The Impact of Probe Data Resolution on the Estimation of Stitched Route Travel Times
David Craft, Sangkey Kim, R. Thomas Chase, Billy M. Williams, and Nagui M. Rouphail

Overview
Travel time reliability, which is defined as the temporal consistency of route travel time, has recently become an important study in the field of transportation. The aggregation interval determined for reporting data may have a significant impact in the resolution of the performance measures derived from the data. The increased traffic condition smoothing created by the long aggregation intervals can result in a potentially significant loss of accuracy in reliability metrics such as derived route travel times. The study presented in this paper analyzed and compared the difference in reliability measures based on route travel time information derived from concurrent data aggregated at intervals of 1, 5, 10, and 15 minutes. The loss of travel time resolution in the data from larger interval aggregation was analyzed. Maximum differences in travel times were found for five different sets of data covering three different routes. Probabilities for specific loss in resolution thresholds were found and consideration was given to route length as loss in resolution was expressed as a percentage of travel time. The data for this study is provided by INRIX, a global provider of real-time traffic information.

Selected Routes
Three I-40 routes in North Carolina were selected as study routes. Route 1 is westbound from I-440 to Apex Highway (NC55), while Route 2 is the eastbound direction of Route 1. Route 3 is westbound from the I-95 interchange to the I-85 interchange. Route 1 consists of 22 INRIX TMC segments with a total travel length of 13.31 miles. Route 2 also contains 22 INRIX TMC segments that sum to a total travel length of 13.57 miles. Route 3 consists of 65 INRIX TMC segments with a 69.11 miles total travel length.

Data Processing and Cleaning
During 2010 and 2011, each INRIX TMC segment’s one minute speed data were collected from the RITIS server. After collecting and cleaning the yearly one minute segment data, travel times were determined based on the segment speeds. For building route travel time by each departure time, this study uses the stitched route travel time method due to the fact that drivers do not experience an entire route simultaneously. The stitched method uses space mean speed to determine the trajectory of a pseudo vehicle.

Route Travel Times
After calculating the three route travel times by the four different aggregated time intervals, all weekdays 95th percentile travel times and average travel times were calculated for each departure time. 95th percentile route travel time is often used as the planning time, therefore it is important to research the 95th percentile route travel time by each aggregated time interval. Because Route 3 is a significantly longer route, it tends to produce the largest loss in resolution for the estimated travel times. This poster presents the results for Route 3 and the 95th percentile.

Loss in Resolution Comparison

<table>
<thead>
<tr>
<th>2010 Route 3 Percentage 95th Percentile Travel Time Loss</th>
<th>1 Minute vs. 5 Minute</th>
<th>1 Minute vs. 10 Minute</th>
<th>1 Minute vs. 15 Minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>Max Over</td>
<td>Max Under</td>
<td>7.45%</td>
</tr>
<tr>
<td>10 min</td>
<td>9.77%</td>
<td>16.80%</td>
<td>11.21%</td>
</tr>
<tr>
<td>15 min</td>
<td>0.0021</td>
<td>0.0021</td>
<td>11.21%</td>
</tr>
</tbody>
</table>

95th Percentile Travel Time Results

95th Percentile Loss in Resolution Probability

Conclusions
The probability of the loss in resolution becoming greater than ±2 minutes is less than 1% in average route travel time and less than 1% for ±5 minutes in 95th route travel time through all different aggregated time intervals, routes, and years. Therefore it is possible to use 5, 10 or 15 minute aggregated time interval data to build travel time index if the accuracy acceptance limit is larger than ±5 minutes. According to the Tokyo Metropolitan Expressway survey, ±5 minute differences in travel times are in the acceptance range for 70% of the survey participants. These participants gave similar responses for both a 30 minute and 60 minute route, indicating that users tend to look at time loss or gain for accuracy rather than percentage of travel time. Also, the aggregated 5, 10 and 15 minutes intervals in this study were based on stitched one minute travel times. Further research could focus on how aggregating raw one-minute speed data before stitching compares to aggregating one minute travel times after stitching.

Institute for Transportation Research and Education (ITRE) at North Carolina State University (NCSU) – http://itre.ncsu.edu