Development of a Framework for Collecting Traffic Data Using Anonymous Wireless Address Matching

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Agenda

• Background
• What it is
• What we did
• What is next
• Lessons Learned
Houston Background

- Regional desire for expansion of existing traffic monitoring system.
- Exploration of more cost effective alternatives (AVI equip +$50k per site)
- Demonstration of address matching technologies
- Assessment of feasibility
- Field deployments for arterial networks
Existing TranStar Website

- Award winning website experiences over 10 million page accesses/500,000 users per month on average
- Freeway travel times are very well received by the public
- Display of arterial travel times are desired by the public
- Existing AVI technology may not be cost effective for wide area deployment on arterials
Existing Technologies

TranStar system currently utilizes a combination of RFID (Transcore) and radar (Wavetronix) for travel time and speed information (over 450 combined)
Why try anything else?

- Cost
- *Bluetooth™* peripherals are becoming widespread
- Easier, non-intrusive field installation and maintenance
- Desire of complete ownership of traffic data samples by operating agencies
Address Matching Concept
Host Software Interfaces

- External Applications
- Data Interface
  - Travel Time Status
  - 15 Minute Match Summaries
  - Raw Matches
  - Raw Reads
- Existing Applications
  - Speed/Travel Time Web Map Display
  - Traffic Data Analysis Package
    - Real-time and historical web-based charts
City of Houston Study
Fall 2008

First phase of study determined that sufficient devices were in operation in the corridor, for travel time measurements.

Subsequent phase proved that Bluetooth address matching was a viable technique for providing arterial travel time information.
Previous Demonstrations

- License Plate Recognition (LPR) technologies were tested successfully in 2007 and 2008 as a potential alternative to toll tags.
- A successful demonstration showed Bluetooth Address Matching as a viable alternative.
- Further deployments extended coverage in the area.
South Main Congestion Map
Average Speeds on I-75 SB: I-70 to North of US 35 (7.5 miles)
April 14, 2009

8 scheduled test vehicle runs per hour (7.5 minute headway)
~ 50 valid Bluetooth travel times per hour
Bluetooth Field Equipment
Toll Tag/Bluetooth Comparison

AVIS Toll Tag Speed Data Samples - I-610 Northbound from I-10 to Ella (2.2 Miles)
Thursday, October 1, 2009

Bluetooth Speed Data Samples - I-610 Northbound from I-10 to Ella (2.2 Miles)
Thursday, October 1, 2009
Bluetooth Data Sample Rate - Freeway

Bluetooth Data Sample Rate - I-610 Northbound from I-10 to Ella (2.2 Miles)
Thursday, October 1, 2009 5 AM to 8 PM

Average Data Samples Per 15 Minutes: 36
Bluetooth Data Sample Rate - Arterial

**Bluetooth Data Match Sample Rate: Westheimer Eastbound**

From Kirkwood to Wilcrest - Monday, February 15, 2010 5 AM to 8PM

Average Data Samples Per 15 Minutes: 14
Prototype Congestion Map
I-45 Current Deployments
Current Houston Deployments

20 units installed in existing signal cabinets
   Total coverage 48 directional miles

2 Traffax units
Bryan-College Station Deployments

24 units installed in existing signal cabinets
Total coverage 36 directional miles
Austin, TX
Deployments

3 units installed in existing ITS traffic cabinets
Total coverage 8 directional miles on IH-35 Freeway.
Phoenix, AZ
Deployments

6 units installed in existing signal cabinets

Total coverage
16 directional miles
# Current Coverage Summary

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of Readers</th>
<th>Directional Mileage</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Houston Arterials</td>
<td>20</td>
<td>48</td>
</tr>
<tr>
<td>Bryan-College Station, TX</td>
<td>24</td>
<td>36</td>
</tr>
<tr>
<td>TxDOT IH-45</td>
<td>4</td>
<td>76</td>
</tr>
<tr>
<td>TxDOT Austin IH-35</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>City of Phoenix Arterials</td>
<td>6</td>
<td>16</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>57</strong></td>
<td><strong>184</strong></td>
</tr>
</tbody>
</table>
Next Step
City of Houston

50 locations, consistent with ATM deployments
170+ Directional Miles of coverage
Next Step
Dallas, TX ICM Pilot

Originally proposed as RFID detection

6 Intersections with Bluetooth Readers
12+ Directional Miles
Ultimate Deployment
Dallas, TX ICM Demonstration

- US 75 Freeway with Continuous Frontage Roads
- HOV lanes on US 75 and IH-635
- Dallas North Tollway
- 167 Miles of Arterials
- DART Bus Network Including Express Service
- DART Light Rail
  - Red and Blue Lines
Next Step

TxDOT Evacuation Route

• Houston to Dallas
• 20+ locations
• Mix of power and equipment
• 400+ miles of Directional Coverage
Next Step
Harris County

387 Intersections with Bluetooth Readers
Lessons Learned
Consider the traffic volume

<table>
<thead>
<tr>
<th>Roadway Segment</th>
<th>AADT</th>
<th>Average Daytime Hourly Matches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westheimer EB – Kirkwood to Wilcrest (1 mile)</td>
<td>21,710</td>
<td>99</td>
</tr>
<tr>
<td>Kirkwood NB – Westheimer to Briar Forest (.7 miles)</td>
<td>10,825</td>
<td>24</td>
</tr>
</tbody>
</table>
Lessons Learned
Choose the right antenna for reidentification

- Antenna 1 - 51% of MAC Addresses read at A & B
- Antenna 2 – 88% of MAC Addresses read at A & B
Lessons Learned
Choose the right field software

Improvement to field software inquiry process resulted in a 50% increase in daily traffic data samples.
Lessons Learned
Choose the right travel time algorithm

- One size fits all approach may not work.
- Consider variance, volume, and roadway characteristics.
Benefits

• Low cost, standards-based, non-proprietary equipment and protocols.
• Easy, non-intrusive field installation and maintenance.
• Large penetration of field devices and data samples.
• Real-time summary calculations.
• Complete ownership of data by operating agency.
Questions?

For more information:

http://ttihouston.tamu.edu/bluetooth