F.G. Gardiner Expressway
Strategic Rehabilitation Plan

Michael D’Andrea, P.Eng.
Executive Director, Engineering & Construction Services

Stephen Buckley
General Manager, Transportation Services

Public Works & Infrastructure Committee
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Presentation Outline

• Background
• Condition Assessment
• Conventional Rehabilitation
• Accelerated Rehabilitation Plan
• Traffic Congestion Assessment
• Scheduling and Financial Implications
• Recommendations
Background
• Provided an overview of the planned rehabilitation works for the F.G. Gardiner Expressway

• Recommended a revised rehabilitation plan – starting with West Deck – given resumption of the F.G. Gardiner East EA

• Recommended corresponding cash flow adjustments to address rehabilitation needs in Transportation Services’ 2013 to 2022 Capital Budget and Plan:
  – 2013 to 2022 total (10 year) cash flow of $495 million;
  – 2013 to 2025 total (13 year) cash flow of $663 million
City Council (May 7, 2013):

- Approved revised rehabilitation plan and associated revisions to capital budget cash flows recommended in staff report to PWI.

- Requested General Manager, Transportation Services and Executive Director, Engineering & Construction Services to incorporate options to accelerate phasing of the F.G. Gardiner Expressway rehabilitation in a report to PWI in early 2014 on the F.G. Gardiner Expressway Strategic Rehabilitation Plan.
Strategic Rehabilitation Plan Considerations:

- Study area: Highway 427 to Logan Avenue (DVP)
- Recent condition assessments and prioritization of works based on public safety and needs
- Consideration given to recently completed studies
- Identify: immediate, short term and longer term rehabilitation needs
Condition Assessment
“Anatomy” of the F.G. Gardiner Expressway:

• At Grade Section: Hwy. 427 to Dufferin Street (1955 to 1958)

• Elevated Section: Dufferin Street to Logan Avenue (1959 to 1966)
“Anatomy” of the F.G. Gardiner Expressway:

- 3 types of structures support steel reinforced concrete deck shown with % of total length of “elevated” section:

  a) Concrete T-Beam (5%)
  b) Steel Girder (80%)
  c) Concrete Box Girder (15%)
Cross Section of Steel Girder Span: Along “Bent”

F.G. Gardiner Expressway

Lake Shore Boulevard
Construction of Steel Girder Sections

Bents
Construction of Steel Girder Sections
Construction of Steel Girder Sections
Construction of Steel Girder Sections

Barriers
Construction of Steel Girder Sections
Condition Assessment
Investigations of Elevated Sections:

• 2012 Detailed Deck Condition Survey
• 2012 Falling Concrete Independent Assessment (IBI)
• 2012 Ontario Bridge Inspections (OSIM)
• 2012 Ground Penetrating Radar Survey
• 2003/2013 Steel Girder Inspection (Jarvis-DVP)
• 2009 Precast Box Girders (York-Jarvis)
• 2004 Detailed Deck Condition Survey (Jarvis-DVP)
• Other inspections including hammer soundings & visual inspections
Area of Condition Assessment

**Condition Assessment**

- Deck & Barriers
- Girders

**Section Type**

- Concrete T-Beam
- Steel Girder
- Concrete Box Girder

- Bents (substructure) - some require extensive work
- Bearings – good to poor
- Drainage System – functional issues
Survey/Investigations of At-Grade Section

- 2013 visual inspection of the 32 at-grade structures
- 2013 structural evaluations of the 10 bridges over the main-line, in accordance with the Canadian Highway Bridge Design Code (CHBDC)
- 2013 visual inspection of the pavement, including ramps
- 2013 visual inspection of the existing roadside safety measures
- 2013 assessment of the at-grade drainage
- 2001 pavement design report F.G. Gardiner Expressway, Highway 427 to Dowling Ave.
At-Grade Section Structures Key Plan

[Diagram of roadway and structures with annotations]

LEGEND
- RED: OVERPASS
- BLUE: RAMP
- GREEN: UNDERPASS
- PURPLE: PEDESTRIAN

- N & S RAMP OVER THE EAST MALL
- 423 - N & S W RAMP OVER MIMICO CREEK
- WB OFF-RAMP TO LAKESHORE WB OVER HUMBER RIVER
- LAKESHORE WB OVER HUMBER RIVER
- WB ON-RAMP FROM LAKESHORE WB OVER HUMBER RIVER
- WB OFF-RAMP TO S. KINGSWAY (UNDER CNR)
- SOUTH KINGSWAY
- WINDERMERE AVE
- ELLIS AVE
- COLBORNE
- LODGE DR
- PARKSIDE DR
- DOWLING AVE
- JAMESON AVE
- DUFFERIN ST
- KING ST W

- 175 - SUNNYSIDE PEDESTRIAN BRIDGE
- 29 & 30 - EBL & WBL OVER HUMBER RIVER
- 425 - EB OFF-RAMP TO LAKESHORE OVER WB OFF-RAMP TO LAKESHORE
- 424 - EB OFF-RAMP OVER MIMICO CREEK
Condition Assessment: At-Grade Section

- Overpass and Underpass Concrete Repairs
- Pavement Reconstruction
- Roadside Safety Improvements
- Storm sewer reconstruction
- Complete High Mast Lighting Illumination program
- Incorporate recommendations from completed Environmental Assessments:
  i) Kipling Avenue to Park Lawn Road widening (2012)
  ii) Interchange reconfigurations at Kipling Avenue and Islington Avenue (2012)
  iii) York/Bay/Yonge ramp reconfigurations (2013)
Conventional Rehabilitation
Conventional Reconstruction Approach
Conventional Construction Conclusions

Advantages
- Low capital construction cost;
- The scope of work is well understood by local contractors;
- Flexibility to address unforeseen conditions.

Disadvantages
- Excessive noise, dust, vibrations;
- Long construction duration increasing user impact costs;
- Weather dependent;
- Risk of damaging girders during saw-cutting and chipping;
Accelerated Rehabilitation Plan
Accelerated Reconstruction Approach
Accelerated Reconstruction Approach
Accelerated Reconstruction Approach
Accelerated Reconstruction Approach

Typical duration for 2 lane reconstruction (8 metres X 400 metres): 2 months ie. 6 months for entire section*

Note: * - represents a reduction in time by about 40% over conventional reconstruction
Accelerated Reconstruction Approach

Montreal: Jacques Cartier Bridge Rehabilitation

Prefabrication Facility

Placement of Prefabricated Deck-Girder Section
Accelerated Reconstruction Approach

Massachusetts: I-93
Accelerated Construction Conclusions

**Advantages**
- Less weather dependent.
- Mitigates noise, dust, vibrations
- Highest quality end product due to prefabrication in controlled environment
- Traffic delays and public disruption on the Expressway is minimized by reducing the duration of lane closures thereby lowering the user cost

**Disadvantages**
- Unforeseen risks inherent with unconventional methods exist.
- Capital cost premium
Traffic Congestion Assessment
Traffic Impact Analysis

• 30 minute queue delay assumes diversion rates of up to 45% in some areas

• There is not enough spare capacity on parallel routes to accommodate diverted Gardiner traffic

• 30% diversion requires a very aggressive public education strategy

• 40% diversion is extremely difficult to achieve, requiring a significant diversion to other modes of travel
Assumptions Used to Develop User Impact Costs

- One lane closure in each direction
- 24 hour profile developed based on peak hour traffic
- QUEWZ queuing methodology used
- 30 minute average delay for both Gardiner and diverted traffic
- Average delay and queued traffic calculated for each hour of the day
- Average value of time for the commuter of $20/hr
Mainline traffic impacts

Traffic Impacts – Location and Duration
Scheduling and Financial Implications
Summary of Total Costs (Capital & User Impact): Conventional versus Accelerated Construction

<table>
<thead>
<tr>
<th></th>
<th>Conventional</th>
<th>Accelerated</th>
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<tbody>
<tr>
<td>Capital Costs</td>
<td>1.21</td>
<td>1.31</td>
</tr>
<tr>
<td>User Impact Costs</td>
<td>7.40</td>
<td>4.50</td>
</tr>
<tr>
<td>Total Cost</td>
<td>8.61</td>
<td>5.81</td>
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</tbody>
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Note: All costs are in billions of dollars.
Cumulative Total Costs of Construction Options and Transportation Services’ Capital Budget/Plan
Recommendations
Recommendations

- Approve the accelerated approach for the rehabilitation of the F.G. Gardiner Expressway:

The Alternative (Accelerated) construction method

- Mitigates noise, dust, vibrations
- Less weather dependent
- Reduces interim repairs required
- Significantly reduces the user impact costs
- Provides time to work on adjacent roads
- Highest quality end product due to prefabrication in controlled environment
- Longer service life (new girders, higher quality deck)
- Reduces interim repairs required

Significantly reduces the user impact costs

Longer service life (new girders, higher quality deck)
Recommendations

• Report back through Transportation Services’ 2015 Capital Budget and 2016 to 2024 Capital Plan on:
  o procurement approach & project delivery schedule
  o multi-year cash flow requirements & financing strategy

• Update the Strategic Plan in the event that City Council opts for either the remove, replace or improve options in the Gardiner East EA

• Proceed with the conventional construction approach for the West Deck (Exhibition Place to west of Bathurst Street) given that “at-grade” construction activity is planned for the 2014; and the estimated 3 year lead time to begin construction if the accelerated approach is approved