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

Vidhya Kumaresan, M.S.E., E.I.; Advisor: Dr. Mohamed Kaseko, Ph.D.
Department of Civil and Environmental Engineering and Construction, University of Nevada Las Vegas

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

Statistical Modeling

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

Where:
- \( Y \) = Travel Time Reliability Indices
- \( b \) = regression coefficients
- \( x \) = 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.

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