



U.S. Department of Transportation
Federal Highway Administration

OFFICE OF OPERATIONS
<https://ops.fhwa.dot.gov>

FHWA-HOP-21-079



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

Colorado Department of Transportation

Reliability of Travel Times on Urban and Rural Highways

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 Colorado Department of Transportation (CDOT) project included the following tools:

DATA COLLECTION

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.

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.

nonrecurring congestion. Additionally, CDOT used the L05 guidance to refine and streamline performance measures and reporting. CDOT identified three primary challenges driving the need for a TTRMS:

- Several highways do not have alternate routes due to Colorado's mountainous geography.
- CDOT has deployed comprehensive devices and systems to record traffic and congestion data, but much of the data resides in disparate databases.
- Several performance measures were in place, but there was an opportunity to consolidate and refine them.

The project team tested the TTRMS for each source of congestion on segments grouped by roadway classes. The initial testing of the tool focused on two segments in the Denver metropolitan area where roadwork was present:

- A 9-mile segment of I-225 between Colfax Avenue to I-25 (figure 1). This segment is a critical urban corridor connecting to a major business center and was the site of a regular night lane closures for restriping work.
- A 2-mile segment of I-70 between Colorado State Highway 58 and Kipling Street in Wheat Ridge (figure 2). This segment is in a dense urban setting with high traffic volumes where there was ongoing bridge maintenance, striping, and pothole repair operations.

In addition, CDOT selected several other segments to validate the performance of the TTRMS for work zones.

BACKGROUND

CDOT participated in the SHRP2 Implementation Assistance Program (IAP) with a project (concluded in 2020) applying the L02 and L05 products. The objective of the study was to use the L02 product to develop a travel time reliability monitoring system (TTRMS) linking travel time data with sources of



Figure 1. Map. Example of I-225 between I-25 and Colfax Ave in Denver, CO. Source: CDOT. Map Data © 2020 Google.

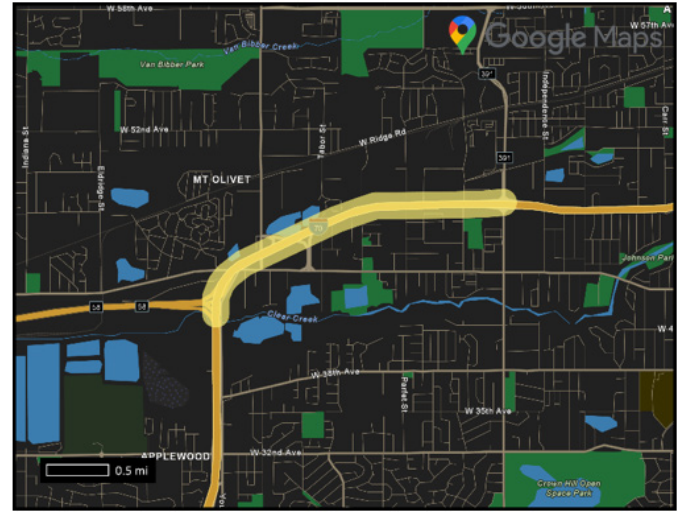


Figure 2. Example of I-70 between Colorado State Highway 58 and Kipling Street. Source: CDOT. Map Data © 2020 Google.

PRODUCT IMPLEMENTATION

Data

CDOT used data from several sources, including INRIX® Massive Data Downloader and the National Performance Management Research Data Set (NPMRDS). Work zone data, including start/end times and lane closures, were collected from the CDOT CoTrip Construction Reports. CDOT tested and evaluated collision data from three sources: CDOT’s Event Audit reports from performance management software COGNOS® Analytics, COGNOS Courtesy Patrol report, and the Vision Zero Suite. Ultimately, CDOT used only the COGNOS Audit report for TTRMS development. Weather data from the National Oceanic and Atmospheric Administration (NOAA) and data from CDOT traffic management center calendars were also considered for TTRMS weather and special events data, respectively. Further testing led CDOT to choose the traffic management center event log for both weather and special events.

L02

CDOT sought to establish a TTRMS for work zones. The agency wrote a Python® tool to merge Traffic Message Channel (TMC) segment information with travel times. Baseline travel time for a work zone was calculated by taking the monthly average travel time for that day of the week and time interval of the previous year.

To modify the tool to handle incidents, CDOT integrated COGNOS Analytics Event Audit Data. For the initial pilot, the project team manually input incident closure times and types, but the process will be automated to read a comma-separated file.

To visualize the data, the TTRMS generates an interactive HTML chart with baseline travel times, travel times while the work zone was active, and the percent change between the two for the duration of the study period. The TTRMS also plots the travel time distributions for baseline and affected periods.

L05

CDOT used the L05 guidance to streamline existing performance reporting efforts. Following the guidance for best practices to communicate performance metrics, the agency consolidated the performance reports into a comprehensive Travel Time and Incident Clearance Time report on priority roadways across the State. The guidance was also used to update the I-70 Mountain Corridor Winter Operations Weekly Report.

ASSESSMENT OF THE TOOLS: BENEFITS, CHALLENGES, AND RECOMMENDATIONS

CDOT found the L02 and L05 guidance to be useful for improving travel time reliability monitoring and performance measurement in the State.

L02

CDOT believes the TTRMS will be a valuable tool to inform CDOT engineers, planners, and decision makers with actionable information about travel time reliability. By making data analysis easier, CDOT will be able to analyze and take action to counteract sources of unreliability.

When developing the TTRMS, CDOT had to balance the benefits and challenges of each data set. The data sets available for incidents presented tradeoffs in the level of detail and accountability of the information against the timeliness of its availability. The data sets available for travel time reliability presented a tradeoff of coverage throughout the State and availability of the full travel time distribution.

For other DOTs considering implementing a TTRMS, CDOT recommends taking an inventory of potential data sources early on and following an iterative development model, implementing the system one route at a time.

L05

The L05 guidebook proved to be very helpful for Colorado’s efforts to consolidate performance reporting for travel time reliability.

IMPACTS ON BUSINESS PRACTICES

The L02 TTRMS and L05 guidance will be beneficial to CDOT’s business practices for monitoring and evaluating travel time reliability. CDOT has developed plans for how to integrate each tool into its business practices.

CDOT plans to use the TTRMS to study the impacts of work zones and incidents, especially for larger projects, and identify strategies to mitigate congestion. The TTRMS may also inform CDOT of which transportation systems management and

operations strategies are most effective on high priority roadways, such as the I-70 Mountain Corridor.

As mentioned, CDOT has already used the L05 guidance to update some existing Statewide, regional, and highway-specific performance reports. CDOT expects to continue improving reporting and communication of travel time reliability measures following the guidance of the L05 products.

CONCLUSION

CDOT’s participation in the SHRP2 IAP gave the State the opportunity to implement the guidance of the L02 and L05 products to build a TTRMS and improve its reporting of travel time reliability performance. The tools and procedures developed through the project will help CDOT leverage its investments in ITS infrastructure and increase the utility of their data.

FOR MORE INFORMATION

Colorado Department of Transportation
<https://www.codot.gov/>
 SHRP 2 Solutions
<https://www.fhwa.dot.gov/goshrp2>

Except for any statutes or regulations cited, the contents of this document do not have the force and effect of law and are not meant to bind the public in any way. This document is intended only to provide information regarding existing requirements under the law or agency policies.

The U.S. Government does not endorse products, manufacturers, or outside entities. Trademarks, names, or logos appear in this document only because they are considered essential to the objective of the document. They are included for informational purposes only and are not intended to reflect a preference, approval, or endorsement of any one product or entity.

CONTACTS

San Lee
 Colorado Department of Transportation
san.lee@state.co.us

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