Probe Data for Arterial Performance Measures

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Vehicle Probes

- Alternative source of travel time data
- Third party vendors aggregate highway vehicles’ travel data
- Many different devices within or embedded in vehicles transmit the data
- Aggregated data is usually cleaned to get one reading per segment of roadway per time period
- Data available to users through web-interface / API
Applications

Operations

Traffic Management Centers

Traveler Info

Planning

Investment Justification

Performance Monitoring

Picture Sources: WSDOT, VDOT, Creative Loafing ATL, Maryland SHA, FHWA
Not All Probe Data is Created Equal

• Probe data was first used for freeway-based applications
• Probe data users became interested in arterial-based applications
• The I-95 Corridor Coalition Vehicle Probe Project’s (VPP) validation program accessed the accuracy of the probe data
• Freeway data is generally more accurate than arterial data for several reasons
Fundamental Facility Differences

Freeways (Uninterrupted)
- High volumes
- Continuous Flow

Arterials (Interrupted)
- Lower volumes
- Interrupted flow
  - Red lights
  - Driveways
  - Adjacent land uses
- Not all arterials data is created equal
  - Vary by volume, signalized intersections, driveways, geometry
  - Mobility Vs. Accessibility
- Which arterials can have probe data to derive performance measurements?
VPP Validation

• Contract requires vendors to meet certain quality metrics
• This requires frequent validation studies on representative corridors to ensure that data meets metrics
• For freeways these metrics include Average Absolute Speed Error (AASE) and Speed Error Bias (SEB)
• These metrics work well for a uni-modal freeway travel time distributions, but not multi-modal arterial travel time distributions

Picture Sources: BTS, FHWA
Alternate Validation Method (1/2)
24 Hour Overlay Plot
Alternate Validation Method (2/2)
The Whole View

\[ PTI = \frac{95\text{th Percentile}}{15\text{th Percentile}} = \frac{7.7}{1.7} = 4.5 \]
Example 1 Corridor Description

- US-1, Mercer County, New Jersey (Princeton)
- 6-8 lanes total
- <1 Signal per mile, 3.2 miles long
- Grade separate interchanges
- Minimal access points
- Resembles a freeway
Example 1 Comparison

- VPP
- BTM

\[ \text{PTI} = 2.1 \]
Example 2 Corridor Description

- US-130, Burlington County, New Jersey
- 6 lanes total
- 2 Signals per mile, 1.5 miles long
- Multi-cycle signal failures
Example 2 Comparison

PTI = 1.4

PTI = 2.5
## Recommendations

<table>
<thead>
<tr>
<th>Arterials likely to have accurate probe data</th>
<th>Arterials possibly to have accurate probe data</th>
<th>Arterials unlikely to have accurate probe data</th>
</tr>
</thead>
<tbody>
<tr>
<td>• AADT &gt;40000</td>
<td>• AADT 20K to 40K</td>
<td>• Low volume, AADT &lt;20K</td>
</tr>
<tr>
<td>• 2+ lanes each direction</td>
<td>• 2+ lanes each direction</td>
<td>• &gt;=2 signals per mile</td>
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<tr>
<td>• &lt;= 1 signals per mile</td>
<td>• 1 to 2 signals per mile</td>
<td>• Major collectors (HPMS)</td>
</tr>
<tr>
<td>• Principal Arterials</td>
<td>• Minor Arterials (HPMS)</td>
<td>• Probe data not recommended</td>
</tr>
<tr>
<td>• Limited Curb cuts</td>
<td>• Some segments work (likely), others fail (unlikely)</td>
<td>• Frequent cycles failures</td>
</tr>
<tr>
<td>• Confidently characterize congestion and performance measures</td>
<td>• No cycle failures</td>
<td>• Use re-identification for performance monitoring</td>
</tr>
</tbody>
</table>
Future

• Probe data will improve with:
  • Larger sample sizes
  • Better processing (point pairing as opposed to instantaneous)
  • Improved segmentation (already happening)
• Arterials that previously did not have accurate probe data may have accurate probe data (check every 18 to 24 months)
• In the mean time, verify validity if unknown
• Use the whole spectrum of the travel time distribution