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EVALUATION OF ALTERNATE MEANS (ROUTES) FOR CARRYING OUT THE PROPOSED 407 EAST TRANSPORTATION CORRIDOR

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EXECUTIVE SUMMARY

The 407 East Transportation Corridor study completed by the Ontario Ministry of Transportation (MTO) in early 2010 identified a Preferred Alternative consisting of transportation demand management, transportation system management, enhanced transit, previously planned road network improvements and a new 70 km limited access freeway extension. Transport Action Ontario (TAO) has long felt that there is poor justification for the eastern parts of the freeway, which are almost entirely in the Greenbelt. TAO has felt that this portion of the freeway could readily be replaced with improved regional roads in existing corridors.

In August, 2010, TAO received participant funding to participate in the ongoing federal comprehensive environmental assessment. The approved work plan is to use travel demand modeling to identify alternative means of carrying out the project, i.e. alternative locations, routes, construction methods, etc.

The modeling used EMME/3 and a GTHA data set provided by MTO. This is the same model and data used by MTO for the updated modeling in the EA Report. No changes were made to the MTO model or assumptions other than road and freeway network.

The model was validated by comparing output with actual 2006 vehicle movements and with 2031 predicted movements generated by MTO for their report.

Nine alternatives corridor scenarios were evaluated using this updated model. These were MTO's Preferred Alternative (never evaluated using updated model), four other alternatives identified by MTO (never evaluated using updated model), the Phase I Build scenario (Mainline to Simcoe + West Link) and three alternatives involving the Phase I Build + widened regional roads to the east.

TAO confirmed that, using the updated model and MTO's assumptions, a freeway corridor of some type is needed in the western portion of the study area to satisfy demand. However, there are numerous viable scenarios where less freeway is built and acceptable traffic flow is maintained. In particular, scenarios that eliminated the East Link or the easterly part of the Mainline were acceptable. Based on these results, TAO recommends that CEAA approve only that portion of the project under the Phase I Build, thereby avoiding the significant environmental issues and costs associated with building the balance of the freeway, which is largely in the greenbelt. These remaining lands, if left alone, can remain in viable agricultural use unless future needs change.
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1 Background

The 407 East Transportation Corridor study was initiated by the Ontario Ministry of Transportation (MTO) in 2005. The Environmental Assessment was approved by the Ontario Minister of the Environment in June, 2010. A screening level federal Environmental Assessment relating to the portion of the corridor which crossed water and federal lands was completed in January, 2010. The Preferred Alternative identified in these studies consisted of transportation demand management, transportation system management, enhanced transit, previously planned road network improvements, and (most importantly) a new limited access freeway extension.

The proposed freeway extension consists of about 50 km of East-West mainline running from the current eastern end of the 407 Freeway in Pickering to a junction with Highway 35/115 and two North-South links running between the 407 and the 401 Freeways, each about 10 km long. The lane requirements (2031) are between 6 and 10 lanes. The project involves 19 interchanges, 32 over/under passes and 85 water crossings. The project also includes two highway maintenance facilities, two commercial vehicle inspection stations and three truck lay-bys. A transitway right of way, including land for stations and maintenance facilities, is being protected, but is not part of the early construction plan. About two thirds of the route is within Greenbelt lands. The cost of building the extension is over $8 Billion (Peterborough Examiner, Nov 12, 2010). The freeway extension will be a tolled highway.

Transport Action Ontario (TAO), together with SHIFT (Stop Highways, Invest in Feet and Transit, an alliance of environmental organizations), has been concerned about this project since 2008. The concerns have largely related to the poor justification for the eastern parts of the freeway, which are almost entirely within the Greenbelt and therefore will never be redeveloped to an urban form. We recommended that this portion of the freeway could readily be replaced with improved regional roads in existing corridors.

In February, 2009, SHIFT wrote to Ministry of Transportation (MTO) questioning the validity of the travel demand modeling and alternatives evaluation. In response, MTO updated their modeling but still concluded that the full freeway project was needed. A face-to-face meeting was held in July, 2009. We agreed that the updated model appeared to be acceptable, but expressed concern that there were a number of viable alternative means of carrying out the project that had not been evaluated. These involved expansion of existing regional road corridors in the eastern part of the study area.

In October, 2009, SHIFT commented extensively on the EA report, noting, among other things, that there was inadequate documentation of the results of the updated modeling, and also providing more detail on various alternatives that were inadequately explored.

The same points were made in our letter of January, 2010, where three specific viable alternative corridor routes were identified that had not been evaluated. We also expressed our disappointment that the MOE did not acknowledge our concerns with inadequate model documentation. We also suggested various conditions that the Minister should impose on the project.

As mentioned above, the Ontario Minister of the Environment issued a Notice of Approval to Proceed with the Undertaking, which was approved by the Lieutenant Governor on June 2, 2010.
On June 11, 2010, the MTO announced that the first phase of construction would be from the current terminus of the 407 at Brock Rd, Pickering to Simcoe St in Oshawa including the West Link. Requests for Qualifications were issued by Infrastructure Ontario to prequalify project teams for this work.

2 Canadian Environment Assessment Agency (CEAA) and Participant Funding

In May, 2010, CEAA determined that, as a result of the Red Chris Mine decision by the Supreme Court of Canada, the federal EA responsibility was in relation to the entire highway proposal. As a result, a Comprehensive EA was required for the 407 East Transportation Corridor. As part of the Comprehensive EA process, participant funding is available to groups or individuals who wish to participate in the federal EA.

TAO applied for participant funding and received an award in August, 2010. The approved work plan was (in italics, taken from the final signed Contribution Agreement):

The Recipient's overall objectives are to:
Our objective is first to properly document the various alternatives evaluated by MTO using the updated model. Second, and more important, we would evaluate and properly document the new alternatives identified in our earlier submissions.

To reach its objectives, the Recipient will undertake the following participation and consultation activities associated with the environmental assessment process of the Project:
We believe these alternatives (see above) are technically and economically feasible. The evaluation would use the same travel demand model and transportation consultant (to be confirmed) used by MTO in the EA. The evaluation would confirm the travel demands, determine impacts on local communities such as Brooklin and Columbus, and evaluate the environmental effects of these alternative means.

Based on the amount of funding available, the FRC (Funding Review Committee) recommends that $8500 be awarded to Transport Action Ontario in professional fees to assist the applicant in reviewing the draft comprehensive study report and supporting EA material and to assist the applicant in providing comments relating to alternative means in carrying out the project.

As the funds awarded were less than what TAO had applied for, only the higher priority activities were undertaken (evaluation of travel demand and capacity in alternative cases).

These modeling results will form input into the Comprehensive EA as an "alternate means of carrying out the project". Per guidance from CEAA, "'Alternative means' are the various technically and economically feasible ways the project can be implemented or carried out. This could include, for example, alternative locations, routes, methods of development, implementation and mitigation". Further clarification was provided by email from Jim Chan (CEAA) on July 30, 2010: "alternative means" may include an examination of other routes, alternative construction methods, different bridge designs, different materials, the use of sound barriers, mitigation measures.
The "DRAFT Comprehensive Study Report Pursuant to the Canadian Environmental Assessment Act for the proposed 407 East Transportation Corridor (October, 2010)" was published in early November for a 30 day public review period ending on December 13, 2010. Section 4.2 describes "Alternative Means of Carrying Out the Project". This section describes that various route alternatives were studied by MTO, including 12 for the East Mainline and 13 for the East Link. It is noted that the other aspects of "alternative means", such as methods of development or construction methods, were not evaluated.

3 Travel Demand Modeling Methodology and Description of Scenarios

3.1 Modeling Methodology

TAO's modeling used EMME/3 and a GTHA data set provided by MTO. This was indicated to be the same model and data used by MTO for the updated modeling contained in the EA Report.

In order to ensure maximum validity of results, great care was taken to duplicate the modeling methodology used by MTO. This was accomplished by strictly using the data provided by MTO as much as possible, and verifying that our model was performing consistently with MTO's. No changes were made to the MTO model apart from adjustments to the road and freeway network within the EA study area.

Travel Behaviour Data: Travel behaviour enters the model in the form of an origin-destination matrix (i.e. number of trips from each origin zone to each destination zone). MTO provided us with OD matrices for both the AM and PM peak hours, for 2006 and 2031. Thus all of the following assumptions remained unchanged from those cited in the EA Report:

- Extent of trip reduction due to Transportation Demand Management (8% per pg 6-9)
- Effect of Transportation System Management (negligible per pg 6-10)
- Diversion of freight to rail (7% per pg 6-12)
- Transit Mode Split (per Ex. 5.37 and 5.38)
- Auto occupancy (1.18 to 1.19 per Ex. 5.37-5.38)
- Effect of tolling not included (pg 6.24)

Network Data: In addition, MTO also provided the roadway network for the preferred 2031 option, as well as the base 2006 network. From these networks, various additional scenarios were derived, as outlined in Section 3.2 below. The MTO 2031 network included some regional and local roads that were assumed to be severed by the freeway. For the TAO cases where portions of the freeway were not present, the appropriate local and regional roads were reconnected to their 2006 state.

For scenarios where the freeway network was terminated at Simcoe Street, an end intersection similar to that currently present at Brock Street was assumed.

The prime metric used to evaluate the various alternatives is Volume/Capacity (V/C) Ratio across screen lines. This measures the ratio of the volume of traffic across a screen line to the capacity of the road network at that screen line. This is the same metric used by MTO in the EA Report.
3.2 Validation of the Model

To ensure consistency, models were evaluated in the same fashion used by MTO, using screen line analysis. A screen line is a virtual boundary, where traffic crossing the screen line would be measured and aggregated. Two sets of measurements were made: total automobile volume, and volume to capacity (V/C) ratios.

Screen line definition turned out to be the most difficult aspect of the modeling work, as screen line boundaries were vaguely defined in the EA Report. In addition, while the network data provided by MTO contained data useful in reconstructing the screen lines, it was not evident precisely which links were used. Final screen line definitions were developed and validated thoroughly to ensure consistency with MTO's model.

As stated above, two metrics were used to validate the model. The first compared predicted vehicle movements for 2006 AM and PM peak hour to actual movements as reported in Ex. 5.31 and 5.32 of the EA Report. Tables 3.1 and 3.2 provide this comparison.

<table>
<thead>
<tr>
<th>Screen Line</th>
<th>Observed</th>
<th>Simulated</th>
<th>Sim/Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>East of Durham/York Townline Road</td>
<td>17,859</td>
<td>18,879</td>
<td>1.06</td>
</tr>
<tr>
<td>East of Brock Road</td>
<td>16,990</td>
<td>17,524</td>
<td>1.03</td>
</tr>
<tr>
<td>East of Lake Ridge Road</td>
<td>13,545</td>
<td>14,130</td>
<td>1.04</td>
</tr>
<tr>
<td>West of Thornton Road</td>
<td>11,951</td>
<td>11,928</td>
<td>1.0</td>
</tr>
<tr>
<td>East of Courtice Road</td>
<td>5,815</td>
<td>6,190</td>
<td>1.06</td>
</tr>
<tr>
<td>North of Taunton Road</td>
<td>9,231</td>
<td>6,704</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Table 3.1: 2006 PM Peak Hour Auto Volumes crossing Screen Lines

<table>
<thead>
<tr>
<th>Screen Line</th>
<th>Observed</th>
<th>Simulated</th>
<th>Sim/Obs</th>
</tr>
</thead>
<tbody>
<tr>
<td>East of Durham/York Townline Road</td>
<td>16,431</td>
<td>18,417</td>
<td>1.12</td>
</tr>
<tr>
<td>East of Brock Road</td>
<td>17,499</td>
<td>16,050</td>
<td>0.92</td>
</tr>
<tr>
<td>East of Lake Ridge Road</td>
<td>13,315</td>
<td>12,912</td>
<td>0.97</td>
</tr>
<tr>
<td>West of Thornton Road</td>
<td>10,689</td>
<td>10,275</td>
<td>0.96</td>
</tr>
<tr>
<td>East of Courtice Road</td>
<td>5,740</td>
<td>6,011</td>
<td>1.05</td>
</tr>
<tr>
<td>North of Taunton Road</td>
<td>7,298</td>
<td>6,409</td>
<td>0.88</td>
</tr>
</tbody>
</table>

Table 3.2: 2006 AM Peak Hour Volumes crossing Screen Lines

The results show good consistency between both models, with the exception of the southbound screen line across Taunton Road. It was unclear as to why such a large discrepancy was observed, as no changes were introduced during tested. Further validation was needed.

The second approach was to compare TAO’s results of a 2031 model run with MTO’s result for the same input. MTO used slightly different screen lines for the 2031 runs as for the 2006 runs, so we took care to ensure...
consistency with MTO. The screen lines used for 2031 work are defined in Table 3.3. Average V/C ratios for these screen lines were tested against those outputted by MTO's updated model (which was provided). There is only one documented scenario in the EA report where the updated model was used (an issue TAO has mentioned previously), reported in Exhibits 6.30 and 6.31. This scenario is enhanced transit/TDM/TSM and all planned road network improvements, but no freeway at all. This was named Combination 1 by MTO.

The comparison presented in Table 3.4 shows good consistency between MTO's model and our model, including along the N/S screen lines. Given these results, as well as the fact that little changes have been made to MTO's original model, we have concluded that the models match.

### 3.3 Alternative Corridor Scenarios

The following alternative scenarios shown in Table 4 were run, all using the updated validated MTO model. These include (a) the alternatives examined by MTO that were never assessed using the updated model (b) other alternatives.

<table>
<thead>
<tr>
<th>No.</th>
<th>Scenario Name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Validation Case</td>
<td>Combination 1–see Section 3.2</td>
</tr>
<tr>
<td>2</td>
<td>Combination 3, Option 1</td>
<td>Entire Mainline only</td>
</tr>
<tr>
<td>3</td>
<td>Combination 3, Option 2</td>
<td>Entire Mainline + Western Link only</td>
</tr>
<tr>
<td>4</td>
<td>Combination 3, Option 3</td>
<td>Entire Mainline + Eastern Link only</td>
</tr>
<tr>
<td>5</td>
<td>Combination 3, Option 4</td>
<td>Mainline from Brock Rd to E Link + Both Links</td>
</tr>
<tr>
<td>6</td>
<td>Preferred Alternative per EA Combination 3, Option 5</td>
<td>Entire Mainline + both Links</td>
</tr>
<tr>
<td>7</td>
<td>Phase I Build</td>
<td>Mainline up to Simcoe + West Link. And some interchanges are deferred. This is the portion MTO intends to construct first</td>
</tr>
<tr>
<td>8</td>
<td>Phase I Build + widened existing EW corridor (south)</td>
<td>Phase I Build + Winchester Rd to Harmony Rd to Conlin Rd to Reg. Rd 57 (Martin) to Reg. Rd 4 to Hwy 35/115 (all Roads widened by one lane each direction)</td>
</tr>
<tr>
<td>9</td>
<td>Phase I Build + widened existing EW corridor (north)</td>
<td>Phase I Build + Winchester Rd to Grandview Rd to Reg. Rd 3 to Reg. Rd 57 (Martin) to Reg. Rd 20 to 35/115 (all Roads widened by one lane each direction)</td>
</tr>
<tr>
<td>10</td>
<td>Case 8 + widened existing NS corridor</td>
<td>Case 8 + widened Reg. Rd 57(one lane each direction) to Hwy. 401</td>
</tr>
</tbody>
</table>

Maps of all alternative scenarios and lane configurations can be found in Appendix A.
## 4 Modeling Results and Discussion

Results for these scenarios are summarized in Table 4.1, below and in Figures 4.1 to 4.20. For each scenario, two figures are shown:

- V/C Results for E-W screen lines
- V/C Results for N-S screen lines

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Description</th>
<th>Screen Line Label</th>
<th>EW1</th>
<th>EW2</th>
<th>EW3</th>
<th>EW4</th>
<th>NS5</th>
<th>NS6</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No Freeway</td>
<td></td>
<td>1.15</td>
<td>1.03</td>
<td>0.85</td>
<td>0.89</td>
<td>0.93</td>
<td>0.74</td>
</tr>
<tr>
<td>2</td>
<td>Comb 3, Option 1 (ML only)</td>
<td></td>
<td>0.90</td>
<td>0.79</td>
<td>0.71</td>
<td>0.69</td>
<td>0.84</td>
<td>0.81</td>
</tr>
<tr>
<td>3</td>
<td>Comb 3, Option 2 (ML+WL)</td>
<td></td>
<td>0.90</td>
<td>0.67</td>
<td>0.71</td>
<td>0.70</td>
<td>0.79</td>
<td>0.78</td>
</tr>
<tr>
<td>4</td>
<td>Comb 3, Option 3 (ML+EL)</td>
<td></td>
<td>0.90</td>
<td>0.79</td>
<td>0.71</td>
<td>0.48</td>
<td>0.85</td>
<td>0.68</td>
</tr>
<tr>
<td>5</td>
<td>Comb 3, Option 4 (shorter ML +WL+EL)</td>
<td></td>
<td>0.90</td>
<td>0.68</td>
<td>0.70</td>
<td>0.52</td>
<td>0.76</td>
<td>0.63</td>
</tr>
<tr>
<td>6</td>
<td>MTO Preferred Alternative</td>
<td></td>
<td>0.90</td>
<td>0.68</td>
<td>0.71</td>
<td>0.49</td>
<td>0.76</td>
<td>0.66</td>
</tr>
<tr>
<td>7</td>
<td>Phase I Build</td>
<td></td>
<td>0.89</td>
<td>0.67</td>
<td>0.72</td>
<td>0.90</td>
<td>0.81</td>
<td>0.74</td>
</tr>
<tr>
<td>8</td>
<td>Phase I Build + widened existing EW corridor (south)</td>
<td></td>
<td>0.88</td>
<td>0.67</td>
<td>0.72</td>
<td>0.87</td>
<td>0.80</td>
<td>0.71</td>
</tr>
<tr>
<td>9</td>
<td>Phase I Build + widened existing EW corridor (north)</td>
<td></td>
<td>0.88</td>
<td>0.67</td>
<td>0.72</td>
<td>0.87</td>
<td>0.80</td>
<td>0.74</td>
</tr>
<tr>
<td>10</td>
<td>Case 8 + widened existing NS corridor</td>
<td></td>
<td>0.89</td>
<td>0.67</td>
<td>0.72</td>
<td>0.87</td>
<td>0.80</td>
<td>0.71</td>
</tr>
</tbody>
</table>

Table 4.1: Summary of Modeling Results, V/C Averages on Screen Lines
4.1 Discussion of Results

The alternative scenarios identified by MTO (2-5) behaved very well in general in comparison with the MTO preferred scenario. All showed good or reasonable levels of service for all screen lines. For example, scenario 3 (Mainline + West Link only) showed excellent performance in the eastern part of the study area.

Our alternative scenarios (7-10) behaved fairly well in comparison to the MTO preferred alternative (Scenario 6). Screen line results west of Simcoe Street were nearly identical to the preferred alternative, unsurprising since scenarios 7-10 include the 407 extension to Simcoe. However, the easternmost east-west screen line, EW4 in Table 2, shows an increase in congestion; going from 0.49 (a 'good' level of service) to 0.87 (an 'unstable' level of service, approaching 'congested'). This is still an improvement on the base case (0.89 to 0.87). Furthermore, it was observed that this congestion is concentrated in the segment of the Highway 401 corridor east of the Courtice Rd. exit. It is also very noteworthy that southbound congestion east of Simcoe increases only slightly compared to the preferred alternative, but is still within the realm of 'good' level of service.

5 Conclusions

Our modeling results are consistent with MTO in that their Combination Option 1 (our Scenario 1) - enhanced transit/TDM/TSM and planned road improvements, but no freeway at all- does not provide sufficient transportation capacity. This of course assumes that the assumptions in the MTO model, as cited in Section 3.1, are unchanged. We have challenged these assumptions in the past but will not repeat those points here.

The results from our model also show that alternatives (Scenarios 7-10) to MTO's preferred option (Scenario 6) are sufficient in providing the study area's long-term transportation capacity needs. The screen line analysis shows that, with the exception of EB4, the alternatives performed on-par with the preferred case in providing east-west service. Even the exception is acceptable, given that traffic in the westernmost sections will still be substantially congested. Furthermore, while the results show some congestion in the easternmost screen line, it is worth noting that this will occur primarily within the highway 401 corridor - as opposed to affecting local and arterial roads - and does not justify a full east-west corridor far to the north of urban development.

There is poor transportation demand justification for approving the Preferred Option. Most of the MTO and other alternate cases provides adequate transportation capacity and avoid some or all the environmental and social problems with a new freeway. We note for example that the report by "ecocare international", on behalf of the Ontario Road Ecology Group/Toronto Zoo, entitled "A review of proposed wildlife mitigation along the 407 east extension", submitted to CEAA in November, 2010, made their first recommendation to be "removal of the north-south east link from construction plans", and cited numerous benefits and cost savings. The results from Scenario 3, and Scenarios 7 through 10 show that this link could be removed with minimal transportation impacts.

It is disappointing that MTO did not fully evaluate and document their own alternatives cases using the updated model (our Cases 2-6) in the EA Report. Had they done so, it would have given a much
different perspective on their recommendation of a full-blown freeway network - namely that it is not justified.

6 Recommendations

We recognize that the Phase I Build program involving the Main Line to Simcoe + the West Link and an abridged list of interchanges is nearly under construction. This portion does have some justification from a demand perspective, and does not traverse the greenbelt. Pragmatically, we recommend that CEAA only approve the corridor up to the Phase I Build levels. The balance of the corridor, namely the remainder of the Mainline and the East Link should not be approved. We note that these lands are largely in the Greenbelt and will continue to be protected from development via the Greenbelt Act. Thus they are available for corridor use should future land development or transportation needs change from what is assumed in the updated model.

The lands should be retained in current ownership so that a viable agricultural business, including reinvestment as needed, can occur.