Using Ground Truth Geospatial Data to Validate Advanced Traveler Information Systems Freeway Travel Time Messages

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Outline

• Project Overview
• Summary of Test Area
• Experimental Design
• Data Collection
• Data Comparison
• Results
• Next Steps
Project Overview

Goals

1. Evaluate Oregon Department of Transportation’s (ODOT) travel time estimating and reporting capabilities
2. Identify locations where additional detectors might improve estimates
Project Overview

- ODOT Region 1 Traffic Management Operations Center (TMOC)
  - 485 inductive loop detectors
  - 19 variable message signs (VMS), 3 currently displaying travel times
Project Overview

Portland Regional Transportation Archive Listing (PORTAL)
http://portal.its.pdx.edu

- Funded by NSF
- Direct fiber-optic connection between ODOT and PSU
- 20-second loop detector data
  - Volume
  - Speed
  - Occupancy
- Customized travel time area
Summary of Test Area

- 18 original directional freeway links
- 3 links eliminated
  - Construction
  - Detectors not functional
  - Not pertinent to study
Experimental Design

• Analysis of PORTAL estimates to determine required number of runs
• Data collection plan
  – 5-10 runs required for most links
  – 4 routes designed
  – Transitional periods targeted
  – Groups with 5-7 minute headways
  – Standard probe vehicle instructions
Data Collection

- **Hardware**
  - Palm handheld computers
  - Magellan GPS devices

- **Software**
  - ITS-GPS
    - Free!
    - Available at [www.its.pdx.edu](http://www.its.pdx.edu)

- Individual runs and groups of probe vehicles

- Variety of traffic conditions
Data Collection

- 87 probe vehicle runs
- 904 minutes (~15 hours) of collection time
- 516 miles of data
- 12 drivers
- 7 days
Data Comparison

- Probe data
  - Individual runs downloaded
  - Runs plotted on freeway network map showing link endpoints
  - Pertinent data segments extracted
Data Comparison

- Detector data
  - Assignment of influence areas
    1. Midpoint method
    2. ODOT modified midpoint method
  - Aggregation
    1. Nearest 20-second interval
    2. Average of nearest interval and 1 minute before
    3. Average of nearest interval and 3 minutes before
Results

- ATMS estimates reasonably accurate

P- Value -Statistical Significance

<table>
<thead>
<tr>
<th>Link Number</th>
<th>Midpoint</th>
<th>ODOT</th>
<th>Midpt -1</th>
<th>Midpt -3</th>
<th>ODOT -1</th>
<th>ODOT -3</th>
</tr>
</thead>
<tbody>
<tr>
<td>LINK 2 - I-5 NB</td>
<td>0.073</td>
<td>0.103</td>
<td>0.034</td>
<td>0.071</td>
<td>0.038</td>
<td>0.079</td>
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<tr>
<td>LINK 3 - I-5 NB</td>
<td>0.272</td>
<td>0.012</td>
<td>0.214</td>
<td>0.202</td>
<td>0.010</td>
<td>0.035</td>
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<td>LINK 4 - I-5 NB</td>
<td>0.651</td>
<td>0.665</td>
<td>0.545</td>
<td>0.287</td>
<td>0.560</td>
<td>0.301</td>
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<tr>
<td>LINK 5 - I-5 SB</td>
<td>0.470</td>
<td>0.470</td>
<td>0.503</td>
<td>0.256</td>
<td>0.503</td>
<td>0.256</td>
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<tr>
<td>LINK 6 - I-5 SB</td>
<td>0.435</td>
<td>0.095</td>
<td>0.676</td>
<td>0.605</td>
<td>0.052</td>
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<td>LINK 7 - I-5 SB</td>
<td>0.009</td>
<td>0.009</td>
<td>0.021</td>
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<tr>
<td>LINK 8 - OR-217 NB</td>
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<td>0.011</td>
<td>0.012</td>
<td>0.024</td>
<td>0.009</td>
<td>0.011</td>
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<td>LINK 9 - OR-217 SB</td>
<td>0.381</td>
<td>0.040</td>
<td>0.199</td>
<td>0.159</td>
<td>0.146</td>
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<td>LINK 10 - I-205 NB</td>
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<td>0.277</td>
<td>0.040</td>
<td>0.896</td>
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<td>LINK 12 - I-205 SB</td>
<td>0.537</td>
<td>0.020</td>
<td>0.478</td>
<td>0.731</td>
<td>0.003</td>
<td>0.003</td>
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<tr>
<td>LINK 13 - I-84 EB</td>
<td>0.273</td>
<td>0.070</td>
<td>0.518</td>
<td>0.402</td>
<td>0.098</td>
<td>0.077</td>
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<tr>
<td>LINK 14 - I-84 WB</td>
<td>0.736</td>
<td>0.736</td>
<td>0.754</td>
<td>0.530</td>
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<tr>
<td>LINK 16 - US 26 EB</td>
<td>0.026</td>
<td>0.026</td>
<td>0.009</td>
<td>0.012</td>
<td>0.009</td>
<td>0.012</td>
</tr>
<tr>
<td>LINK 17 - US 26 WB</td>
<td>0.013</td>
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<td>0.014</td>
<td>0.012</td>
<td>0.013</td>
<td>0.011</td>
</tr>
</tbody>
</table>
Results

- ATMS estimates reasonably accurate
Results

- Detector density and location critical
Results

- Incidents difficult to capture
Results

- No uniform difference between methods
- Aggregation improves accuracy
Results

Candidate locations for increased detection

- Recurring congestion
- Detector spacing > 1 mile

1. Hwy 217 NB at MP 3.2
2. US-26 EB at MP 70
3. US-26 WB at MP 69
4. US-26 WB at MP 70
5. I-5 NB at MP 298.5
6. I-5 SB at MP 306.5
7. I-84 EB at MP 2.0
Next Steps

• More data
  – Incidents
  – Capture transitions
• Different algorithms
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