Regional Assessment of Weather and Freight Impacts

DTFH61-12-D-00048-T-13005

FHWA Road Weather Program Stakeholder Meeting
Salt Lake City, Utah

Presented by:
Cambridge Systematics
August 13, 2014
Project Background
Background

Commercial vehicles main mode of freight transportation

» $500 billion freight sector

» 70% of total value and 60% of weight moves by truck

» Estimates that adverse weather is responsible for 12% to 25% of all delay

» Trucking delays due to weather = $3.1 billion/yr for the 50 largest cities

» Lost commerce due to snow closures = $10 billion/day

Other economic impacts of adverse weather

» More than $2 billion/yr is spent on snow and ice control by State DOTs

» Weather accounts for 25% of non-recurring congestion
Project Background

1st Phase Study 2012

» National estimate of delay $8-$9 billion annually
» Developed model primarily on state-by-state basis
» Key data sources – used 3 year period 2008 to 2010
  • ATRI truck travel speed data (now in FHWA NPMRDS dataset)
  • NOAA weather data – Global Summary of the Day (GSOD)
  • Truck O-D data developed by project team from Global Insight Data

» Recommendations
  • Finer detail needed on truck movements and weather events
  • Conduct test scenarios in smaller areas/regions
These stations were selected because they overlaid the truck speed data very well.
Second Phase
Key Analysis Questions

- How do different weather events impact truck travel speed and delay?
- What is the impact when different weather events combine?
- How do impacts vary between regions and roadways?

<table>
<thead>
<tr>
<th>Weather Conditions</th>
<th>Average Speed</th>
<th>Free-Flow Speed</th>
<th>Volume</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Rain/Snow</td>
<td>3%-13%</td>
<td>2%-13%</td>
<td>5%-10%</td>
<td>4%-11%</td>
</tr>
<tr>
<td>Heavy Rain</td>
<td>3%-16%</td>
<td>6%-17%</td>
<td>14%</td>
<td>10%-30%</td>
</tr>
<tr>
<td>Heavy Snow</td>
<td>5%-40%</td>
<td>5%-64%</td>
<td>30%-44%</td>
<td>12%-27%</td>
</tr>
<tr>
<td>Low Visibility</td>
<td>10%-12%</td>
<td>–</td>
<td>–</td>
<td>12%</td>
</tr>
</tbody>
</table>
Scope of Work

Areas of improvement to previous methodology

» Truck speed data on additional roads beyond NHS
» More detailed freight O/D and trip length data
» Distinguish between impacts of “regular” weather events and “major” events
» Comparison of truck speed data to other highway speed data (Advanced Traffic Management Systems)

» Greater detail in weather data
  • Surface condition
  • Increased temporal detail (hourly at minimum)
  • Increased geographic detail (closer to truck routes)
Scope of Work

Selection of case study locations

» Key trucking corridors
» Major access route to ports or key industrial/warehouse areas
» Different types of terrain
» Variety of climatic conditions
» Vulnerability to major weather events
» Detailed reliable roadway performance data available
» Data available to advance knowledge of freight OD’s, load content and supply chain
» Availability of detailed weather data
Scope of Work

Select Weather Event Categories

Select Specific Weather Event(s)

Select Specific Roadway Segment(s)

Freight Travel Time – No Weather Event

Freight Travel Time – Weather Event

Calculate Delay Factors

Assign Delay Factors to Freight Movements

Compare with Factors in First Phase Analysis

Add Additional Variables (Road Type, Terrain, Peak/Off-Peak)

Estimate Truck Movements Using FTR Model

Add Cost Factors from FTR Model

Compile and Map Weather Data and Map and Calculate Weather Event Occurrence by Roadway Segment(s)
## Scope of Work

» Sample of relationships to be derived from weather and roadway data

<table>
<thead>
<tr>
<th>Percentage of Capacity In Use</th>
<th>&lt;0.21</th>
<th>0.21-0.40</th>
<th>0.41-0.70</th>
<th>0.71-0.79</th>
<th>0.80-0.95</th>
<th>&gt;0.95</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Fog</td>
<td>73%</td>
<td>70%</td>
<td>67%</td>
<td>63%</td>
<td>60%</td>
<td>56%</td>
</tr>
<tr>
<td>High Wind</td>
<td>93%</td>
<td>92%</td>
<td>91%</td>
<td>89%</td>
<td>88%</td>
<td>87%</td>
</tr>
<tr>
<td>Very High Wind</td>
<td>87%</td>
<td>86%</td>
<td>85%</td>
<td>83%</td>
<td>82%</td>
<td>80%</td>
</tr>
<tr>
<td>High Wind and Light Snow</td>
<td>84%</td>
<td>81%</td>
<td>78%</td>
<td>76%</td>
<td>72%</td>
<td>69%</td>
</tr>
<tr>
<td>High Wind and Moderate Snow</td>
<td>75%</td>
<td>70%</td>
<td>65%</td>
<td>59%</td>
<td>53%</td>
<td>47%</td>
</tr>
<tr>
<td>Very High Wind and Moderate Snow</td>
<td>69%</td>
<td>64%</td>
<td>59%</td>
<td>53%</td>
<td>47%</td>
<td>40%</td>
</tr>
</tbody>
</table>
**Scope of Work**

**Key Issues**

» Comparability of different regions
  - Driving habits
  - Different types of freight content and movement patterns

» Use of gridded weather data
  - Potentially provides more detail but processing can be resource intensive
  - Assess tradeoffs

» Adequate sample to isolate weather events (account for incidents, construction, etc.)
## Schedule

<table>
<thead>
<tr>
<th>Task Name and Deliverables</th>
<th>Due Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Task 1. Project Management</strong></td>
<td></td>
</tr>
<tr>
<td>1.1 – Kickoff Meeting</td>
<td>July 23</td>
</tr>
<tr>
<td>1.1.1 – Kickoff Meeting Presentation</td>
<td>July 21</td>
</tr>
<tr>
<td>1.2 – Draft PMP</td>
<td>July 17</td>
</tr>
<tr>
<td>1.3 – Final PMP</td>
<td>August 11</td>
</tr>
<tr>
<td>1.4 – Project Status Updates</td>
<td>Monthly</td>
</tr>
<tr>
<td>1.5 – Closeout Meeting</td>
<td>2 weeks prior to contract closeout</td>
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<tr>
<td><strong>Task 2. Develop Proposed Approach and Methodology</strong></td>
<td></td>
</tr>
<tr>
<td>2.1 – Potential Data Sources and Resolutions Summary</td>
<td>November 7</td>
</tr>
<tr>
<td>2.2 – Potential Study Areas Summary</td>
<td>November 7</td>
</tr>
<tr>
<td>2.3 – Recommended Study Area and Data Source(s) Document (Technical Memo)</td>
<td>November 7</td>
</tr>
<tr>
<td><strong>Task 3. Regional Scaling and Impacts</strong></td>
<td></td>
</tr>
<tr>
<td>3.1 – Impact Assessment Plan and Methodology – with Control Case</td>
<td>January 9</td>
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<tr>
<td><strong>Task 4. Test and Verify Results and Develop Weather Delay Index</strong></td>
<td></td>
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<tr>
<td>4.1 – Detailed Report</td>
<td>May 1</td>
</tr>
<tr>
<td><strong>Task 5. Assess Impacts at Varying Levels of the Supply Chain</strong></td>
<td></td>
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<tr>
<td>5.1 – Detailed Report of Freight Model Refinements and Varying Impacts of the Supply Chain</td>
<td>July 1</td>
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<tr>
<td><strong>Task 6. State Congestions Modeling Analysis</strong></td>
<td></td>
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<tr>
<td>6.1 – Memo of Congestion Modeling Analysis</td>
<td>September 4</td>
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<tr>
<td><strong>Task 7. Final Report</strong></td>
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<tr>
<td>7.1 – Draft Final Report</td>
<td>October 16</td>
</tr>
<tr>
<td>7.2 – Final Report</td>
<td>November 13</td>
</tr>
<tr>
<td>7.2 – Final Report 508</td>
<td>December 31</td>
</tr>
</tbody>
</table>
Help?

registrered in haying your area as a case study?

Data on surface weather conditions?
  » Variety of conditions?
  » Precipitation type?
  » Precipitation intensity?
  » High temporal frequency?

Weather data and traffic data integrated through ATMS?

Major generator of truck traffic?
Contact

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Questions/Discussion