

50<sup>th</sup> Annual Transportation Research Forum  
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March 17, 2009

## **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

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

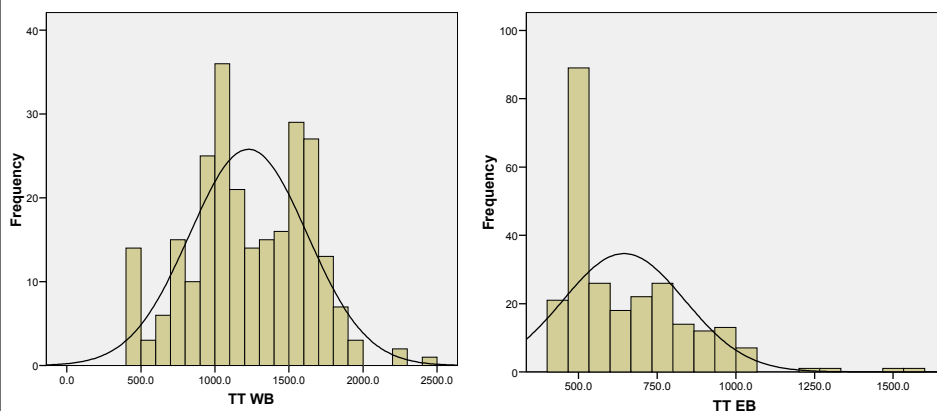
$$\text{Buffer Index (\%)} = \left[ \frac{\text{95th percentile TT} - \text{Average TT}}{\text{Average TT}} \right] * 100\%$$

Source: TTI, Cambridge

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

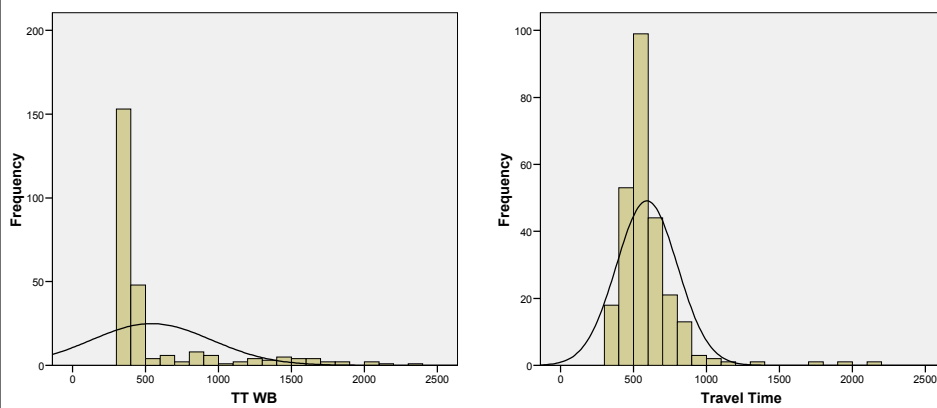
Source: CalTrans

## Skewed Distribution



SR 520 Seattle section

## Skewed Distribution



SR 520 Redmond section

## Proposed Reliability Statistics

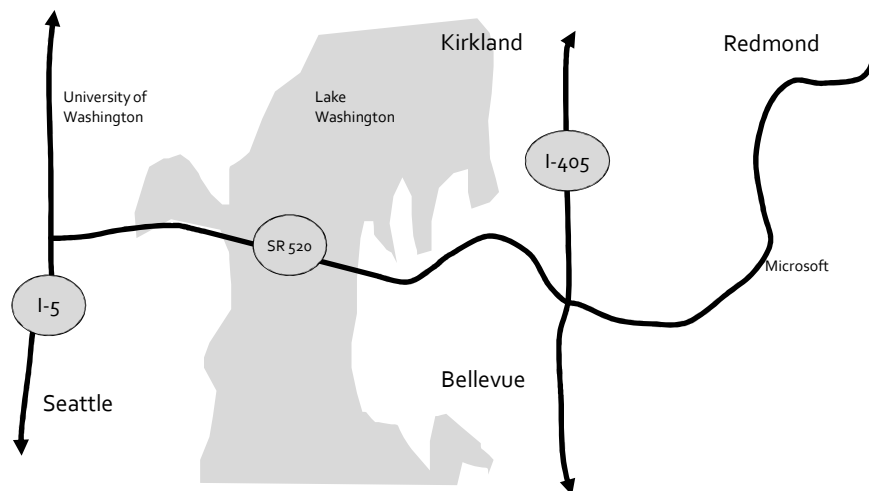
$$UI_n = \begin{cases} \frac{\lambda^{var} \ln(\lambda^{skew})}{L_n} & \lambda^{skew} > 1 \\ \frac{\lambda^{var}}{L_n} & \text{otherwise} \end{cases}$$

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

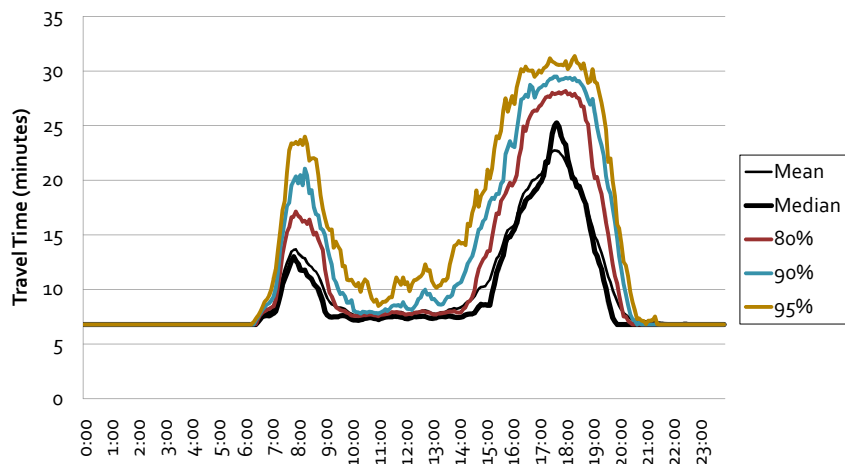
$$\lambda^{var} = \frac{TT90 - TT10}{TT50}$$

Source: Van Lint, et al

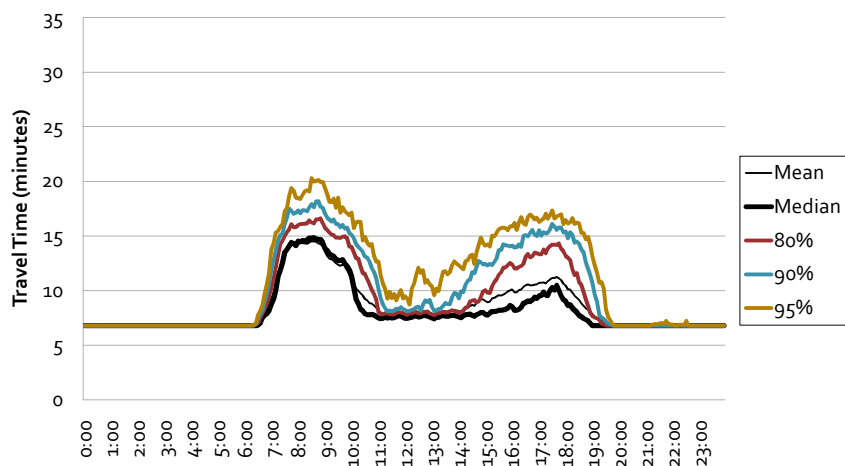
## WSDOT Data



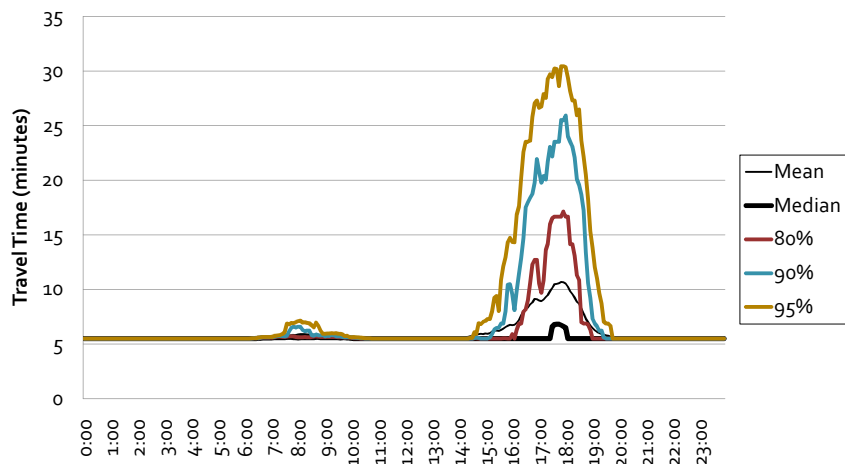
## SR 520 WB - Seattle section



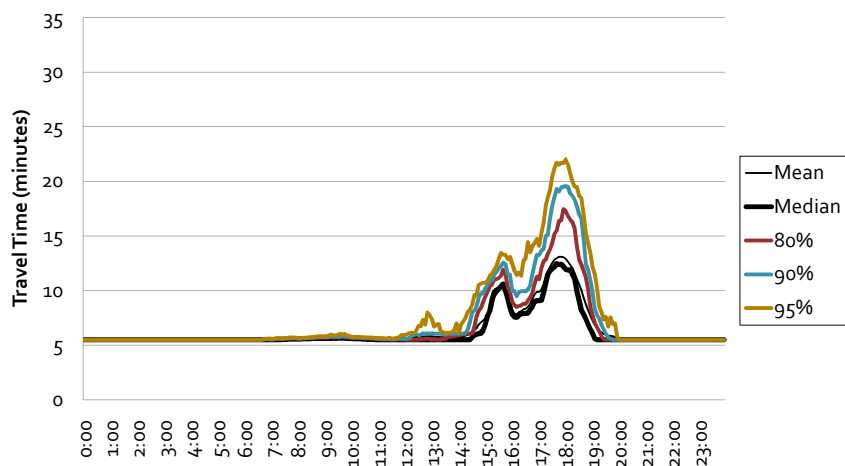
## SR 520 EB - Seattle section



## SR 520 WB – Redmond section



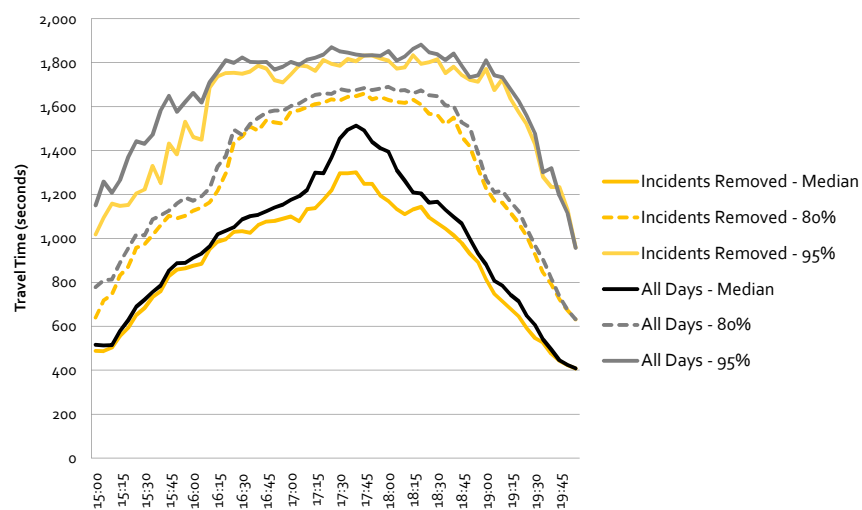
## SR 520 EB – Redmond section



## Recommended Reliability Statistics

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

## Reliability Analysis

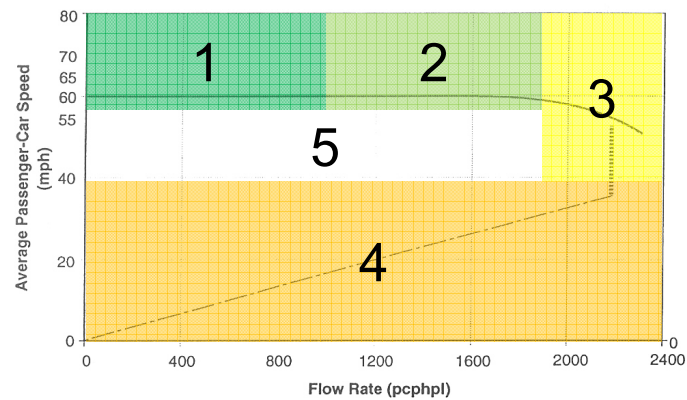


## Ongoing Work

- 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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- This research is funded through the Transportation Research Board SHRP 2 Reliability program