NOCoE
National Operations Center of Excellence

Peer Exchange Report

Work Zone Management and TSMO Peer Exchange Report

Purpose And Overview

NOCoE's *Work Zone Management and TSMO* Virtual Peer Exchange is intended to host transportation agency professionals with experience and interest in developing, implementing, and managing maintenance and construction work zones. The goal is to expose practitioners to the latest developments in work zone management and hold discussions among peers about practical experience, opportunities, and challenges with different practices.

The peer exchange will be virtual using the NOCoE's Zoom software and developed as a two-day exposure to various aspects of the topic, open to state, regional, and local TSMO stakeholders. Staff from specific programs with experience in the topic will be invited to speak and attend.

Agenda

TUESDAY, MARCH 12, 2024

Time	Topic	Speakers
11:00 am – 11:20 am (20 min.)	**Welcome and Introduction** • Facilitator Welcome • Agenda Review • Summary of expectations for this peer exchange • *Transportation Operations Manual* and work zones	Nick Ramfos, NOCoE Douglas Noble, ITE Douglas Noble, ITE Raj Ponnaluri, Florida DOT
11:20 am – 12:30 pm (70 min.)	**Segment 1 – Federal Resources and Connected Work Zone Standards** • FHWA Resources and Transportation Pool Fund Studies • CWZ Standards Q&A	David Johnson and Jawad Paracha, FHWA Raj Ponnaluri, Florida DOT
12:30 pm – 1:30 pm	**Break**	

	Segment 2 – Data Usages and Performance Measurement Part I: Case Studies	
1:30 pm – 2:30 pm (60 min.)	• Case Study 1: Condition Acquisition and Reporting System (CARS) event management	Garrett Schreiner Minnesota DOT
	• Case Study 2: WZDx Feed Implementation	Chris Lambert Kentucky Transportation Cabinet
	Q&A and Discussion	
	Segment 3 – Group Discussions on the 11th Edition of the MUTCD	
2:30 pm – 3:30 pm (60 min.)	• Initial Remarks / Brief Presentation on Changes	Douglas Noble, ITE

	• Breakout groups on
	  • General Items and CAV
	  • Signs and Markings
	  • Temporary Traffic Control
		Moderated Discussion

3:30 pm – 3:50 pm (20 min.)	**Summary from Breakout Rooms** • Report-outs from all breakout room discussions	Self-Reported by Breakout Leader
3:50 pm – 4:00 pm (10 min.)	**Day Wrap Up** • Summary and what to expect next • Day closing remarks	Douglas Noble, ITE Nick Ramfos, NOCoE

* All times shown are Eastern Standard Time.

WEDNESDAY, MARCH 13, 2024

Time	Topic	Speakers
11:00 am – 11:15 am (15 min.)	**Recap from first day** • Highlights discussed on day 1 and objectives for day 2	Douglas Noble, ITE
11:15 am – 12:30 pm (75 min.)	**Segement 4 – Safety Sync: Integrating Safe System Approach with Work Zone** • Initial Remarks Relating SSA to Work Zone Functions • Enhancing Road Safety Through Connected Workers • Live Work Zone Connected Vehicle Demo • Mobile and Static Connected Work Zone Messaging _____ • Positive Protection • Variable Speed Limits • Automated Speed Management / Speed Cameras Q&A and Discussion	Ahnaf Morshed, ITE Chris Brookes, Michigan DOT Olivia Townsend, Florida DOT Chris Siavrakas, Utah DOT Sung Yoon Park, Maryland State Highway Admin.
12:30 pm – 1:30 pm	**Break**	
1:30 pm – 2:30 pm (60 min.)	**Segment 5 – Exploring Data Utilization and Performance Measurement: Case Studies-Part II** • Data Integration • Seamless adoption of connectivity Q&A and Discussion	Skylar Knickerbocker, InTrans at Iowa State Univ.*

2:30 pm – 3:15 pm (45 min.)	**Segment 6 – Peer to Peer Discussion on Communication of Strategies**
	• Initial Remarks
	• Discussion specific issues and strategies, such as:
	  • *Construction vs. maintenance WZ*
	  • *Changes to time of day (INRIX data?)*
	  • *Alternate routing / equity*
	  • *Impact of special events*
	  • *Accommodating Vulnerable Road Users in Work Zones*
		Douglas Noble, ITE
		Moderated Discussion

3:15 pm – 3:30 pm (15 min.)	**Day Wrap Up** • Gaps, Potential Actions, and Next Steps • Closing remarks	Douglas Noble, ITE Nick Ramfos, NOCoE

* *All times shown are Eastern Standard Time.*

Sessions

INTRODUCTION

The *Work Zone Management and TSMO* peer exchange was conducted virtually over two days using the NOCoE's Zoom web software. The peer exchange included representatives of university research programs, state departments of transportation (DOTs), and the Federal Highway Administration (FHWA) as well as individuals involved in the Connected Work Zone standard development process. The meeting began with an introductory discussion of work zones in the *Transportation Operations Manual*, followed by presentations on Federal Highway Administration resources and the connected work zone standards. Subsequently, there were presentations with Q&A on data utilization and performance measurement from Minnesota DOT, Kentucky Transportation Cabinet, and InTrans at Iowa State University. Other presentations cover application of the following topics to work zones: Safe System Approach (Michigan DOT), connected workers and vehicles (Michigan DOT), positive protection (Florida DOT), variable speed limits (Utah DOT), and automated speed management (Maryland State Highway Administration). Discussion sessions were held on the implications of the December 2023 release of the *Manual on Uniform Traffic Control Devices*, 11th Edition (MUTCD) as well as a peer-to-peer conversation on specific issues and strategies.

TRANSPORTATION OPERATION MANUAL OVERVIEW FOR WORK ZONES

Raj Ponnaluri (Florida DOT) provided a brief overview of the Transportation Operations Manual and its content covering work zones. The Transportation Operations Manual serves as comprehensive resource for transportation system management and operations (TSMO) and offers guidance to agencies for implementing TSMO. The Manual provides a common basis for practicing TSMO and serves as a tool to advocate for and train TSMO practitioners, complementing other resources such as A Policy on Geometric Design of Highways and Streets (aka the Green Book),the Highway Capacity Manual, the Highway Safety Manual, and the MUTCD. The Manual is intended to be periodically updated as TSMO practice changes over time and the next cycle of this process has already begun.

Sections of the Manual focus on work zones, specifically Part D - Project Development, Section 15.5.2.6 - Smart Work Zones discusses queue warning signs, variable speed limits, and dynamic lane merge. In Part E - Tactical Elements, Section 20.4 Work Zone Traffic Management provides content on assessing impact of work zones and determining strategies to mitigate work zone impacts such as, road project coordination, lane closure policies, traffic management plans, work zone strategies, use of intelligent transportation systems (ITS), work zone crash management, and data needs. He closed his presentation by noting that there are 20 other relevant section applicable to work zone management although the topic is more implicit in content than directly called out.

FEDERAL RESOURCES AND CONNECTED WORK ZONE STANDARDS

Summary

FHWA Resources and Transportation Pool Fund Studies

Work zone safety is a key focus of the National Roadway Safety Strategy, a comprehensive U.S. Department of Transportation initiative based on the Safe System Approach. David Johnson and Jawad Paracha (FHWA) noted that every year, construction zones disrupt traffic flow, costing billions in crashes ($36 billion in 2021), and congestion and delays ($8.1 billion in 2022). The Bipartisan Infrastructure Law (BIL) provides crucial funding including grants for work zone safety and the National Work Zone Safety Information Clearinghouse, a one-stop shop for work zone resources.

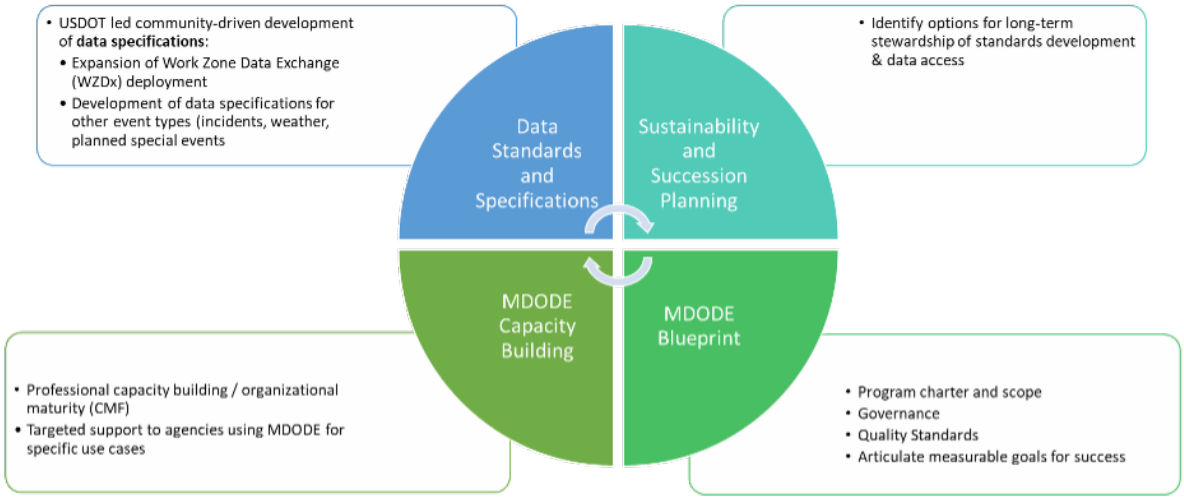
Source: Federal Highway Administration
Figure 1: Safe System Approach

The FHWA Work Zone Management Program tackles this challenge head-on, aiming to make work zones safer, smoother, and more efficient by supporting the development and deployment of work zone management solutions and strategies that integrate safety, mobility, and constructability. The fosters collaboration between various stakeholders, including other FHWA programs, state and local agencies, and industry partners. The program offers a wide range of training, knowledge transfer, and support resources, including conferences, awareness weeks, and courses on advanced work zone design, flagger training, and work zone traffic analysis. The presenters shared that peer exchanges and technical assistance programs allow agencies to learn from each other's experiences with specific examples noted in presentation.

The work zone management program focuses on non-recurring congestion (55% of all congestion, 10% attributable to work zones), which arises from unexpected disruptions events like work zones or special events, as opposed to daily rush hour traffic. By understanding these disruptions, transportation agencies can develop better strategies to manage them.

Source: Federal Highway Administration
Figure 2: Recurring Congestion vs. Disruptions

The Managing Disruptions to Operations Data Exchange (MDODE) is a program initiative to help agencies to improve their ability to collect and report information. The initiative aims to create a central hub to exchange information between agencies and external parties for consistent and accurate data on disruptions (see five year road map in Figure 3). This data will be invaluable for analyzing trends and developing better work zone management practices. An element of MDODE is the Work Zone Data Exchange (WZDx). WZDx currently has active feeds from 19 states and the National Park Service, and work on continues in the updated the standard, now on v4.2.



Source: Federal Highway Administration

Figure 3: MDODE Five Year Road Map

The speakers shared that a Notice of Proposed Rule-Making (NPRM) was published on September 20, 2023 (commenting closed on November 30, 2023) with proposed changes to 23CFR630 Subpart J (Work Zone Safety & Mobility) focusing on:

- Change work zone process review frequency from every 2 years to every 5 years.
- Encouraging more data-driven, holistic reviews of an agency's entire work zone management program.
- Clarify definitions and other ambiguities.

and to 23CFR630 Subpart K (TTC Devices) where it:

- Changes in requirement for usage of Positive Protection Devices.
- Clarify definitions and other ambiguities.

Among the various work zone management projects, work under way related to speed safety cameras and connected vehicle data was presented in more detail. *The Use and Effectiveness of Speed Safety Cameras* (SSC) in Work Zones project has updated project objectives to:

- Review the state-of-the-practice of how transportation agencies are currently using SSC in work zones.
- Identify noteworthy practices as well as opportunities where SSC can be used to improve work zone safety.
- Interview states and summarizing lessons learned.
- Develop supplemental communications to the new SSC guide.
- Conduct a webinar and peer exchange workshop to share findings.

In addition, FHWA is focusing on the use of connected vehicle data for work zone management in the areas of performance monitoring, policy evaluation, and countermeasure evaluation. FHWA is developing planning, active, and historical use cases with an emphasis on safety outcomes. Other related efforts include data driven work zone process reviews and the Work Zone Analytics (TPF-5(514)) Transportation Pooled Fund Study (lead organization is Indiana DOT).

Connected Work Zone Standards

Raj Ponnaluri (Florida DOT) returned to share an update on Connected Work Zone (CWZ) standards. CWZ is supported by a set of standards that aim to improve safety and efficiency in work zones by collecting and broadcasting work zone information between workers, travelers, and vehicles. Vehicles equipped with CWZ technology would receive and interpret this data, enabling features like dynamic speed adjustments and queue warnings.

There are several compelling reasons to standardize work zone communication:

- **Safety:** CWZ can significantly reduce work zone crashes by keeping drivers informed.
- **Reduced Delays:** Real-time information allows drivers to adjust routes or slow down proactively, minimizing congestion.
- **Improved Efficiency:** Standardized data exchange simplifies communication between work zone managers, transportation agencies, and travelers.

There are currently challenges with implementing CWZ due to ambiguities and gaps in existing standards, inconsistent interpretation and implementation, and lack of technical expertise.

Led by the Institute of Transportation Engineers (ITE), the CWZ Initiative brings together USDOT, AASHTO, standards development organizations (SDOs), other government agencies, industry leaders, and early adopters. The goal of the CWZ Initiative is to develop and publish clear, consensus-based information for a non-proprietary standard for reliable and interoperable CWZ. The process uses a system engineering approach and leverages existing standards with design content that satisfies multiple SDOs. The expected outcome is consistent interoperable CWZ environments across various stakeholders as result of harmonization of standards activities across centers, vehicles, field devices, and vulnerable road users/workers.

With CWZ, work zones can transform from obstacles into information hubs that offers:

- **Real-time traffic information:** Drivers receive updates on delays, lane closures, and alternative routes.
- **Advanced driver assistance systems:** Vehicles automatically adjust speed based on work zone conditions.
- **Improved work zone safety:** Alerts warn workers of approaching vehicles, reducing the risk of crashes.

The CWZ Initiative has made significant progress, and the core standard is nearing completion with stakeholders currently reviewing the recommended practices. The next steps involve publishing the standard, verifying its effectiveness, and developing a reference implementation. Overall, CWZ has the potential to improve work zone safety and efficiency by providing real-time information to travelers and vehicles.

DATA USAGES AND PERFORMANCE MEASUREMENT PART I: CASE STUDIES

Summary

Condition Acquisition and Reporting System (CARS) Event Management

The Condition Acquisition and Reporting System (CARS) acts as a central nervous system for Minnesota DOT (MnDOT) transportation management center, gathering information on road conditions from a variety of sources. This data is then used to create a clear picture of what is happening on Minnesota's roads, allowing MnDOT to make informed decisions. Garrett Schreiner (MnDOT) shared that the data streams provide a constant flow of information connecting:

- **State Patrol:** Crash and stall data is automatically imported from the State Patrol's Computer Aided Dispatch (CAD) system. MnDOT users can then add details to these events. They can also delete events that are no longer relevant, ensuring the system stays up-to-date.

- **Automated Event Creation:** Vehicles equipped with Automatic Vehicle Location (AVL) data can automatically trigger the creation of work zone events when they stop on the road. This is particularly useful for mobile operations like mowing or guardrail repair crews who might not call in to dispatch.

- **Smart Devices and RWIS:** MnDOT is incorporating data from smart devices like connected arrow boards and the Road and Weather Information System (RWIS) with its 167 sites. This data provides valuable real-time information on weather conditions, like blizzards and winter storms, keeping both operators and the public informed.

- **Crowdsourcing:** CARS integrates Waze reports, providing valuable insights into traffic conditions across the state, excluding the metro area to avoid duplicate reports.

- **Maintenance Decision Support System (MDSS):** Road condition data is pulled from MDSS, updated every five minutes. This information can be overridden if a forecast model is inaccurate.

- **Manual Entry:** There's always room for human input. Road conditions can be manually entered or overridden if needed, and work zone events, not triggered by other methods, are entered through online lane closure forms.

- **The Future of Data Sharing:** MnDOT is at the forefront of data sharing with a grant from the Federal Highway Administration (FHWA) to implement a WZDx feed. This will allow for even richer data exchange, including information from MnDOT's WZDx Publisher, Work Zone Worker Presence App, and MN WZDx Fusion Engine.

By combining data from automated systems, crowdsourcing, and human expertise, CARS provides MnDOT with a comprehensive view of road conditions across Minnesota. This allows them to respond to incidents quickly, deploy resources efficiently, and keep travelers informed.

Case Study 2: WZDx Feed Implementation

Chris Lambert and Erica Russell of the Kentucky Transportation Cabinet (KYTC) shared that the agency utilizes a comprehensive work zone monitoring program that gathers data from a wide range of sources. This data includes:

• **Traffic flow:** Real-time traffic speeds are collected from HERE Maps and Waze, along with incident reports from both platforms.

• **Weather data:** KYTC taps into KYMesonet, CoCoRaHS weather stations, National Weather Service (NWS) forecasts and radar, to get a complete picture of weather conditions that might impact work zones.

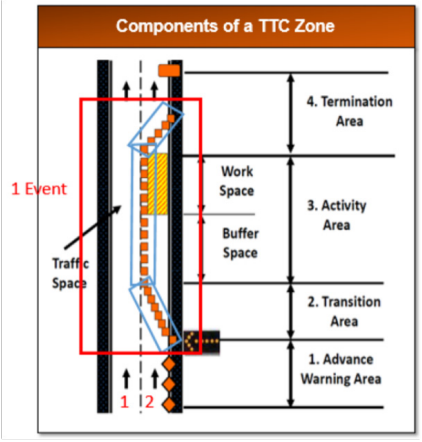
• **Roadway data:** Information on permitted work zones, dynamic message signs, truck parking availability, and even snowplow locations through AVL (Automatic Vehicle Location) data is all factored in.

• **Crowd-sourced data:** Twitter feeds and TMC (Traffic Message Channel) reports provide additional insights from travelers on the road.

This wealth of data is then processed to create a clear picture of work zone activity across the state. This allows KYTC to provide real-time traveler information through the "goky.ky.gov" website provides up-to-date information on work zones, allowing travelers to plan their routes accordingly. The agency also filters and analyzes work zone data to identify trends and patterns, leading to better work zone management practices. Work zone crash summaries help KYTC identify areas where safety improvements are needed.

The Work Zone Data Exchange (WZDx) is a national initiative to standardize work zone data. While KYTC actively participates in WZDx, they have encountered some challenges with location accuracy (see Figure 4) and inconsistencies in how different Traffic Management Centers (TMCs) defined locations as well as staff turnover and IT system changes hampered consistent data entry. These challenges caused delays in implementing WZDx in Kentucky. By continually improving data collection and analysis, KYTC is working towards a future where work zones are less disruptive, and travel is safer and smoother for everyone in Kentucky.

Questions:
• How many events are there?
This can all be one event.
• How is the geometry (polyline) described? Using the merging lane or the through lane?
This is straight forward, lane 2 is closed from the end of section 1 to midway through section 4, actual latitude/ longitude would be reflected. Assume numbering from bottom to top and assume both shoulders are less than 1 m wide (otherwise they would count as lanes).



Source: Kentucky Transportation Cabinet

Figure 4: WZDx Challenge - Location

Group Discussions on the 11th Edition of the MUTCD

Summary

With the recent release of the MUTCD, 11th Edition and its updates to Chapter 6 on temporary traffic control this discussion segment was used to gauge the current status of agencies as the move towards implementation of the new manual. To start four poll questions were asked of participants, with the following responses:

How well-informed do you feel about the updates and changes related to General and Connected and Autonomous Vehicles (CAV), signs and markings, and temporary traffic control guidelines in the 11th Edition of the MUTCD?

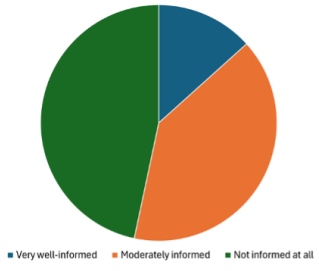


Figure 5: How Well Informed About Updates and Changes in MUTCD, 11th Edition

In your opinion, what impact will the new MUTCD guidelines have on the work zone management practices?

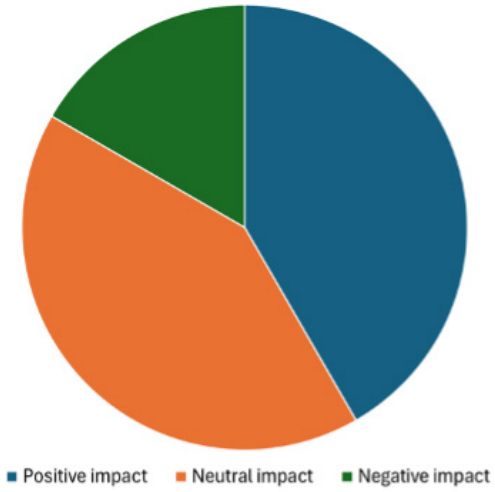


Figure 6: Impact of MUTCD, 11th Edition on Work Zone Management Practices

In your experience, what is the most significant aspect of Temporary Traffic Control that needs improvement or further clarification in the new MUTCD?

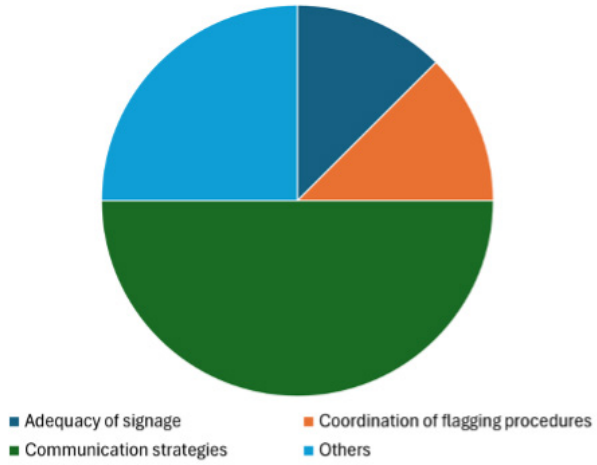


Figure 7: What Aspect of Temporary Traffic Control Needs to be Improved?

Do you believe the 11th Edition adequately addresses the challenges posed by work zones and temporary traffic control situations?

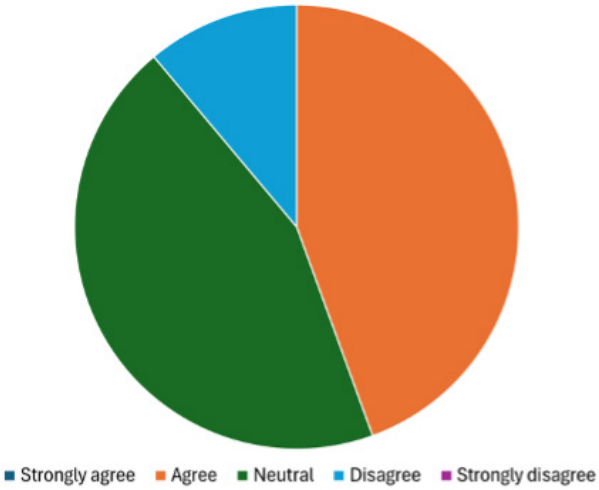


Figure 8: Does the MUTCD, 11th Edition Adequately Address Challenges?

Discussion

The ensuing discussion was prompted by an additional set of questions (see Appendix A) intended to gather insights into the understanding, challenges, and practical implementation of the MUTCD, 11th Edition guidelines, specifically in the context of general topics and connected and automated vehicles (CAV), signs and markings, and temporary traffic control with a focus on work zones. A breakdown of the key points includes:

Challenges and Gaps in MUTCD

- Ensuring signs and markings are removed promptly after work zone completion.
- Inspections to verify proper signage placement and condition.
- Lack of clear guidelines for Pedestrian Access Routes (PROWAG) and ADA compliance.
- Locations for speed feedback signs in connected work zones.
- Limited guidance on flagging procedures.
- Interest in using orange work zone pavement markings (used in Ontario, Canada) as well as the revised experimentation and interim approval process.
- Signing requirements for speed safety cameras that comply with state laws.
- Integrating overhead signs with Advanced Traffic Management Systems (ATMS) for displaying graphics and speeds.
- More information on positive protection.

Optimizing Temporary Traffic Control (TTC) Strategies

- Utilizing Digital Variable Speed Signs for real-time speed adjustments.
- Implementing clear communication strategies to inform motorists about active work zones.
- Determining optimal placement and message content for Dynamic Message Signs (DMS).
- Avoiding unnecessary messages on static signs far ahead of work zones.
- Exploring innovative solutions like driveway assisting devices (DADs) for better traffic flow.

Effective Communication of TTC Plans

- Providing accurate and up-to-date information on construction projects through platforms like 511 and Waze.
- Using a combination of flyers, webpages, detour plans, and commercial driver information channels.
- Leveraging dynamic arrow boards, drones, and connected devices for real-time traffic updates.
- Implementing public awareness campaigns on zipper merging and following the Move Over Law.
- Sorting out conflicting messaging between travel times, lane closures, and general safety message campaigns.

Adapting General and CAV Guidelines for Work Zones

- Utilizing connected vehicle data to adjust lane closures and routes for improved traffic flow.
- Implementing safety prediction models to proactively address potential risks.

- Addressing concerns about data accuracy, verification, and long-term investment costs for Connected Vehicle (CAV) technologies.
- Exploring data integration methods from smart cones and boards to provide real-time information to road users.

In summary, there is a need for better enforcement of removing temporary signage and markings after work zone completion. The new MUTCD offers some improvements but there are still gaps, particularly regarding ADA compliance and flagging procedures. Communication plays a crucial role in work zone safety. Clear, accurate, and consistent information about active zones and traffic control plans is essential. Technological advancements like connected vehicles and real-time data hold promise for optimizing traffic flow and improving safety in work zones, but challenges regarding data accuracy and infrastructure need to be addressed.

SAFETY SYNC: INTEGRATING SAFE SYSTEM APPROACH WITH WORK ZONE

Summary

Safety System Approach is a shift from a more conventional approaches to road safety due to the focus on both human vulnerability as well as human errors, the creates a redundant system to protect all users. This approach is implemented by designing roadway environments to mitigate human mistakes and account for injury tolerances, to encourage safer behaviors, and to facilitate safe travel by the most vulnerable users. Two of five core objectives of the Safety System Approach are:

- **Safer Roads:** Design roadway environments to mitigate human mistakes and account for injury tolerances, to encourage safer behaviors, and to facilitate safe travel by the most vulnerable users.
- **Safer Speeds:** Promote safer speeds in all roadway environments through a combination of thoughtful, equitable, context-appropriate roadway design, appropriate speed-limit setting, targeted education, outreach campaigns, and enforcement.

In that context, the following topical presentations were made on connected work zones, positive protection, variable speed limits, and automated speed enforcement.

Connected Work Zones

Chris Brookes from the Michigan Department of Transportation (MDOT) observed that work zone crashes will happen and to make sure there is an escape path. He emphasized the importance of proper traffic control devices and staying alert while driving through work zones. Agencies need to talk about crashes and not be complacent.

MDOT is at the forefront of implementing connected work zone technology. This technology allows work zones to communicate with vehicles, providing drivers with real-time information about worker presence, lane closures, and variable speed limits as well as construction zone start and end points. Brookes noted that the technology is ready today to help prevent crashes, but in the meantime promote the use of Waze in MiDrive until there are enough work zone devices available. The pilot program on I-96 used connected vehicle technology to reduce speeds near workers. By providing drivers with clear information, the pilot program successfully lowered speeds and improved safety.

While connected work zone technology holds promise, there are still challenges to address regarding:

- **Digital Speed Limits:** Determining who manages speed limit changes, ensuring low latency (minimal delay) in updates, and recording changes for enforcement purposes are all aspects that need to be ironed out.
- **Worker Presence Detection:** MDOT is testing devices that crews can wear to signal their presence to connected vehicles. These devices come with limitations, like a single activation switch and the possibility of human error.
- **Alert Fatigue:** The constant stream of in-car alerts can lead to driver fatigue. MDOT needs to find the right balance between providing necessary information and overwhelming drivers.

MDOT is also exploring other innovative technologies to enhance work zone safety, such as:

- **Mobile camera trailers:** These trailers use video analytics to detect vehicles, workers, and traffic conditions.
- **Smart work zone equipment:** This equipment includes traffic sensors and real-time work condition messaging signs.
- **Real-time in-vehicle alerts:** These alerts can be delivered through navigation apps like Waze or Google Maps.

MDOT's commitment to exploring and implementing new technologies paves the way for a future where Michigan's work zones are safer for everyone by combining connected vehicles, innovative devices, and a focus on worker safety.

Positive Protection

Florida's Department of Transportation (FDOT) is taking a multi-pronged approach to improve work zone safety for both drivers and workers. Olivia Townsend (FDOT) shared information about the agency's key initiatives.

Introduced in October 2022, the Lane Closure Notification System requires contractors to use a special app to report lane closures within 5 minutes of setting up or removing cones. This real-time information is then verified by inspection staff and transmitted to navigation apps, ensuring drivers have the latest closure details.

DOT released a Design and Traffic Ops Bulletin in January 2024, outlining a roadmap for Smart Work Zones (SWZ) implementation. This includes a guidebook, design criteria, specifications, and standard plans for SWZ technology. The focus is currently on projects with simple layouts to ensure constructability. FDOT plans a gradual rollout, allowing them to assess and refine SWZ technology based on real-world performance. The ultimate goal is to make SWZ technology commonplace for all construction projects linked to dynamic speed harmonization (see Figure 9).

The positive protection for workers in high-risk situations is important to FDOT. Positive protection refers to physical barriers that separate workers from traffic, like concrete barriers. FDOT's specifications outline when positive protection is mandatory in work zones. This includes situations like:

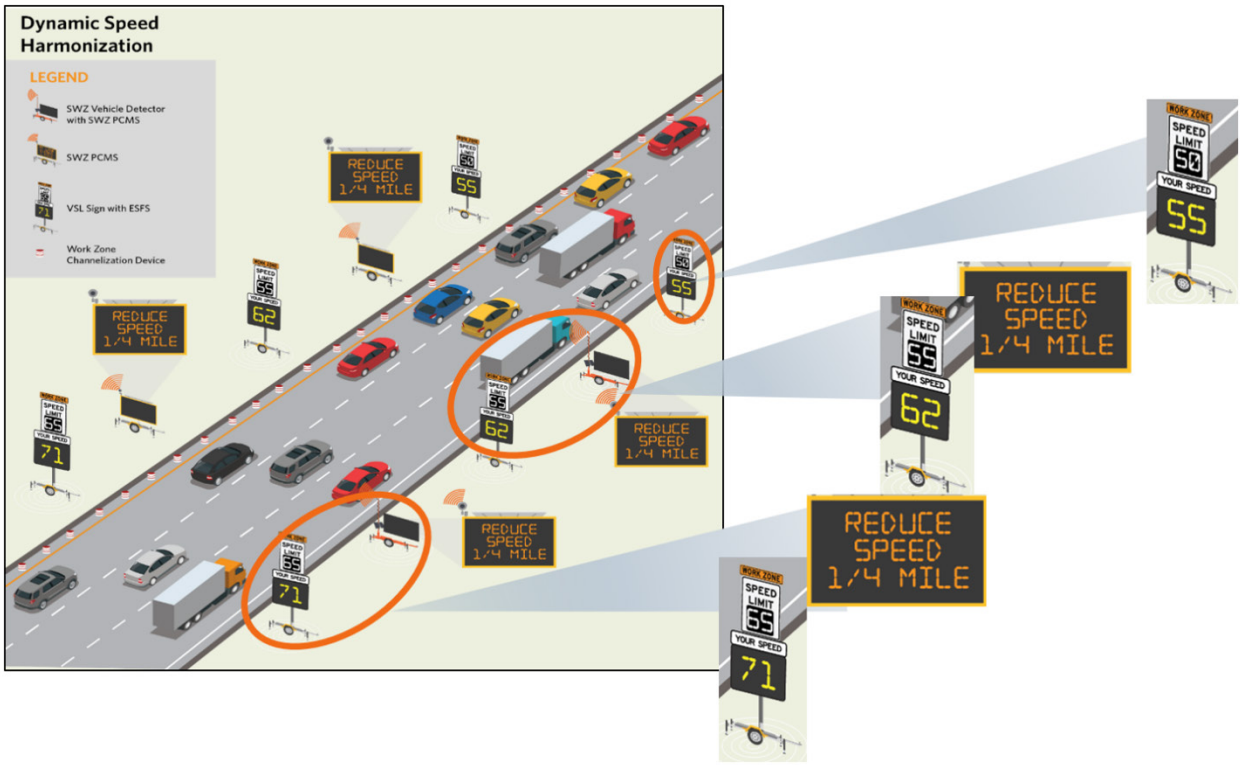
- Work on tunnels, bridges, or long-term work zones (over two weeks).
- Work zones with speeds exceeding 45 mph.
- Operations placing workers close to traffic lanes.

- Roadside hazards present overnight or longer.

…as well as requirements:

- These guidelines specify barrier types (concrete, steel, water-filled) and anchoring requirements (free-standing or anchored).
- The specifications also define minimum and preferred placement distances from traffic lanes.
- Procedures for repairing damaged concrete barriers are outlined, ensuring they maintain their protective qualities.

Speed enforcement and law enforcement officers are used to supplement positive protection in specific scenarios.



Source: Florida DOT

Figure 9: Smart Work Zone with Portable Changeable Message Signs with Electronic Speed Feedback Signs for Dynamic Speed Harmonization

Variable Speed Limits

One important tool Utah Department of Transportation (UDOT) uses to support traffic safety is variable speed limits (VSL). Chris Siavrakas, Utah DOT presented information on UDOT's VSL program and the specific example of I-80 east of Salt Lake City. UDOT has the authority to set speed limits based on traffic engineering and safety studies. These studies consider factors such as roadway design speed, typical vehicle speeds, and crash history as well as road and weather conditions.

While the 85th percentile speed is a starting point, UDOT recognizes the need to adjust speeds based on real-time conditions. Even so, there are challenges in speed setting. Under prima facie law drivers are expected to adjust their speed based on prevailing conditions, making perfect speed data

collection difficult. Short-term studies may not capture the full picture of traffic patterns due to the small sample size.

UDOT's VSL system covers a 13-mile stretch of I-80, a critical corridor that traverses Parley's Canyon. This system uses a network of technology to monitor conditions, including road weather information systems, VSL display signs, closed-circuit television, and traffic monitoring stations. UDOT uses VSL to adjust speeds in response to various situations, such as snowfall and rain. Crashes, animal crossings, and other incidents.

UDOT has recently upgraded its VSL system. This new system incorporates automated prompts for decision support that offers several advantages and a range of choices from the earlier version. Operators can now set speed limits for specific sections of Parley's Canyon, providing more options and granular control. The system can automatically adjust speeds based on pre-defined criteria, such as road grip, visibility, and snowfall rate. This reduces reliance on manual intervention and ensures a faster response to changing conditions.

Automated Speed Management / Speed Cameras

The Maryland SafeZones program is a multi-agency initiative aimed at reducing speeding and improving safety in work zones. Sung Yoon Park of the Maryland State Highway Administration shared the program's goals, operations, and future plans. The program is a partnership of MDHSA, the Maryland Transportation Authority (toll road operator), and state police agencies. The programs goals are to:

- Reduce speeding in work zones through a three-pronged approach: Engineering, Education, and Enforcement (3-E).
- Raise awareness of the dangers of speeding in work zones.
- Protect workers and motorists by encouraging slower, safer speeds in work zones.

Since the program's initiation in 2010, the number of enforcement vehicles has expanded from 7 to 10. Enforcement is conducted on weekdays in two shifts, daytime (6:00 a.m. to 3:00 p.m.) and nighttime (7:00 p.m. to 4:00 a.m.). Enforcement vehicles (Figure 10) can be deployed any day of the week, even when workers are not present. Deployment locations are rotated based on work zone activity. Enforcement uses LIDAR technology for accurate speed measurement. The percentage of vehicles exceeding the speed limit has dropped significantly, from 7% in 2010 to less than 1% on average in 2023.

Enforcement locations are chosen based on legislative requirements and the level of worker and motorist exposure and risk within a work zone. Factors like lane closures, lane width reductions, and rough pavement are considered. Close coordination occurs between design engineers, construction contractors, and the ASE contractor to ensure proper signage, vehicle placement, and communication.

To create a SafeZone location two sets of warning signs are required by law to be placed before the enforcement zone and a speed display trailer shows drivers their speed. Enforcement is currently limited to expressways and controlled access highways with posted speed limits of 45 mph or higher. The speed threshold for a citation is for the vehicle to exceed the posted speed limit by 12 mph or more. An operator must be present to monitor the system although workers do not need to be present for enforcement to occur.

The citations are considered civil penalties and do not carry points. A warning period ran until 2023. Current fines are: First offense: $40; Second offense: $40; Third and subsequent offenses: $40. Effective June 1, 2024, the fine will increase on fine to $80 and to $250 January 1, 2025. Citations follow a uniform format and are mailed within 14 days for in-state addresses and 30 days for out-of-state addresses. Payment is due within 90 days of the mailing date. Delinquent payments are referred to a state collection agency after 90 days.

Source: Maryland State Highway Administration

Figure 10: Maryland Automated Speed Enforcement Vehicle in Work Zone

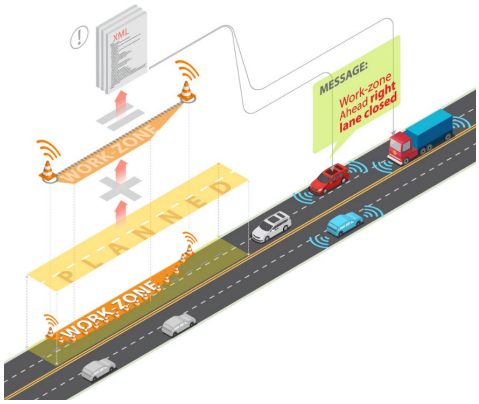
The program is exploring expansion to shorter-duration projects with "Flexible Deployments." This includes daily lane closures and variable speed limits based on worker presence. In addition, the agency is examining Point-to-point speed enforcement (aka "average speed zones") using travel time over a distance is being investigated. The agency collaborating with the Maryland Governor's legislative office has proposed legislation for 2024 to address issues such as, revenue sharing for work zone safety initiatives, removing limitations on highway types for enforcement, allowing staffed or unstaffed enforcement systems, and increased fines for repeat offenders.

EXPLORING DATA UTILIZATION AND PERFORMANCE MEASUREMENT: CASE STUDIES-PART II

Summary

Data Integration and Connectivity for Work Zone Management

Skylar Knickerbocker (InTrans at Iowa State University) explored how data integration and connected devices can revolutionize work zone safety and efficiency. Self-driving cars rely on accurate, real-time information to navigate the road. Unfortunately, most state and local agencies lack a central database detailing current construction zones. This leaves self-driving cars (and human drivers for that matter) challenged and potentially at risk. Looking forward, a solution is connected temporary traffic control devices (cTTCD), i.e., traffic cones, arrow boards, and barricades that automatically report their location and status. These devices offer several benefits by providing automatic reporting, real-time data, improved accuracy, and streamlined operations: though automated tasks and improved data management.



Source: InTrans at Iowa State University

Figure 11: WZDx and Smart Arrow Boards

Iowa DOT's Smart Arrow Board program demonstrates the potential of cTTCD. Arrow boards communicate with the Advanced Traffic Management System (ATMS) using a standardized protocol, providing real-time data on location of the work zone and arrow board pattern (e.g., flashing left turn). While cTTCD is a promising technology, there are challenges to overcome:

- Standardization: The industry is moving toward a single, universal communication protocol. Iowa has legacy systems development before the WZDx

standard. This can create technology transition and compatibility issues between devices and systems.

• Data Integration: Integrating cTTCD data with existing traffic management systems requires careful planning and effort.

• Local Agency Resources: Smaller agencies may lack the resources to fully integrate cTTCD with their systems.

• Duplicate Data: Multiple sources reporting on the same work zone can lead to confusion and inaccurate information.

Despite the challenges, cTTCDs can provide real-time information on work zone activity. By collaborating on standards, developing data integration solutions, and promoting resource-sharing, transportation agencies can create safer work zones.

PEER TO PEER DISCUSSION ON SPECIFIC ISSUES AND STRATEGIES

Summary

To close the peer exchange, NOCoE staff facilitated a discussion prompted by questions about various topics of interest in work zone management (see Appendix A) that were noted in advance conversation with speakers but not otherwise on the peer exchange agenda. A summary of key points follows:

Construction vs. Maintenance Work Zones:

This conversation centered around challenges in planning and implementing work zones, particularly regarding:

• **Standardization between Permit Holders:** Utility companies and maintenance crews often bypass permit procedures, creating safety hazards.

• **Differing Expectations for Construction vs. Maintenance:** Construction projects have stricter planning requirements due to liability concerns, while maintenance activities are more flexible but resource-intensive to manage properly.

• **Short-Term Work Zone Needs:** The MUTCD does not adequately address signage requirements for very brief work zones, leading to inefficiencies.

Overall, the discussion highlighted the need for:

• Clearer permit procedures and enforcement for all work zone activities.

• Standardized guidelines for short-term work zones to balance safety with efficiency.

• Continuously improving data-driven tools for work zone planning and scheduling.

• Exploring innovative solutions like dynamic lane management to optimize traffic flow during work zones.

Minimizing Time of Day Traffic Disruption:

Traffic disruption is a significant effect of work zones that can be mitigated by:

- **Data-Driven Planning:** Using traffic sensor data and planning tools helps assess traffic volume and potential congestion caused by lane closures.
- **Time-Based Planning:** Scheduling work during off-peak hours (nights or weekends) can minimize disruption to commuters. However, night work introduces constructability challenges and safety concerns for workers.
- **Seasonal Considerations:** Traffic patterns and weather conditions can influence work zone planning. For example, some states restrict daytime work during peak tourist or harvest seasons.
- **Dynamic Lane Management:** Utilizing dynamic zipper merge (aka late merge) has the potential to extend work hours on high-traffic roads by minimizing traffic queues.

Work zone planning should prioritize minimizing disruption for all residents. Planning flexibility and considering seasonal fluctuations in traffic patterns are crucial for successful work zone execution.

Alternate Routing / Equity:

This discussion focused on ensuring fair access to and mitigating impact of alternate routes during work zones, particularly for residents of economically diverse communities, where there are challenges of:

- **Limited Route Options:** Restrictions on using residential streets often force traffic onto main roads, creating congestion and bypassing shortcuts used by local residents, especially in low-income areas.
- **Communication Barriers:** Disseminating information about work zones and detours can be difficult for residents without internet access or limited English proficiency.

Some strategies to potentially address these issues may include:

- **Open Communication:** Maintaining open communication with all communities about planned work zones and alternative routes is crucial. This might involve multilingual flyers, public meetings, and utilizing trusted community leaders to spread the word. Effective communication and collaboration with diverse communities are central to achieving equitable outcomes during work zones.
- **Data-Driven Planning:** Considering traffic data and historical patterns can help identify alternate routes suitable for all types of vehicles, including those used by residents in lower-income communities.
- **Flexibility:** Whenever possible, work zone plans should be flexible enough to avoid major disruptions during special events or peak travel seasons.

Impact of Special Events:

Special events can complicate work zones; however, can be managed through:

- **Seasonal Considerations:** Some special events occur within the date window of various tourist

seasons and holidays can minimize disruptions for both residents and visitors.

- **Contractual Agreements:** Including clauses in construction contracts that restrict work during special events or require early completion before major holidays helps ensure smooth traffic flow. The same can apply to maintenance or utility work except in strictly defined cases for emergency work.

- **Event-Specific Planning:** For large events like concerts or sporting events, coordinating with organizers to avoid work zones in critical areas and creating plans for post-event traffic management is essential.

Accommodating Vulnerable Road Users in Work Zones:

This discussion centered on improving work zone safety for pedestrians and cyclists (vulnerable road users) in line with the MUTCD, 11th Edition and the Public Rights-of-Way Access Guidelines (PROWAG). This includes challenges currently facing the transportation profession as supporting documents for these to publications are developed:

- **Outdated Guidance:** Existing guidance documents on accommodating vulnerable road users in work zones need revision to reflect the latest MUTCD and PROWAG standards.

- **Confusion over PROWAG Requirements:** Agencies are unsure about the exact requirements of PROWAG, leading to potential non-compliance and accessibility issues under the Americans with Disabilities Act (ADA).

- **Balancing Safety with Temporary Needs:** Balancing the temporary nature of work zones with the need to maintain accessibility for pedestrians and cyclists can be difficult. Striking a balance between cost-effectiveness and safety is crucial.

- **Equity Considerations:** Work zone planning needs to consider the needs of residents who rely on alternative transportation like bicycles and public buses. Maintaining access during construction is crucial for diverse communities.

Some consideration for best practices:

- **Clear and Realistic Guidelines:** FHWA and the US Access Board need to provide clear, practical guidance on PROWAG implementation, with examples of best practices for temporary work zones.

- **Temporary Accessibility Standards:** Establishing realistic accessibility standards specifically for temporary work zones can help achieve better compliance and address cost concerns.

- **Communication and Public Outreach:** Engaging with the public, particularly during the project scoping phase, is essential to understand pedestrian and cyclist needs and develop solutions that address equity concerns.

- **Prioritizing Bike Lanes:** Agencies should consider the growing number of cyclists and explore options for maintaining bike lane access during construction, even if it means sacrificing some vehicle traffic lanes.

Another element to be considered is the application of data-driven decision making with utilization traffic simulation tools can help assess the impact of different alternate routing plans on traffic flow

and inform work zone design. In addition, developing best practices for short-term work zones can help minimize disruptions for pedestrians and cyclists while ensuring safety.

Overall, the discussion highlighted the need for collaboration between transportation agencies, advocates for vulnerable road users, and the federal government to develop clear and practical guidelines that prioritize safety and accessibility in work zones for all.

Next Steps

Gaps and Future Actions

This peer exchange focused on work zone management and operations technology, with participation from various agencies across the country. NOCoE will meet the AASHTO, ITE, ITS America, and FHWA representatives to review the Work Zone Management and TSMO peer exchange findings and work on next steps as well as potential products. Based on participants' feedback, it is anticipated that the following priority topics and questions need to be further explored:

• **Standardization:** A lack of standardized communication protocols between connected work zone devices and traffic management systems was a major concern. This can lead to compatibility issues and hinder data exchange, especially in the context of transitioning from legacy devices and systems. This makes it difficult for devices from different vendors to talk to each other and share data effectively.

• **Data Integration:** Integrating data from connected work zone devices with existing traffic management systems requires careful planning and effort. Many agencies struggle with this aspect.

• **Resource Limitations:** Smaller agencies may not have the resources to fully integrate connected work zone devices with their systems or develop necessary IT infrastructure.

• **Cybersecurity:** Cybersecurity threats to connected work zone devices and data exchange were raised as a growing concern.

• **Data Quality:** Ensuring the accuracy and timeliness of data reported by connected work zone devices is crucial. However, there are concerns about the quality of the data being collected.

• **Best Practices Sharing:** Participants highlighted a perceived lack of a central repository where agencies can share best practices, standard operating procedures, and lessons learned related to connected work zone technologies (although the Work Zone Information Clearinghouse was cited, the expressed desire was for something different). This makes it difficult for agencies to learn from each other's experiences.

• **Vulnerable Road Users:** Accommodating pedestrians, cyclists, and other vulnerable road users in work zones needs more consideration, especially when implementing new technologies.

• **Construction vs. Maintenance Work Zones:** There is a need for clearer guidelines and best practices for managing data and information flow that is distinct between construction and maintenance work zones.

• **Special Events:** The impact of special events on work zones and traffic management needs to be addressed, considering factors like alternate routes, equity, and vulnerable road user safety.

The next steps following the peer exchange on Work Zone Management and TSMO involve addressing the key gaps and needs identified during the discussions. Some of these items can be addressed by improving awareness of existing resources as well as structuring new products from NOCoE, its partners, and sponsor to directly address the identified gaps. Other concepts that may be supportive could include one hour “drop-in” peer-to-peer conversations for interested professionals and/or an on-going webinar series to share current experiences, reports, guidelines, and recent implementation’s design, data, study results, and outcomes.

Overall, the peer exchange highlighted the potential of work zone technologies to improve safety and efficiency. However, addressing the identified gaps and needs through collaboration, standardization, and resource sharing is crucial for future successful implementation.

Resources

US DOT / FHWA / ITS-JPO

FHWA Work Zone Management Program https://ops.fhwa.dot.gov/wz/index.asp
National Work Zone Safety Information Clearinghouse https://workzonesafety.org/
National Highway Institute (NHI) https://www.nhi.fhwa.dot.gov/
National Work Zone Awareness Week https://www.nwzaw.org/
Work Zone Data Exchange (WZDx)
ITS in Work Zones Case Studies and Assessments
Automated Work Zone Information Systems
Traffic Management Systems

- Dynamic Lane Merge Systems
- Speed Management Systems

Portable Changeable Message Signs (PCMS)
Work Zone ITS Deployment Examples
Additional Work Zone ITS Resources

- Smarter Work Zones
- Traffic Management Resources and Examples
- Transportation Management Plans
- Specific Strategies
  - Coordinating Road Projects
  - Incident Management
  - Lane Closure Policies
  - Traffic Control
  - Use of Intelligent Transportation Systems (ITS)

Work Zone Speed Management

AASHTO and Specific State Agencies (alphabetical by state)

AASHTO Transportation Operations Manual, 1st Edition
Florida Department of Transportation Work Zone Safety
Florida Department of Transportation Smart Work Zone Initiative
Illinois Department of Transportation Automated Enforcement
Iowa Department of Transportation Work Zone Reference Library
Kentucky Office of Highway Safety
Maryland State Highway Administration SafeZones Program
Michigan Department of Transportation Work Zone Safety
Michigan Department of Transportation Work Zone Mobility
Minnesota Department of Transportation Work Zones - Temporary Traffic Control
Virginia Department of Transportation Work Zone Safety and Operations

Transportation Research Board

NCHRP Report 1055: Addressing Encroachment-Related Safety Issues in Work Zones: A Guide
NCHRP Web-Only Document 361: Determination of Work Zone Encroachments
NCHRP Synthesis: 587 Use of Smart Work Zone Technologies for Improving Work Zone Safety
NCHRP Report 1051: Preparing Transportation Agencies for Connected and Automated Vehicles in Work Zones
NCHRP Report 1003: Guide to Alternative Technologies for Preventing and Mitigating Vehicle Intrusions into Highway Work Zones
NCHRP Report 1037: Reducing Risks to Worker Safety in Work Zones Due to Distracted Drivers
NCHRP Synthesis 574: Temporary Pavement Markings Placement and Removal Practices in Work Zones
NCHRP Report 945: Strategies for Work Zone Transportation Management Plans
NCHRP Web-Only Document 276: Evaluating Strategies for Work Zone Transportation Management Plans
NCHRP Report 581: Design of Construction Work Zones on High-Speed Highways
NCHRP Synthesis 533: Very Short Duration Work Zone Safety for Maintenance and Other Activities
NCHRP Project 17-107 Guide for Work Zone Intrusion Prediction and Prevention
Pending consultant selection
NCHRP Project 17-128: Reducing Adverse Driving Behaviors in Work Zones: Strategies and Guidelines
Pending consultant selection

Other Information of Interest

Connected Work Zone Implementation Guidance Standardization
NOCoE Work Zone Case Studies:
My35 Waco Construction
I-26 Integrated Corridor Management for Construction
Uses of Smart Work Zone Devices for Work Zone Data Feeds: Five Case Studies (MnDOT, RTCSNV, KYTC, Iowa DOT, MassDOT)
InTrans at Iowa State University Research
Evaluation of Messaging Techniques to Increase Vehicle Spacing at Work Zones
Developing a Research-Grade Iowa Work Zone Database
Iowa Work Zone Data Hub

Appendix A: Breakout Group Interactive Discussion Questions

Segment 3 – Group Discussion on the 11th Edition of the MUTCD

Breakout Group Interactive Questions:

1. Although the 11th Edition MUTCD has only recently been released, share your experience or approach to implementing the new Signs and Markings guidelines within work zones. What specific challenges or successes have you encountered so far or expect to face in the future?

2. In the context of work zones, how can Temporary Traffic Control strategies be optimized to minimize disruptions and enhance safety for both workers and motorists? Does the new MUTCD help or hinder this?

3. Discuss effective ways to communicate Temporary Traffic Control plans within work zones to ensure public awareness and compliance. What communication strategies have proven successful in your experience?

4. How can the General and CAV guidelines be adapted to address the unique challenges presented by work zones, especially in areas with high construction or maintenance activities?

Segment 6 – Peer to Peer Discussion on Specific Issues and Strategies

Breakout Group Interactive Questions:

<u>Construction vs. Maintenance Work Zones:</u>

• In your experience, what key differences and challenges do you observe between managing construction work zones and maintenance work zones?

• How can the MUTCD guidelines be tailored to address the specific needs and safety considerations of each type of work zone? Is there a distinction in your agency

• How do you coordinate standards in traffic control device applications, processes/procedures, and technology between construction and maintenance functions in your departments?

<u>Minimizing Time of Day Traffic Disruption:</u>

• How does time of day / day of week change your planning and implementation of work zones and the associated safety and operational impacts? Share insights on traffic and safety patterns based on INRIX data or other relevant sources.

• What strategies can be employed to minimize disruptions during high-traffic hours while still meeting project timelines?

Alternate Routing / Equity:

- Discuss strategies for providing equitable access to alternate routing options during work zones, particularly in economically diverse communities.
- How can transportation authorities ensure that alternate routes are accessible and fair for all members of the community, regardless of socioeconomic factors?

Impact of Special Events:

- How do special events, such as concerts or sporting events, influence the planning and execution of work zones? Share experiences and best practices in coordinating these activities.
- What communication strategies can be employed to inform the public about potential disruptions due to work zones during special events?

Accommodating Vulnerable Road Users in Work Zones:

- How can work zones be better designed and managed to accommodate vulnerable road users, such as pedestrians and cyclists, ensuring their safety during construction or maintenance activities?
- Share examples of successful initiatives or technologies that have effectively protected vulnerable road users in work zones.