

North/West Passage: Traveler Information Work Zone Alerts Feasibility Study Project Summary

November 25, 2019

Prepared by Athey Creek Consultants

Background and Introduction

The [North/West Passage \(NWP\) Transportation Pooled Fund Study](#) focuses on cross-border Intelligent Transportation Systems (ITS) coordination along the I-90 and I-94 corridors through the states of Washington, Idaho, Montana, Wyoming, North Dakota, South Dakota, and Minnesota. See **Figure 1**.

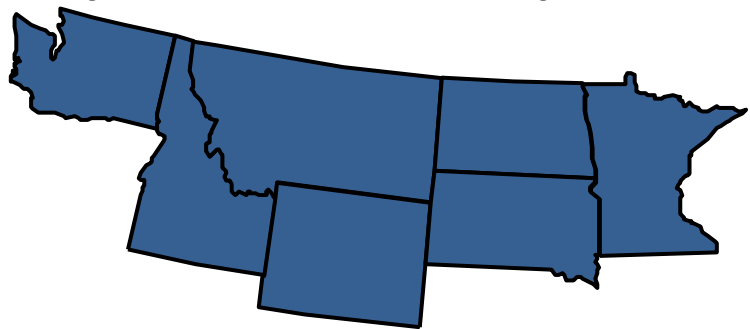


Figure 1: North/West Passage Members

The North/West Passage members were aware of national work zone data management efforts, including the Federal Highway Administration (FHWA) Work Zone Data Initiative (WZDI) and US Department of Transportation (USDOT) Work Zone Data Exchange (WZDx), that aim to create a consistent language for communicating work zone activity data (WZAD) across jurisdictional boundaries. **The purpose of this project was to track current national work zone data efforts, including pilot activities and funding opportunities, and document current practices in NWP states.** This report summarizes the information gathered and shared by NWP members on project webinars.

National Work Zone Data Efforts

Several efforts are underway nationally that focus on work zone data management.

The [Work Zone Data Initiative \(WZDI\)](#) is creating a consistent language for communicating WZAD across organizational boundaries and throughout project life cycles as shown in Figure 2 and Figure 3 to:

- Simplify and accelerate the adoption of a WZAD standard, and
- Advance development of processes and applications around availability of standardized WZAD.

The [Work Zone Data Exchange \(WZDx\)](#) focuses on a subset of the WZDI data dictionary to refine the data specification for the traveler information use case and is a mechanism for publication of data consistent with WZDI principles. There is currently active deployment of this WZAD standard by participating organizations. Participants include data generators deploying a real-time feed (JSON) following the current WZDx specification, version 1.1 as of November 10, 2018.

The [Work Zone Data Working Group](#) is currently working to expand the WZDx specification, with a goal to publish version 2 of the WZDx spec by early 2020. This group was established under the Federal

Geographic Data Committee (FGDC) Transportation Subcommittee (TSC) and provides long-term data governance and maintenance of WZDx specification through open development. Additionally, this group is working to create a Work Zone Data Exchange Prototype Validation Tool.

Finally, [WZDx Demonstration Grants](#) are expected to be available as a funding opportunity for agencies. A pre-solicitation webinar on August 22, 2019 described these potential awards would be up to \$200,000 each for a 12-month period of performance and a 20 percent non-Federal cost share for agencies to:

- Publish a new WZDx-compliant data feed,
- Increase jurisdictional coverage of an existing WZDx-compliant data feed, or
- Add optional fields to an existing WZDx-compliant data feed.

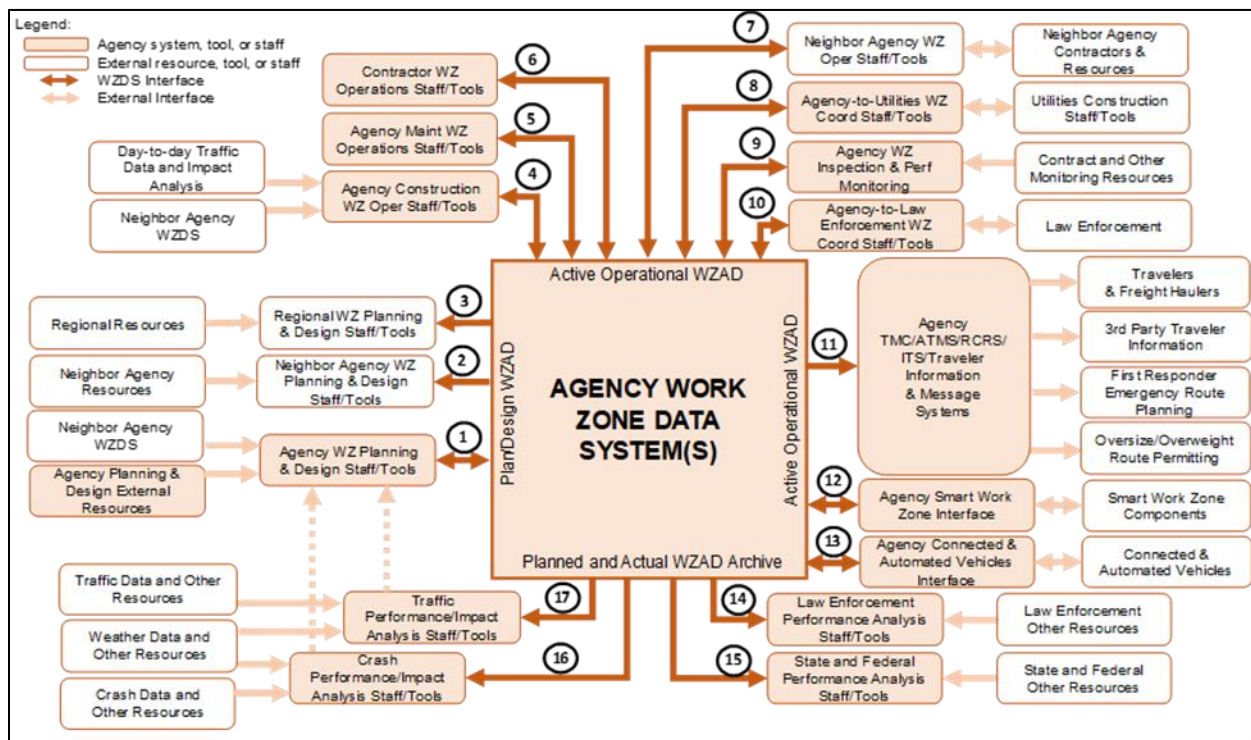


Figure 2. Comprehensive view of all WZAD and users considered as part of the WZDI specification

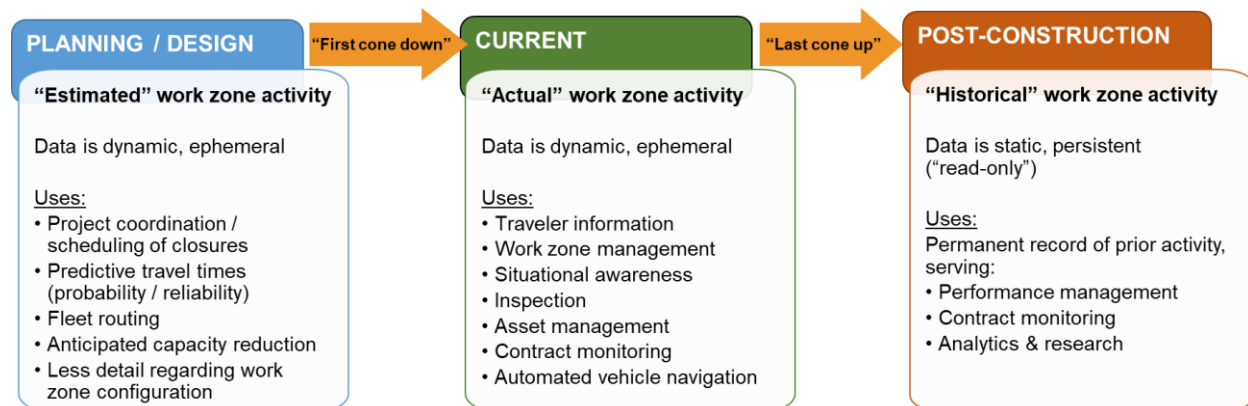


Figure 3. The WZDI considers WZAD over the entire project delivery lifecycle

Resources for all these efforts are available online. The WZDI Collaboration Site contains links to websites with more information about the WZDI, WZDx, WZDx Demonstration Grants, and other resources: <https://collaboration.fhwa.dot.gov/wzmp/wzdi/Forms/AllItems.aspx>. Links to specific products of the WZDI, such as those depicted in Figure 4, and other efforts include:

- WZAD Needs and Opportunities Report: <https://collaboration.fhwa.dot.gov/wzmp/Needs%20and%20Opportunities%20Report/Forms/AllItems.aspx>;
- WZAD Framework: [https://collaboration.fhwa.dot.gov/wzmp/updateddocuments/WZAD%20FRAMEWORK%20\(DRAFTV3_1A\)_1.11.2019_v2.pdf](https://collaboration.fhwa.dot.gov/wzmp/updateddocuments/WZAD%20FRAMEWORK%20(DRAFTV3_1A)_1.11.2019_v2.pdf);
- WZAD Data Dictionary Report: <https://collaboration.fhwa.dot.gov/wzmp/Data%20DictionaryDocuments/Forms/AllItems.aspx>;
- WZDx Github: <https://github.com/18F/usdot-jpo-ode-workzone-data-exchange/wiki>;
- Work Zone Data Working Group: <https://github.com/usdot-jpo-ode/jpo-wzdx/wiki>;
- WZDx Demonstration Grants
 - Presentation: <http://itsa.adobeconnect.com/pjr5asgsyi4b/>;
 - Presentation slides: https://www.its.dot.gov/presentations/2019/WZDX_grants.pdf;
 - New information: <https://www.transportation.gov/av/data/wzdx>.



Figure 4. Several WZDI resources are available

Work Zone Data Initiative Pilot Activities

The FHWA WZDI is working with a number of agencies around the country that are examining their existing data systems and considering implementation of the WZDx specification. The two major parts of a WZDI Pilot are

1. Modifying data systems to the standard, and
2. Automating and increasing quality data collection efforts.

WZDI pilot efforts mostly focus on modifying data systems, but those agencies also tend to advance data collection efforts. Every pilot is specific to the agency based on their current status. Some examples of current agency status are included in Figure 5 and below.

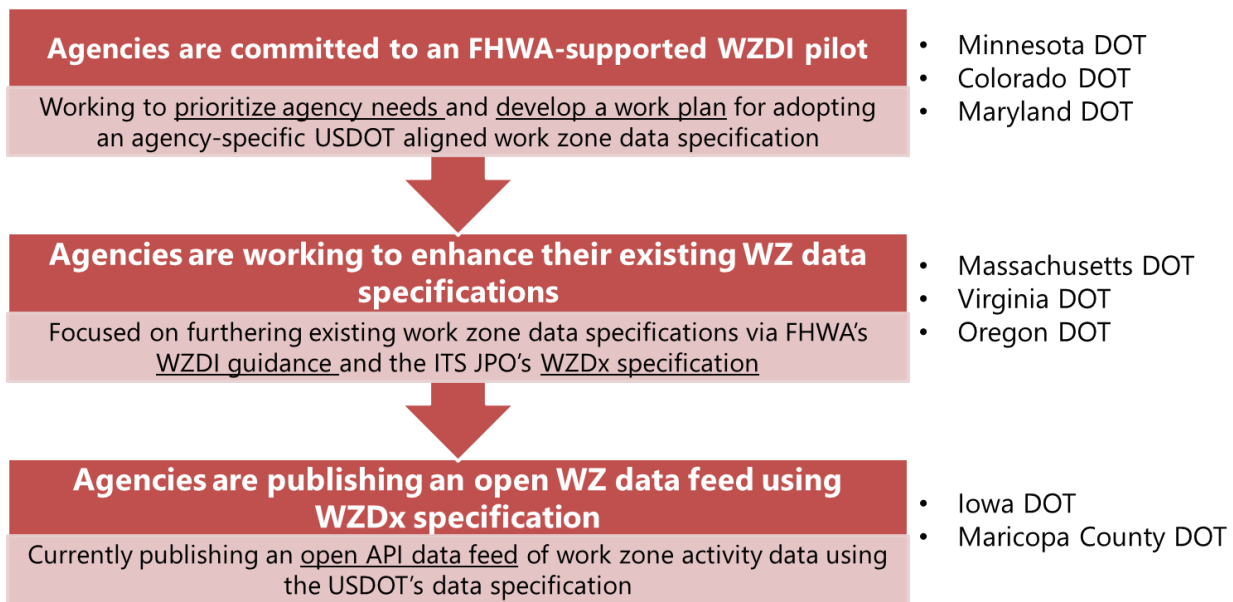


Figure 5. Stages of WZDI pilot implementation and agency status

Iowa DOT is implementing a comprehensive Work Zone Data Hub with a focus on data integration and collection as part of their WZDI pilot. This effort began with implementation of a WZDx specification-compliant data feed, with data sources including 511 Traveler Information and Roadway Asset Management System. Iowa DOT is publishing a real-time feed generated when “devices” are active during a corresponding planned event, based on spatial and temporal extents, which is available at: <https://public-iowadot.opendata.arcgis.com/datasets/iowa-work-zone-data-exchange-wzdx>.

Additionally, Iowa State University has mapped all existing Iowa work zone data to the WZDI specification in order to prioritize implementation of additional use cases that will expand the Work Zone Data Hub functionality.

The **AZTech Partnership**, which includes Maricopa County DOT, Arizona DOT, and other local agencies in the Phoenix metropolitan area has published a WZDx demonstration feed for two work zones. As part of the WZDI pilot efforts, a quality assessment was conducted of the work zone data that is input from 10

local agencies to the data system. A goal for the second phase of the AZTech WZDI pilot is to transition existing agency feeds to the WZDx specification.

Massachusetts DOT, a WZDI pilot site, as well as **Virginia DOT** and **Oregon DOT** have each independently used the WZDI Data Dictionary to compare to their existing work zone data specifications. This process has identified some data elements that are critical to each agency, challenging to modify, or missing from the Data Dictionary

Minnesota DOT is conducting a 2-phase effort for their WZDI pilot. Phase 1 involves a systems engineering process and ConOps development. Phase 1 findings will inform a decision about how to implement WZDI in Minnesota for Phase 2.

Colorado DOT is the fifth WZDI pilot site of the initial round. Current efforts include work to understand current work zone data collection and management processes, including manual versus automated collection processes, “owners” of the work zone data, how it is shared if at all, and prioritizing WZDI use cases for implementation.

The FHWA WZDI is currently expanding efforts to include additional agencies for pilot efforts.

Current Practices of NWP Agencies

Each NWP agency presented about their current work zone data practices on either the October 10, 2019 or November 14, 2019 Steering Committee Meeting webinar. Information provided by each state is summarized below and aims to address the following questions:

- What work zone data is currently collected?
 - What work zone data is collected with automated processes?
 - What is the extent of automated data collection?
- How is this work zone data used and shared?
- Does your agency have any plans to enhance work zone data systems or automate data collection processes?
- Does your agency coordinate with neighboring states about work zone activities, e.g. near the state line that could affect permitting, traffic, or alternate routes? If so, how is this done?

Washington State Department of Transportation (WSDOT)

At WSDOT, work zone data has historically been very internal centric for better coordination of work zone activities across different business units, offices, and districts. Efforts to track work zone activities at WSDOT began in early 2000s. The work zone coordinator for one region developed a work zone database using file maker pro that involves a form being filled out prior to each project, which can be consolidated into a weekly construction report that is used by:

- Public information officers (PIOs) to communicate with the public,
- Commercial vehicle services for freight permitting activities, and
- Transportation management center (TMC) operators to be aware of traffic impacts.

From those beginnings, WSDOT developed web applications to help manage crews and activities and created a web-based application to update that original data entry format. The same, original form has been converted to a modern interface to help users understand traffic impacts and is more automated to pull in information from other projects. PIOs can download a summary report, and TMC operators can track this data and utilize an export feature that reduces typos and provides better information overall. WSDOT is not engaged as an official WZDI pilot agency, but this work is foundational to potentially join the WZDI effort at a future time and also reduce any future workload to some minor coding changes. WSDOT hopes that this data stream can ultimately be used to inform travelers, either in a GIS interface or on a traveler information map, as a one-stop shop rather than having to check multiple sources. This work can also be translated into a public API feed and used as a future input for CAVs.

Idaho Transportation Department (ITD)

Each ITD District is responsible for inputting planned work zone events to the traveler information system. Each District follows a different process for entering and updating this information. Ideally, events are entered about two weeks in advance, however maintenance events are not entered as far in advance. If a planned end date is entered when the event is created, the event will automatically expire and be removed from the system, however if the end date entry is “until further notice” then the event must be manually removed. These events are not archived. Further, ITD has not deployed work zone ITS except for portable dynamic message signs. ITD has no immediate plans to update the traveler information system, which was developed to be a real-time system, and the architecture does not lend itself well to record keeping. The system vendor is creating data archiving capabilities for another agency, and ITD may explore the possibility of implementing this feature in the future.

Montana Department of Transportation (MDT)

All MDT work zone data is collected with manual entry. MDT polls all districts and enters information about width restrictions and work zone impacts, e.g. speed reductions, lane widths, and lane closures. MDT is currently working to begin using smart work zone technologies to collect speed data and populate lane closure information on the traveler information map.

One MDT smart work zone was part of an interstate construction project on a bridge that involved a lane restriction of 10 feet that created speed differentials because travelers would see the narrow lanes, slow down, and create speed differences with other traffic. See Figure 6. Additionally, wide loads would not always view information in advance and had some vehicles get stuck or try to turn around, which would shut down the entire interstate to remove the vehicle. MDT developed a smart work zone system that included portable dynamic message signs (PDMS), cameras, and sensors to monitor the speed of traffic. Based on the observed speed differential at each sensor location, the PDMS were updated to indicate what was occurring downstream:

- For a 35-40 mph range, PDMS would stay blank.
- For speeds under 35 mph, the PDMS would activate to display a message about the queue ahead like INCIDENT AHEAD.
- If speeds dropped under 10 mph, a warning message would say something like STOPPED TRAFFIC AHEAD, PREPARE TO STOP.

Next year, MDT will try to integrate PDMS into its traveler map for the public to view pre-trip. MDT is also examining whether to implement smart arrow boards and other technologies to show the actual length of work zones on the traveler map. Any project that impacts traveling public, including maintenance projects that are less than a day, are updated on the construction layer of the traffic map.

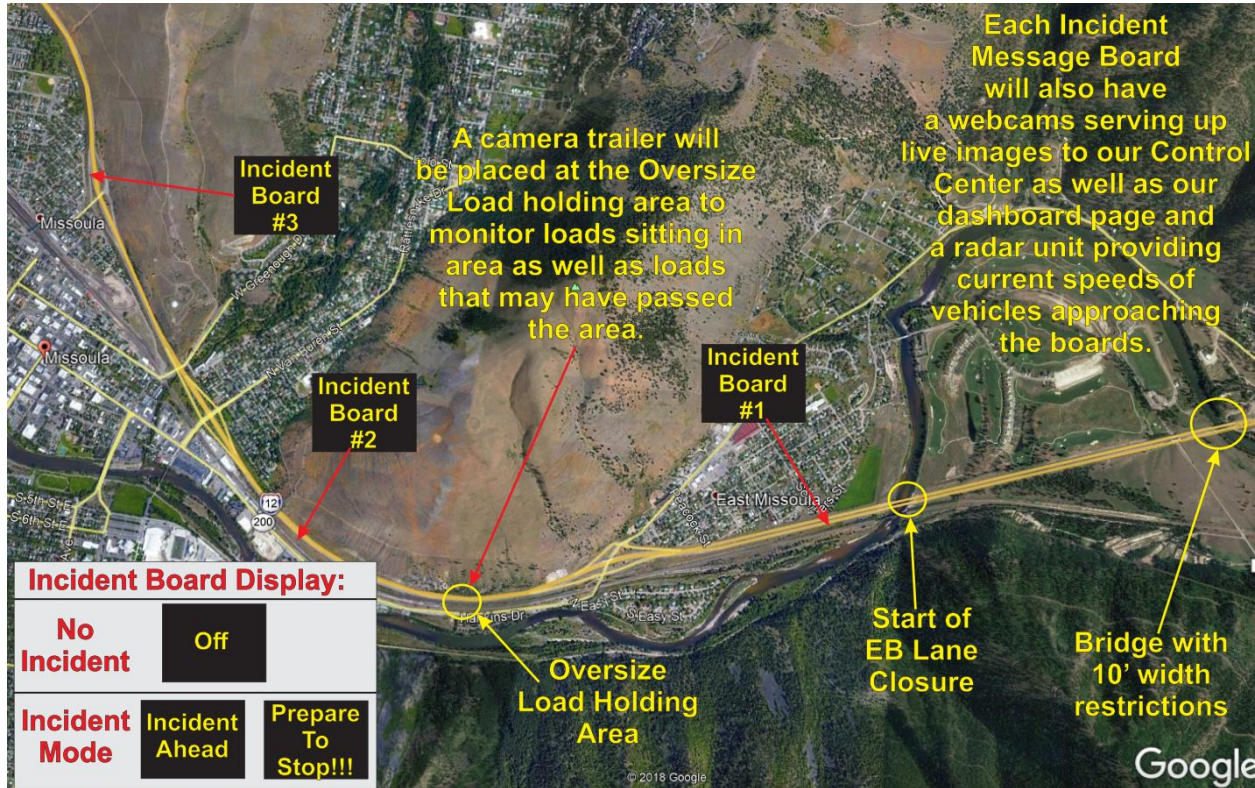


Figure 6. MDT Smart Work Zone system for an interstate bridge project with 10' width restrictions

Wyoming Department of Transportation (WYDOT)

WYDOT has no automated methods for disseminating work zone data. Field personnel provide weekly updates on construction projects, and TMC staff are contacted by field personnel if changes are seen in the field. WYDOT tracks the project limits and duration, as well as speed or time delays. However, there are no automated queuing technologies used at this time. WYDOT experience has shown that travelers want to know what the impact will be to the lanes and the surface condition. This is driven in part by tourism, including recreational vehicles and motorcycles that are impacted more by unpaved or grooved surfaces. WYDOT traveler information systems provide work zone information about 2 weeks in advance. Additionally, WYDOT will collaborate with other agencies if a project is near the state line.

For the USDOT Connected Vehicle Pilot effort, WYDOT adapted the Traffic Management Data Dictionary (TMDD) method of creating a data feed to make it available to Connected Vehicle Pilot users. Finally, WYDOT is currently discussing whether to join the WZDx effort.

North Dakota Department of Transportation (NDDOT)

Project engineers are responsible for entering lane closure information about any state construction project for the NDDOT 511 traveler information website. This is typically done the day of the closure.

Project engineers are similarly responsible for making any updates to that event and removing the event when the lane closure has concluded. If the event includes restrictions, a notification is automatically sent to the permitting office. However, additional coordination with the permitting office is conducted in advance for larger projects that are known to include width restrictions.

Regarding the use of work zone ITS, a recent project in Bismarck included a queue detection and warning system, which was successful. Additionally, NDDOT is planning to test some iCone products, including smart arrow boards, that would have the capability to be integrated with the 511 traveler information website and also provide notifications to drivers via Waze.

South Dakota Department of Transportation (SDDOT)

SDDOT has used a variety of ITS in work zones, including radar speed feedback signs, advance queue detection, digital speed limit signs, and smart data collection. The digital speed limit signs are a type of variable speed limits for implementing reduced speed limits in work zones that comply with the state code. SDDOT maintains a file of the digital speed limit locations, which have been implemented twice in the Sioux Falls area where congestion was anticipated. During normal conditions, speed limits drop from 65 mph to 55 mph through work zone area. If vehicle speeds are detected to drop to 5-30 mph, the speed limit is reduced to 45 mph. If travel speeds fall below 5 mph, the digital speed limit is dropped to 30 mph and “Be prepared to stop” is displayed on dynamic message signs as part of the queue warning system. Additionally, SDDOT has deployed iCones to collect speed data in work zones and the radar speed feedback signs are capable of archiving speed data. SDDOT does not have any dedicated staff to use this information in real-time and there is no automated connection from these ITS devices to traveler information websites. Finally, project staff enter planned work zone events into 511, but these events are not necessarily updated day to day.

Minnesota Department of Transportation (MnDOT)

Most of MnDOT’s work zone data practices involve manual entry with some automated processes. Fully automated WZAD collection was realized as part of a 1-year pilot project with 20 Smart Arrow Boards in 2018-2019 in the Twin Cities area. These Smart Arrow Boards were integrated with Intelligent Roadway Information System (IRIS) and Condition Acquisition and Reporting System (CARS), respectively MnDOT’s advanced traffic management system (ATMS) and road condition reporting system (RCRS), to automatically generate lane closure reports in 511. Although the Smart Arrow Board devices are no longer in place, the foundation remains to similarly integrate other smart work zone devices in the future.

Aside from this exception, the contractor or project engineer must complete a 511 lane closure form for work zones. Entry is made by either the District office, Construction office, or Regional Transportation Management Center (RTMC) Statewide Traffic Operations (STO). After this, simple updates are called into the STO; after hours and weekends this call is forwarded to State Patrol Dispatch for them to update events. For more extensive event updates, a new 511 lane closure form must be completed and submitted to STO. Ideally, MnDOT would enter lane closure events in 511 at least one week in advance, but they are entered into 511 upon receipt, i.e. this may be weeks, days, or hours in advance. Events that are created in advance will show a calendar icon until the event date and time, at which time the calendar icon

changes to the entered event icon, e.g. road closed, lane closed or general construction. When the end date and time comes, the event is automatically removed.

Work zone data is used by RTMC operators for situational awareness to monitor queues and post messages on DMS and 511. Additionally, the traveling public accesses work zone-related traveler information on 511 that provides detailed descriptions and detour information, as shown in Figure 7 below.

MnDOT has initiated a 2-phase WZDI Pilot Project, as described above. Phase 1 involves a systems engineering process and ConOps development to examine the holistic view of work zones, including data collection, technologies, and dissemination. Phase 1 findings will inform a decision about how to implement or modify use of work zone technologies and data systems in Minnesota for Phase 2, such as:

- Creating an archive database within CARS and 511;
- Identifying data gaps, e.g. lack of precision in lane closure location or time;
- Evaluating field devices for automation of work zone data into 511; and/or
- Exploring feasibility of a mobile app for MnDOT and contracted staff to enter information.

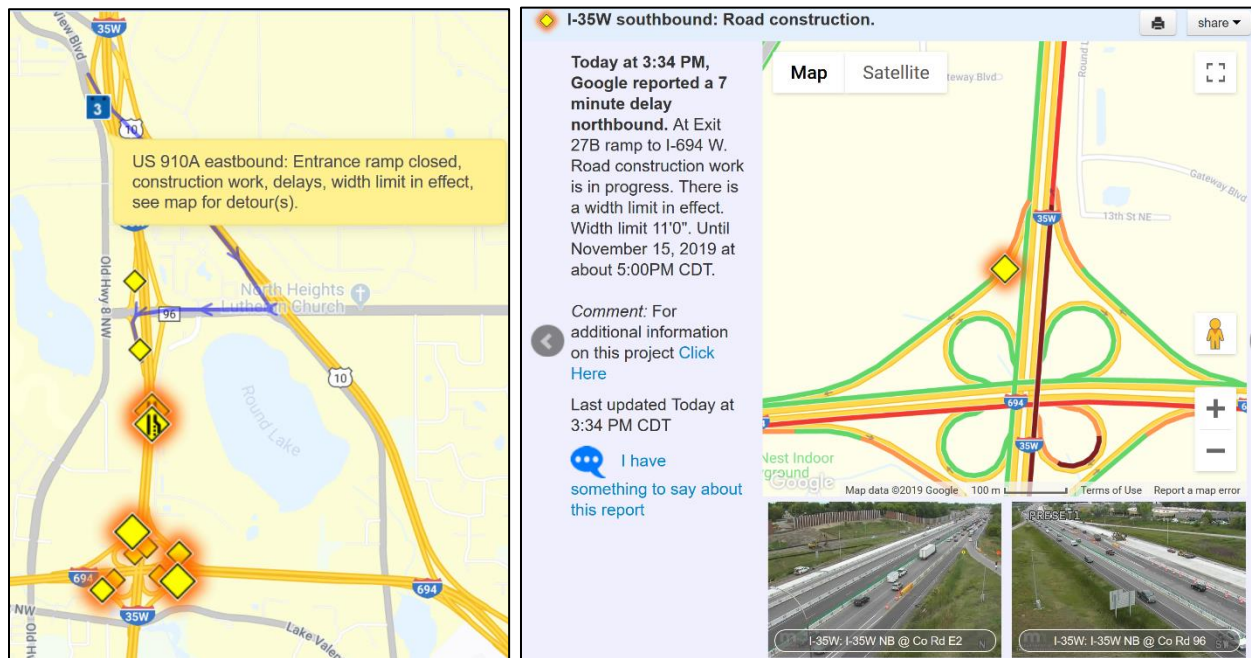


Figure 7. MnDOT work zone-related traveler information including detours and detailed descriptions