



**TORONTO WATERFRONT**  
REVITALIZATION CORPORATION

# Great Street Approach Variation 1

# DRAFT

## Construction Staging Plan & Traffic Disruption



November 2004



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**“GREAT STREETS APPROACH” - VARIATION 1  
Detailed Construction Staging Plan and  
Assessment of Traffic Disruption  
DRAFT - November, 2004**

## 1.0 INTRODUCTION

Before any changes can be made to the Gardiner Expressway and Lake Shore Boulevard system, it is important to understand their function and interdependence. The two facilities operate in a similar fashion to the express and collector lane systems found on many of the 400 series highways in and around Toronto. Both roads deliver traffic to and from downtown Toronto, however, the Gardiner attracts more long distance trips based on the higher average speeds and limited access points, while Lake Shore Boulevard operates at slower average speeds and provides the link between the express lanes and the local road network. Their interdependence is further evidenced through their physical inter-connection in which Lake Shore Boulevard shares the same right-of-way with the Gardiner and in many sections exists entirely beneath the elevated Gardiner structure. The operational and physical interdependence of the above-grade (Gardiner) and at-grade (Lake Shore Boulevard) makes construction of a new at-grade road network, while maintaining some level of traffic operations, extremely challenging.

This report outlines a construction staging plan for the “Great Streets” Variation 1 option to reconfigure the Gardiner Lake Shore Corridor. Based on the staging plan, the extent and duration of disruption to traffic during the various stages of construction is assessed. The assessment also includes an estimate of the expected construction costs. The cost estimate was based on the costing work previously completed by Morrison Hershfield to ensure that all aspects of the proposed staging plan are included. It is important to note that this study represents a preliminary exploration of an approach to construction for this particular option and may be subject to change as the preferred option evolves. This assignment was undertaken jointly by Marshall Macklin Monaghan, BA Group and Morrison Hershfield.

The “Great Streets Approach (GSA)” - Variation 1 is one of several design options under consideration for the Gardiner Lake Shore corridor. The GSA – Variation 1 option involves maintaining the elevated structure west of Spadina. A pair of transition ramps would connect the elevated section west of Spadina to the surface east of Spadina. The Gardiner and Lakeshore would be replaced by a surface boulevard transition section (with 5 lanes in each direction and a wide landscaped median) from east of Spadina to Simcoe, a pair of five-lane one-way streets from Simcoe to Jarvis, and a ten-lane surface boulevard from Jarvis to the Don River. More recent analysis has indicated that an 8-lane boulevard is a viable alternative east of Jarvis Street.



This report documents the following:

- A potential construction staging plan;
- The estimated costs and duration of construction: and
- An assessment of future traffic operations during the various construction stages.



## 2.0 CONSTRUCTION STAGING PLAN

The construction staging plan comprises the following:

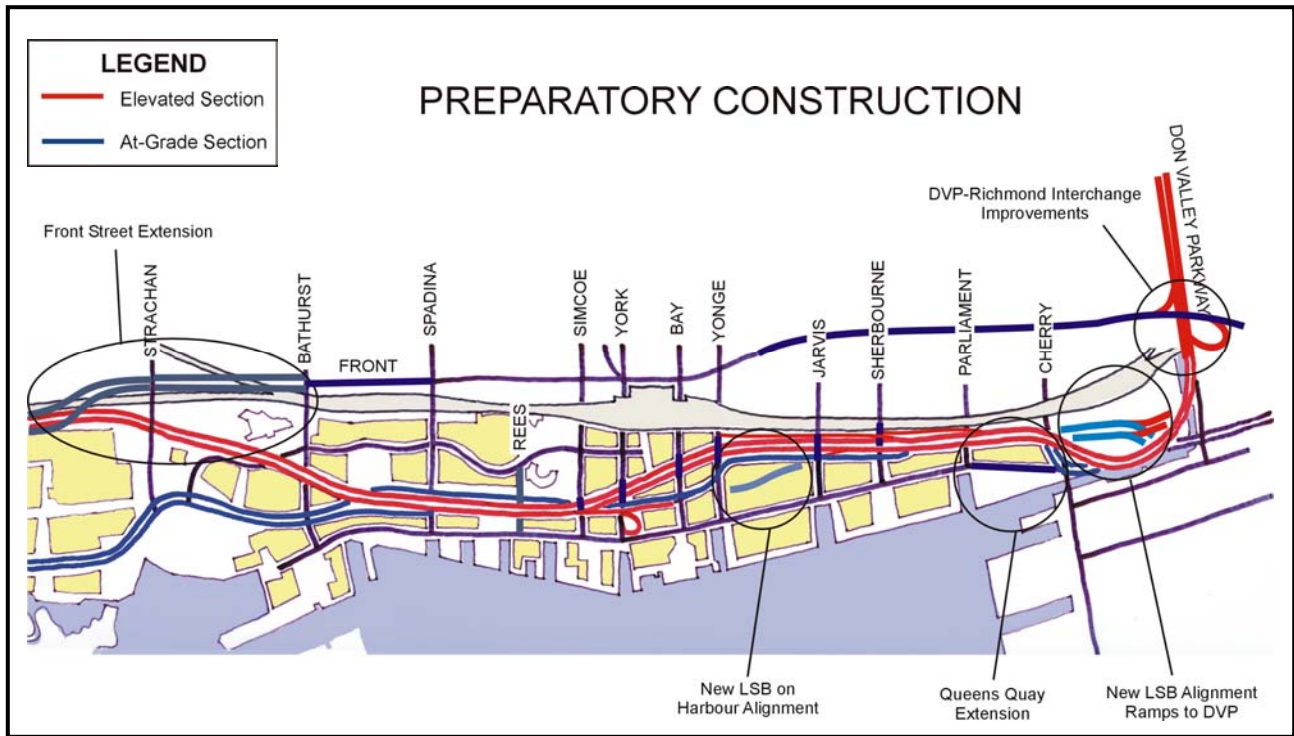
- Preparatory Construction
- Stage 1 – Central Section
- Stage 2 – Transition Section
- Stage 3 – Eastern Section

The staging plan has been designed to maximize traffic capacity to the extent possible throughout the duration of the construction process. Although this may lengthen the construction period, the traffic delays associated with the various stages will be minimized to ensure traffic operates at the best Level of Service possible given the numerous constraints.

There are several phases involved in each of the stages. The specifics of each stage are summarized in the detailed drawings included in the Appendix of this report. The purpose and key points of each stage are also summarized below.

### 2.1 Preparatory Construction

Before construction of the GSA option can begin, a number of road network improvements must be in place. These improvements will allow for diversion of approximately 30 percent of corridor traffic on to other routes serving the central area. The most notable include the construction of the Front Street Extension (FSE), improvements to the DVP/Richmond interchange and construction of the Queens Quay Extension (QQE). These improvements are shown in **Figure 2.1**.



**FIGURE 2.1: PREPARATORY CONSTRUCTION**

Before demolition of the elevated section could begin, several elements of the GSA would also be put in place:

- Closure and removal of the ramp from Spadina to WB LSB;
- Closure and removal of the WB FGE exit ramp to LSB and Spadina;
- Construction of a temporary WB FGE on-ramp from LSB, just west of Spadina, to accommodate two lanes of traffic;
- Closure and temporary re-construction of EB FGE on-ramp at Jarvis to accommodate two lanes of traffic;
- Closure and temporary reconstruction to provide two lanes on the EB off-ramp to Spadina. Ramp terminal reconfigured to allow through traffic to LSB EB;
- Narrowing LSB EB to two lanes approaching Spadina; and
- Improvements to Harbour Street, east of Bay Street, and extension of Harbour Street, from east of Yonge to Jarvis.

These improvements are shown in the Stage 1A and 1B drawings included in the Appendix. The temporary two lane ramps provide for the subsequent construction phase.

## 2.2 Stage 1- Central Section

The primary purpose of Stage 1 is to remove the central Gardiner structure from just west of Rees Street to Jarvis Street. Traffic would be diverted off this segment of the elevated



structure in stages as noted for each Phase. This stage has the demonstrable benefit of removing the Gardiner elevated structure in the central section, the area with the highest potential for revitalization, within the early stages of the construction process (approximately two years from starting). The four phases of Stage 1 are described below.

### 2.2.1 Stage 1A

During Stage 1A the structure will be removed from Simcoe Street to Jarvis Street. The key steps are shown in the Stage 1A drawing in the appendix and are summarized as follows:

- Closure of EB FGE through lanes (2) at the York/Yonge/Bay exit ramp;
- Closure of the WB FGE through lanes (2) at the Yonge exit ramp;
- Closure and removal of the EB FGE on-ramp from LSB located just east of Rees Street;
- Closure of the EB FGE on-ramp from Bay Street;
- Closure of the EB FGE off-ramp at Jarvis Street; and
- Removal of the section of Gardiner structure between Simcoe Street and Jarvis Street.

During this stage, Gardiner traffic can continue to use most ramps:

- |           |  |
|-----------|--|
| Eastbound | - exit to Spadina (widened to 2 lanes)                           |
|           | - exit to York/Bay/Yonge and LSB                                 |
|           | - entry from LSB east of Jarvis (widened temporarily to 2 lanes) |
| Westbound | - exit to Sherbourne / LSB                                       |
|           | - exit to Yonge / LSB  |
|           | - entry from York  |
|           | - entry from LSB, west of Spadina                                |

### 2.2.2 Stage 1B

Stage 1B is a building stage. With the Gardiner removed across the central section, the new at-grade road network between Simcoe and Jarvis can be constructed. Westbound LSB from west of Rees Street to the new WB FGE on-ramp would be temporarily widened from a 3 to 4-lane cross-section. The details of this stage are shown in the Stage 1B drawing included in the Appendix.

### 2.2.3 Stage 1C

During this stage, an additional section of the Gardiner would be removed from Simcoe Street to just west of Rees Street. The WB on-ramp from York Street and the Yonge portion of the EB off-ramp to York/Bay/Yonge would be closed and



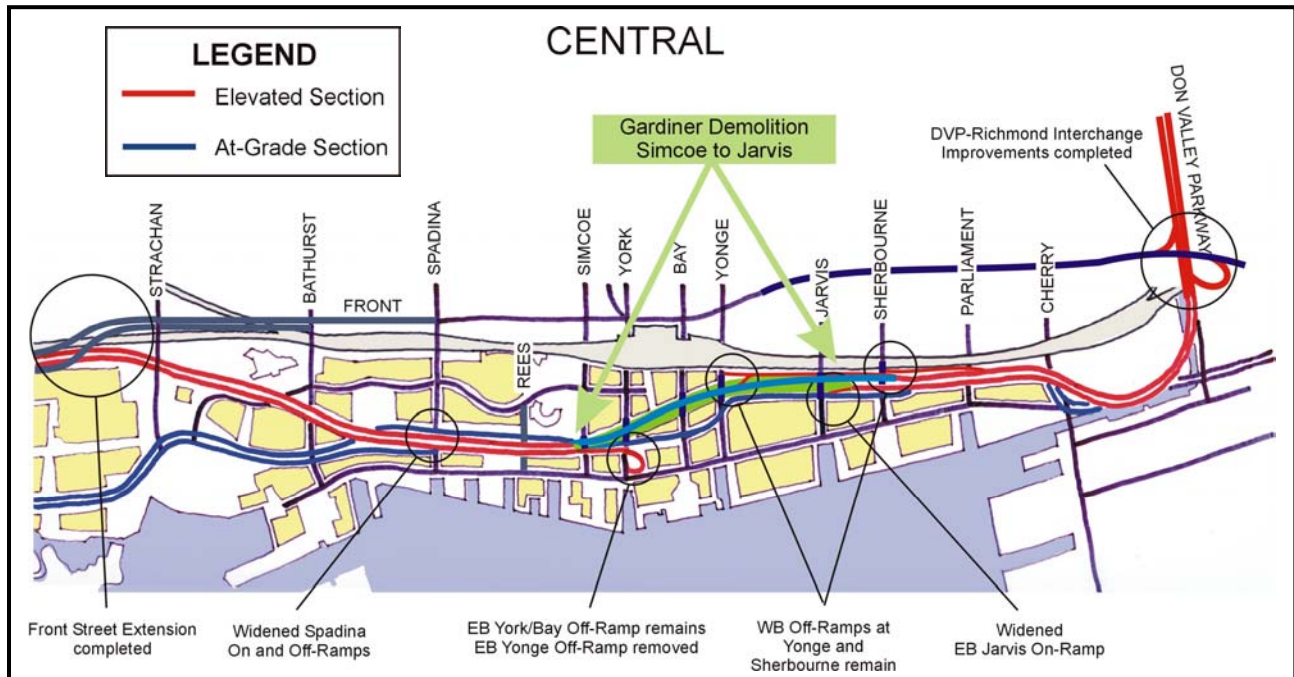


removed. The EB exit to York/Bay would remain in operation. The details of this stage are shown in the Stage 1C drawing included in the Appendix.

### 2.2.4 Stage 1D

Stage 1D is a building stage. WB LSB from Simcoe to Rees would be built. As a result of the Yonge ramp removal, EB LSB between York and Bay can be widened. EB LSB, between Rees and Simcoe, cannot yet be widened with the EB exit ramp to York/Bay still in place. It is important to maintain this ramp as long as possible in order to minimize the number of EB vehicles using the constrained section of LSB between Spadina and Rees Street. This is discussed in further detail in Section 3.0 of this report. The details of this stage are shown in the Stage 1D drawing included in the Appendix.

The road network changes associated with Stage 1 are also summarized in **Figure 2.2**.



**FIGURE 2.2: STAGE 1 – CENTRAL SECTION (condition at end of Phase 1D)**

### 2.3 Stage 2 – Transition Section

The primary purpose of Stage 2 is to build the new permanent transition ramps, which connect the elevated section of the Gardiner west of Spadina to the surface road network east of Spadina. The WB LSB structure over Spadina and the temporary Spadina ramps



would be removed during this stage after completion of the permanent transition ramps. Stage 2 comprises three phases, each of which is described below.

### 2.3.1 Stage 2A

In this stage the EB off-ramp to York/Bay would be closed and removed. North-south traffic movements at LSB would be temporarily prohibited on Spadina and on Rees with only right-in/right-out movements permitted. These changes may need to be implemented during Stage 1C as discussed in Section 3.0 of this report. The details of this stage are shown in the Stage 2A drawing included in the Appendix.

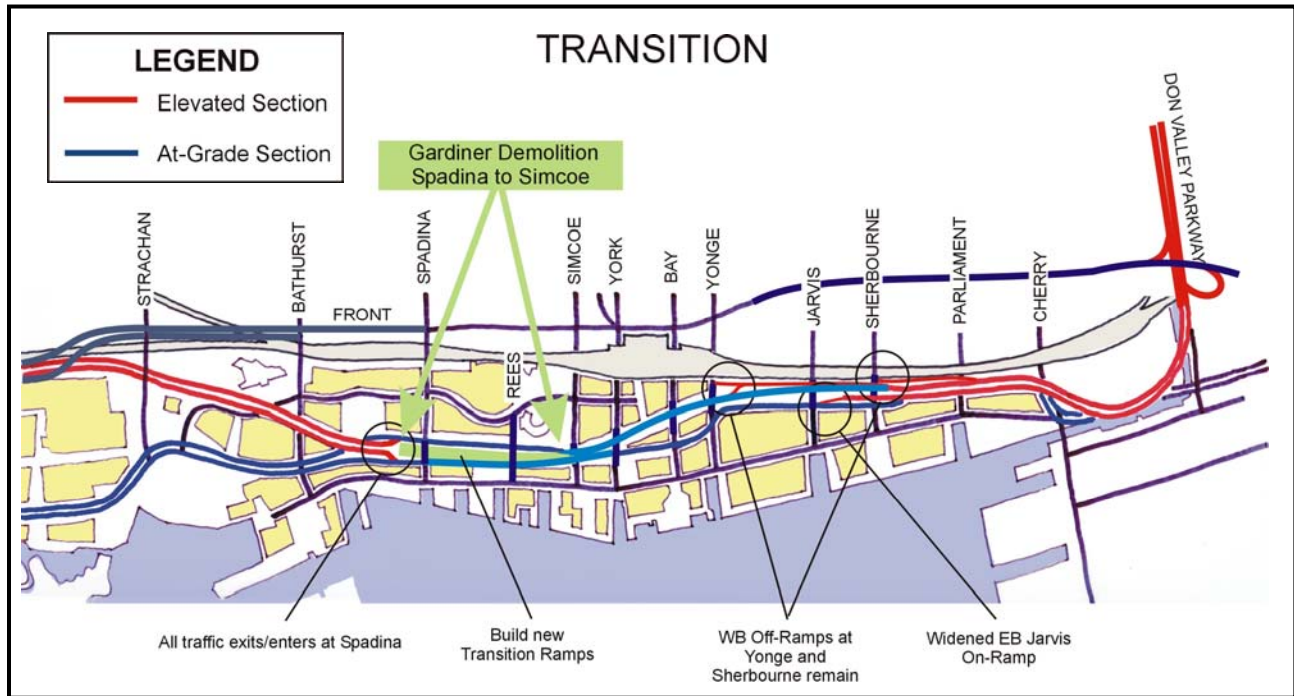
### 2.3.2 Stage 2B

Stage 2B is a building stage. The new transition ramps would be built as well as the new LSB between Spadina Avenue and Rees Street. The details of this stage are shown in the Stage 2B drawing included in the Appendix.

### 2.3.3 Stage 2C

During Stage 2C the new transition ramps would be in place and open to traffic. The WB LSB structure over Spadina and the temporary Spadina ramps would be closed and removed. The temporary WB LSB to Gardiner ramp would be closed and replaced with a 2-lane ramp from the Gardiner to LSB. This ramp is required since all WB traffic would be temporarily routed to the transition ramp while the existing WB LSB structure over Spadina is removed. The details of this stage are shown in the Stage 2C drawing included in the Appendix.

The road network changes associated with Stage 2 are also summarized in **Figure 2.3**.



**FIGURE 2.3: STAGE 2 – TRANSITION SECTION** (condition at the end of Phase 2C)

## 2.4 Stage 3 – Eastern Section

Stage 3 involves the removal of the east section of the Gardiner structure (Jarvis to the DVP) as well as the construction of new ramps to connect the Don Valley Parkway (DVP) to the new at-grade road network. Stage 3 comprises four stages, each of which is described below. Some aspects of Stage 2 and Stage 3 could be completed concurrently in order to compress the expected construction schedule.

### 2.4.1 Stage 3A

Before this stage begins, the new LSB alignment from Cherry to Don Roadway would need to be in place. It is also important to temporarily extend the new Queens Quay extension east, to the existing LSB alignment.

All traffic to and from the DVP is shifted to the existing W-N ramp, operating with one lane per direction. This allows for the closure and removal of the existing N-W DVP ramp. Temporary connections need to be constructed to allow DVP and Gardiner traffic to share the existing W-N ramp. With the existing N-W DVP removed, construction would proceed on the new N-W ramp and the portion of the new W-N ramp that does not impact the existing W-N ramp.



Ideally, the new Don River channel would be constructed in conjunction with the new LSB alignment so that any new bridges do not have to be rebuilt. The details of this stage are shown in the Stage 3A drawing included in the Appendix.

#### 2.4.2 Stage 3B

In Stage 3B the new N-W DVP to LSB ramp is in place. Traffic will be switched over to this ramp which will be temporarily operated as a two-way facility (one-lane per direction) until the new W-N LSB to DVP ramp is built. With DVP traffic diverted, the remaining Gardiner structure east of Jarvis Street can be closed and removed. The details of this stage are shown in the Stage 3B drawing included in the Appendix.

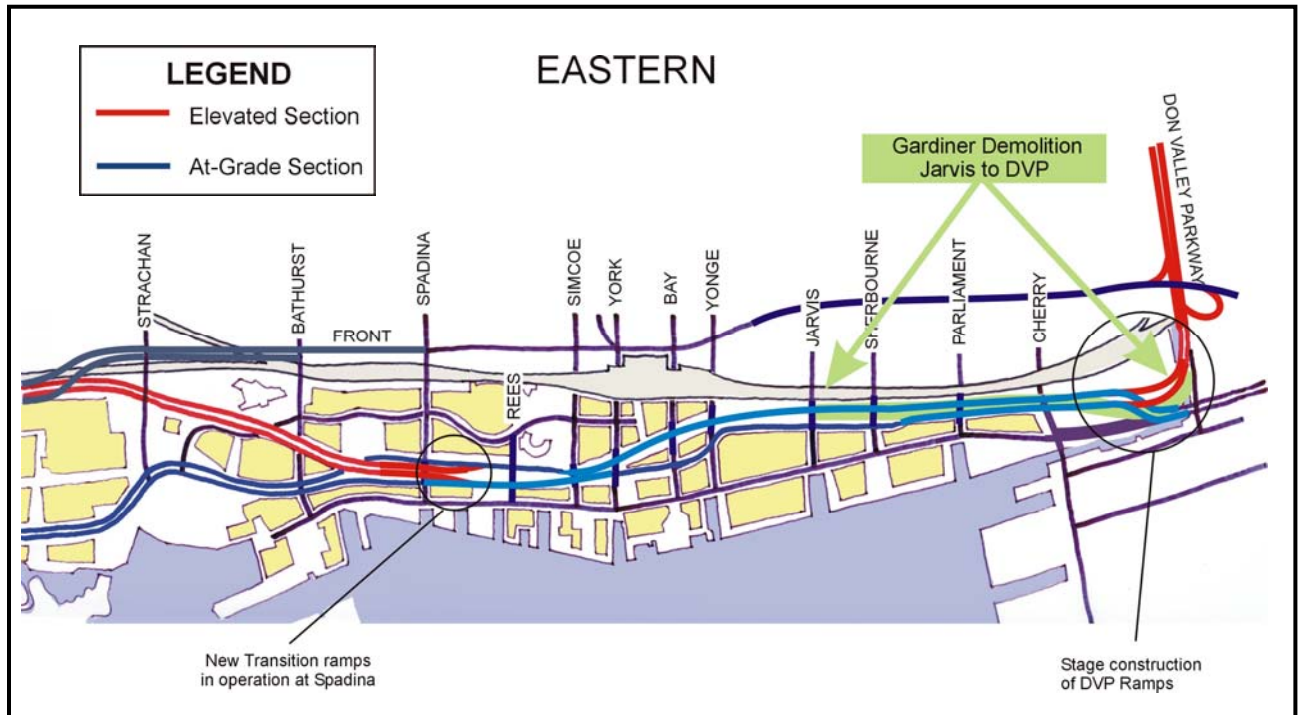
#### 2.4.3 Stage 3C

Stage 3C is primarily a building stage. With the Gardiner structure removed, reconstruction of the at-grade road network between Jarvis and the Don Roadway can be completed. This includes connecting the new LSB alignment to the existing LSB alignment just west of the Don Roadway. The details of this stage are shown in the Stage 3C drawing included in the Appendix.

#### 2.4.4 Stage 3D

Stage 3D involves the removal of the temporary Queens Quay Extension connection to LSB just east of Cherry Street. This will allow the ultimate road network associated with the QQE to be constructed. The details of this stage are shown in the Stage 3D drawing included in the Appendix.

The road network changes associated with Stage 3 are also summarized in **Figure 2.4**.



**FIGURE 2.4: STAGE 3 – EASTERN SECTION** (condition at the end of Stage 3D)



### 3.0 ESTIMATED COSTS AND DURATION OF CONSTRUCTION

This section of the report documents the estimation of costs and duration of construction for the staging plan discussed in Section 1. The results are presented in a stage-by-stage and modular format, enabling adjustments to be made without having to revisit the entire project.

#### 3.1 Cost and Construction Duration Estimate Methodology

The following methodology was applied in the estimation process:

- Determine the scope of work involved and limits of the estimation;
- Identify the elements of the work involved and consider any items that may not have been considered as part of the previous cost estimation work summarized in the Constructability, Structural Engineering Feasibility and Cost Study for the Gardiner-Lake Shore Options –Report (completed by Morrison Hershfield);
- Determine unit rates for typical elements at acceptable levels of accuracy. For this study, units such as cost per square metre of bridge deck, cost per square metre of pavements, etc., are used. The following elements are covered:
  - Roadwork;
  - Structural Work;
  - Signals;
  - Tunnels;
  - Demolition; and
  - Miscellaneous, including all staging and temporary work for demolition and temporary supports.
- Ensure all elements of work items are included (i.e. a section of at-grade road may be comprised of both pavement and signals);
- Determine quantities for all elements of each work item located within the limits of the work;
- Estimate total cost of each work item by applying unit rates to all identified work item elements;
- Apply percentage for contingencies and unforeseen expenses. The percentage used for these purposes is 30 percent;
- Apply percentage to cover engineering and other soft costs such as taxes, and utility diversions and permits. The percentage used for these purposes is 32 percent;
- Round cost estimates up to the nearest thousands of dollars; and
- Estimate the expected duration of each work item.

It is noted that all costs for staging, winter shut downs, interfacing between sections for traffic management, etc. are covered as part of the contingency.



### 3.2 Estimate of Costs and Construction Duration

As discussed in detail in Section 4 of this report, the work is recommended to be undertaken in stages to provide as much traffic capacity along the Gardiner – Lake Shore Corridor as possible during the Gardiner demolition.

The following general assumptions apply to the cost and construction duration estimate:

- Construction is assumed to be continuous daily from April to October, roughly 36 weeks. Winter shutdown is not assumed to entail any reinstatement work. These details can be revised or updated for future design stages;
- The removal of the elevated road segments will be carried out primarily while traffic flow is maintained beneath the structure. This is common practice but will require protection and careful planning. Safety aspects of the removal process can be controlled in the specifications when the tenders are issued; and
- During pier removal, some lane restrictions will be inevitable on Lake Shore Boulevard. It is not expected to be practical or cost effective to divert LSB traffic from under the expressway structure, via a network of temporary roads, during demolition.

The Cost Estimate and Construction Time Estimate are summarized by stage in **Table 3.1, Table 3.2, Table 3.3 and Table 3.4.**

**TABLE 3.1 – CONSTRUCTION COST AND DURATION ESTIMATE  
PREPARATORY CONSTRUCTION (PRE-BUILD)**

STAGE	ITEM	DESCRIPTION	ESTIMATE (in thousands of dollars)	CONSTRUCTION DURATION
<b>Pre-build, DVP / Eastern Avenue Interchange</b>	1	Bridge Structure	\$15,691	Not Included. See notes below.
	2	Road Works	\$30,490	
<b>TOTAL FOR PRE-BUILD</b>			<b>\$46,181</b>	

The following points are noted with respect to Pre-Build stage:

- The DVP/Eastern Avenue (Richmond) interchange cost is now included in the “pre-build” years;
- Other works in the pre-build stage, which **are not** included in this cost and construction duration estimate, include the Front Street Extension and various connections to the Queens Quay Extension; and
- The Pre-build stage has not been included in the overall schedule planning of the Gardiner work.



**TABLE 3.2 – CONSTRUCTION COST AND DURATION ESTIMATE  
STAGE 1 – CENTRAL SECTION**

STAGE	ITEM	DESCRIPTION	ESTIMATE (in thousands of dollars)	CONSTRUCTION DURATION
<b>Stage 1A, 1B - Simcoe to Jarvis Removal</b>	1	Remove FGE EB Off-Ramp at Spadina: replace with widened EB Off-Ramp	\$12,355	Stage 1 is estimated to take 2 years to complete.  The total expenditure is estimated at approximately \$100M or \$50M per year.
	2	Remove FGE WB On-Ramp at Spadina; replace with widened WB On-Ramp	\$12,510	
	3	Remove FGE WB Off-Ramp at LSB/Spadina	\$772	
	4	Remove EB FGE On-Ramp at Rees	\$278	
	5	Gardiner Demolition from Simcoe to Jarvis	\$15,640	
	6	Allowance for Detours	\$5,526	
	7	Remove EB FGE On-Ramp at Jarvis; replace with widened EB On-Ramp	\$16,680	
	8	Road Works	\$31,516	
<b>TOTAL STAGE 1A, 1B</b>			<b>\$95,276</b>	
<b>Stage 1C, 1D – Rees to Simcoe Removal</b>	1	Remove WB FGE On-Ramp at York	\$386	
	2	Remove Yonge Street portion of EB FGE off-ramp at York/ Yonge/Bay	\$309	
	3	Gardiner demolition from Rees to Simcoe	\$3,185	
	4	Road Works	\$515	
<b>TOTAL STAGE 1C, 1D</b>			<b>\$4,395</b>	
<b>TOTAL STAGE 1</b>			<b>\$99,671</b>	





It is more practical and cost effective to replace the structures at Spadina and Jarvis with two-lane temporary ramps rather than temporarily widening the existing ramps, which would be difficult and impractical.

**TABLE 3.3 – CONSTRUCTION COST AND DURATION ESTIMATE  
STAGE 2 – TRANSITION SECTION**

STAGE	ITEM	DESCRIPTION	ESTIMATE (in thousands of dollars)	CONSTRUCTION DURATION
<b>Stage 2A – Portland to York Removal</b>	1	Widen WB-LSB bridge structure to 4 lanes	\$26,903	Stages 2A, 2B and 2C are estimated to take 2 years to complete.  The total expenditure is estimated at approximately \$158M or \$79M per year.
	2	Gardiner Demolition	\$9,838	
	3	Rees to Church, Gardiner ramp demolition	\$2,306	
	4	Column footing removal	\$89	
	5	Road Work	\$35,417	
<b>TOTAL STAGE 2A</b>			<b>\$74,553</b>	
<b>Stage 2-B, West Transition Ramps</b>	1	Construct new EB LSB	\$2,059	
	2	Transition Ramps for EB and WB traffics	\$14,586	
	3	Temporary WB Lakeshore to existing WB Lakeshore	\$8,031	
	4	Road Work	\$4,976	
<b>TOTAL STAGE 2B</b>			<b>\$29,652</b>	
<b>Stage 2-C, Lake Shore / Spadina Works</b>	1	Remove WB-LSB Structure over Spadina	\$2,397	
	2	Remove EB FGE Off-Ramp	\$1,004	
	3	Remove WB FGE On Ramp	\$1,004	
	4	Road Work for Permanent LSB	\$49,249	
<b>TOTAL FOR STAGE 2-C</b>			<b>\$53,654</b>	
<b>TOTAL STAGE 2</b>			<b>\$157,859</b>	



**TABLE 3.4 – CONSTRUCTION COST AND DURATION ESTIMATE  
STAGE 3 – EASTERN SECTION**

<b>Stage 3 – FGE East of Jarvis</b>		<b>Jarvis to Don River</b>		Stage 3 is estimated to take 3 years to complete.  The total expenditure is estimated at approximately \$187M or \$62.3M per year.
	1	Gardiner demolition	\$12,484	
	2	WB-LSB Construction	\$16,474	
	3	EB-LSB Construction	\$16,474	
	4	Other Road Works	\$41,610	
		<b>Don River to DVP</b>		
	5	Gardiner demolition	\$8,650	
	6	Temporary bridges and associated embankments	\$27,765	
	7	WB-LSB Construction	\$1,459	
	8	EB-LSB Construction	\$1,459	
		<b>Don to East Abutment</b>		
	9	WB and EB Don Bridges	\$18,876	
	10	DVP Connecting structure	\$4,118	
	11	WB-LSB Construction	\$6,540	
12	EB-LSB Construction	\$6,598		
13	Gardiner Ramp demolition	\$1,514		
14	Miscellaneous Road Works	\$22,931		
<b>TOTAL FOR STAGE 3</b>			<b>\$186,950</b>	
<b>TOTAL ALL STAGES, GREAT STREETS APPROACH - VARIATION 1</b>			<b>\$490,661</b>	
<b>TOTAL ALL STAGES, LESS PRE-BUILD WORK</b>			<b>\$444,480</b>	

The duration of construction could be reduced if some aspects of Stage 2 and Stage 3 could be completed simultaneously. However, the work associated with the DVP connections to the Gardiner and the new GLC corridor is too large to be combined with other sections. Therefore it is not recommended that this work be kept as a final stage, following the rest of the Stage 3 work.



## 4.0 ASSESSMENT OF TRAFFIC OPERATIONS DURING DISRUPTION

### 4.1 Methodology

This section describes the strategic assessment of traffic operations for each stage of the proposed construction staging plan for the Gardiner "Great Street Approach (GSA)" Variation 1. The assessment was intended to determine the implications of construction on travel into and out of the study area. If the EA process selects this option as the "preferred" option, a more detailed traffic assessment should be undertaken using the Paramics simulation software. However, the cost and level of effort associated with such an analysis is not justified at this stage of the planning process.

The report includes the following:

- An assessment of travel demand and capacity (volume-to-capacity) across screenlines strategically located for existing conditions, preparatory construction and during each stage of construction. A screenline is an imaginary line strategically located to assess travel demand and capacity across a number of road links;
- An assessment of existing conditions to identify the traffic demands to be accommodated on the road network during various stages of construction; and
- An assessment of travel demand and capacity across the critical sections for each stage. The critical sections are typically the transition areas where highway traffic, from the Gardiner and Don Valley Parkway, merges with traffic on the at-grade arterial road network. Other critical areas include key ramp closures or areas where the highway and surface road network traffic are combined and the surface road cross-section remains constrained by the Gardiner structure above

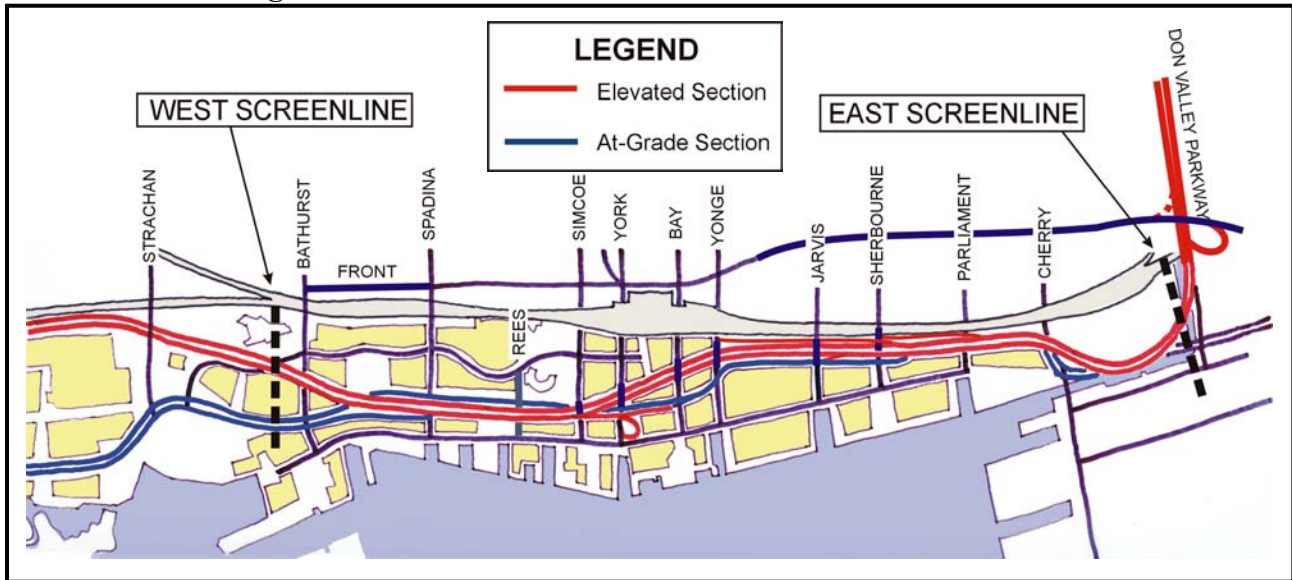
The assessment is based on principles contained within the 2000 Highway Capacity Manual (HCM) for traffic operations on highways and urban arterial roads. The assignment of future traffic volumes has been based on the results of the Paramics micro-simulation for the road network associated with the GSA- Variation 1 option as well as the distribution and travel patterns associated with existing traffic.

### 4.2 Existing Conditions

Existing conditions were investigated in order to identify the travel demands that need to be accommodated during construction of the GSA –Variation 1 option. Travel demands and capacities were compared across two north-south screenlines. The West Screenline was located just west of Bathurst Street and includes the Gardiner Expressway (FGE) and Lake Shore Boulevard (LSB). The East Screenline is located just west of Don Roadway and includes the ramps from the Don Valley Parkway, the Gardiner Expressway and



Lake Shore Boulevard. The approximate locations of the east and west screenlines are shown in **Figure 4.1**.



**FIGURE 4.1: EAST AND WEST SCREENLINE LOCATIONS**

The theoretical road capacities used in the analysis are based on typical values for different types and classifications of road segments. **Table 4.1** summarizes the capacity of the existing road network. It is noted that the capacities summarized in Table 4.1 represent theoretical capacities for typical sections; some sections may have higher or lower capacities depending on local conditions such as the frequency of signalized intersections, adjacent parking, number of unsignalized driveways etc.



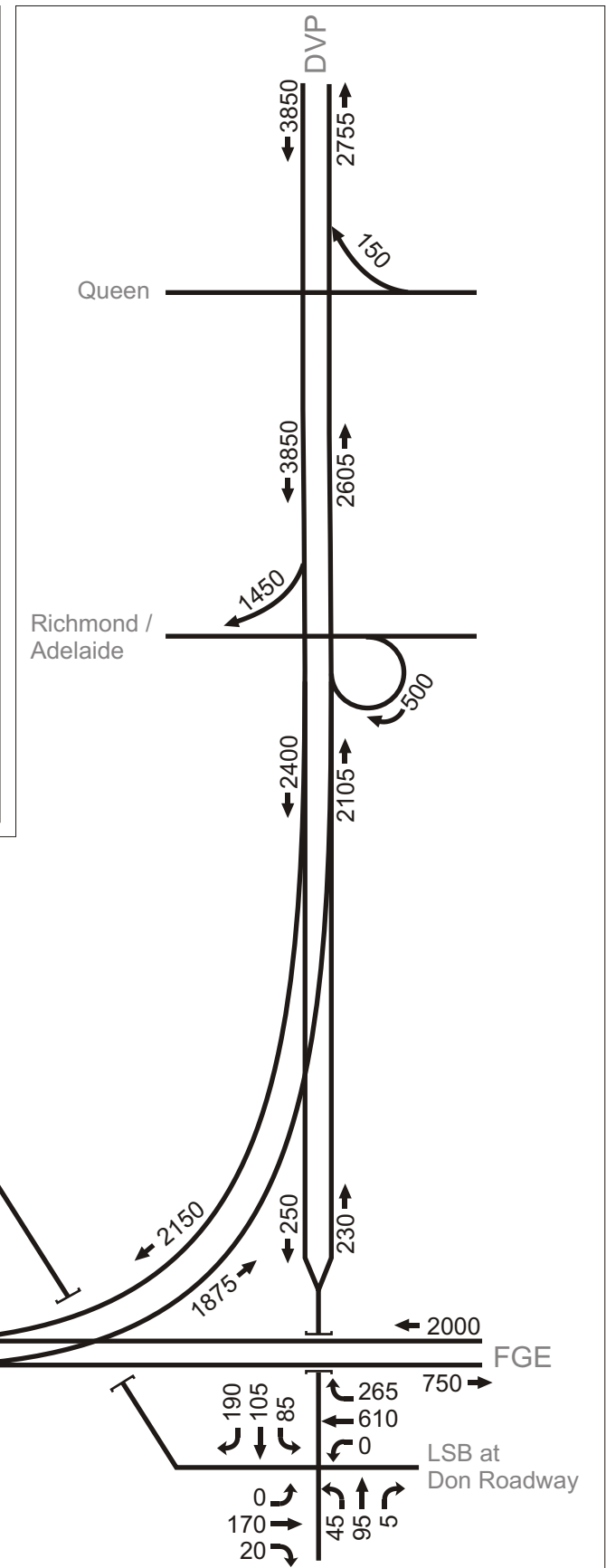
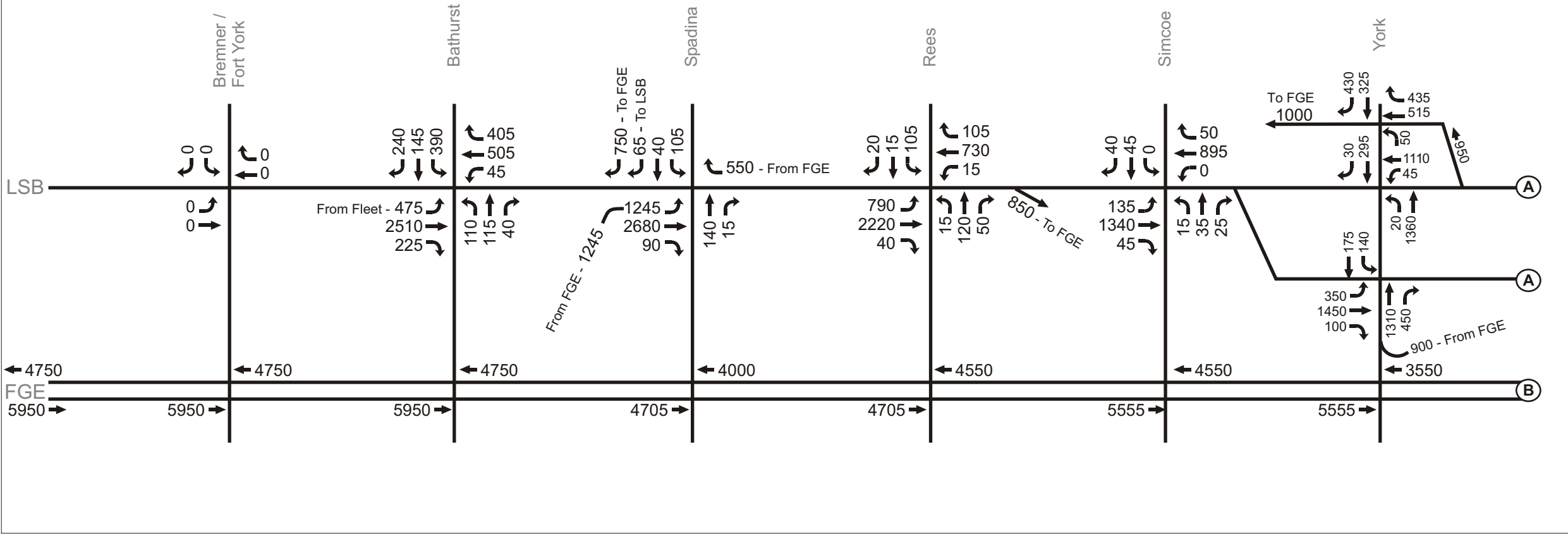
**TABLE 4.1  
EXISTING CAPACITY**

	LANE CAPACITY (vehicles/hr/lane)	TOTAL CAPACITY (vehicles/hour)	
		EASTBOUND	WESTBOUND
<b>WEST SCREENLINE (JUST WEST OF BATHURST)</b>			
Gardiner Expressway (FGE)	2,000	6,000	6,000
Lake Shore Boulevard (LSB)	1,000	3,000	3,000
<b>TOTAL</b>		<b>9,000</b>	<b>9,000</b>
<b>EAST SCREENLINE (JUST WEST OF DON ROADWAY)</b>			
Ramps to/from DVP	1,500	3,000	3,000
Gardiner Expressway	2,000	4,000	4,000
Lake Shore Boulevard	900	2,700	2,700
<b>TOTAL</b>		<b>9,700</b>	<b>9,700</b>

Existing traffic volumes during the a.m. and p.m. peak hours are shown in **Figures 4.2 and 4.3**.

A comparison of existing travel demand to capacity is summarized in **Table 4.2**. The existing volumes are based on current count data provided by the City of Toronto, primarily from the years 2002 and 2003.

# WEST SECTION



**FIGURE 4.2**  
**EXISTING CONDITIONS**  
**AM PEAK HOUR VOLUMES**





**TABLE 4.2  
EXISTING SCREENLINE VOLUMES**

	TOTAL CAPACITY (vehicles/hour)	A.M. PEAK HOUR		P.M. PEAK HOUR	
		EB (V/C Ratio) <sup>1</sup>	WB (V/C Ratio) <sup>1</sup>	EB (V/C Ratio) <sup>1</sup>	WB (V/C Ratio) <sup>1</sup>
<b>WEST SCREENLINE (JUST WEST OF BATHURST)</b>					
Gardiner Expressway (FGE)	6,000	5,950 (0.99)	4,750 (0.79)	5,650 (0.94)	5,600 (0.93)
Lake Shore Boulevard (LSB)	3,000	3,200 (1.07)	850 (0.28)	1,450 (0.48)	3,200 (1.07)
<b>TOTAL</b>	<b>9,000</b>	<b>9,150</b> <b>(1.02)</b>	<b>5,600</b> <b>(0.62)</b>	<b>7,100</b> <b>(0.79)</b>	<b>8,800</b> <b>(0.98)</b>
<b>EAST SCREENLINE (JUST WEST OF DON ROADWAY)</b>					
To/From Don Valley Parkway (DVP)	3,000	1,900 (0.63)	2,150 (0.72)	2,050 (0.68)	2,100 (0.70)
Gardiner Expressway (FGE)	4,000	750 (0.19)	2,000 (0.50)	1,750 (0.44)	1,200 (0.30)
Lake Shore Boulevard (LSB)	2,700	200 (0.07)	850 (0.31)	600 (0.22)	450 (0.17)
<b>TOTAL</b>	<b>9,700</b>	<b>2,850</b> <b>(0.29)</b>	<b>5,000</b> <b>(0.52)</b>	<b>4,400</b> <b>(0.45)</b>	<b>3,750</b> <b>(0.39)</b>

Note 1. V/C ratio stands for volume-to-capacity ratio

The following points are noted from the table:

- Across the west screenline, eastbound a.m. peak hour volumes and westbound p.m. peak hour volumes are at capacity;
- There is some unused capacity in the off-peak directions across the west screenline; and
- Across the east screenline, volumes are less than 50 percent of the available capacity.

Based on the existing volumes summarized above, the operational assessment will focus on the peak directional flows, which include inbound movements during the a.m. peak hour and outbound movements during the p.m. peak hour. These volumes, in conjunction with the results of the Paramics micro-simulation of the GSA – Variation 1





option, were used to assess traffic conditions in the Gardiner-Lake Shore Corridor (GLC) during construction.

### 4.3 Preparatory Construction

As discussed in Section 2, before construction of the Remove option can begin, a number of road network improvements must be in place. The most notable include the construction of the Front Street Extension (FSE), improvements to the DVP/Richmond interchange, construction of the Queens Quay Extension (QQE) and construction of new road segments or widening of existing segments of LSB where possible before Gardiner demolition commences. The traffic implications of this "Preparatory Construction" are described in more detail below.

#### 4.3.1 Front Street Extension

The FSE will provide access between the Gardiner (to and from the west) and Front Street, west of Strachan Avenue. For purposes of this study, the FSE is assumed to consist of four lanes (2 lanes eastbound and 2 lanes westbound). The FSE is an attractive route connecting to the central area, and is expected to attract a significant number of trips, both inbound and outbound during the a.m. and p.m. peak hours. Based on the results of the Paramics traffic simulation, the FSE is expected to accommodate approximately 25 percent of the total inbound and 35 percent of the total outbound existing peak hour volumes on the FGE and Lake Shore Boulevard (LSB). As a result of the reduced volumes, the Gardiner (east of the FSE) and LSB (east of Bathurst) will be reduced from six lanes to four lanes.

With the FSE in place, the capacity of the road network for eastbound and westbound traffic across the west screenline is summarized in **Table 4.3**. It is noted that based on existing conditions, the peak eastbound volume is approximately 9,150 vehicles (a.m.) and the peak westbound volume is approximately 8,800 vehicles (p.m.).



**TABLE 4.3  
CAPACITY ACROSS WEST SCREENLINE (WEST OF BATHURST)  
WITH FRONT STREET EXTENSION IN PLACE**

	EASTBOUND	WESTBOUND
Front Street Extension <sup>1</sup>	2,200	2,600
Gardiner Expressway	4,000	4,000
Lake Shore Boulevard	3,000	3,000
<b>TOTAL</b>	<b>9,200</b>	<b>9,600</b>

Notes: 1. Eastbound and westbound capacities for the Front Street Extension are based on results of the Paramics simulation

From the table it can be seen that existing eastbound and westbound vehicle demands are expected to be accommodated across the west screenline with the FSE in place. East of Exhibition Place a significant amount of LSB traffic will use Strachan, Queens Quay, Fort York Boulevard and Bathurst Street, thereby reducing LSB volumes so that only four lanes will be required on LSB east of Bathurst Street.

#### 4.3.2 DVP/Richmond Interchange

Improvements to the DVP/Richmond interchange will increase the cross-section of the north-to-west DVP to Richmond ramp from one lane to two lanes. The results of the Paramics assignment shows that the improved ramp is expected to attract approximately 25 percent of the existing inbound a.m. and p.m. peak hour trips crossing the east screenline. As is the case for the existing condition, no capacity constraints are expected across the east screenline.

#### 4.3.3 Queens Quay Extension

Construction of the Queens Quay Extension (QQE), from Parliament Street to Cherry Street is also expected to be a critical link that needs to be in place as construction of the GSA – Variation 1 option proceeds. This link is expected to ease demands on LSB during construction, particularly during Stage 3, when the new ramps to the DVP are being built.

#### 4.3.4 Other Preparatory Construction

Other preparatory construction includes the new LSB alignment between Cherry Street and the Don Roadway, the new eastbound LSB (Bay to Jarvis) on the Harbour alignment as well as other minor improvements intended to improve capacity during specific stages of construction. These improvements will not



impact existing traffic operations and are all assumed to be in place for purposes of the traffic assessment.

#### 4.4 Stage 1 – Central Section

Stage 1 – Central Section involves closing and removing the Gardiner between Simcoe Street and Jarvis Street. As described in Section 1.0 of this report, there are several steps required to close and remove this section of the Gardiner. As discussed in section 4.2, traffic is operating at capacity across the west screenline in the eastbound direction during the a.m. peak hour and in the westbound direction during the p.m. peak hour.

##### 4.4.1 Temporary Closure of the Spadina and Jarvis Ramps

Before any closures can be implemented on the Gardiner, temporary improvements to the on and off-ramps at Spadina, and the EB on-ramp at Jarvis must be completed. The improvements will widen these ramps from one to two lanes.

The expected impacts are as follows:

##### Spadina On and Off Ramps

- EB FGE off-ramp to Spadina is closed and temporarily re-built to accommodate 2 lanes. Existing vehicles using this ramp (approximately 1,250 a.m. and 850 vehicles p.m.) will be accommodated via the FSE and the other remaining EB off-ramps (York/Yonge/Bay and Jarvis);
- WB on-ramp to FGE and LSB from Spadina is closed. A new temporary ramp is built just west of Spadina to accommodate 2 lanes of traffic from WB LSB. The existing ramp only accommodates traffic from Spadina southbound. Existing vehicles using this ramp (approximately 750 a.m. and 1,450 p.m.) will be accommodated via the FSE and the other remaining FGE WB on-ramps (York and Jarvis); and
- WB FGE off-ramp to LSB and Spadina is closed and removed. This ramp carries approximately 500 vehicles per hour during the a.m. and p.m. peak hours. Most of these trips will be accommodated via the Yonge and Sherbourne off-ramps. The DVP/Richmond interchange improvements are expected to provide sufficient excess capacity to allow additional trips to be accommodated on these ramps



## Jarvis On-Ramp

- EB FGE on-ramp at Jarvis is closed and temporarily re-built to accommodate 2 lanes. The existing 800 a.m. and 450 p.m. peak hour trips will be accommodated via the on-ramps at Rees Street and Bay Street

As a result of construction of the FSE and improvements to the DVP/Richmond Interchange, as discussed for the "Preparatory Construction", the number of vehicles travelling on the Gardiner as well as the associated on and off ramps, is expected to be lower than the existing volumes discussed above.

### 4.4.2 Stages 1A and 1B

With the widenings of the on and off ramps at Spadina and the EB on-ramp at Jarvis in place, the Gardiner structure is closed and removed from Simcoe to Jarvis. The following ramps are closed and removed:

- EB FGE on-ramp located east of Rees Street;
- EB FGE on-ramp at Bay Street; and
- EB FGE off-ramp at Jarvis Street

Inbound traffic from the west on the FGE is able to exit via the FSE, the Spadina (widened) ramp and the York/Yonge/Bay ramp. Inbound traffic from the east is able to exit via the improved DVP/Richmond interchange, as well as the Sherbourne and Yonge Street ramps.

Central area outbound traffic to the west is able to access the FGE via the York ramp, the widened Spadina ramp as well as the FSE. Most outbound traffic to the east will utilize the widened Jarvis ramp, although some traffic is also expected to utilize the Eastern on-ramp to access the DVP northbound.



## West Screenline

The critical section for Stages 1-A and 1-B is expected to be on LSB between the widened Spadina ramps and Simcoe Street. The capacity through this section to a large extent controls the capacity of the temporary road network during these stages. This is the section of LSB where the FGE traffic and LSB traffic are combined onto the at-grade road network, which is still constrained by the FGE structure above. The FGE structure is removed from east of Simcoe Street during this stage. However, from west of Simcoe to the Spadina ramps, EB LSB is still completely under the existing structure and is limited to a three-lane cross-section. WB LSB is outside the structure from just west of Simcoe Street, and the structure will be removed from Simcoe Street to Jarvis as part of this stage. However, WB LSB is limited to a three-lane cross-section for a short section from just west of Simcoe Street. Maintaining the Gardiner open to the York/Bay/Yonge off-ramp and from the York on-ramp during Stages 1A and 1B is expected to ease the burden on this critical section.

In order to improve the capacity of the critical section for eastbound and westbound traffic, the following operational changes are proposed:

- Spadina Avenue is closed to north-south traffic between Queens Quay and Bremner Boulevard, with the exception of streetcars, and vehicles exiting from the widened EB Spadina off-ramp. With these prohibitions in place, traffic exiting from the Spadina off-ramp will be able to access Spadina northbound and LSB eastbound as primarily freeflow movements, only being stopped to allow access for north-south streetcars along Spadina. It is noted that westbound LSB traffic continues to use the bridge over Spadina Avenue at this intersection;
- The LSB at Rees Street intersection would be simplified by removing the existing signals and operating the intersection with north-south right-in/right-out access only;
- WB LSB is increased to a four-lane cross-section from Rees Street to the Spadina on-ramp. The southbound right turn from Rees Street to WB LSB can operate as a freeflow movement;
- EB left turns at the LSB at Simcoe Street intersection will be prohibited to provide three through lanes. WB left turns are already prohibited at this intersection under existing conditions; and
- EB left turns will be accommodated at Spadina (free flow) and at York, Bay and Yonge.



These changes are expected to maximize the capacity of the three lane eastbound and westbound critical section of LSB. The capacity of this section is determined based on two factors: 1) The capacity of three LSB lanes operating primarily under freeflow conditions; and 2) The capacity of the signalized LSB at Simcoe Street intersection to accommodate east-west and north-south traffic.

The capacity of a multilane facility operating under uninterrupted or free flow conditions is typically 2,000 passenger cars per hour per lane (pcphpl) when all conditions are ideal. Ideal conditions include the following:

- A minimum design speed (greater than 60 km/h);
- Minimum lane widths of 3.6 metres;
- Minimum lateral clearances of 1.8 metres;
- Only passenger cars in the traffic stream; and
- A driver population consisting of all regular road users.

Many of these conditions will not be known until a detailed design of the GSA – Variation 1 is completed. However, some assumptions can be made based on the preliminary designs already completed. The design speed will likely be close to 60 km/h, the lane widths will likely be closer to 3.5 metres and the traffic stream will consist of both passenger cars and trucks. To account for these factors, a 40 percent reduction factor was applied to the ideal per lane capacity. This results in a per lane capacity for the free flow section of the LSB between the Gardiner and Simcoe of approximately 1,200 vehicles per hour per lane. Therefore, the maximum capacity of the 3-lane section of LSB, between the Spadina ramps and Simcoe Street is expected to be approximately 3,600 vehicles per hour in each direction.

This capacity was tested (using the Synchro software package) at the LSB/Simcoe Street intersection, which is the first signalized intersection for eastbound merged Gardiner and LSB traffic. Future traffic volumes at the intersections of Spadina and Rees Streets were re-assigned based on the proposed operational changes detailed above. The analysis showed that the Simcoe Street intersection is expected to operate at capacity, with maximum eastbound and westbound demands of approximately 3,600 vehicles per hour on the west leg.

### ***Eastbound Travel***

With the FSE and associated network changes to the FGE and LSB in place, the road network is capable of delivering approximately 6,000 peak hour trips (4,000 trips on the FGE and 2,000 trips on LSB) to a point just west of the improved eastbound Spadina off-ramp. The effectiveness of the temporary road network, east of the Spadina off-ramp, is measured by its ability to accommodate the 6,000



vehicles per hour that are expected to be delivered by the upstream road network. A comparison of eastbound travel demand and capacity at the improved Spadina off-ramp is summarized in **Table 4.4**. It is noted that the highest eastbound volumes at this location are expected to occur during the a.m. peak hour.

**TABLE 4.4  
AM PEAK HOUR TRAVEL DEMAND AND CAPACITY  
EASTBOUND TRAFFIC - AT SPADINA OFF-RAMP**

PROJECTED EASTBOUND DEMAND (vehicles per hour)		AVAILABLE EASTBOUND CAPACITY (vehicles per hour)	
Lake Shore Boulevard	2,000	Lake Shore Boulevard	3,600
Gardiner Expressway	4,000	Spadina Northbound	2,000
		York/Bay/Yonge Off-Ramp	1,800
<b>TOTAL EB DEMAND</b>	<b>6,000</b>	<b>TOTAL EB CAPACITY</b>	<b>7,400</b>
		<b>TOTAL V/C RATIO</b>	<b>0.81</b>

The following points are noted from the table:

- EB LSB is expected to deliver approximately 2,000 vehicles to the critical section based on the capacity of the two eastbound lanes;
- Most of the 4,000 vehicles on the FGE can exit via the widened Spadina ramp or the existing York/Bay/Yonge ramp;
- The York/Bay/Yonge off-ramp is expected to be able to accommodate approximately 1,800 vehicles during the a.m. peak hour. This capacity is based on the existing a.m. peak hour ramp volume;
- Traffic from the widened EB Spadina off-ramp can access either NB Spadina or EB LSB as freeflow movements;
- The exit ramp to northbound Spadina is expected to have a capacity of approximately 2,000 vehicles per hour. This capacity is based on dual left turn lanes operating primarily under freeflow conditions from the ramp terminal to the first signals at Bremner Boulevard;
- The available eastbound capacity through the critical section on LSB for traffic from the EB Spadina off-ramp is expected to be 1,600 vehicles during the peak hour. This is determined based on an eastbound LSB demand west of the EB Spadina off-ramp of 2,000 vehicles and a total capacity of 3,600 vehicles per hour; and
- Eastbound traffic operations through the critical section of LSB are expected to be acceptable because the capacity of the temporary road network across



the critical section is expected to exceed the volume of traffic delivered by the upstream road network. The volume-to-capacity ratio for this eastbound section is approximately 0.81 which equates to a Level of Service (LOS) of 'D'.

**Westbound Travel**

The peak westbound traffic volume occurs during the p.m. peak hour. The FSE is expected to accommodate approximately 2,600 of the 8,800 total westbound p.m. peak hour vehicles from the central area, leaving approximately 6,200 vehicles to be accommodated on the temporary GLC road network. As stated previously, the critical westbound section is located just west of Simcoe Street, and restricts the WB LSB capacity to approximately 3,600 vehicles per hour. West of Rees Street, westbound LSB is widened to four-lanes, increasing the capacity to approximately 4,000 vehicles per hour.

The assessment for westbound travel is summarized in **Table 4.5**. It is noted that the highest westbound volumes at this location are expected to occur during the p.m. peak hour.

**TABLE 4.5  
PM PEAK HOUR TRAVEL DEMAND AND CAPACITY  
WESTBOUND TRAFFIC – OUTBOUND FROM CENTRAL AREA**

PROJECTED WESTBOUND DEMAND (vehicles per hour)		AVAILABLE WESTBOUND CAPACITY (vehicles per hour)	
<b>TOTAL WB DEMAND</b>	<b>8,800</b>	Front Street Extension	2,600
		Lake Shore Boulevard	3,600
		York On-Ramp	2,000
		Spadina On-Ramp (via Bremner)	1,800
		<b>TOTAL WB CAPACITY</b>	<b>8,800</b>
		<b>TOTAL V/C RATIO</b>	<b>1.00</b>

The following points are noted from the table:

- The two-lane westbound York Street on-ramp is expected to be able to accommodate approximately 2,000 vehicles per hour. The capacity of this ramp is limited by the signals at York Street since there will be no westbound traffic on the Gardiner east of this ramp. York Street will still accommodate significant northbound volumes from the York/Bay/Yonge off-ramp;
- Westbound LSB, west of Simcoe can accommodate approximately 3,600 vehicles through the critical section;





- The York on-ramp and westbound LSB account for approximately 5,600 of the total 6,200 westbound vehicles; and
- The remaining 600 westbound vehicles can be accommodated on the widened Spadina on-ramp via Bremner Boulevard and the freeflow southbound right turn at Rees Street.

### East Screenline

The improvements to the DVP/Richmond interchange will attract more traffic so that traffic using the Gardiner/LSB to and from the east via the Don Valley Parkway will be reduced. Based on the Paramics simulation, peak inbound trips during the a.m. peak hour are expected to be reduced by approximately 800 trips and peak outbound trips during the p.m. peak hour are expected to be reduced by approximately 200 trips.

### Westbound Travel

Traffic travelling westbound on the Gardiner, west of the DVP will be forced to exit at either the two-lane Yonge Street off-ramp or at the Sherbourne off-ramp. Traffic will also have the option of using Lake Shore, which currently operates below capacity during the a.m. and p.m. peak hours. A comparison of a.m. peak hour travel demand and capacity from the east (westbound traffic) is summarized in **Table 4.6**. It is noted that the highest westbound volumes at this location are expected to occur during the a.m. peak hour.

**TABLE 4.6  
AM PEAK HOUR TRAVEL DEMAND AND CAPACITY  
WESTBOUND TRAFFIC – WEST OF DON ROADWAY**

PROJECTED WESTBOUND DEMAND (vehicles per hour)		AVAILABLE WESTBOUND CAPACITY (vehicles per hour)	
From DVP Southbound (reduced by 800)	1,350	Yonge Off-Ramp (two-lane)	1,400
Gardiner Expressway	2,000	Sherbourne Off-Ramp	1,200
Lake Shore Boulevard	850	Lake Shore Boulevard	2,700
<b>TOTAL WB DEMAND</b>	<b>4,200</b>	<b>TOTAL WB CAPACITY</b>	<b>5,300</b>
		<b>TOTAL V/C RATIO</b>	<b>0.79</b>

The table shows that there is expected to be sufficient capacity to accommodate traffic from the east. The volume-to-capacity ratio for this eastbound section is approximately 0.79 which equates to a Level of Service (LOS) of ‘C’.



### ***Eastbound Travel***

In the eastbound direction, traffic will access EB FGE via the temporarily widened Jarvis on-ramp. The assessment is summarized as follows:

- Based on the results of the Paramics simulation, the total existing eastbound demand of 4,400 vehicles is reduced by 200 as a result of trips using the DVP/Richmond interchange;
- A two-lane on-ramp with a freeflow speed of 50 to 65 km/h can accommodate approximately 3,800 vehicles per hour (HCM 2000). The capacity of this ramp will likely be controlled by the signals at Jarvis Street; however, a significant portion of the cycle can be dedicated to the east-west movements since north-south volumes are not expected to require much time. Recognizing that the ramp will be metered by the signals at Jarvis, the capacity of the widened Jarvis on-ramp is expected to be approximately 2,400 vehicles per hour;
- Lake Shore Boulevard is three lanes wide in this section with a per lane capacity of approximately 900 vehicles per hour. The total capacity on LSB in this section is 2,700 vehicles per hour;
- Therefore, the total eastbound demand of approximately 4,200 vehicles per hour can be accommodated via the Jarvis on-ramp (2,400 vehicles per hour) and Lake Shore Boulevard (2,700 vehicles per hour), which have a combined capacity of approximately 5,100 vehicles in this area; and
- The a.m. peak hour volume-to-capacity ratio for this eastbound section is approximately 0.82 which equates to a Level of Service (LOS) of 'D'.

#### **4.4.3 Stage 1C and 1D**

In Stages 1C and 1D, the structure is closed at the Spadina ramps and removed to west of Rees Street. This results in the closure and removal of the following ramps:

- The westbound FGE on-ramp at York Street; and
- The Yonge Street portion of the eastbound FGE York/Bay/Yonge off-ramp.

The road network between Simcoe and Jarvis is constructed to the ultimate cross-section where possible, with a minimum of four lanes per direction for eastbound and westbound travel.

### **West Screenline**



***Eastbound Travel***

The updated assessment for eastbound travel across the west screenline is summarized in **Table 4.7**. It is noted that the highest eastbound volumes at this location are expected to occur during the a.m. peak hour.

**TABLE 4.7  
AM PEAK HOUR TRAVEL DEMAND AND CAPACITY  
EASTBOUND TRAFFIC - AT SPADINA OFF-RAMP**

PROJECTED EASTBOUND DEMAND (vehicles per hour)		AVAILABLE EASTBOUND CAPACITY (vehicles per hour)	
Lake Shore Boulevard	2,000	Lake Shore Boulevard	3,600
Gardiner Expressway	4,000	Spadina Northbound	2,000
		York/Bay Off-Ramp	1,000
<b>TOTAL EB DEMAND</b>	<b>6,000</b>	<b>TOTAL EB CAPACITY</b>	<b>6,600</b>
		<b>TOTAL V/C RATIO</b>	<b>0.91</b>

The closure and removal of the Yonge section of the York/Bay/Yonge off-ramp is expected to temporarily decrease eastbound capacity. However once this is removed, LSB eastbound can be widened to provide a dedicated eastbound lane for traffic from the York/Bay ramp destined to Bay Street or eastbound LSB. Eastbound traffic operations through the critical section of LSB are expected to be acceptable based on the fact that the capacity of the temporary road network across the critical section is expected to exceed the volume of traffic delivered by the upstream road network. The volume-to-capacity ratio for this eastbound section is approximately 0.91 which equates to a Level of Service (LOS) of 'E';

***Westbound Travel***

It is recommended that as part of Stage 1B, approximately four Gardiner piers are temporarily replaced and the existing piers removed to allow WB LSB to be expanded to a four-lane cross-section between Simcoe and Rees Streets. This should be completed before the WB on-ramp at York Street is closed. This will provide a significant capacity increase through the critical westbound section.

Once the westbound York Street on-ramp is closed, the critical section of WB LSB, still located beneath the structure, is limited to a capacity of approximately 3,600 vehicles per hour until the structure is removed to west of Rees Street at the end of Stage 1C. This capacity can be increased to approximately 4,800 vehicles per hour by adding another LSB lane as a result of relocating some existing Gardiner piers, as noted above. The York on-ramp was accommodating approximately 2,000 vehicles per hour in Stages 1A and 1B. These trips will be



forced to utilize LSB through the critical section as well as other parallel routes including Bremner Boulevard, Queens Quay and Front Street in order to access LSB and the FGE westbound.

### East Screenline

There are no significant changes east of Jarvis included for Stages 1C and 1D.

## 4.5 Stage 2 – Transition Section

Stage 2 – Transition Section involves construction of the new transition ramps to connect the elevated Gardiner Expressway located west of Spadina to the at-grade road network east of Spadina. This stage also involves closure and removal of the westbound Lake Shore Boulevard structure over Spadina. The key steps from a traffic operations perspective are described below.

### 4.5.1 Stages 2A and 2B

The following road network components are in place at the beginning of Stages 2A and 2B (refer to drawings contained in the Appendix):

- Eastbound LSB with a 4 to 5 lane cross-section from west of Simcoe Street to west of Bay Street and with the ultimate 5-lane cross-section from west of Bay Street to Jarvis Street; and
- Westbound LSB with the ultimate 5-lane cross-section from Jarvis Street to Simcoe Street. West of Simcoe Street, westbound LSB has a four-lane cross-section which operates primarily under freeflow conditions with the operational improvements between Simcoe and Spadina, discussed in Section 3.4.2, still in place

### West Screenline

#### *Eastbound Travel*

The EB York/Bay off-ramp is closed and removed during these stages. All eastbound traffic is forced to exit via the widened Spadina off-ramp with free flow (no traffic signal) movement to NB Spadina and to EB LSB. A comparison of eastbound a.m. peak hour travel demand and capacity at the improved Spadina off-ramp is summarized in **Table 4.8**. It is noted that the highest eastbound volumes at this location are expected to occur during the a.m. peak hour.



**TABLE 4.8  
AM PEAK HOUR TRAVEL DEMAND AND CAPACITY  
EASTBOUND TRAFFIC - AT SPADINA OFF-RAMP**

PROJECTED EASTBOUND DEMAND (vehicles per hour)		AVAILABLE EASTBOUND CAPACITY (vehicles per hour)	
Lake Shore Boulevard	2,000	Lake Shore Boulevard	3,600
Gardiner Expressway	4,000	Spadina Northbound	2,000
<b>TOTAL EB DEMAND</b>	<b>6,000</b>	<b>TOTAL EB CAPACITY</b>	<b>5,600</b>
		<b>TOTAL V/C RATIO</b>	<b>1.07</b>

Until the FGE structure can be removed from over the EB LSB lanes, between the Spadina ramps and west of Rees Street, only 93 percent of the eastbound demand is expected to be accommodated. The FSE and parallel roads such as Queens Quay and Bremner Boulevard will accommodate some of the excess demand. It is recommended that demolition of the structure be focused on providing additional capacity for EB LSB between the Spadina ramps and Rees Street as quickly as possible.

***Westbound Travel***

Westbound traffic operations during Stages 2A and 2B are expected to be acceptable. With the York on-ramp removed, westbound traffic operates on a four-lane cross-section operating under free flow conditions from west of Simcoe Street to the widened Spadina on-ramp. Based on the Paramics micro-simulation, the westbound peak hour volume is expected to be approximately 4,500 vehicles. This volume can be accommodated on the four-lane cross-section as a result of the operational simplifications to the Rees Street, Simcoe Street and Spadina Avenue intersections, discussed in section 4.4.2.

**East Screenline**

There are no significant changes east of Jarvis included for Stages 2A and 2B.

**4.5.2 Stages 2C and 2D**

At the end of Stage 2B, the new transition ramp for eastbound and westbound traffic connecting from the elevated Gardiner west of Spadina to the at-grade LSB east of Spadina is in place. Eastbound and westbound traffic utilize the new transition ramp. The temporarily widened eastbound Spadina off-ramp and the westbound grade separation over Spadina can then be closed and removed. While the WB LSB structure over Spadina is being removed, WB LSB traffic must use



the new WB transition ramp over Spadina, to access a temporary two-lane ramp connection to WB LSB located just west of Spadina. New WB LSB surface lanes are constructed to provide a signalized LSB/Spadina intersection. The surface road network between Spadina and Jarvis is no longer constrained by the Gardiner elevated structure which has been removed during the previous stages.

### ***Eastbound and Westbound Travel***

Eastbound traffic on the FGE merges with eastbound traffic on the LSB at a location east of Spadina on the ultimate 5-lane cross-section. North-south movements can be reinstated at the LSB at Spadina intersection, since the Gardiner traffic no longer has access to or from Spadina. North-south traffic at the Rees Street intersection will likely have to remain limited to right-in/right-out only in order to accommodate westbound traffic flows which are still constrained to a four-lane cross-section until the WB LSB structure over Spadina is removed. Eastbound and westbound left turns at Simcoe will likely also have to remain prohibited in order to accommodate westbound traffic. Vehicles destined to the downtown core from the west via the Gardiner will either utilize the FSE or can access York, Bay or Yonge northbound from the new at-grade GLC.

There are no significant changes east of Jarvis included for Stages 2C and 2D.

## **4.6 Stage 3 – Eastern Section**

Stage 3 – Eastern Section involves closing and removing the Gardiner from east of Jarvis, including new relocated DVP ramps. The staging of the DVP ramp relocation poses the most significant challenge from a traffic operations perspective.

The following components must be in place at the beginning of Stage 3A:

- New LSB alignment between Cherry Street and Don Roadway;
- Queens Quay Extension with a temporary connection to the existing LSB alignment east of Cherry;
- Pre-build of as much of the new DVP ramps as possible without impacting the existing N-W DVP ramp; and
- Pre-built temporary intersection to connect the new LSB alignment to the old LSB alignment, just west of the Don Roadway.

As with Stages 1 and 2, there are several steps required in order to close and remove this section of the Gardiner. The key steps and the associated impact on traffic operations are described below.



#### 4.6.1 Stage 3A

With the preparatory construction in place, the existing N-W DVP to Gardiner ramp is closed and N-W DVP-Gardiner traffic is shifted to operate two-way on the existing W-N Gardiner to DVP ramp. This ramp was widened during the last round of rehabilitation so it can accommodate two lanes with a centre barrier. This will allow for construction of the new W-N DVP to LSB ramp.

With the DVP/Richmond interchange improvements in place, the peak hourly DVP ramp volumes are expected to be approximately 1,350 inbound vehicles during the a.m. peak hour and 1,800 outbound vehicles during the p.m. peak hour. These reflect peak hour rerouting of approximately 800 and 200 vehicles per hour based on the results of the Paramics micro-simulation for the GSA - Variation 1 option.

The capacity of a single lane ramp with a freeflow speed of 50 to 65 km/h is approximately 2,000 vehicles per hour (HCM 2000). This equates to volume-to-capacity ratios of 0.68 and 0.90 for the inbound and outbound trips on the two-way ramp respectively. It is noted that some delays may result from merging traffic from two lanes to a single lane on the ramp.

Inbound traffic on the Gardiner will still be able to exit via the single lane off-ramp at Sherbourne or the two-lane off-ramp at Yonge Street. Outbound traffic to the Gardiner will continue to use the two-lane on-ramp at Jarvis.

Traffic operations are not expected to significantly change for the portion of the Gardiner Expressway located east of the Don Roadway or for LSB in this area. Both facilities can remain open during Stage 3A with no significant changes to their existing configurations.

#### 4.6.2 Stage 3B

In Stage 3B the remainder of the Gardiner expressway is removed from east of Jarvis to east of Don Roadway. Two-way Gardiner to DVP traffic is shifted from the existing W-N Gardiner to DVP ramp to the new N-W DVP to LSB ramp. This ramp is connected to the new alignment of LSB between Cherry and Don Roadway. Travel demand and capacity for two-way traffic operating on the new N-W DVP to LSB ramp is expected to be the same as the situation in Stage 3A.

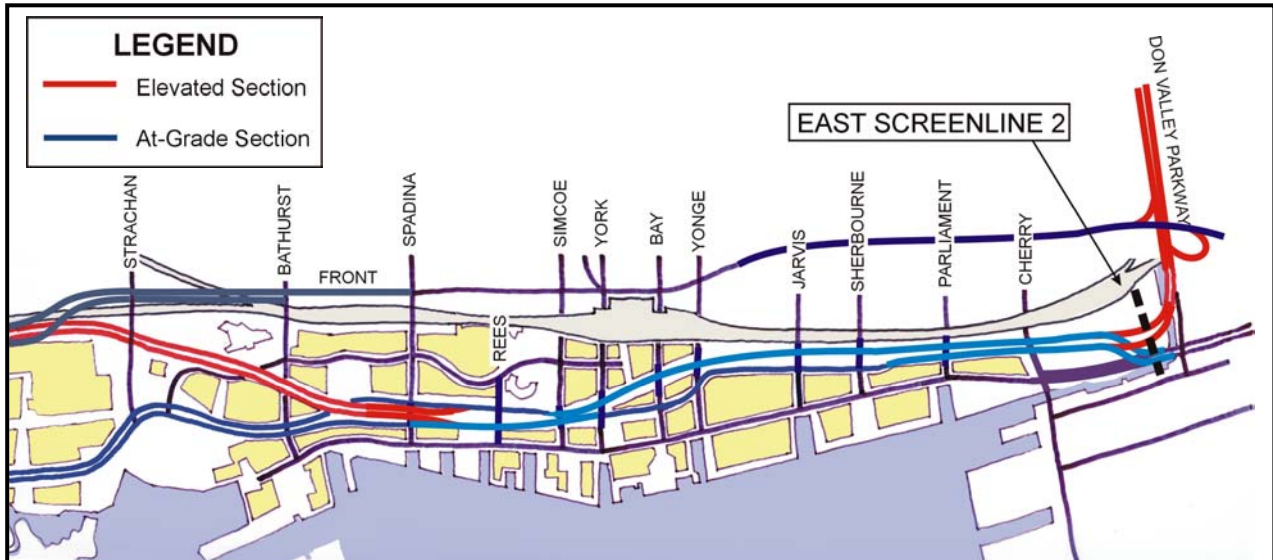
The new LSB alignment will be connected to the existing LSB alignment at Cherry Street. Traffic to and from the east on the existing LSB alignment will use



the temporary connection to the Queens Quay Extension. Connection to both the LSB alignment and the Queens Quay Extension to the east will temporarily increase the capacity in this area until the FGE structure is removed and LSB widened.

The eastbound and westbound travel demand and capacity associated with Stage 3B was assessed across east screenline 2, located at a point between the connection of the DVP ramps to the Gardiner and Don Roadway. East screenline 2 is shown in **Figure 4.4**.





**FIGURE 4.4 – LOCATION OF EAST SCREENLINE 2**

**Table 4.9** summarizes the comparison of eastbound travel demand and capacity across East Screenline 2 during Stage 3C. It is noted that the highest eastbound volumes are expected to occur during the p.m. peak hour.

**TABLE 4.9  
PM PEAK HOUR TRAVEL DEMAND AND CAPACITY  
EASTBOUND TRAFFIC – EAST SCREENLINE 2**

PROJECTED EASTBOUND DEMAND (vehicles per hour)		AVAILABLE EASTBOUND CAPACITY (vehicles per hour)	
Lake Shore Boulevard	2,700	Lake Shore Boulevard to DVP Ramp	2,000
Queens Quay Extension	1,650	Lake Shore Boulevard	2,700
<b>TOTAL EB DEMAND</b>	<b>4,350</b>	<b>TOTAL EB CAPACITY</b>	<b>4,700</b>
		<b>TOTAL V/C RATIO</b>	<b>0.93</b>

The table shows that there is expected to be sufficient capacity to accommodate eastbound travel demands during the peak hours. The peak volume-to-capacity ratio is expected to be 0.93, which equates to a LOS of ‘E’.

**Table 4.10** summarizes the comparison of westbound travel demand and capacity across east screenline 2 during Stage 3C. It is noted that the highest westbound volumes are expected to occur during the a.m. peak hour.



**TABLE 4.10**  
**A.M. PEAK HOUR TRAVEL DEMAND AND CAPACITY**  
**WESTBOUND TRAFFIC – WEST OF EAST SCREENLINE 2**

<b>PROJECTED WESTBOUND DEMAND (vehicles per hour)</b>		<b>AVAILABLE WESTBOUND CAPACITY (vehicles per hour)</b>	
Lake Shore Boulevard	2,800	Lake Shore Boulevard	2,700
DVP to LSB Ramp	1,350	DVP to LSB Ramp	2,000
<b>TOTAL EB DEMAND</b>	<b>4,150</b>	<b>TOTAL EB CAPACITY</b>	<b>4,700</b>
		<b>TOTAL V/C RATIO</b>	<b>0.88</b>

The table shows that there is expected to be sufficient capacity to accommodate the total peak westbound travel demands during the peak hours. The peak volume-to-capacity ratio is expected to be 0.88, which equates to a LOS of 'D'. It is noted that not all of the traffic currently travelling westbound on the Gardiner from east of Don Roadway will be able to use westbound Lake Shore Boulevard during the a.m. peak hour. The cross-section of westbound LSB, east of Sherbourne, is constrained to a three-lane cross-section until the Gardiner structure above is removed. The capacity for this section is expected to be approximately 2,700 vehicles per hour and the travel demand is approximately 2,800 vehicles per hour. In order to address this temporary capacity deficiency, a temporary at-grade intersection can be built to connect the new LSB alignment to the existing LSB alignment underneath the DVP ramps. This intersection would allow vehicles traveling to and from the east to use either the new LSB alignment or the Queens Quay Extension and the existing LSB alignment.

#### 4.6.3 Stage 3C

In Stage 3C, the Gardiner structure is completely removed and the ultimate surface road network is completed. Traffic operations will improve with two-lane DVP ramps and a ten-lane or possibly eight-lane LSB (east of Jarvis) in place.



## 5.0 CONCLUSIONS AND RECOMMENDATIONS

The following points are concluded from this report:

### Construction Staging Plan

- The proposed plan will be built in four stages:
  - 1) Preparatory Construction - Road network improvements which need to be in place before the construction of the GSA- Variation 1 can begin.
  - 2) Stage 1 – Central Section – Remove the central Gardiner structure, from just west of Rees Street to Jarvis Street.
  - 3) Stage 2 – Transition Section – Build the new transition ramps, which connect the elevated section of the Gardiner west of Spadina to the surface road network east of Spadina.
  - 4) Stage 3 – Eastern Section – Remove the east section of the Gardiner and build the new connections to the Don Valley Parkway.

There are several steps involved in each of these stages.

- In order to shorten the duration of construction, some aspects of Stage 2 and Stage 3 could be completed simultaneously. However, the work associated with the DVP connections to the Gardiner and the new GLC corridor is too large to be combined with other sections. Therefore this work should be kept as a final stage, following the rest of the Stage 3 work.

### Construction Duration and Cost Estimate

The project will cost an estimated \$444.5M and can be constructed over a seven year duration after the advanced components are in place.

- Stage 1 is expected to take 2 years to complete at an estimated cost of approximately \$100M or \$50M per year;
- Stage 2 is expected to take 2 years to complete at an estimated cost of approximately \$158M or \$79M per year;
- Stage 3 is expected to take 3 years to complete at an estimated cost of approximately \$186M or \$62.3M per year;
- These costs do not include the Front Street Extension and the Queens Quay Extension, both of which must be in place before this program is started. The costs for the DVP at Richmond interchange improvements are included by the construction time is part of Preparatory Construction stage; and



- The removal of the Gardiner Structure will be primarily carried out over live traffic. This is common practice but will require protection and careful planning. Safety aspects of the removal process can be controlled in the specifications when the tenders are issued.

### **Assessment of Traffic Operations during Disruption**

- Travel demand and capacity (volume-to-capacity) has been assessed across screenlines strategically located for existing conditions, preparatory construction and during each stage of construction;
- Existing traffic volumes are at capacity to and from the west during peak periods. There is some excess capacity in the off-peak directions. There is also excess capacity for travel to and from the east;
- In the Preparatory Construction stage, additional capacity is provided by the Front Street Extension (FSE), improvements to the DVP/Richmond interchange, and the Queens Quay Extension plus other minor improvements. Once completed the FSE and DVP/Richmond improvements are expected to divert a significant number of vehicle trips from the Gardiner-Lake Shore Corridor (GLC);
- As construction proceeds over the projected 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 the Gardiner WB on and EB off-ramps at Spadina and widening the Gardiner EB on-ramp at Jarvis Street;
- Operational simplifications along the GLC are also recommended in order to increase through movement capacity. Simplifications include temporarily prohibiting north-south traffic on Spadina at Lake Shore and limiting Rees Street to right-in/right-out access only;
- It is expected that the road network during construction can accommodate approximately 80 to 90 percent of existing traffic volumes to and from the west during the critical Stage 2A and 2B period. 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; and
- Any road closures would be scheduled to occur during off-peak times.



The following actions are recommended:

1. The FSE, DVP/Richmond improvements, the Queens Quay Extension and other Preparatory Construction must be in place before construction of this option can begin;
2. It is noted that if the EA process selects this option as the "preferred" option, a more detailed traffic assessment should be undertaken using the Paramics simulation software. The cost and level of effort associated with such an analysis is not justifiable at this stage of the planning process; and
3. The construction staging plan outlined in this report should be used to inform future work, as a basis for policy related decision-making and for the scoping of future technical studies.

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