

50th Annual Transportation Research Forum
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Reliability Measures: Which Statistics Will Actually Help Manage our Roadways?

Why travel time reliability?

- Agencies monitor congestion levels on freeways
- Travel time useful statistic
- Used for:
 - operational decisions
 - mode choice model inputs
 - effectiveness of high occupancy toll lanes
 - freeway system performance monitoring
 - congestion mitigation measurement
- Average travel time is not enough

Topics

- Existing reliability statistics
- SR 520 results
- Recommended statistics
- Ongoing research

Proposed Reliability Statistics

$$\text{Planning Time Index} = \frac{\text{95th percentile TT}}{\text{Free Flow TT}}$$

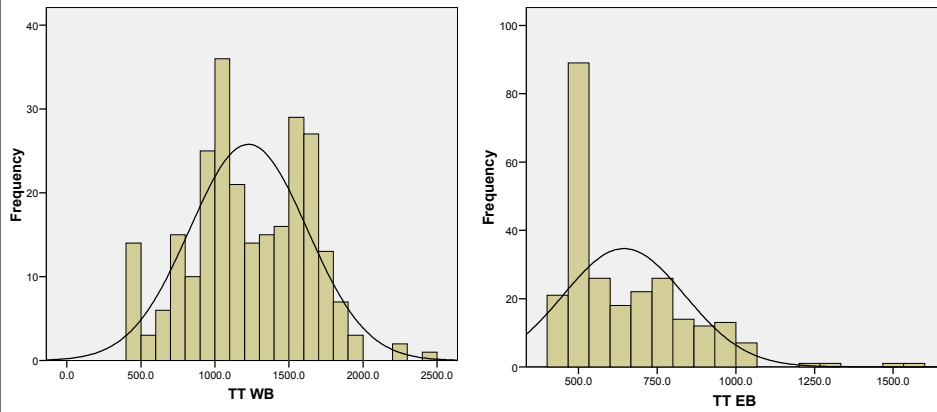
$$\text{Buffer Index (\%)} = \left[\frac{\text{95th percentile TT} - \text{Average TT}}{\text{Average TT}} \right] * 100\%$$

Source: TTI, Cambridge

$$\text{TT Variability} = \frac{\text{Standard Deviation of TT}}{\text{Average TT}}$$

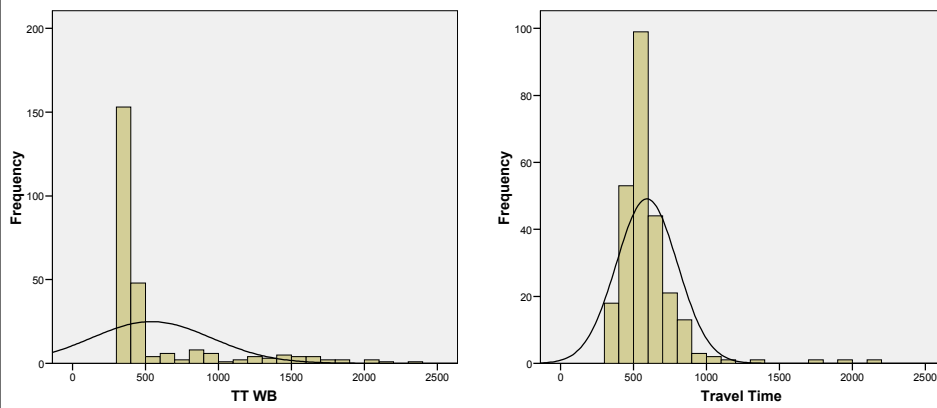
Source: CalTrans

Skewed Distribution



SR 520 Seattle section

Skewed Distribution



SR 520 Redmond section

Proposed Reliability Statistics

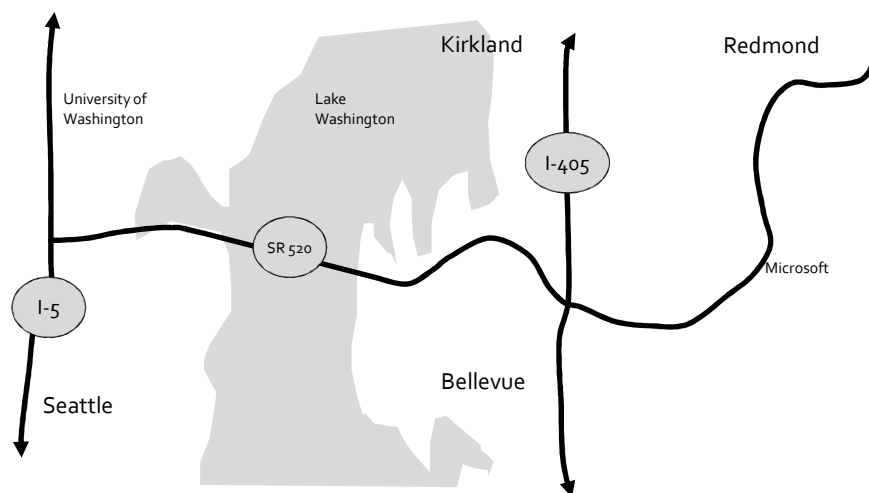
$$UI_n = \begin{cases} \frac{\lambda^{var} \ln(\lambda^{skew})}{L_n} & \lambda^{skew} > 1 \\ \frac{\lambda^{var}}{L_n} & \text{otherwise} \end{cases}$$

$$\lambda^{skew} = \frac{TT90 - TT50}{TT50 - TT10} \quad \text{where } TT10 < TT50 < TT90$$

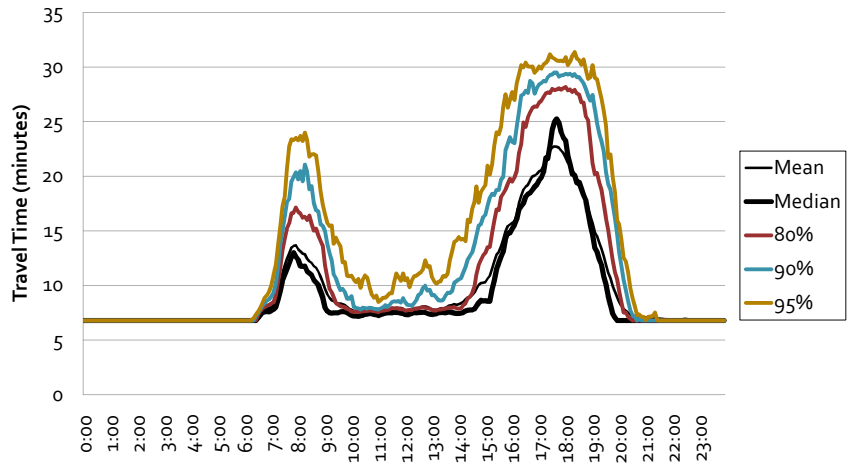
$$\lambda^{var} = \frac{TT90 - TT10}{TT50}$$

Source: Van Lint, et al

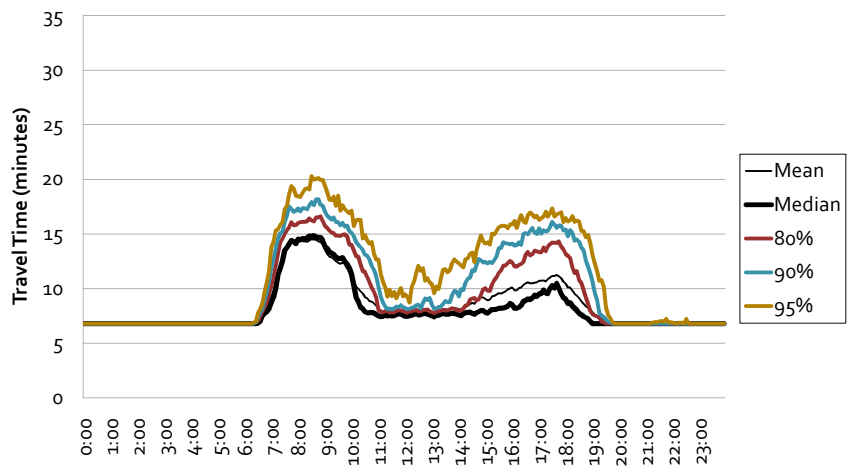
WSDOT Data



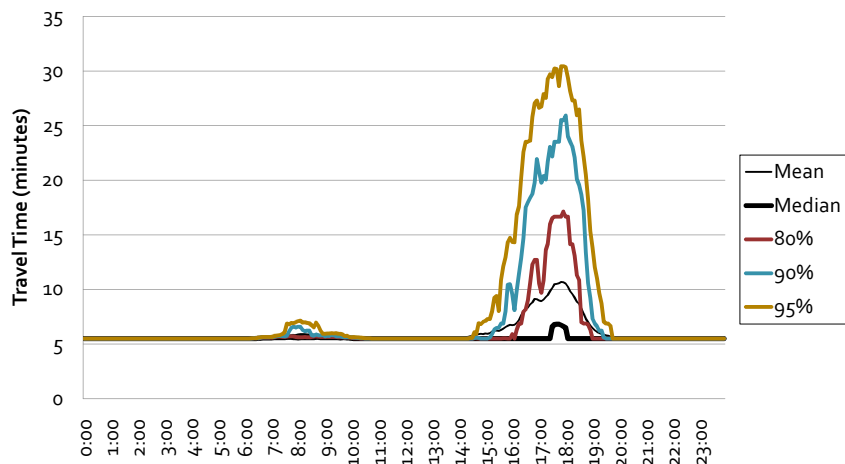
SR 520 WB - Seattle section



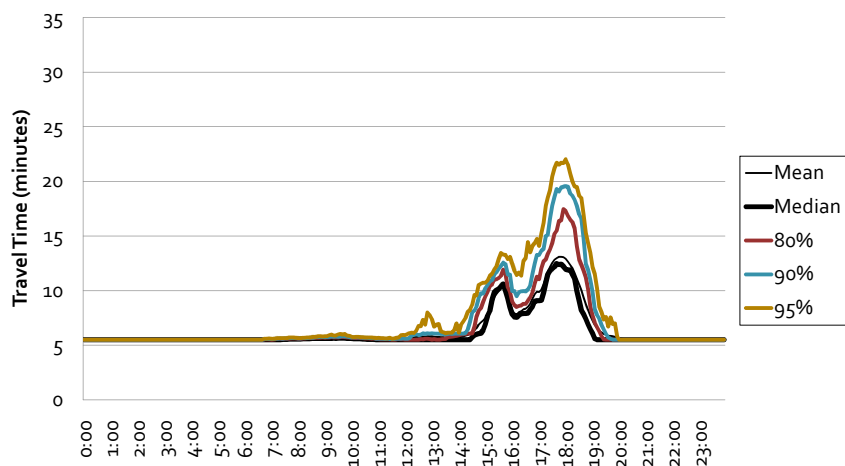
SR 520 EB - Seattle section



SR 520 WB – Redmond section



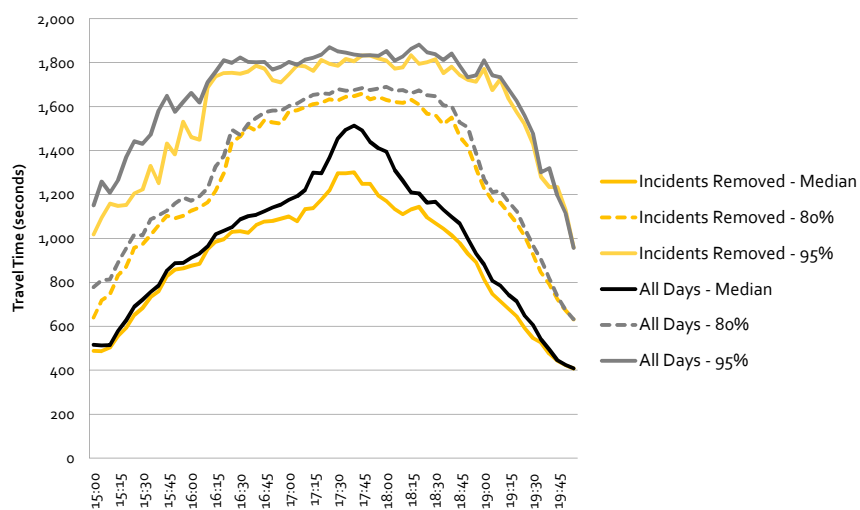
SR 520 EB – Redmond section



Recommended Reliability Statistics

- More than one definition of TT reliability
- Median is a better central tendency statistic
- Variation in TT requires:
 - 80th percentile
 - 90th percentile
 - 95th percentile

Reliability Analysis

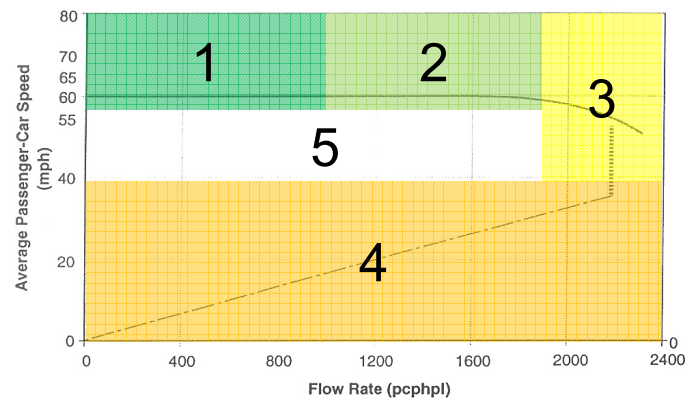


Ongoing Work

- SR-520 data expanded to other corridors
- Impacts to TT reliability due to:
 - Traffic volume regimes
 - Incidents
 - Weather

Traffic Regime

- Uses maximum speed and minimum volume from any loop detector in corridor
- Testing boundaries and effects



Incidents and Accidents

- WSDOT Incident Response Tracking System (WITS) data
 - Max incident length
 - Max closure length (if lane closed)
- WA State Patrol (WSP) data
 - Crash
 - Severity
- Expansion on data
 - Rubbernecking
 - Time and Queue Extended

Weather Variables

- Uses NOAA National Weather Service data from the airport
 - Presence of Rain, Heavy Rain, Wind, Snow / Ice
 - Amount of Rain in last hour, last 2 hours, last 4 hours
 - Wind Speed

Ongoing Work

- Major Goal : Develop statistical relationships between highway improvements and travel time reliability
- Better understand impacts of variables on travel time reliability
- Expand statistics to transit TT reliability

Thank you

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