Statewide Traffic Flow Data: Probe Vehicle Study for Iowa DOT

Erik Minge, PE
SRF Consulting Group, Inc.

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Types of Mobile Probe Data

- Cellular Telephone-Based Methods
  - Angle of arrival (E911)
  - Cellular network traffic analysis
  - Tower association

- Device-Based Tracking Methods
  - Cellular phone application-based tracking
  - GPS-based fleet systems
  - Wireless device detection (Bluetooth reader)

- Hybrid Methods
## Iowa DOT Data Needs

<table>
<thead>
<tr>
<th>Need Area</th>
<th>Examples</th>
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<tbody>
<tr>
<td>Planning applications</td>
<td>• Statewide travel demand modeling</td>
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<tr>
<td></td>
<td>• Origin/destination studies</td>
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<tr>
<td>Traveler information</td>
<td>• Statewide 511 and flow map</td>
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<td></td>
<td>• Travel time posted on DMS</td>
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<td>Traffic management applications</td>
<td>• Incident detection</td>
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<tr>
<td>Federal requirements</td>
<td>• Section 1201 (Real-Time System Management Information Program)</td>
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<td></td>
<td>• Performance measures</td>
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<tr>
<td>Research</td>
<td>• Various</td>
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</tbody>
</table>
A Different Animal

BLACK BOX

- Travel time
  - DMS display
  - 511 system
  - Web map
  - Incident detection
  - Calibrate travel demand model

- Average speed
- Origin/Destination
- Research
## Data Collection Methods

<table>
<thead>
<tr>
<th>Location Based</th>
<th>Area Based (Mobile Probe)</th>
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<tbody>
<tr>
<td><strong>Pro</strong></td>
<td>Pro</td>
</tr>
<tr>
<td>Reliable</td>
<td>Large geographic area</td>
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<tr>
<td>Accurate</td>
<td>No infrastructure deployment</td>
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<tr>
<td>Real-time</td>
<td></td>
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<tr>
<td>Granular</td>
<td></td>
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<tr>
<td><strong>Con</strong></td>
<td>Con</td>
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<tr>
<td>Limited geographic area</td>
<td>Time lag</td>
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<tr>
<td>Comm infrastructure needs</td>
<td>Less robust in low volumes</td>
</tr>
<tr>
<td>Capital costs</td>
<td>No volume data</td>
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<tr>
<td>O&amp;M costs</td>
<td>Ongoing cost</td>
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</tbody>
</table>
Agencies Surveyed
Survey Questions

• Describe roadway system and coverage area
• How are you using data?
  – Planning
  – Dynamic message signs
  – 511 system
  – Severe weather impact analysis
• How have you dealt with the non-technical issues?
• Have you conducted an evaluation?
• Data accurate enough for intended applications?
• Greatest benefits?
• Lessons learned?
Survey Findings

- Data field indicates data source
- Historical data substituted in low volume conditions
- Time lag in data
  - Lag is longer when speeds are low
  - Lag occurs when need for data is greatest (i.e. incident)
  - Data will sometimes revert to historical conditions
- Roadway segments based on Traffic Message Channel (TMC)
- Improved performance seen over time, probably due to greater penetration
Survey Findings (cont.)

- Massachusetts 511 system received data at no cost in return for advertising.
- Data costs are higher if:
  - Real time data (as opposed to historical)
  - Non-standard (non-TMC) roadway segments
- Clearly state data requirements
  - Length of time data is made available
  - Allowed uses for data
INRIX Data Evaluation

- 30-day trial evaluation, August-September 2010
- 17 roadway segments chosen in Iowa
- Existing sensors (loops, NIT) used as baseline for comparison
- Data was queried from INRIX’s database and stored for analysis
Test Methodology

- Evaluate Performance
  - High and low volume roadways
  - Peak and off peak periods
  - Work zone caused congestion
  - Incident caused congestion

- Document source of data (real time vs. historical)
  - Urban vs. rural roadways
  - Number of lanes
  - Freeway vs. expressway vs. arterial
  - Time of day
Metadata Analysis

**Data Source by Road Segment**

- # of lanes/rural vs. urban/hwy vs. expy, fwy, or arterial/segment #

- **Real-Time Data**
- **Mixed Data**
- **Historical Data**
Metadata Analysis

### Data Source by Time (2-Lane Rural Highway)

- **Late Night Period** (10PM - 5AM)
- **AM Peak Period** (6:30AM - 8:30AM)
- **PM Peak Period** (4PM - 6PM)
- **Remaining Periods**

- **Real-Time Data**
- **Mixed Data**
- **Historical Data**

### Data Source by Time (4-Lane Rural Expressway)

- **Late Night Period** (10PM - 5AM)
- **AM Peak Period** (6:30AM - 8:30AM)
- **PM Peak Period** (4PM - 6PM)
- **Remaining Periods**

- **Real-Time Data**
- **Mixed Data**
- **Historical Data**
Traffic Incident – July 8, 2010

I 35 SB at 1st St

Vehicle speed (mph)

I 35 SB from IA 87 to 1st St

Vehicle Speed (mph)

I 35 SB at IA 87

Vehicle Speed (mph)
Traffic Incident (cont.)

I 35 SB from IA 210 to IA 87

Vehicle Speed (mph)

I 35 SB at IA 210

Vehicle Speed (mph)

I 35 SB from US 30 to IA 210

Vehicle Speed (mph)
Comparison with Existing Sensor Data

**I-80 at IA 1 (Iowa City)**
8/31/10 - 9/7/10

**US 59 NB (0.6 miles north of IA 141)**
9/16/2010
INRIX Evaluation Summary

- Amount of real time data correlates with volume
- Speeds reduced by work zones and major traffic incidents
- Speed correlates with roadway detector stations
Potential Non-Technical Issues with Probe Approaches

- **Administrative issues**
  - Changes in data quality
    - Changes in data source
    - Changes in data frequency
    - Changes in method of aggregation/synthesis
  - Business model / contract changes
  - Bankruptcy

- **Political issues**
  - Loss of control over data management
    - Difficulties with anonymity
    - Difficulties in data security
  - Public reaction
  - Potential for abuse
Malte Spitz was surprised by how much detail Deutsche Telekom had about his whereabouts.
Recommendations & Conclusions

- Engage DOT stakeholders to explore use and value of mobile probe data
- Review metadata analysis to see if they meet DOT’s needs for various uses
- Consider potential non-technical issues
- Monitor marketplace
Questions/Comments?

Erik Minge, PE
eminge@srfconsulting.com