U.S. Department of Transportation
Federal Highway Administration

CASE STUDY

PLANNING, DEVELOPING, AND IMPLEMENTING A CENTRALIZED WORK ZONE DATA HUB—IOWA DEPARTMENT OF TRANSPORTATION

As the nation develops an increasing reliance on technology and next generation transportation management, ensuring the availability of consistent, reliable data describing work zone events is critical to enabling agency management of highway operations. The FHWA is leading the Work Zone Data Initiative (WZDI) to improve the availability of information on work zone events—the "when, where, and how" of highway construction activity—by promoting standards and processes that enhance agency capabilities to manage transportation operations around work zones and enable sharing this valuable information with other transportation operations stakeholders.

This case study focuses on efforts by the Iowa Department of Transportation (DOT) to leverage WZDI resources to create a centralized work zone data hub that provides enhanced information for a variety of planning, operating, and post-construction use cases.

The Motivation for a Work Zone Data Hub

Due to unexpected congestion in and around the State's work zones, Iowa DOT began the **Traffic Critical Projects (TCP) Program**. TCP is a data-driven effort to strategically identify key construction projects across the State that may cause significant safety or mobility issues to the traveling public. Using various mitigation methods, the TCP program works to identify, mitigate, or eliminate any potential safety or mobility concerns.

Under the TCP Program, Iowa DOT deployed **Intelligent Work Zones (IWZs)**, leveraging intelligent transportation system (ITS) technologies that monitor and collect work zone event and mobility data about active projects. Data are then communicated to the Transportation Management Center (TMC), where these data are used to evaluate effectiveness, mobility, and safety impacts. Typically, there are 15 to 20 active IWZ projects across Iowa each year with over 200 different temporary traffic control devices deployed. Work zone event data from these field devices in active work zones supplement and expand on the planned event information available for traveler information in 511. The success of the TCP Program and IWZs led to community interest and support for developing a Work Zone Data Hub.

Iowa Work Zone Data Hub

Iowa's Work Zone Data Hub effort is focused on identifying and implementing essential use cases across the State, based on those outlined by the WZDI. Iowa DOT has a strong partnership with Iowa State University Center for Transportation Research and Education (CTRE), which provides work zone performance monitoring for the TCP program. CTRE also provides expertise and support to advance Iowa DOT work zone practices, including developing and operating the Work Zone Data Hub.

Intended outcomes for the Work Zone Data Hub include:

- Incremental integration of priority use cases to either improve and formalize current procedures, or develop new ways of collecting data to achieve a use case.
- Improvement of work zone event data through supporting efforts to deploy and test new technologies that collect event data for active work zones, and

changing business processes to modify data elements for planned work zones.

- Publication of a public application programming interface (API) feed that follows the USDOT's Work Zone Data Exchange (WZDx) common core data specification.

Work Plan and Roadmap for Implementation

To begin this effort, CTRE developed a work plan and examined all available work zone data at Iowa DOT to prioritize next steps. This initial effort included the following steps that exemplify best practices for any agency pursuing the WZDI:

- Identifying issues with data quality and accuracy
- Identifying and prioritizing deployment of field devices to allow work zone activity data (WZAD) to verify active work zone status
- Identifying and prioritizing use cases to develop a roadmap for future activities. CTRE examined all available WZAD at Iowa DOT to identify what data were available, what data could be available with minor effort, and data that were not currently available.

After reviewing the use cases described in the WZDI framework as described above, Iowa DOT developed a roadmap for expanding the Work Zone Data Hub. This included identifying five priority use cases to focus Fiscal Year 2020 efforts to build on the existing use cases in the data hub.

Iowa DOT has identified the following four categories of activity to fully prepare and integrate each prioritized use case within the data hub:

1. Integrate Data Sources. Using available data, develop a process for integrating additional data sources into the data hub.
2. Improve Data Accessibility. Identify changes needed for easier data collection and use.
3. Develop Back End Processes. Create a procedure to integrate data for a specific purpose and develop outputs for the process.
4. Identify Use Case Implementation. Implement use cases, including development of front-end applications, reports, and/or data feeds as needed.

Iowa DOT prioritized five WZDI use cases to implement for the Work Zone Data Hub effort:

1. Work Zone Mobility Performance Analysis
2. Agency Project Initiation and Planning Temporary Traffic Control (TTC) coordination
3. Work Zone Plan Dissemination to Third Party Data Providers
4. Work Zone Safety Performance Analysis
5. Corridor Mobility Impact Assessment

As an example of the anticipated effort, the Work Zone Mobility Performance Analysis use case requires external mobility data, including historic and pre-construction data. This use case will focus on building external databases and the connections required for access in order to then estimate mobility impacts. The use case would likely focus on just the Traffic Critical Program (TCP) work zones initially. The performance reporting would build off of the ongoing Lane Closure Planning Tool (LCPT) and TCP performance monitoring by CTRE, but would formalize the work flows (identifying all of the data sources and how they map to the WZAD) and ensure data are stored according to the WZAD data dictionary.

In addition to the efforts described above, CTRE developed an API data feed that followed the WZDx v 1.1 specification as the first application of the Work Zone Data Hub and a preliminary demonstration to understand potential issues. The developed WZDx feed utilizes data from the 511 traveler information system and Iowa's Roadway Asset Management System (RAMS). These data sources support the adopted integration approach that is currently being tested, which generates the real-time feed for active work zones when: (1) devices are active, and (2) during a corresponding planned event that is matched to the active devices based on spatial and temporal extents. This feed was later modified to reflect when multiple closures occur at the same time and include freight-specific data, and will be further refined as part of the use case for Work Zone Plan Dissemination to Third Party Data Providers. As developed, the WZDx feed is fully functional and connects to the 511 data every 15 minutes; in the long term, however, the Iowa DOT Advanced Traffic Management System (ATMS) vendor will produce the WZDx feed as part of the fully developed ATMS.

Organization	Availability	Data Frame	Description	Data Elements	Description
Owner Agency	Available			orgName	The name of an organization associated with a project that requires a work zone.
				orgType	A type of organization that is associated with an organization.
				orgTelephone	A contact telephone number associated with related organization.
				region	A known jurisdiction or area.
				orgURL	The web address for the organization. This may specify a file storage site.
Owner Agency Project Manager	Available with effort			orgType	A type of organization that is associated with an organization.
				orgTelephone	A contact telephone number associated with related organization.
				region	A known jurisdiction or area.
				orgURL	The web address for the organization. This may specify a file storage site.
Contractor/ Subcontractor	Not available currently			contractRole	The organization subject to the contract requirements
				roleType	The role of the organization with respect to the project event (task, subtask or activity).
Funding Allocation Status	Available with effort			allocationValue	The funding requirements to complete the project.
				allocationType	The type of financial allocation associated with this project, e.g., planned, requested, pending, partially allocated, fully allocated, etc.
Expected Number of Phases	Not available currently			totalPhases	The number of phases in the project.
Actual Number of Phases	Not available currently			totalPhases	The number of phases in the project.
Expected Phase Duration	Not available currently	StartDateTime	The date and time starts. The datetime may be estimated or verified depending on the work zone state (wz-state).		
		EndDateTime	The date and time the work zone ends. The datetime may be estimated or verified depending on the work zone state (wz-state)		

Table 1. This image shows a subset of the full list of data frames and data elements from the Data Dictionary that were examined to identify the current availability of data at Iowa DOT related to organization; green items are currently available, yellow items are available with minor effort, and red items are not currently available. *(Source: Adapted from Iowa Department of Transportation. Cell colors have been changed and text has been added in order to meet Section 508 accessibility requirements.)*

Back to Use Cases	User Needs for Workzone Impact Analysis					
Data Elements	Data Availability	Workzone Mobility Impact Assessment	Workzone Safety Impact Assessment	Assessment of Expected Effects of Alternative TMP Mitigation Strategies	Corridor Mobility Impact Assessment	Network Mobility Impact Assessment
Workzone Life Cycle		X	X	X	X	X
Stakeholders		II_A,, II_B,, II_H	II_A,, II_B,, II_H	II_A,, II_B,, II_H	II_A,, II_B,, II_H,, E_A	II_A,, II_B,, II_H,, E_A
Organization						
Owner Agency	Available	1	2	3	4	5
Owner Agency Project Manager	Available with Effort					
Contractor / Subcontractor	Not Available Currently					
Funding Allocation Status	Available with Effort					
Expected Number of Phases	Not Available Currently	1	2			
Actual Number of Phases	Not Available Currently					
Expected Phase Duration	Not Available Currently					
Actual Work Duration	Available with Effort					
Project ID	Not Available Currently	1	2	3	4	5

Table 2. A subset of the next step in the process is shown, as conducted for the Work Zone Impact Analysis use cases, to map the needed data elements to implement each use case, and identify when it occurs in the work zone life cycle. Red use cases were designated by Iowa DOT as high priority, and blue use cases were designated as a medium priority. Stakeholders identified for each use case based on the Work Zone Event Data (WZED) Framework were identified here and are presented with more detail in Table 3. *(Source: Adapted from Iowa Department of Transportation. Cell colors have been changed and text has been added in order to meet Section 508 accessibility requirements.)*

Back to Use Cases	Stakeholders																									
Data Elements	Workzone Planning and Coordination					Design and Engineering					Workzone Data Systems Development Operations		Construction Operations Manager and Inspector		Roadway Maintenance Manager Function		Utilities Construction Workzone Coordination		Law Enforcement Coordination		ATMS Operator Function					ITS/DMS/ Traveler Information Systems
Workzone Life Cycle	II_A					II_B					II_C		II_D		II_E		II_F		II_G		II_H					II_II
Stakeholders																										
Organization																										
Owner Agency	1	2	3	4	5	1	2	3	4	5											1	2	3	4	5	
Owner Agency Project Manager																										
Contractor / Subcontractor																										
Funding Allocation Status																										
Expected Number of Phases	1	2				1	2	3	4	5											1	2	3	4	5	
Actual Number of Phases																										
Expected Phase Duration																										
Actual Work Duration																										
Project ID	1	2	3	4	5	1	2	3	4	5											1	2	3	4	5	
Event ID	1	2	3	4	5	1	2	3	4	5											1	2	3	4	5	

Table 3. The stakeholders associated with each data element and use case were also identified, as shown here for a subset of data elements for the five work zone impact analysis use cases that were examined. *(Source: Adapted from Iowa Department of Transportation. Cell colors have been changed and text has been added in order to meet Section 508 accessibility requirements.)*

Challenges and Lessons Learned

Iowa DOT and CTRE have encountered a number of challenges and lessons learned as part of this effort to develop a Work Zone Data Hub, including:

- Leave data where it is currently available in order to focus on data integration and collection.
- The WZDI Framework and Data Dictionary is a major effort that can be challenging to digest without support.
- A Work Zone Data Hub should be approached incrementally based on agency priorities and data availability to make the effort and transition more manageable.

Resources

A variety of FHWA reference documents and materials relating to planning and deploying standardized WZED are available at FHWA's Work Zone Management Program website: **https://ops.fhwa.dot.gov/wz/**.

The Iowa Work Zone Data Exchange (WZDx) can be accessed at the following link: **https://public-iowadot.opendata.arcgis.com/datasets/iowa-work-zone-data-exchange-wzdx**.

For More Information

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