



We listen. We solve.®

SMART WORK ZONE GUIDELINES FOR PROJECT IMPLEMENTATION

CDOT Region 1 in Collaboration with Ulteig

Roadway construction projects offer real-time challenges for commuters, commercial haulers and tourists driving in and around work areas. Construction projects frequently reduce lane widths and shoulders, creating slowdowns and crashes, and exposing highway workers to hazardous conditions working close to traffic lanes. Combined with construction vehicles entering and exiting work sites intermittently, these factors cause interruptions in traffic flow and, ultimately, slowdowns. While work zones are necessary for maintaining and upgrading highway systems, Smart Work Zone (SWZ) strategies are needed to reduce work zone crashes and increase worker safety.

Since its inception in 2015, 27 states have utilized the Federal Highway Administration's Smart Work Zone (SWZ) strategies to limit roadway congestion, reduce crashes during peak traffic flow and increase critical incident response times. As pressure mounts to comply with the rules for federal highway funding, acceptance by more state and local governments is inevitable.

According to FHWA's Work Zone Management Program web-based compendium of resources, Variable

Speed Limits (VSL) or advisories have been used on at least 30 interstate corridors in 14 states. States such as Minnesota, Oregon, Washington and Wyoming use VSL on certain corridors continuously as a standard practice, increasing the exposure of the motoring public to this concept. In addition, at least 10 states, including Michigan, Minnesota, Oregon and Washington, have mature queue management systems that generate accurate and dependable results.

The SWZ initiative includes both project coordination and technology applications. While project coordination is more commonly used to reduce the number of times traffic is impacted by eliminating multiple separate projects in the same corridor or location, technology applications have not garnered the same implementation, due in part to reluctant "buy-in" by upper management, a fiscally constrained funding environment and confusion about the burgeoning technology.

Implementing the proper Intelligent Transportation Systems (ITS) technology through Smart Work Zones can make them safer for highway workers and motorists.

The question is, what are the strategies and guidelines for optimizing these technologies?

In collaboration with Ulteig, Region 1 Traffic is developing a CDOT SWZ guideline document with a toolbox for executing the appropriate SWZ systems to control existing traffic concerns and to mitigate anticipated problems on upcoming projects. SWZ technologies have been piloted on a small scale in several construction projects in 2017 under a State Transportation Innovation Council (STIC) Grant, and are now being utilized in two major construction projects — I-25 South Gap and C-470 Express Lanes — to provide feedback (in the form of performance metrics) that will be used to guide and refine strategies with the ultimate goal of improving traffic operations and reducing incidents and accidents in highway construction work zones throughout Region 1.

The overall success of these projects will encourage the future use of this technology throughout the state to improve work zone safety and mobility.

SWZ TECHNOLOGY

In its basic form, smart work zone systems utilize ITS technology (computer software, communication links, and sensor components) to monitor and manage motorized vehicles in construction work zones. Automated with mobile components that obtain and analyze traffic flow data in real time, these tools provide frequently updated information to motorists to keep them better informed and less frustrated. These systems provide accurate and reliable information 24/7, helping emergency responders react to incidents more quickly, reduce congestion and reduce secondary accidents in traffic queues.

SWZ UTILIZATION IN COLORADO

The Smart Work Zone concept was first introduced in Colorado in July 2012 at the Western Association of State Highway and Transportation Officials (WASHTO) Annual Conference in Colorado Springs.

Although the technology was promising, deployment costs were extremely expensive and the benefits were not quantifiable, creating difficulty for upper management to justify the expense. For the vast majority of projects outside the metro area, traditional temporary traffic control measures were effective at addressing traffic mobility and safety through the active work zones.

With CDOT Traffic Programs staffed differently in each Region, project level staffing and the development of subject matter experts (SME) becomes a significant, ongoing challenge. For these reasons, statewide rollout was simply not practicable or necessary.

Today, costs to install smart work zone systems have decreased thanks to ever-evolving technology and greater availability of portable “off-the-shelf” systems.

Since construction traffic conditions are unique for each region, SWZ strategies should be selected and implemented on a “per region” basis rather than taking a state-wide approach. CDOT Headquarters/ Staff Branches supporting the project development process can establish standards and statewide consistency by identifying and sharing “best practices” among Regions in the form of project specific details and specifications.

Smart Work Zone systems provide:

- **Real-time Traveler Information** – Drivers receive information about current travel conditions, encouraging diversion to another route if necessary.
- **Queue Warnings** – Signs provide warnings to drivers about stopped or slow traffic ahead to reduce rear end crashes.
- **Dynamic Lane Merges (early merge, late merge)** – Signs encourage drivers to merge at a specified point based on current conditions, keeping traffic flowing smoothly.
- **Incident Management** – Data enables faster detection of incidents for quicker response and clearance time.
- **Variable Speed Limits (VSL)** – Provides early notice for slow or stopped traffic ahead to help avoid rear end collisions.
- **Speed Monitoring** – Work zone speed limit signs with current speed.
- **Entering/Exiting Vehicle Notifications** – Signs warn drivers of a slow-moving construction or emergency vehicle entering or existing the roadway.
- **Performance Measurement** – Monitor and archive traffic conditions data to support real-time traveler information, modify operations, and support evaluation.





REGION 1 TRAFFIC — SWZ PROJECTS

As previously mentioned, SWZs are deployed as a method to inform drivers dynamically about traffic conditions within individual work zones. Using sensors to detect traffic flow, the information can be used to alert drivers of congestion or speed differentials in advance of the work zone to improve overall operations as well as driver and worker safety. Region 1 Traffic is deploying these SWZ strategies in three current roadway construction projects to gather data for CDOT SWZ Guidelines to help promote future utilization of ITS technology throughout Colorado.

2017 SWZ Pilot Project – funded by STIC Grant

This pilot project included short-term deployment of both iCone and Speed-Mac portable sensor systems on a number of construction projects around the Denver metro area in the winter/spring of 2017. A longer-term iCone deployment at the I-76/US-85 major construction project was initiated in June 2017 with the queue warning system engaged and speed data being amalgamated for local law enforcement. This same site may be used for comparative longer-term evaluation of other queue warning systems, notably Speed-Mac portable sensors and in combination with RoadQuake portable rumble strips.

Under the 2017 SWZ Pilot Project, CDOT Region 1 evaluated the flexibility, durability, output and defined safety benefits (relative to cost) for deployment of iCones (and similar portable sensor systems) for the following applications:

- Advanced warning for queued traffic
- Localized enforcement area identification
- Remote incident detection and warning

I-25 South Gap Project, Monument – Castle Rock

This project encompasses an 18-mile stretch of Interstate 25 from south of Castle Rock to Monument, called “The Gap.” It is the only four-lane section of I-25 connecting Colorado’s two largest cities, Denver and Colorado Springs. In addition to building one Express Lane in each direction, the project will deliver wider inside and outside shoulders, wildlife crossings, improved infrastructure and pavement, but existing traffic volumes make work zone safety and mobility an everyday challenge. As an integral part of this project, Smart Work Zone technology was incorporated with a project specific traffic control room to manage/monitor traffic.

SWZ systems include:

- Advanced warning for queued traffic
- Variable speed limits
- Construction vehicle ingress/egress notification
- Portable cameras for incident response

C-470 Express Lanes

The C-470 Express Lanes Project is located along 12.5 miles of C-470 between I-25 and Wadsworth Boulevard. Over 100,000 motorists currently use this segment of C-470 each day with volumes projected to increase 40 percent by 2035. Express Lanes increase road capacity and help manage congestion on the highways, eliminating the need to continue to build more lanes. With high peak-hour traffic volumes daily, SWZ strategies were identified to help address secondary accidents during construction traffic congestion and improve traffic mobility around merging construction traffic.

SWZ systems include:

- Advanced warning for queued traffic
- Construction vehicle ingress/egress notification

Once these and other SWZ strategies are formalized and compiled into a Smart Work Zone guideline document for Region 1, it will allow other CDOT Regions to establish their own approach to how and when these systems are to be deployed on projects. Most states with an established SWZ guidance document are avoiding a formal statewide policy by moving forward with SWZ deployment on a project by project basis.



CONCLUSION

Developing a systematic methodology for SWZ implementation — CDOT Region 1 SWZ Guidelines — is the first step in expanding work zone ITS utilization throughout Colorado. As SWZ strategies become more widely used in projects, the information gained can be used to develop benefit-to-cost (B/C) ratios for a variety of construction traffic management alternatives unique to Regions and their projects.

As work zone ITS technology options expand and costs to deploy mobile “off-the-shelf” SWZ systems drop, the time to incorporate these strategies into current and future highway construction projects is NOW.



Clark Roberts, Senior Engineer

clark.roberts@ulteig.com | 720.873.5860
www.ulteig.com

Contact us today to talk to about ITS technology and how to incorporate SWZ strategies into your next highway construction project.

SOURCES

1 <https://www.fhwa.dot.gov/innovation/everydaycounts/edc-3/swz.cfm>

