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SHRP2 SOLUTIONS
TOOLS FOR THE ROAD AHEAD

RELIABILITY DATA AND ANALYSIS TOOLS (L02/L05/L07/L08/C11)

A tool suite to help transportation planners and engineers improve data monitoring and analysis to achieve more consistent, predictable highway travel.

CASE STUDY

Utah Department of Transportation

Implementing a Suite of Travel Time Reliability Tools in Utah

ABOUT THIS CASE STUDY

The second Strategic Highway Research Program (SHRP2) developed data and analysis tools to improve the measurement and management of travel time reliability by transportation practitioners. The SHRP2 Program provided funding to help agencies test the tools and incorporate reliability into their business practices. The Utah Department of Transportation (UDOT) project included the following tools:

DATA COLLECTION AND INTEGRATION

L02 Guide to Establish Monitoring Programs for Travel-Time Reliability
Guidebook, visualization tools, and methods for integrating data to analyze reliability, including causes and locations of unreliable performance and identification of potential mitigating strategies.

ANALYSIS

L08 Incorporating Travel-Time Reliability into the Highway Capacity Manual
Highway Capacity Manual (HCM) update to estimate travel-time reliability performance measures on major freeways and urban arterials in a corridor.

BETTER DECISIONS

L05 Handbook for Incorporating Reliability Performance Measures into Transportation Planning and Programming
Guide to the institutional arrangements and technical steps needed for State Departments of Transportation (DOTs) and metropolitan planning organizations (MPOs) to incorporate reliability into their decision-making.

BACKGROUND

UDOT, working together with the University of Utah, validated the adaptability of travel time reliability (TTR) measurements using the L02, L05, and L08 tools between June 2019 and June 2020. The objective of the project, concluded in 2020, was to apply the methodologies developed in each tool and to assess the feasibility of integrating them into UDOT's business practices.

Product implementation focused on a 25-mile segment of I-15 in Salt Lake County between milepost 285 to milepost 310 (figure 1). Traversing the highly populated Salt Lake City metropolitan area, this segment experiences high levels of congestion during the morning and evening peak periods.

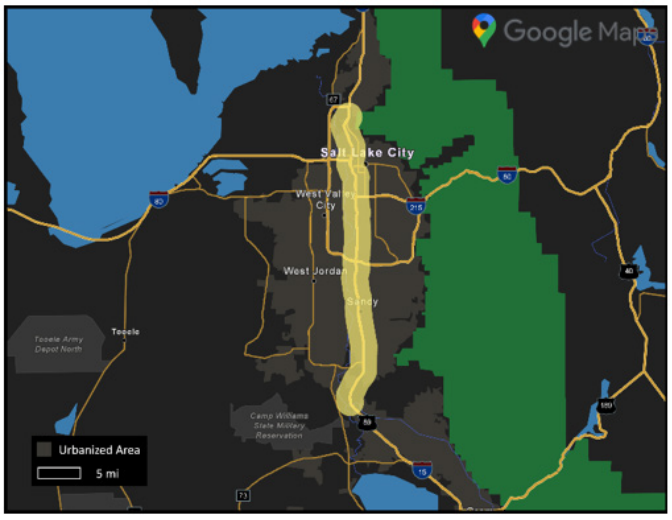

Figure 1. Map. I-15 project segment in Salt Lake City, UT. Source: UDOT. Map Data © 2020 Google.

PRODUCT IMPLEMENTATION

Data

For the study, UDOT used travel time and speed data from mapping firm HERE Technologies for the I-15 corridor, coupled with loop detector data (figure 2). Incident records, including location, type, severity, and start and clearance times, were collected from police reports. Weather data were obtained from MesoWest, a collaborative effort to provide access to current and archived weather data across the US.

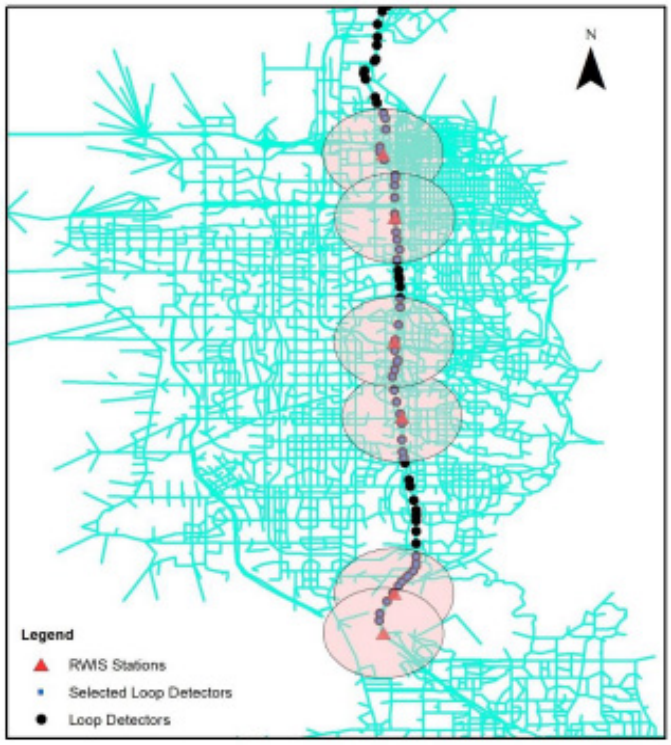

Figure 2. Map. Example of Road Weather Information System stations and loop detectors used for data collection along I-15 corridor in Salt Lake County. Source: UDOT

L02

The SHRP2 L02 project uses statistical distribution of travel time to build highway performance evaluation and monitoring systems. To validate the adaptability of L02 measures, researchers conducted a reliability analysis on the I-15 freeway in Salt Lake City using the TTR measures under different roadway conditions. These measures were then compared against the TTR measure which UDOT currently uses, which categorizes segments into four categories based on median speed and buffer time index (BTI), which is the ratio of the extra time required to arrive at the destination on time 95 percent of the time compared to the average travel time. UDOT found that the two measures produce consistent assessments of TTR and identification of the source of unreliability. On I-15, UDOT found incidents contribute more to unreliability than adverse weather conditions.

L05

The researchers evaluated the L05 products for the feasibility of applying them into the project planning and prioritization process in Utah. The team selected five projects in the Transportation Investment Fund (TIF) aimed at improving the capacity of I-15 at locations in the Salt Lake City Area and across the State. UDOT followed the L05 methodology to prioritize projects based on their impact on travel time reliability. The evaluation used UDOT's current standard metrics for TTR, median speed and BTI. The results of the project prioritization using the TTR metric were then compared against UDOT's current framework for assessing TIF projects, which is based on four goals: good health, better mobility, strong economy, and connected communities.

L08

UDOT's evaluation of the SHRP2 L08 product, FREEVAL-RL, had two objectives: 1) to incorporate non-recurrent congestion into the HCM procedure; and 2) to expand the time horizon of reliability analysis into an extended time period of weeks or months. UDOT analyzed reliability during the evening peak hour (from 5:00-6:00 p.m.) on I-15 northbound.

FREEVAL-RL takes several input files to develop the model. UDOT created two tools to generate the input files automatically: a segmentation tool that automatically divides the freeway corridor into segments, and a seed file generator to produce the features of each segment. The most critical feature for evaluating each segment is travel demand, which UDOT generated using FREEVAL-RL's method for filling in annual average daily traffic and a user-selected demand profile.

To evaluate reliability on the segment, UDOT generated 200 scenarios based on the demand variation and national incident rate used by FREEVAL-RL. UDOT used the travel-time index (TTI), which is the ratio of travel time on a segment during the peak period to travel time during free-flow conditions. For both directions of I-15, UDOT found that FREEVAL-RL modeled TTI that was similar along the length of the corridor, with most values around 1.1-1.2.

ASSESSMENT OF THE TOOLS: BENEFITS, CHALLENGES, AND RECOMMENDATIONS

L02

To assess the L02 guide, UDOT conducted a segment-by-segment TTR analysis and cross-validated the reliability results with the method currently used at the department. UDOT concluded that the two measures are consistent in TTR assessment and unreliability source identification. The cross-validation method can help UDOT evaluate the thresholds for the quadrant-based TTR measure.

L05

In the assessment of the tool, UDOT notes that the L05 program has proven effective in multiple case studies. UDOT used the State's current TTR metric to evaluate five projects according to the L05 framework. The L05 reliability results are effective and consistent with the current approach.

L08

UDOT found that FREEVAL-RL accurately estimates traffic speed and TTR on segments which are not particularly congested. However, at locations which suffer from more congestion, the modeled travel time index was considerably lower than the historical values which UDOT calculated using the average speed during the study periods.

IMPACTS ON BUSINESS PRACTICES

As discussed, UDOT currently uses a quadrant-based method of evaluating TTR for highway segments based on classification of median speed and buffer time index. This metric of TTR is included in the TIF project evaluation framework for scoring projects' impacts on mobility. Utah has not adopted any of the SHRP2 tools into their business processes yet.

CONCLUSION

Through their participation in the SHRP2 project, UDOT gained familiarity with the SHRP2 tools and other methods of processing TTR data and metrics. UDOT noted their collaboration with the University of Utah was valuable to the completion of the case study and gaining experience with the tools. They also expect to carry the lessons and experience gained from this case study forward as they continue to assess reliability in highway operations, planning, and programming.

FOR MORE INFORMATION

UDOT Website
https://www.udot.utah.gov/connect/
SHRP2 Solutions
https://www.fhwa.dot.gov/goshrp2

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CONTACTS

David Stevens
Utah Department of Transportation
davidstevens@utah.gov

Cathy Liu
University of Utah
cathy.liu@utah.edu

Tracy Scriba
Federal Highway Administration
tracy.scriba@dot.gov