ACTIVE TRANSPORTATION AND DEMAND MANAGEMENT

ATDM PROGRAM BRIEF: ATDM AND WORK ZONES

U.S. Department of Transportation
Federal Highway Administration

WHAT IS THE CONNECTION BETWEEN ATDM AND WORK ZONE MANAGEMENT?

This brief is intended to discuss the connection between ATDM and work zone mobility and safety including strategies and tactics for successful implementations and associated benefits and lessons learned. Many strategies that agencies commonly deploy during construction activities could be enhanced by embracing ATDM concepts to become more dynamic and actively managed to further improve work zone mobility and safety. The information presented in this brief focuses on ATDM with respect to work zone management, supporting transportation agencies in the beginning phases of developing a Transportation Management Plan (TMP) that includes a temporary traffic control plan, traffic operations component, and public information and outreach component, all relevant to ATDM.

MITIGATING WORK ZONE IMPACTS THROUGH ATDM

Aging roadway infrastructure and increasing highway congestion means more road work by States, localities, and utilities resulting in greater work zone impacts. As the number of work zones increase so do mobility and safety issues. In fact, 131 work zone-related injuries are noted to occur every day while one work zone-related fatality occurs every 15 hours.[1] It is estimated that work zone related travel delay accounts for up to 24 percent of all non-recurring delay.[1] In response to these concerns, agencies are beginning to shift from the notion that congestion is an "inevitable consequence" of work zones to more proactive management approaches of implementing ATDM strategies to improve mobility and safety in and around work zones.

Agencies can consider ATDM strategies during the planning and operational phases of a work zone to influence travel demand:

- Planning for Construction. Agencies may take an active work zone management approach in their TMP – including targets, and performance metrics in line with regional objectives and the Work Zone Safety and Mobility Rule (23 CFR 630 Subpart J)[2], which requires use of work zone safety and operational data to improve projects. ATDM technologies enable agencies to generate and use data to satisfy the Rule.
- Managing Demand during Construction. Agencies utilize active demand management strategies to encourage reduced travel along a work zone route in a number of ways, including: incentivizing travelers to use different routes, encouraging alternate modes, and adding capacity to public transit.
- Using Active Traffic Management for Work Zone Operations. Many permanent and temporary Intelligent Transportation Systems (ITS) can mitigate potential mobility and safety impacts caused by work zones.

What is Active Transportation and Demand Management (ATDM)?

ATDM is the dynamic management, control, and influence of travel demand, traffic demand, and traffic flow of transportation facilities. Through the use of available tools and assets, traffic flow is managed and traveler behavior is influenced in real-time to achieve operational objectives, such as preventing or delaying breakdown conditions, improving safety, promoting sustainable travel modes, reducing emissions, or maximizing system efficiency. Under an ATDM approach the transportation system is continuously monitored. Using archived data and or/predictive methods, actions are performed in real-time to achieve or maintain system performance.

[1] FHWA Work Zone Management Facts & Statistics: http://www.ops.fhwa.dot.gov/wz/resources/facts_stats.htm
[2] FHWA Work Zone Safety and Mobility Rule: http://www.ops.fhwa.dot.gov/wz/resources/final_rule.htm

IMPLEMENTING ATDM STRATEGIES IN WORK ZONES

A variety of ATDM approaches have been and are currently being used to mitigate work zone impacts across the country. While numerous strategies are available, the examples below describe successful deployments of ATDM strategies that enhanced mobility and safety in and around work zones:

Portable queue detection and warning system upstream of a work zone in Texas.

Queue Warning Systems. Static signing is placed in advance of a work zone to alert drivers of changing conditions, and may include a word message to watch for slow or stopped traffic ahead. However, agencies may opt for a more dynamic approach by deploying a queue warning system. These systems generally use sensors to detect slow traffic in advance of a work zone and post a message to a portable changeable message signs (PCMS) to increase the awareness of approaching drivers, thereby improving safety. As an example, the Texas DOT uses sensors on I-35 to detect the formation of queues upstream of work zones, and warn drivers downstream of slowed or stopped traffic using PCMS. Some systems may display a simple "slow traffic ahead" message based on real-time conditions, while others provide a more specific message to indicate the distance to the queue or the real-time, slower vehicle speeds occurring ahead through the work zone. Benefits of a queue warning system in Illinois included significantly reduced speed variance, reduced vehicle conflicts, and 14 percent reduction of queuing crashes, despite increases in both lane closures and vehicle exposure.

Dynamic Lane Merge Systems. Early and late dynamic lane merge strategies are sometimes deployed prior to a work zone involving a lane reduction. Static signing may encourage drivers to either merge "early" in advance of the lane closure to potentially reduce forced merges, rear-end crashes, or work zone encroachment, or "late" closer to the closure to increase capacity during congested conditions. Both of these approaches can improve safety, however the late merge is less appropriate during periods of low congestion. However, a dynamic system with a series of PCMS and sensors can be activated to provide different messages to drivers depending on the real-time congestion conditions to improve capacity and traffic throughput, as well as safety as they advise drivers of the appropriate location to merge prior to the work zone. Dynamic lane merge systems in Michigan reduced forced and dangerous merges by factors of seven and three, respectively, and increased average travel speeds from 40 mph to 46 mph, improving both safety and mobility. Dynamic lane merge systems have also been used in Maryland, Minnesota, and Florida to enhance work zone safety and operations.

Dynamic Late Merge system in a Minnesota work zone.

Comparative travel time displays in a Michigan work zone.

Real-Time Traveler Information. Agencies can leverage a variety of technologies to disseminate real-time traveler information in various ways. Permanent or temporary sensors or detectors, private sector probe data, and Bluetooth data are used by agencies to determine real-time travel conditions through work zones. Information can be posted in real-time on PCMS to alert drivers enroute about work zone conditions. Many agencies also disseminate information via mobile applications, and some have partnered with private sector providers to reach more drivers and exchange information about real-time conditions. Agencies may post delay information so that drivers approaching the work zone can choose to divert to an alternate route. As an agency progresses toward more active management capabilities, PCMS may be used to recommend specific

alternate routes during congested periods, or provide a travel time comparison between the route under construction and an alternate route to reduce delays, traffic, emissions, and the number and severity of incidents. The Michigan DOT monitored and posted the travel times for I-75 and I-96 on static signage with dynamic elements during a major construction project, as shown here. Real-time traveler information improved mobility in Utah by routinely diverting 20 percent of vehicles from a route under construction, with diversion rates of up to 50 percent at times. Pre-trip real-time traveler information via websites or social media can also encourage travelers to change mode, route, or trip time.

Example of a portable regulatory variable speed limit sign used in a Utah work zone.

Variable Speed Limit (VSL) Systems. Some agencies lower the posted speed limit when a work zone is in place based on whether or not workers are present. Agencies can more actively manage work zones by adding sensors and signs through the work zone to have a more dynamic VSL system based on real-time conditions. Advisory or enforceable variable speeds can help traffic flow through a work zone at more uniform speeds reflecting current conditions. A truly dynamic system can result in less stop-and-go traffic, reduce the potential for incidents, improve safety, and increase throughput. The Utah DOT uses portable trailers with mounted VSL signs, shown here, that are easily set up in work zones for both single-day maintenance projects and longer-duration work zones, and have resulted in greater speed compliance compared with static signing, reduced average speed, and reduced speed variation. VSL systems have also been used in Michigan, Virginia, and Washington State to improve work zone mobility.

USING PERMANENT ATDM INFRASTRUCTURE TO SUPPORT MAJOR WORK ZONES

Aside from temporary ATDM strategies that remain in use only until the work zone ends, permanent ATDM infrastructure may also be leveraged for work zones. For instance, major work zone activities in Washington State were an impetus for deploying lane control signing with VSLs; lane control signs were deployed on northbound I-5 as a construction mitigation strategy for the Alaska Way Viaduct tunnel replacement project. These signs provide traveler information and VSLs for congestion and incident conditions, as well as work zone activities. The Nevada DOT is taking a similar approach, deploying permanent lane control signing upstream of a major work zone on I-15 in Las Vegas to display regulatory VSLs, which will remain in use following construction. Installing ATDM devices in the field at the same time as other construction activities on the corridor will minimize disruption to traffic and reduces the cost of the deployment, which could expedite installation.

Lane control signs with variable speed limits were deployed near Seattle as a construction mitigation strategy.

BENEFITS OF ATDM IN WORK ZONES

Safety. ATDM can help minimize work zone impacts on both traveler and worker safety. Credible warnings of the presence of unexpected queues, notification of travel times to reduce driver stress, credible warnings of construction vehicle access and egress, automatic adjustment of the posted work zone speed limit to current conditions, automated enforcement of traffic laws, and quicker identification of incidents within work zones are examples of how ATDM in work zones can improve safety. An incident management system for a New Mexico work zone more quickly identified incidents for quicker response, reducing average incident clearance time by 20 minutes and reducing the frequency of secondary crashes. Automated speed enforcement in Maryland work zones resulted in a 54 percent reduction of vehicles exceeding the posted speed limit by 10 mph or more, as well as reduced speed disparity and more uniform flow.

Mobility. Reduced travel time delay is a primary benefit of many work zone ATDM applications. Travelers making adjustments to their route, departure time, or mode choices based on provided information, or the use of alternate traffic management practices (e.g., dynamic lane merging, VSL systems) can reduce delay. These adjustments benefit not only those travelers who made changes to their trips, but others who continued to travel through the work zone. Mobility benefits will be especially high on facilities that serve a large amount of commercial vehicle traffic, as the value of commercial vehicle travel time is very high. During the Woodrow Wilson Bridge project in Virginia, Washington D.C. and Maryland, incentives made 20 percent of commuters more likely to use alternatives, according to a follow-up survey, which improved work zone mobility with fewer vehicles. Additionally, encouraging mode shift with increased transit services can result in fewer vehicles traveling through the work zone, and improve mobility.

Additional Benefits. Include the promotion of sustainable travel modes, reduced emissions, maximization of system efficiency, improved customer satisfaction, and improved work zone productivity that results in a shorter project duration. Benefits of specific strategies are further detailed in FHWA's Work Zone ITS Implementation Guide [3] and various case studies [4].

WORK ZONE CONSIDERATIONS

Whether or not ATDM strategies are deployed in a work zone depends on a variety of factors. Primarily, the impact and duration of a work zone will determine whether the cost for an ATDM deployment outweighs the potential benefits, particularly for a shorter duration project. For instance, the costs for mobilizing and validating a large-scale temporary system will be relatively high for a shorter-duration project. However, a limited installation of additional sensors in the field or purchasing private-sector third-party data can augment and leverage existing permanent ITS infrastructure, personnel, or TMC resources, and may result in more viable option for deploying ATDM in a work zone. In addition, costs could be lower if an agency decides to purchase a system for repeated use in other work zone applications, or implements ATDM on a permanent basis for general incident and congestion management purposes. Traditional and social media can be leveraged to encourage people to cancel or modify their trips by making travelers aware of road work impacts.

HOW CAN I FIND OUT MORE?

The ATDM Program is intended to support agencies and regions considering moving towards an active management approach. Through workshops, tools, guidance documents, resources, and peer exchanges, the program can assist with the technical support needed to implement ATDM. Importantly, ATDM is not an exclusive program restricted to specific agencies. Every agency that is considering moving towards active and dynamic capabilities can benefit from the ATDM program's efforts.

ATDM Informational Briefs

This informational brief is one in a suite of outreach materials. Other available briefs include:

- ATDM Program Overview
- ATDM Program Brief: ATM
- ATDM Program Brief: ADM
- ATDM Program Brief: APM
- ATDM Program Brief: Data Needs for ATDM
- International Influence on ATDM in the US

The FHWA's ATDM Website has additional information on ATDM concepts and tactics, current research, future events, and available resources, including resources to help agencies prioritize potential ATDM deployments: *http://ops.fhwa.dot.gov/atdm/about/program.htm.* For information on innovative work zone strategies and technologies visit FHWA's Smarter Work Zones website: *https://www.workzonesafety.org/swz/*.

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[3] FHWA's *Work Zone ITS Implementation Guide*: http://www.ops.fhwa.dot.gov/publications/fhwahop14008/
[4] FHWA Work Zone Management Program, ITS & Technology: http://www.ops.fhwa.dot.gov/wz/its/

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