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Measuring and Valuing Travel Time Reliability From the Traveler Perspective

23 January 2011

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presented at
Travel Time Reliability-World View and Lessons Workshop
TRB Annual Meeting
Washington DC
Overview

• System Reliability = Aggregated Traveler Reliability Experiences

• Limitations of Facility-Centric Reliability Aggregation

• Can Traveler Reliability Be Observed? (and consequently be measured and valued?)

• Addressing the Challenge of Quantifying the Traveler Reliability Experience
  – USDOT Integrated Corridor Management Program (ICM)
  – USDOT HOWLATE Studies
  – SHRP2 L14 Experiments

• Conclusions
Measuring Travel Reliability: Facility vs. Traveler Perspectives

Assume Blue route is 50% reliable and Purple route is 50% reliable. Both routes have roughly the same average travel time.

What is the traveler on-time reliability experience between Pasadena and Long Beach?

   a. 50%
   b. 0%
   c. 100%

A traveler might use different paths and facilities... might depart at different times, forgo or abandon a trip.

No simple aggregation of individual facility reliability over time accurately replicates the traveler reliability experience.
USDOT Integrated Corridor Management (ICM) Program: Reliability in Complex Networks

DALLAS ICM CORRIDOR

SAN DIEGO CORRIDOR
ICM: Challenges in Measuring Reliability
Traffic Simulation Analyses (Phase 2)

- Complex, Multi-Modal networks
  - Transit facilities
  - HOV and/or priced managed lanes
  - Parking facilities
  - Parallel freeway and arterial routes

- Consistency in Reliability Measurement, Traffic Simulation
  - Standard calculation procedures established for all ICM sites
    - Travel time, delay, reliability, reliability-weighted system throughput
  - These calculation procedures based on individual trip records obtained from three different traffic simulation models
  - Reliability improvements account for roughly half of all ICM benefits (valuation of reductions in travel time variance)
  - Documents on ICM Knowledgebase
    (http://www.its.dot.gov/icms/knowledgebase.htm)
Measuring and Valuing Travel Time Reliability: HOWLATE

• Heuristic On-line Web-Linked Arrival Time Estimation
  – HOWLATE is a (relatively) low-cost evaluation method that can comprehensively assess and quantify trip-level reliability
  – Simple dynamic programming techniques employed to assess how well various user strategies

• Based on archived travel time data, underlying travel time error estimates, usually a year or more

• Estimates user benefit only
  – Can’t estimate future system reliability if system changes
  – Can’t estimate effect on non-users

• More than a dozen case studies (1999-2007), evaluating and valuing impacts of traveler information on travel reliability
"Re-Enacting" Commutes via Simulation

Travel Times

<table>
<thead>
<tr>
<th>Day</th>
<th>Outer Loop</th>
<th>Inner Loop</th>
<th>B/W Pkwy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>56</td>
<td>61!</td>
<td>52</td>
</tr>
<tr>
<td>2</td>
<td>48</td>
<td>54</td>
<td>59</td>
</tr>
<tr>
<td>3</td>
<td>77!</td>
<td>63!</td>
<td>61!</td>
</tr>
</tbody>
</table>

511 Pre-Trip Pick

! Late Arrival

Optimal Choice

Start Laurel @ 4:00 PM

End Dale City @ 5:00 PM
Risk of Being Late vs. Travel Budget

- Experienced Commuter (Risk-Averse)
- Advisory User
- Personalized ATIS User
- Experienced Commuter (Risk-Taking)
- Unfamiliar Traveler (Risk-Averse)
- Unfamiliar Traveler (Risk-Taking)

Time Expended in Excess of Optimal Travel Budget

Percent Late Trips
SHRP2 L14: Value of Travel Reliability Information Experiments

- Collaborative effort with Texas Transportation Institute (TTI)
  - Co-PIs: Sue Chrysler and Beverly Kuhn

- Conduct experiments that address the types of information that provide reliability context to unfamiliar trips
  - Subjects are engaged in a game managing the commute to work in an unfamiliar location
  - Some subjects receive contextual information on overall system reliability expectations
  - Some subjects receive real-time travel time estimates on primary and alternative routes
  - Each subject rates stress and willingness to pay for information types throughout the game

- Experiments designed to yield data intended to value both contextual and real-time data for unfamiliar travelers
You choose between starting your commute at 7:45, 8:00, or 8:15 in the morning. You want to be on time, but you also don't want to waste money on the meters downtown. Also, your family back home can only call you at 7:45am, so your preference would be to head out at 8:00 am or later.

You subscribe to a traffic information service that you can check every morning at 7:30. The service gives you real-time travel time information.

Now, it's 7:30am Monday morning, your first day getting ready for work. You're looking at the message sign on the highway from your hotel window... let's begin day 1!
SHRP2 L14: Value of Travel Reliability Information Experiments

SHRP2 L14: Effectiveness of Different Approaches to Disseminating Traveler Information on Travel Time Reliability
Travel Time Reliability Should Be Valued With Respect to Travel Context and Traveler Choice

• Travel Context
  – Trip purpose
  – Target time of arrival and preferred destination
  – Trip motivation, decisions and outcomes
  – Note: there is inherent utility in travel but this is *rarely* measured

• What defines a successful trip outcome?
  – Safe, on-time arrival
  – Constrained by costs and expectations
    • Monetary
    • Non-monetary (hassle)

• Reliability-related productivity of the integrated transportation system = the number of successful trip outcomes the system delivers over time
Summary of Considerations: Measurement and Valuation of Travel Time Reliability

• In complex networks with extensive traveler choice, reliability is best calculated by the aggregation of trip experiences, not the aggregation of facility measures of reliability

• Travel time reliability measurement always makes assumptions about traveler behavior/information, explicitly or implicitly

• A number of techniques can be used to analyze reliability from the trip-level, or traveler perspective

• Current research continues to tie measurement and valuation closer to trip context and traveler decision