Determination of Origin-Destination Using Bluetooth Technology

Anita Shanker, P.E., PTOE
ITS Arizona Annual Meeting
September 26, 2013
I-526 Corridor Analysis

- Project Background
- BluFax Origin-Destination Data Collection
- VISSIM Analysis Model
I-526 – Project Background

I-526 is one of the most congested corridors in South Carolina.

Designated as a “Mega Project” in the State Long-Range Interstate Plan.

Mega Projects = Construction costs for improvements exceeds the funding of the entire interstate program for South Carolina for multiple years.

No funding for any construction improvements currently identified.
I-526 Work Efforts

• Define Existing Corridor Deficiencies
• Quantify Future Problem Areas
• Identify Potential Improvement Strategies
• Evaluate Strategies for Effectiveness – VISSIM
• Develop Menu of Recommendations

Begin Project at US 52/Rivers Avenue

End Project at US 17/Savannah Highway
I-526 Potential Improvement Strategies

Evaluate the following strategies to reduce congestion:

1. Travel Demand Management (TDM)
2. Modal/Freight
3. Traffic Operations
4. Capacity Improvement
Evaluation of I-526 Strategies

BluFax Data Collection
  • Origin-Destination (O-D) Percentages – CHATS Travel Demand Model
  • Travel Times – VISSIM simulation
  • Weaving Movements
  • New Transit Routing

VISSIM Microsimulation Tool
BluFax Data Collection

Bluetooth Device MAC IDs

BluFax devices record spatially-based data, time and location to measure travel time and speed:
• ~130’ detection radius
• Omni-directional
BluFax Device Installation

BluFax Devices – internal GPS, battery, SD card, Bluetooth
Radio/Antenna
Pole Mounting Brackets
I-526 Device Locations

- 13 Sensors at Interstate Locations, 5 Sensors at Arterial Locations
- 5 days of data collected, Sat. through Wed.
BluStats Software

Processing of BluFax Device data - Stations & Segments

• O-D Percentages
• Mean/Median Travel Times
• By Time Period (AM/PM/Daily)
• By Day (Weekday/Weekend)
BluStats Software – I-526 Data

Processing of BluFax Device data

- Station Processing – 450,000+ total data hits over 5 days
- Segment Processing – 300,000+ matched O-D pairs over the 72-hour weekday period
## O-D Matrix Results

### Balancing of O-D Data

<table>
<thead>
<tr>
<th>INTERSTATE LINK ORIGIN</th>
<th>Aviation Avenue</th>
<th>Remount Road</th>
<th>Montague Avenue (@ I-26)</th>
<th>I-526 East of Montague Avenue</th>
<th>Virginia Avenue</th>
<th>Rhet Avenue</th>
<th>Rivers Avenue</th>
<th>Interi Boulevard</th>
<th>Montague Avenue (@ I-526)</th>
<th>Dorchester Road</th>
<th>Paramount Road</th>
<th>Leeds Avenue</th>
<th>Glenn McConnell Parkway</th>
<th>Sam Rittenburg Boulevard</th>
<th>US 17</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-25 West of Ashley Phosphate</td>
<td>56.4%</td>
<td>6.4%</td>
<td>17.0%</td>
<td>5.3%</td>
<td>0.6%</td>
<td>2.4%</td>
<td>3.6%</td>
<td>2.6%</td>
<td>1.2%</td>
<td>1.7%</td>
<td>0.3%</td>
<td>1.1%</td>
<td>9.6%</td>
<td>1.9%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Aviation Avenue</td>
<td>56.4%</td>
<td>6.4%</td>
<td>17.0%</td>
<td>5.3%</td>
<td>0.6%</td>
<td>2.4%</td>
<td>3.6%</td>
<td>2.6%</td>
<td>1.2%</td>
<td>1.7%</td>
<td>0.3%</td>
<td>1.1%</td>
<td>9.6%</td>
<td>1.9%</td>
<td>6.6%</td>
</tr>
<tr>
<td>Virginia Avenue</td>
<td>46.1%</td>
<td>4.8%</td>
<td>5.6%</td>
<td>32.3%</td>
<td>2.8%</td>
<td>0.3%</td>
<td>1.4%</td>
<td>2.2%</td>
<td>1.2%</td>
<td>0.5%</td>
<td>0.6%</td>
<td>0.1%</td>
<td>0.9%</td>
<td>0.1%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Montague Avenue (@ I-26)</td>
<td>57.0%</td>
<td>6.5%</td>
<td>7.9%</td>
<td>35.0%</td>
<td>0.7%</td>
<td>2.7%</td>
<td>4.1%</td>
<td>2.3%</td>
<td>1.1%</td>
<td>1.5%</td>
<td>0.3%</td>
<td>0.9%</td>
<td>0.2%</td>
<td>0.6%</td>
<td>3.3%</td>
</tr>
<tr>
<td>I-526 East of Virginia Avenue</td>
<td>42.1%</td>
<td>1.2%</td>
<td>1.4%</td>
<td>3.0%</td>
<td>7.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I-26 East of Montague Avenue</td>
<td>42.1%</td>
<td>1.2%</td>
<td>1.4%</td>
<td>3.0%</td>
<td>7.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Note: The table represents the distribution of traffic flows between different road links.*
O-D Results

Daily Traffic from: I-26 West & I-26 East
O-D Results

Daily Traffic from:
I-526 East & US 17
Travel Time Results

Validation of the VISSIM Microsimulation runs
Other BluFax Data Uses

I-526 Corridor Analysis

- Determination of Weaving Movement Percentages – Closely-Spaced Interchanges around I-26 & I-526
- New Transit Route Planning

Other Studies

- Travel Time Runs for Signal Timing Before/After Study
- 45 Sensors for O-D & Wayfinding around Myrtle Beach and Conway, South Carolina (WRCOG)
### Origin-Destination Data Collection Cost Comparison

<table>
<thead>
<tr>
<th></th>
<th>Bluetooth</th>
<th>ALPR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Locations</strong></td>
<td>18</td>
<td>4</td>
</tr>
<tr>
<td><strong>24-Hour Periods</strong></td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td><strong>Detection Rate</strong></td>
<td>6.5%</td>
<td>60-90%+</td>
</tr>
<tr>
<td><strong>Approximate Cost</strong></td>
<td>$25,000</td>
<td>$100,000+</td>
</tr>
</tbody>
</table>
DETERMINATION OF ORIGIN-DESTINATION USING BLUETOOTH TECHNOLOGY

RICHARD REIFF, P.E., PTOE