB Lake Shore structures are removed.

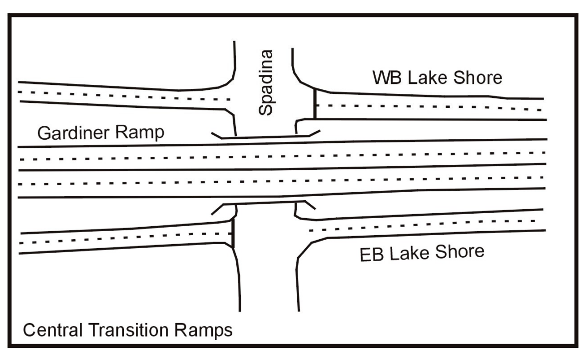
The modification is shown below.

Initial Concept



Separate EB and WB Gardiner Transition Ramps

Modified Concept



Central Transition Ramps

4.2 Traffic Performance Measures

The measures used to assess traffic performance are consistent with the measures used in the Technical Briefing and represent either a "network wide" measure or a "trip" or "route specific" measure.

Average speed of travel is a calculation of the length driven and time spent for all the trips made throughout the study area, and the resulting combined average speed. This is a "network wide" measure which reports vehicle statistics for all trips in the model, no matter the length nor the destination of the trip. These types of measures are important to understand the impacts to all vehicle trips in the network, not just vehicles destined to a specific zone or along a specific route. These measures capture delays on links that may result from people re-routing as a result of network changes. Each model run is comprised of over 30,000 trips for which statistics are recorded during the a.m. and p.m. peak hours. Over 20 model runs were completed for each GLC Approach during the a.m. and p.m. peak hours.

Travel Time (inbound and outbound) measures the time taken on a typical trip from a specific origin to a specific destination via any route. This is a "trip specific" measure which gives an example of how much longer or shorter a commuting trip would take with an origin on the Gardiner at the Humber River and a destination near the intersection of King at Bay. This statistic is based on a significantly smaller number of trips than the "network wide" measures. There are in the order of 100 trips per direction with origins on the Gardiner at the Humber River and a destination near the intersection of King at Bay during the peak hours. Therefore increases or decreases in this measure do not necessarily reflect changes to the overall network.

Key Route Travel Time Through measures the average time for trips along a specific route such as the Gardiner Expressway between the Humber River and Dufferin. This is a "route specific" measure which gives an indication of travel time along a specific route based on all vehicles using that route for all or part of their trip. In the waterfront model, the key route represents the average travel time from one end of the study area to the other. This statistic is based on a larger number of trips for each model run compared to the "trip specific" measures and is therefore more indicative of overall network operations.

4.3 Traffic Performance Update

As a result of the configuration change at Spadina, the traffic performance for the GSA – Variation 1 improved from what was shown in the July 2004 Technical Briefing.

Locating the transition ramp in between Lake Shore Boulevard simplified the weaving for eastbound traffic destined to the downtown core. In the initial concept, eastbound traffic destined to the downtown core from the Gardiner was forced to weave across two lanes of eastbound LSB traffic between Rees and Simcoe in order to turn left. With the centrally located transition ramp, eastbound Gardiner traffic does not have to weave across eastbound LSB traffic, which now merges with Gardiner traffic from the right side. Eastbound traffic on LSB destined to the downtown core will have the option to turn left at Spadina, before it is forced to merge with Gardiner traffic east of Spadina.

The updated traffic performance for the GSA – Variation 1 during the a.m. and p.m. peak hours is summarized in **Table 4.1**. The results are shown together with the results for Existing Conditions, the Replacement Approach and the Transformation Approach for comparison purposes. The results for Existing Conditions and the other approaches have not changed from those shown in the Technical Briefing Report.

Table 4.1: Updated Traffic Performance

	AM Peak Hour				PM Peak Hour			
	Existing	Replace	Transform	Grt. Street*	Existing	Replace	Transform	Grt. Street*
Average Speed *(kilometres per hour)*	43.4	37.9	36.6	33.7	36.5	36.0	36.4	33.8
Travel Time Inbound *(minutes)*								
Humber River to King @ Bay	14.5	16.8	18.4	17.3	14.9	17.2	17.3	16.9
Travel Time Outbound *(minutes)*								
King @ Bay to Humber River	13.2	13.0	15.1	14.7	18.4	17.4	18.0	18.0
Key Route Travel Time Through *(minutes)*								
Eastbound								
Humber River to DVP @ Dundas	17.3	19.0	19.6	22.8	19.6	20.1	22.7	25.9
Westbound								
DVP @ Dundas to Humber River	15.5	15.3	17.0	19.9	18.1	16.2	18.8	21.7

* Speeds and travel times are applicable to the 1st and 2nd Variations of the Great Street Approach

The following points are noted from Table 4.1:

- The GSA – Variation 1 represents the largest decrease in network speed relative to existing condtions for the a.m. and p.m peak hours. This is no surprise given the fact that there is an expressway element through the central waterfront in each of the other approaches. Lower speeds are also more desriable to achieve some of the urban design objectives which promote non-auto modes of travel such as walking and cycling;

- Travel times into and out of the central core are least impacted under the Replacement Approach scheme. Travel times into and out of the central core are comparable or better for the Great Street Approach than the Transformation Approach during the a.m. and p.m. peak hours; and
- Travel times across the study area are highest for the GSA. This is again a result of the fact that there is no expressway element through the central waterfront as part of the Great Street Approach.

The Great Street Approach will have the largest impact on traffic operations. Travel times, both in, out, and across the central waterfront are generally expected to increase. Inbound travel times from the west are expected to increase by 15 to 20 percent (2 to 3 minutes) during the a.m. and p.m. peak hours. Outbound travel times to the west are expected to increase by 10 percent (1½ minutes) during the a.m. peak hour and slightly improve during the p.m. peak hour. The improvement in outbound travel times during the p.m. peak hour is primarily a result of the Front Street Extension. The largest travel time increases are expected for through trips, which no longer benefit from a continuous expressway. Travel time increases for eastbound and westbound through trips are expected to range from 20 to 30 percent (3½ to 6 minutes) during the a.m. and p.m. peak hours.

As stated in the Technical Briefing report, the Great Steet Approach offers the highest potential to provide additional developable land and improves the quality of the development frontage. This improves the "place-making" character of the waterfront and provides the opportunity for more people to live and work in the waterfront. This defines sustainable development. Adding vehicle capacity is not a sustainable solution to increasing accessability to Toronto's waterfront. The Gardiner has been at capacity for many years now. Improved access to the waterfront can only be achieved by improving acccess for non-auto modes of travel while maintaining acceptable access for vehicles. This balance between auto and non-auto accessibility to the waterfront is best achieved by the Great Street Approach.

4.4 Further Analysis of the GSA – Variation 1 Network

The road network associated with the GSA – Variation 1 is best described in three sections:

1. Transition Section – located between the new Spadina transition ramps and Simcoe Street. This section serves a highly functional transportation role and has limited urban design opportunities;
2. Central Section – located between Simcoe Street and Jarvis Street. In the Central Section, the Great Street will be a pair of 5 lane one-way streets providing access to the central waterfront area. The major street links providing pedestrian and vehicle access to the downtown core area are located in this section. There is the opportunity for a high level of urban design as well as a substantial amount of development; and
3. Eastern Section – located between Jarvis Street and the Don Roadway. This section will be a two-way road that is 8 lanes wide. There is the opportunity for a high level of urban design. However this section does not include the same number of north-south road links to the central city, and therefore does not provide as much access.

From an urban design perspective, there are benefits in minimizing road widths. Wider roads introduce more challenges for non-auto modes of travel since they are more difficult to cross for pedestrians and carry higher traffic volumes. However, a certain level of access must also be maintained to the downtown core for vehicular traffic. These competing needs must be balanced, therefore, further modelling work was undertaken for the GSA – Variation 1 to test the impacts of reducing the cross-section of the Great Street. Three scenarios were tested, including:

Scenario 1 – Is the initial concept with five lanes in each direction from the Gardiner transition in the west to the DVP connection in the east;

Scenario 2 - Involves five lanes in each direction from the Gardiner transition in the west to Jarvis Street in the east and four lanes each way east of Jarvis (Jarvis represents the location where the one-way pairs come together); and

Scenario 3 - Involves four lanes in each direction from the Gardiner transition to the Don Roadway in the east.

The results of the model runs are detailed in the Microsimulation of the Toronto Waterfront Revitalization Plan Report.

The results generally showed that traffic operations and travel times improve with a wider cross-section in place. The effect during the a.m. and p.m. peak hours of narrowing to 8 lanes east of Jarvis (Scenario 2) was negligible. There was a more noticeable effect as a result of reducing the number of lanes across the entire GLC section (Scenario 3) although the absolute increases were not severe.

It is recognized that the original measures of effectiveness (MOE) were developed to test the macroscopic impacts of GLC approaches (i.e. Replacement, Transformation, or Great Street) which have significantly different road network characteristics. The results of the model runs show that the MOE's are not as effective for testing approach specific changes that are relatively minor with respect to the size of the entire model road network.

To address this issue, link counts projected by the Paramics microsimulation runs for the GSA were reviewed. The link volumes are shown in the Microsimulation of the Toronto Waterfront Revitalization Plan Report. The conclusions of the review were as follows:

- The Transition section requires 5 lanes in each direction in order to accommodate traffic volumes at an acceptable Level of Service. There are fewer turn movements in this section and as a result the lane capacities are relatively high; however the future volumes in this section are also large;
- The Central section requires 5 lanes on the pair of one-way streets in order to accommodate traffic volumes at an acceptable Level of Service. Although traffic volumes are smaller than those observed for the Transition section, the increased number of turn movements and increased friction resulting from vehicle weaving significantly decreases the lane capacity on these streets; and
- The Eastern section requires 8-lanes in order to accommodate two-way traffic at a reasonable Level of Service. Although link volumes in this section are comparable to links in the Central section, observed link capacities are higher as a result of the large proportion of through trips.