TPF-5(171)
Evaluation of Non-intrusive Traffic Detection Technologies  Phase III

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Project Management Team

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- Georgia, Scott Knight
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- Idaho, Jack Helton
- Illinois, Rob Robinson
- Iowa, Troy Jerman
- Mississippi, Mike Stokes
- Montana, Tedd Little
- New York, Kurt Matias
- Ohio, Lindsey Pflum/Anthony Manch
- Texas, Robert Wheeler
- Wisconsin, Susie Ford
Presentation Outline

- Background
- Detectors
- Methodology
- Findings
Prior Mn/DOT Non-intrusive Detection Research

- FHWA & Mn/DOT sponsored tests
  - NIT Phase I: 1995 Ð 1997
    www.dot.state.mn.us/guidestar/1996_2000/nit1.html
  - NIT Phase II: 2001 Ð 2002
    www.dot.state.mn.us/guidestar/2001_2005/nit2.html
  - Bicycle and Pedestrian Test: 2002
  - PNITDS: 2003-2005
    www.dot.state.mn.us/guidestar/2001_2005/pnitds.html
What is Non-Intrusive?

- Do not intrude into pavement for installation.
- Sensors above, below or to the side of the roadway qualify.
- Advantages over conventional methods (loop detectors and road tubes)
  - Safety
  - Traffic disruption
  - Data types
NIT Test Site: Shelter
Bike/Pedestrian Test Site
Eastbound Lanes of I-394
Detector Placement Options

- Pole Flexible
- Guardrail
- Stand-Alone/
Technical Advisory Committee

- Emphasis on heavy congestion in urban areas.
- Strong interest in examining volume, class (axle and length-based) and speed. Some interest in travel times, turning movements, and bike/pedestrian.
- Examine various weather conditions and different mounting configurations.
- Evaluate specific sensors of interest.
- Do not: evaluate prototype sensors, emerging travel time technologies (i.e. Blue Tooth), solar.
Non-Intrusive Detectors

- Wavetronix
  Smartsensor HD
  (Radar)
- GTT Canoga
  Microloops
  (Magnetometer)
- Miovision (Video)
- Peek AxleLight (Laser)
- TIRTL (Laser)
- Declined: RTMS (Radar)
Evaluation Methodology

- Establish baseline
- Compare sensors to baseline
- 24-hour test periods
- Hourly test periods
- Per-vehicle analysis
- Consistency with other test methods
  - ASTM
  - AASHTO
Baseline Choice

- Baseline
  - Piezo-Loop-Piezo (PLP)
    - Axle-based classification, speed
  - Manual classification
    - Axle-based classification
  - Video
    - Length measurement
### Preliminary Findings
GTT Canoga Microloops  Sample Data

#### Volume

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>GTT Microloops</th>
<th>Percent Error</th>
<th>Absolute Percent Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane 1</td>
<td>663</td>
<td>680</td>
<td>2.6%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Lane 2</td>
<td>530</td>
<td>510</td>
<td>-3.7%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Lane 3</td>
<td>470</td>
<td>475</td>
<td>1.1%</td>
<td>1.1%</td>
</tr>
<tr>
<td>Total</td>
<td>1663</td>
<td>1665</td>
<td>0.1%</td>
<td>2.5%</td>
</tr>
</tbody>
</table>

#### Speed

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>GTT Microloops</th>
<th>Error</th>
<th>Absolute Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane 1</td>
<td>57.8 mph</td>
<td>57.5 mph</td>
<td>-0.3 mph</td>
<td>0.3 mph</td>
</tr>
<tr>
<td>Lane 2</td>
<td>60.9 mph</td>
<td>60.9 mph</td>
<td>-0.0 mph</td>
<td>0.0 mph</td>
</tr>
<tr>
<td>Lane 3</td>
<td>64.0 mph</td>
<td>63.2 mph</td>
<td>-0.8 mph</td>
<td>0.8 mph</td>
</tr>
<tr>
<td>Average</td>
<td>60.9 mph</td>
<td>60.5 mph</td>
<td>-0.4 mph</td>
<td>0.4 mph</td>
</tr>
</tbody>
</table>
## Preliminary Findings

### GTT Canoga Microloops Sample Data

#### Classification

<table>
<thead>
<tr>
<th>Baseline PLP Classifier</th>
<th>PV</th>
<th>SU</th>
<th>MU</th>
<th>Missed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV</td>
<td>1557*</td>
<td>18</td>
<td>5</td>
<td>0</td>
<td>1580</td>
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<tr>
<td>SU</td>
<td>18</td>
<td>34</td>
<td>5</td>
<td>0</td>
<td>57</td>
</tr>
<tr>
<td>MU</td>
<td>1</td>
<td>2</td>
<td>25</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td>“Ghost” vehicles</td>
<td>N/A*</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1576</td>
<td>54</td>
<td>35</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
## Preliminary Findings

### Wavetronix HD Sample Data

#### Volume

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Wavetronix SmartSensor HD</th>
<th>Percent Error</th>
<th>Absolute Percent Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lane 1</td>
<td>663</td>
<td>674</td>
<td>1.7 %</td>
<td>1.7 %</td>
</tr>
<tr>
<td>Lane 2</td>
<td>530</td>
<td>516</td>
<td>-2.6 %</td>
<td>2.6 %</td>
</tr>
<tr>
<td>Lane 3</td>
<td>470</td>
<td>472</td>
<td>0.4 %</td>
<td>0.4 %</td>
</tr>
<tr>
<td>Total</td>
<td>1663</td>
<td>1662</td>
<td>0.0 %</td>
<td>1.6 %</td>
</tr>
</tbody>
</table>

#### Speed

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<tr>
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## Preliminary Findings

**Wavetronix HD Sample Data**

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<tr>
<td></td>
<td>PV</td>
</tr>
<tr>
<td><strong>Baseline</strong> PV</td>
<td>1538*</td>
</tr>
<tr>
<td><strong>PLP</strong> SU</td>
<td>3</td>
</tr>
<tr>
<td><strong>Classifier</strong> MU</td>
<td>0</td>
</tr>
<tr>
<td><strong>“Ghost” vehicles</strong> N/A*</td>
<td>3</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1541</td>
</tr>
</tbody>
</table>
Preliminary Findings

Wavetronix HD sample data
Preliminary Findings

Cumulative Volume - Lane 2

Per-Vehicle Speed - Lane 2

Cumulative Volume - Lane 3

Per-Vehicle Speed - Lane 3
Preliminary Findings
Miovision

Study Dashboard (12/29/09 NIT)

Study ID: 17298
Count Name: 12/29/09 NIT
Project: (none)
Start Date: Tuesday, December 29, 2009 9:00 AM
Upload Notes: First three lanes only.

Hardware ID: 803DC4
Setup Rating: ★★★★★
Classification Options
Vehicle: C / M / H / Bu / RV
Ped (no direction): None
Study Type: TMC
Total Length: 06:30:00
Number of Trms: 1
Turnaround Time
Selected: 72 hours
Delivered: 46.5 hours

Show Approach Labels

Locations:
- I-394 Reversible Express Ln
- Kenwood
- Location
- Bryn Mawr
- Meadows
- W
- E

Video Sharing
Video Playback
Video Download
Video Storage
Export Options
Chart Export
Preliminary Findings

Miovision

- I-394 volume test
  - Miovision differed from ADR by about 2%
    - ADR overcounts by about 2% due to lane changes

- Intersection turning movement counts
  - Total error of less than 0.5% for each movement per 15 minute interval
Preliminary Findings

Laser-based sensors

- AxleLight and TIRTL testing is currently in progress
- Long-term testing at Mn/DOT WIM site
- Short-term testing at NIT Site
Preliminary Findings

PEEK AxleLight
Preliminary Findings

TIRTL
Project Findings

- Weather has minimal effect
- NIT sensors have different applications depending on data/power/lane configurations
- Performance varies little from technology to technology
  - Sensor to sensor variation within a given technology is more prominent
Project Findings

- Some sensors offer more data than speed and volume
- In general, heavy traffic has a moderate effect
- Sensor calibration needs are important and can add to the true cost of using a given sensor
  - Some new sensors have auto-calibration that speeds setup
Project Website:
portal.srfconsulting.com/NITPhase3

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