Modeling Long Term Impacts of Freeway Traffic Incidents on Travel Time Reliability

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Key Terms – Travel Time (TT), Travel Time Reliability (TTR)

Introduction
Travel time reliability is a measure of the consistency of travel times. Since commuters and shippers are averse to unexpected delays, quantification of the reliability of travel time prediction will enable road users to plan a trip efficiently. Transportation agencies are concerned with improving travel time reliability due to the fact that it indicates how the users perceive system performance.

Literature Review
Previous research on TTR focuses on development of indices and estimation of TTR. Very few studies have been dedicated to exploring the effects of incidents on travel time reliability.

Objective
The objective of this study is to calibrate models of relationships between Travel Time Reliability measures and incident and traffic characteristics for a given highway segment.

Significance & Benefits
The significance of this research is that the models developed are based on historical incident and traffic data unlike the few previous studies that use simulation software.

The models developed can be used to supplement B/C studies for incident management programs/projects and justification of implementing Advanced Traveler Information Systems (ATIS) strategies.

Methodology

TTR Measures
Traditional measures of TTR include:
- 90th or 95th percentile TT
- Buffer Time
- Buffer Index

Obtain travel time, incident details for segment by day of week and time of day

Mixed incident and non-incident hours
Plot distribution of data

Only Non-incident hours
Plot distribution of data

Obtain standard deviation, 95th percentile TT, buffer time

Calculate difference in 95th percentile TT, buffer times and buffer index

Create database for calibration and analysis

Statistical Modeling
Linear: \( Y = b_0 + \sum b_j x_j \)
Exponential: \( Y = e^{b_0 + \sum b_j x_j} \)
Power: \( Y = b_0 x_j^{b_1} \)

Where:
- \( Y \) = Travel Time Reliability Indices
- \( b_j \) = regression coefficients
- \( x_j \) = independent variables (incident, traffic characteristics)

Best model will be recommended based on adjusted \( R^2 \), Akaike Information Criteria (AIC) or Bayesian Information Criteria (BIC).

Analysis
Demonstration Case Study:
- I-15 NB from I-215 to US-95
- Alternate Mondays from 1 PM to 9 PM
- Year 2011

Dependent Variables: 95th percentile (Mixed-Non-incident) Independent Variables: Averages of number of incidents, blocked lanes, blocked duration, volume, presence of incidents in the previous hour etc.

Preliminary Results

General Trend:

Sample Inference:
- Reduction of 1 incident will result in increase of TTR (95th percentile TT) by 2.31 minutes
- Reduction of a minute of incident duration will cause an increase in TTR by 0.03 minutes
- Reduction of average density by 1 vehicle per mile per segment will increase TTR by 0.04 minutes