QUALITY ASSESSMENT OF OUTSOURCED PROBE DATA ON SIGNALIZED ARTERIALS: NINE CASE STUDIES IN MID-ATLANTIC REGION

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Abstract

This paper presents results of an I-95 Corridor Coalition sponsored project to assess the ability of outsourced vehicle probe data to provide accurate travel time on signalized roadways for the purposes of real-time operations as well as performance measures.

Introduction

- The quality of outsourced probe data on freeways has led many D.O.T.s to consider such data for arterial performance monitoring.
- From April 2013 through June of 2014, the UMBC Center for Advanced Transportation Technology (CATT) gathered travel times from several arterial corridors within the mid-Atlantic region using Bluetooth traffic monitoring (BTM) equipment, and compared these travel times with the data reported to the I-95 Vehicle Probe Project (VPP) from an outsourced probe data vendor.
- The analysis consisted of several methodologies:
  1. A traditional analysis using precision and bias speed metrics.
  2. A slowdown analysis which quantified the percentage of significant traffic disruptions accurately captured in the VPP data.
  3. A sampled distribution method in which uses overlay methods to enhance and analyze recurring congestion patterns.

Case Study Locations

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<thead>
<tr>
<th>Case Study</th>
<th>Type</th>
<th>Probability</th>
<th>AADT</th>
<th>Signal Density</th>
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Analysis Methods

Traditional Validation

- Daily 24-hour data plots contrasting the VPP data with the BTM reference data were generated for each corridor.
- Average Absolute Speed Error (AASE): The mean absolute value of the difference between the mean speed recorded from the VPP and the reference mean speed for a specified time period.
- Speed Error Bias (SEB): The average speed error in each speed bin. A typical set of speed ranges for an arterial was 0-15 mph, 15-30 mph, 30-45 mph, and >45 mph, though the actual range differs based on the facility.
- Due to insufficient sample size, high-variance, and multi-modal data traditional methods are less effective on arterials.
- The natural variability induced by signals tended to mask actual performance.
- This led to using other methods.

Slowdown Analysis Method

- The slowdown analysis is effective in assessing the ability of probe data to capture significant disruptions in traffic.
- The significant disruption is defined as a speed reduction of at least 15 mph from nominal for a period of one hour or more. On slower speed arterials, the threshold may be reduced to 10 mph, and 30 minutes.
- A Fully Captured slowdown: The probe data indicated a significant disruption in traffic flow, and accurately threshold (80%) characterized its magnitude both in reduction in speed, and in length of duration.
- Partially Captured slowdown: The probe data indicated a significant disruption to traffic, but the magnitude of the slowdown was not accurate either in reduction of speed or duration of event.
- Failed to Capture: The probe data either completely missed the slowdown, or the extent of severity of the slowdown was significantly different from the reference data such that the slowdown would not be interpreted as a significant disruption to traffic.

Sampled Distribution Method

- The sampled distribution method is based on 24-hour overlay plots and corresponding cumulative frequency diagrams (CFDs).
- Overlay plots are constructed by graphing multiple days of data on a single 24 hour timeline.
- Each cumulative frequency diagrams (CFDs) is constructed from the percentiles of the travel time data in the overlay plot for the respective hour.
- Common performance measures (TTI, PTI, BTI, IQR, 25th, 50th, 75th and 95th Percentiles) could be directly calculated for peak periods.
- Whereas the strength of the traditional analysis and slowdown analysis is to assess the performance of the traffic data during specific slowdowns or incidents, this method reinforces repeatable traffic phenomenon, enhancing the density of travel-time samples and thus increasing the detail of any recurring congestion.

Conclusion

- Fundamental issues with Arterial Performance and Probe Data: Whenever there is a bi-modal speed distribution, probe data almost invariably reports the faster of the two modes.
- Recommendations Moving Forward:
  - Outsourced probe data fidelity should be continued to be validated on arterials.
  - Measures that convey the distribution of travel time, including flagging the presence of bi-modal progression needs to be addressed by industry.

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