Transforming Transportation Systems Analysis Using Truck GPS Data

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Presentation Outlines

- Freight studies in MTO
- Truck OD Analysis - What has been achieved?
- Next Steps
- Conclusions and Opportunities
Freight Studies in MTO

Commercial Vehicle Survey
Attributes: trip, driver, carrier, commodity, axel loads, traffic volume, and vehicle

GPS Data
Attributes: encrypted truck ID, location, speed, and time

CVS Data processing & Aggregation
- Truck OD
- Truck Volume
- Value of Goods
- ESAL
- Forecast Truck Volume

GPS Data processing & Aggregation
- Truck travel speeds
- Network performance indices
- Congestion pattern
- Truck OD
- Truck trip chain
- Truck dwell time

Planning studies:
- Truck O/D and travel patterns
- Trade analysis
- Truck traffic forecast
- Commodity flow
- Pavement design
- Bridge Design

Planning studies:
- Travel speed
- Network performance
- OD pattern
- Work zone accident traffic impact studies

iCorridor
Freight Studies in MTO - Commercial Vehicle Surveys

Simcoe Area Transportation Review

Waterloo-Wellington-Brant Review

Northern Ontario Transportation Review

Peel Region Partnership

<table>
<thead>
<tr>
<th>Unique Location</th>
<th>Road Intercepted</th>
<th>Directional DDS</th>
<th>Shifts</th>
<th>Surveyor Hrs</th>
<th>Line Survey Hrs</th>
<th>Surveys (Avg Survey Hrs)</th>
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<td>Hwy 10 NB-Caledon Village</td>
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<td>3</td>
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<tr>
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<td>11</td>
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<td>167</td>
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<td>12</td>
<td>QEW at Hurontario</td>
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<td>5</td>
<td>100</td>
<td>85</td>
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<td>13</td>
<td>Mayfield-Hwy 50 Simona Bolton</td>
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<td>3</td>
<td>60</td>
<td>51</td>
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</tbody>
</table>

TOTAL

19 | 62 | 1048 | 884 | 2431

Ontario
MINISTRY OF TRANSPORTATION
Freight Studies in MTO
- GPS Data for Network Performance Measure

Truck Travel Speed

Road Travel Speed & Performance

Regional Travel Delay Summary

Micro-level Congestion Pattern Analysis
Freight Studies in MTO
- GPS Data for Travel Time Analysis
Freight Studies in MTO
- GPS Data for Truck OD Analysis (Testing and Development)

Approximately 1.8 million of truck trip end locations were identified using the commercial vehicle GPS data from October, 2011.
Truck OD Analysis - Methodology

Using Truck Fleet Data in Combination with Other Data Sources for Freight Modeling and Planning

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Final Report
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July 2014

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Florida DOT</th>
<th>Ontario</th>
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<tr>
<td><strong>Minimum Dwell Time</strong></td>
<td>• Use 30 minutes in the 1st round</td>
<td>Use 15 minutes</td>
</tr>
<tr>
<td></td>
<td>• Use 15 minutes for the circular trips in the 2nd round</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Use 5 minutes for the sub-circular trips in the 3rd round</td>
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<tr>
<td><strong>Minimum Trip Distance</strong></td>
<td>Combine very small trips (&lt; 1 mile trip length) with preceding trips or eliminate them.</td>
<td>No minimum trip threshold</td>
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<tr>
<td><strong>Truck Stop Indicator</strong></td>
<td>5 mile / h</td>
<td>10 km / h or distance between two consecutive points &lt; 5 meters</td>
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</tbody>
</table>
Truck OD Analysis - Truck Trip Chain Example
Truck OD Analysis - Aggregated Truck ODs

Number of truck trip ends aggregated into traffic zones (October 2011)
Truck OD Analysis - Truck OD Density

Truck trip end density at county level (October 2011)
Truck OD Analysis - Dwell Time Distribution

- **53%**
- **74%**
Truck OD Analysis - Dwell Time Distribution at Facility Level
Truck OD Analysis - OD Pattern: GPS vs. CVS

Truck OD from GPS Data

Truck OD from CVS

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Challenges

• What is the most effective mechanism to integrate GPS data with CVS data?
  • Expansion factor
  • Pairing to truck type, commodity, and other truck information.
Next Step - Data Integration

Information from GPS OD Analysis

Mississauga, Ontario
Departure Time: 2013-07-16 18:26:40

Windsor, Ontario
Departure Time: 2013-07-16 14:05:06 EST

Travel Distance: 222 miles
Total travel Time: 4 hours and 21 minutes
Average Travel Speed: 53 mph

Travel Speed (km/h)

- < 20
- 20 - 40
- 40 - 60
- 60 - 80
- 80 - 100
- > 100

Information from Commercial Vehicle Intercept Surveys

Ontario Intercept Survey

<table>
<thead>
<tr>
<th>Body Style</th>
<th>Plated</th>
<th>Axles</th>
<th>Trip Origin Zone</th>
<th>Trip Destination Zone</th>
<th>Ontario Miles</th>
<th>Commodity</th>
<th>Commodity Weight (lbs)</th>
<th>Utilization</th>
<th>Axle Config</th>
<th>Fleet System</th>
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<tr>
<td>Van, Not Refrigerated</td>
<td>C, CN</td>
<td>6</td>
<td>35728</td>
<td>35021</td>
<td>216.3</td>
<td>Salt - for Food Production</td>
<td>52,864</td>
<td>Full Weight</td>
<td>1253</td>
<td>PeopleNet</td>
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</table>
Conclusions and Opportunities

- Information obtained from the truck GPS data analysis is very valuable asset for MTO’s core business:
  - Identify network bottlenecks through traffic congestion analysis.
  - Measure system-wide freight network performance.
  - Evaluate options for truck deliveries.
  - Understand truck trip information.
  - Improve knowledge that we are not currently captured from the existing data sources.
  - Reduce data collection cost through more targeted surveys.
- Potential future opportunities:
  - Improve analysis through new data sources coming available and through better integration and mining of existing data sets.
  - Share best practices and exchange information with MTO’s business partners.
  - Develop new approaches for GPS and CVS data integration through university researches or consultant assignments.
Questions?