Improving Work Zone Safety with the Work Zone Data Exchange

April 29, 2021, 12:00-1:30pm EDT
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Today’s Webinar

National Work Zone Awareness Week and work zone safety data
Martha Kapitanov, FHWA

Improving your agency’s work zone event data using the WZDI Framework
Todd Peterson, FHWA

Using WZDx to deliver work zone event data to vehicles
Nate Deshmukh Towery, USDOT Volpe Center

Adopting the WZDx specification at Wisconsin DOT
Erin Schwark, WisDOT
Steven Parker, University of Wisconsin

Help us get the word out and Put Work Zones on the Map
Martha Kapitanov, FHWA
National Work Zone Awareness Week and work zone safety data

Martha Kapitanov
Federal Highway Administration
2021 National Work Zone Awareness Week (April 26-30)

Activities:

- **April 26**, *National Stand-Down to Prevent Struck-by Incidents* Webinars hosted by The Center for Construction and Training
- **April 27**, (11:00 a.m. ET) Kick-Off Event
- **April 28**, Orange for Safety
- **April 29** (12:00 - 1:30 p.m. ET), *Work Zone Data Exchange Project/Put Work Zones on the Map Campaign Webinar*

Source: National Work Zone Safety Information Clearinghouse
Total Work Zone Fatal Crashes by type of roadway

FARS 2018 Final File and 2019 Annual Report File, NHTSA. FARS data shown here are from the 50 States, the District of Columbia, and Puerto Rico.
Work Zone Fatal Crashes
the following types of crashes increased from 2018-2019

<table>
<thead>
<tr>
<th>Type</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Involving a Rear-End Collision</td>
<td>141</td>
<td>182</td>
</tr>
<tr>
<td>Involving a CMV</td>
<td>215</td>
<td>250</td>
</tr>
<tr>
<td>Where Speeding Was a Factor</td>
<td>172</td>
<td>239</td>
</tr>
</tbody>
</table>

FARS 2018 Final File and 2019 Annual Report File, NHTSA. FARS data shown here are from the 50 States, the District of Columbia, and Puerto Rico.
### Total Work Zone Fatalities by person type

<table>
<thead>
<tr>
<th>Category</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drivers and passengers</td>
<td>621</td>
<td>690</td>
</tr>
<tr>
<td>Pedestrians and bicyclists</td>
<td>131</td>
<td>140</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>12</td>
</tr>
</tbody>
</table>

FARS 2018 Final File and 2019 Annual Report File, NHTSA. FARS data shown here are from the 50 States, the District of Columbia, and Puerto Rico.
Work Zone Fatal Crashes
worker fatalities by year

Worker fatalities in road construction sites

2018: 124
2019: 135

Safety in Work Zones

• In 2019, fatal work zone crashes involved:
  • 24% involved rear-end collisions
  • 31% noted speed as a contributing factor
  • 33% involved commercial motor vehicles

• Additionally,
  • 135 workers were killed in highway work zones

FARS 2018 Final File and 2019 Annual Report File, NHTSA. FARS data shown here are from the 50 States, the District of Columbia, and Puerto Rico.
Improving your agency’s work zone event data using the WZDI Framework

Todd Peterson
Federal Highway Administration
Background

• Transportation operations is increasingly data-driven
  • Need for better coordination across regions to improve safety and mobility
  • Data important to both public agencies and external stakeholders

• Work zones present a complex data-sharing challenge
  • Highly variable
  • Subject to rapid change
  • Involve many stakeholders

• No national standard for communicating dynamic work zone event data
What is the Work Zone Data Initiative?

Response to the need for a reference guide on how to digitally describe dynamic work zone events on roads and highways

• Consistent language for communicating data across organizational boundaries and throughout project life cycles

• Local, regional and national data sharing

• Work Zone Event Data – the when, where, and how of work zone deployment
Benefits of standardizing data

Transportation Agencies:
• Enhance project prioritization and coordination
• Improve safety and mobility impact estimates
• Improve contractor compliance and asset mgmt.
• Enhance performance measurement

Public Entities:
• Law Enforcement – improve dispatching and enforcement practices
• First Responders – modify trip routes

Traveling Public:
• Minimize cumulative impacts to motorists
• Accurate and verified real-time information for decision-making
• Verified source of information for CAVs (emerging need)
Work zone event data

- Work zones are dynamic
- Data describing them changes throughout work zone life cycle

**Planning and Design**
- Planned future work zone event
- Data focused on approximate future location and schedule

**Construction Operations**
- Actual daily work zone event
- Data focused on actual daily configuration and operations

**Performance Analysis**
- Historical planned vs actual events
- Archives focused on historical performance and future impacts
Stakeholders are agency and non-agency individuals and groups who produce, maintain, or use work zone data.

**Planning and Design**
- Local and regional work zone planning and design staff

**Construction Operations**
- Construction, maintenance, and utility work zone operations staff
- Agency traffic mgmt., road condition reporting, and traveler message systems
- Smart work zones and CAV

**Performance Analysis**
- Work zone inspection, performance, and impact analysis staff

**Consumers**
- Law enforcement
- ATMS operator
- ITS, DMS, traveler info systems
- Agency congestion and performance manager
- Agency oversize/weight permitting
- 3rd party info providers
- Travelers
- CAVs
- Freight Haulers
- State and Fed transportation agencies

**Collaborators**
- Neighbor and regional partner agencies
- Utilities
Data uses (by category)

Based on stakeholder needs around data collection, storage, usage, and communication:

1. Work zone planning and project coordination
2. Work zone impact analyzes
3. Construction and maintenance contract monitoring
4. Real-time system management, traveler information provision
5. Safety and mobility performance measurement
6. Law enforcement and emergency service providers
7. Connected and automated vehicle hardware and system readiness

50 use cases developed under these seven categories
Work zone data system structure
for communicating data clearly and consistently between stakeholders and data systems

- Based on stakeholders and use cases
- Includes entire work zone life cycle
- Focused on centralized data storage and mgmt.
- Stakeholders and tools interface with data warehouse to give and receive data as needed
Agencies can pick and choose what they do (don’t need to do it all!)
WZDI resources

• Needs and Assessment Report (FHWA-HOP-20-018)
  • Describes state of the practice and user needs for existing and potential uses of work zone data
  • Covers work zone project life cycle
  • Based on discussions with over 60 public and private stakeholders across the country

• WZDI Framework (FHWA-HOP-20-019)
  • Concepts for structuring data and data systems to support agency needs
  • Identifies use cases and maps them to agency processes
  • Provides a “menu of resources” to pick from when creating data systems

• WZDI Data Dictionary (FHWA-HOP-20-020)
  • Specifies consistent data with respect to meaning and enumerated values
  • Serves as backlog of data elements to add to WZDx spec over time

For more information, contact Todd.Peterson@dot.gov
The Work Zone Event Data Exchange is a data specification that is:

- Putting data on work zones into vehicles to help ADS and human drivers navigate more safely.
- Openly developed and free to use.
- Created to enable agencies to share harmonized work zone data for 3rd party use.

FHWA’s Work Zone Data Initiative provides a framework for communicating information on work zone activity across jurisdictional and organizational boundaries. Key elements include a data dictionary and supporting implementation documents.

FHWA is working to improve work zone safety through new approaches to work zone data.

The Work Zone Data Exchange is a data specification that is:

- Putting data on work zones into vehicles to help ADS and human drivers navigate more safely.
- Openly developed and free to use.
- Created to enable agencies to share harmonized work zone data for 3rd party use.
USDOT offered a one-time grant opportunity in 2020 for public roadway operators such as state/local agencies to establish WZDx data feeds.

**Work Zone Data Exchange Grant Recipients:**

- Maricopa County/Arizona DOT
- Metropolitan Transportation Commission (California – Bay Area)
- Colorado DOT
- Georgia DOT
- Iowa DOT
- Maryland State Highway Administration
- Massachusetts DOT
- Minnesota DOT
- St. Charles County (Missouri)
- Utah DOT
- Virginia DOT
- Washington State DOT
- Wisconsin DOT

Find more information at:
https://ops.fhwa.dot.gov/wz/wzdx/demonstration_grants.htm
Using WZDx to deliver work zone event data to vehicles

Nate Deshmukh Towery
Volpe National Transportation Systems Center
What can we learn from the open transit data story?

A **simple** specification…

…with a **wide range** of uses
The Work Zone Data Exchange (WZDx)

1. Simple, Open Specification
2. Broadly Adopted
3. Saves Lives

USDOT ITS-JPO

https://www.transportation.gov/av/data/wzdx
The Power of Data Standardization

Without a standard

31,410 translations

With a standard

3,151 translations

USDOT - BTS
WZDWG objectives:

• Maintain the WZDx Specification

• Groom the backlog of potential future changes and sources of technical input

• Use open development methods to foster community involvement and support

• Identify and promote best practices for creating, publishing, consuming, mapping, and analyzing work zone activity data and the WZDx Specification

WZDWG documents and meeting notes shared via GitHub Wiki page

https://github.com/usdot-jpo-ode/wzdx
In January 2020, the WZDWG chartered three subgroups:

- **Specification Update Subgroup** to update the WZDx specification
- **Worker Presence Subgroup** to promote the inclusion of real-time information on the presence of workers in work zones
- **Technical Assistance Subgroup** to identify best practices in implementing feeds

In April 2021, the WZDWG chartered two new subgroups:

- **Smart Work Zone Devices Subgroup** to extend the specification to include real-time data from SWZ devices
- **Specification Extension Subgroup** to identify and draft extensions to the WZDx specification beyond work zones
WZDx Specification v3.1

• Version 3.1 of the Work Zone Data Exchange (WZDx) Specification was released on GitHub in April 2021

• Changes in v3.1:
  • Streamlined how road names are communicated
  • Created guidance for implementing a work zone data feed
  • Refined approach for providing lane level detail
  • Added implementation examples for common work zones

• WZDx v3.1 is a stable release, backwards compatible with v3.0

https://github.com/usdot-jpo-ode/wzdx
WZDx Example Use Case: Truck Operator Notification of Upcoming Work Zone

- Maricopa County (AZ) and Drivewyze demonstrated using WZDx to send work zone alerts to truck drivers via electronic logging devices.
- WZDx feeds can include detour routes around a work zone.
- Maricopa County and Arizona DOT will expand the scope of their WZDx feed with a WZDx Demonstration grant in 2021.

Source: Maricopa County

https://api.mcdot-its.com/WZDx/Activity/Get
WZDx Example Tool: Work Zone Data Collection Toolset

- Road owner enters basic information about work zone
- Construction site manager notes current state of road/work zone
- Received information is used to generate a WZDx feed with new geospatial details
- Repository available at https://github.com/TonyEnglish/Work_Zone_Data_Collection_Toolset
WZDx Feed Registry

- WZDx feeds are published and hosted by state/local roadway owners and operators
- USDOT is maintaining a directory of feeds so that data consumers can find an up-to-date list of active WZDx feeds
- Registered feeds will automatically be archived to ITS DataHub’s raw data sandbox

https://datahub.transportation.gov/Roadways-and-Bridges/Work-Zone-Data-Exchange-WZDx-Feed-Registry/69qe-yii
Adopting the WZDx specification in Wisconsin

Erin Schwark  Steven Parker
Wisconsin DOT    University of Wisconsin
Overview

- WisDOT Work Zone Program
- LCS 2.0
- WZDx Project
- Future
WisDOT Work Zone Program

- WisTransportal
  - Lane Closure System
  - Transportation Management Plans
  - Crashes
- Work Zone ITS
- Work Zone Safety Performance Measures
- Work Zone Policy, Standards and Specification Development
Current Wisconsin Lane Closure System

- Launched in 2008
- Supports scheduling, tracking, accepting and reporting of all estimated lane closures
- Provides data feeds to other systems
  - Wisconsin 511 Website
  - Wisconsin 511 Construction Projects Website
  - OSOW Superload Permitting System
- Data is currently archived at the TOPS Lab

Images source: Wisconsin DOT
Wisconsin Lane Closure System – 2.0

• Rollout March 2022

• Objectives
  • Incorporate lessons learned
  • Streamline existing work flows
  • Improve interoperability with external systems
  • Improve data quality and timeliness
  • Support for modern platforms
  • Update the 10-year old software platform

• Incorporate Work Zone Data Dictionary
WZDx Project

• Building on existing investments to publish a new WZDx-compliant data feed
• Create a program template that other agencies may follow in establishing their own WZDx data feeds
• Demonstrate a flow process to transform estimated to verified lane closure information from Smart Work Zone ITS Devices
• Work with both internal and external Stakeholders
Stakeholders

• Collaborative effort between many:
  • UW TOPS Lab
  • IBI Group
  • County Highway Maintenance
  • Improvement Program – construction LET projects
    • Contractors and Project Staff
  • WisDOT Staff
Project Work Plan

1. Develop an internal WZED data service between the WisLCS and ATMS
2. Provide a public facing WZDx compliant data feed as a component of the ATMS, and
3. Incorporate field verified WZED from Smart Work Zone ITS deployments.
System Architecture – Design Principles

- Build on Existing Systems
  - Improve Interoperability
  - Enhance TMC Capabilities
- Service Oriented Architecture
  - Separation of Concerns
  - Extensible Design
- Data Harmonization
  - Modernize WZED Elements and Definitions
  - Align to FHWA WZDI
- WZ Data Management
  - Separate Analytics from the Operational Systems
  - Broader Set of Use Cases
System Architecture – Key Components

- **Wisconsin Lane Closure System**
  - Scheduling and Acceptance
  - Traveler Information
  - OSOW Restrictions
  - Estimated Data

- **WisDOT TMC ATMS**
  - Statewide Traffic Management
  - Real-Time Data Sharing
  - ITS Device Integration
  - Verified Data

- **Work Zone Data Warehouse**
  - Research, Planning, Performance Measures
  - Estimated + Verified Data
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  - Estimated + Verified Data
The WZDx Specification Object Model describes the high-level structure and content of a WZDx GeoJSON document.
Wisconsin Work Zone Data Model

• Design Constraints:
  • Compatibility with WZDx 3.1 Object Model
    • Required elements, standard definitions
  • Retain existing WisLCS data structures
    • Project, closure, facility, lane detail
  • Broader Wisconsin work zone data requirements
    • ATMS, OSOW, 511, Analytics
Data Improvements – Lane Details

• WZDx 3.1 Lane-Level Precision with Flexible Adoption
• 1-1 Translations from WisLCS 2.0 to WZDx 3.1
• Richer Set of Localized Elements for Wisconsin
• Easy to Use UI Tools
Data Improvements – Time & Spatial Verification

- Road Event Accuracy Values
  - Estimated
  - Verified

- Time Verification
  - Start Date Accuracy
  - End Date Accuracy

- Spatial Verification
  - Beginning Accuracy
  - Ending Accuracy

- Wisconsin Prototype
  - Scalable with Additional ITS
  - Device IDs Entered into LCS
Data Improvements – Work Zone Mapping

- Location Improvements
  - Geo-Coordinates
  - Cumulative Mileages
  - Linear Referencing
  - Roadway Geometry
- WZDx Road Events
  - Road Event Geometry
  - LineString / MultiPoint
- Traffic Management
  - ATMS Event Plans
- Performance Measures
  - WZ Safety - Exposure
  - Work Zone Lane Miles

Source: Wisconsin DOT
Future
Help us Put Work Zones On the Map

Martha Kapitanov
Federal Highway Administration
**Put Work Zones on the Map** is an awareness campaign to educate and engage current and potential partners on the capabilities, benefits, and progress of WZDx specification adoption.

- **Goal:** To increase voluntary adoption of the data specification.
- **The focus of this campaign is on audiences who directly engage with work zones:** infrastructure owner operators (IOOs), construction companies, mapping companies, and original equipment manufacturers (OEMs).
Put Work Zones on the Map will:

- Develop and distribute educational materials.
- Raise awareness for pilot projects.
- Increase involvement in the Work Zone Data Working Group.
- Generate excitement — to ultimately encourage and facilitate adoption of the WZDx specification.

Source: FHWA
Toolkit Resources:

Shareable Content
• Graphics
• Social media content
• Postcard
• Fact sheet-coming soon!

Educational Content
• Webinars

Social Media Toolkit:
• https://ops.fhwa.dot.gov/wz/wzd/x/toolkit/index.htm

Source: FHWA
Partners Are Vital to the Success of WZDx

- Connect us with your communications staff/department
- Share materials, social media posts and graphics from our online toolkit
- Help direct people and organizations to our website to learn more
- Help us promote webinars and campaign news
- Collaborate on publicity efforts to generate awareness
Contacts

For more information on:

- **National Work Zone Awareness Week and Put Work Zones on the Map Campaigns**: Martha Kapitanov, martha.kapitanov@dot.gov
- **Work Zone Data Initiative**: Todd Peterson, todd.peterson@dot.gov
- **Work Zone Data Exchange**: Nate Deshmukh Towery, nate.deshmukh-towery@dot.gov
- **Wisconsin DOT**: Erin Schwark, erin.schwark@dot.wi.gov; Steven Parker, sparker@engr.wisc.edu

For more information on the WZDx project or anything else related to the Work Zone Data Working Group, contact AVDX@dot.gov.
Resources

To learn more and access available resources, please visit:

- [WZDx Version 3.1 Specification](#)
- [WZDx GitHub Wiki (Day-to-Day Work Zone Data Working Group Activities)](#)
- [WZDx Discussion Forum](#)
- [WZDx Technical Assistance Help Desk](#)
- [WZDx Data Feed Registry](#)
- [FHWA WZDI Data Dictionary and Framework](#)
- [Work Zone Data Collection Tool](#)
- [FHWA Work Zone Management](#)
- [National Work Zone Safety Information Clearinghouse](#)