Assessing the major causes of travel time reliability on urban freeways

by

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Outline

• Introduction
• Travel Time and Travel Time Reliability
• Measures of Reliability
• Causes of Travel Time Variability and Reliability
• Pilot Case Study
• Conclusion
Averages don’t tell the full story

How traffic conditions have been communicated

Travel time

Annual average


Travel time

What travelers experience

Travel times vary greatly day-to-day


What they remember
Definitions of Reliability

- The consistency or dependability in travel times from day to day
- The variability between the expected travel time and the actual travel time
- The variability and predictability of travel times
Measures of Reliability

- Percentage Variation
- Buffer Time Index
- Misery Time Index
  - Travel Time Window
  - Congestion Frequency
  - Lognormal Distribution
  - On-Time Travel
Reliability measures
Percentage Variation

- Percent Variation (PV) =

\[
\text{Percent Variation (PV)} = \frac{\text{Standard Deviation}}{\text{average travel time}} \times 100
\]
Buffer time index

- Buffer Time Index (BTI) =

\[
\frac{95\text{th percentile travel time} - \text{average travel time}}{\text{average travel time}} \times 100
\]
Misery Time Index

• Misery Time Index (MI) =

\[
\text{Average Travel Time for Worse 20\% trip} - \text{Average Travel Time} \times 100
\]
So Why Do Travel Times Vary?

**Sources of Unreliability**

1. Traffic incidents
2. Weather
3. Work zones
4. Special events
5. Day-to-day demand (volume) fluctuations
6. Traffic control devices (railroad crossing, poor signal timing)
7. Inadequate base capacity
Factors Affecting Reliability

- Special Events
  - Planned
  - Unplanned
- Daily/Seasonal Variation
- Traffic Control Devices
- Congestion ("Recurring" or "Non-recurring")
  - Planned
  - Unplanned
- Demand Volume
- Physical Capacity
- Weather
- Incidents
- Work Zones
- Travel Time Reliability
- Travel Time Variability
Pilot Case Study
Pilot Case Study
Distributions of travel time and traffic volumes
Pilot Case Study
Distributions of travel time and traffic volumes
Pilot Case Study
Traffic volumes and travel time relationship

Segment 1 - Marshal road to Esher St. (Northbound)

Segment 1 - Marshal road to Esher St. (Southbound)
Pilot Case Study
Traffic volumes and travel time relationship
## Pilot Case Study
### Travel time reliability measures

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<th>Segment 1</th>
<th>Northbound (Sec)</th>
<th>Southbound (Sec)</th>
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<td>95% TT</td>
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<tr>
<td>9-Mar</td>
<td>28.2</td>
<td>32.8</td>
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<td>280.8</td>
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Pilot Case Study
Traffic volumes and travel time reliability relationship

- Northbound
Pilot Case Study
Traffic volumes and travel time reliability relationship

- Southbound
Conclusions

- Travel time reliability varies across freeway segments
- Seven main reliability causes identified
- Several definitions each addressing a different concept
- The number of vehicles can be considered as an effective factor in modelling TTR
- To model Travel Time Reliability full set of data is needed
Thank you

Questions