NOCoE

Arizona DOT Dust Detection and Warning System

By Arizona Department of Transportation

Benefits Statement

Arizona, while known for beautiful weather, has a unique section of I-10 where fields of loose dirt and high winds can create massive walls of dust. These conditions dramatically reduce visibility for motorists in a matter of minutes, which has caused 83 dust-related crashes in a five-year period with three of those crashes involving fatalities. With an overall goal is to enhance awareness, mitigate traffic delays and reduce crashes due to low visibility dust events, ADOT deployed an early warning dust detection warning system along a 10-mile segment of I-10 near Eloy that uses remote sensing equipment to automatically control speed limits during periods of low visibility.

In this case study you will learn:

1. How ADOT deployed an early warning dust detection warning system along a 10-mile segment of I-10 that uses remote sensing equipment to automatically control speed limits during periods of low visibility.
2. How ADOT brought together a team of equipment suppliers, engineers, software programmers, IT staff, and system operators to meet the challenge of integrating sensors, software, and motorist information outputs into one seamless automated system.
3. About how data and a dashboard are being generated that will provide useful information for future applications.

NOCoE Case Study

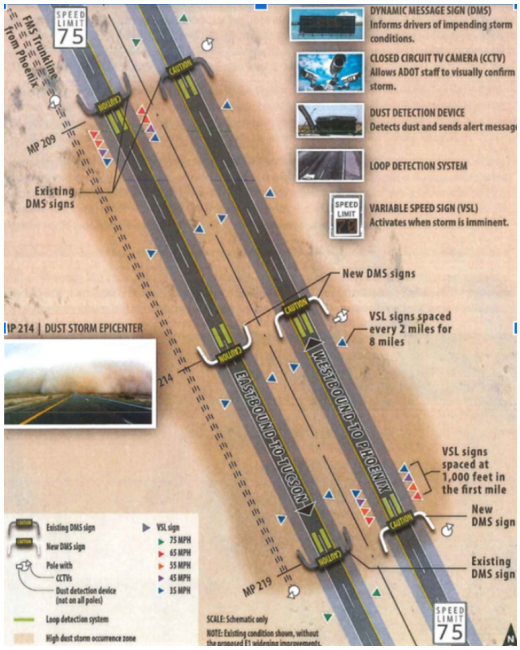
BEST TSMO PROJECT

BACKGROUND

Despite Arizona's reputation for great weather and sunny conditions most of the year, weather conditions can be a serious threat to the safety of motorists along one stretch of the heavily traveled I-10 freeway between Phoenix and Tucson near Picacho Peak. This unique section of I-10 is surrounded by barren fields and abandoned farmland that is no longer cultivated. As seasonal thunderstorms develop nearby, a dangerous combination of fields of loose dirt and high winds can create massive walls of dust. These conditions dramatically reduce visibility for motorists in a matter of minutes. This stretch of I-10 has recorded 83 dust-related crashes in a five-year period between 2010 and 2015, Three of those crashes involved fatalities.

TSMO PLANNING, STRATEGIES AND DEPLOYMENT

The Arizona Department of Transportation applied for a Fostering Advancements in Shipping and Transportation for the Long-term Achievement of National Efficiencies (FAST-LANE) grant and received federal funding for multiple projects addressing transportation issues on I-10 between Phoenix and Tucson. This grant allowed ADOT to implement vital Intelligent Transportation Systems enhancements along with the reconstruction of the SR 87 interchange.



ADOT deployed an early warning dust detection warning system along a 10-mile segment of I-10 near Eloy that uses remote sensing equipment to automatically control speed limits during periods of low visibility. The system includes an X-Band radar, 13 visibility sensors, 32 variable speed limit signs, five closed-circuit television cameras, six dynamic message signs, six traffic detection systems, and two speed feedback signs within the corridor. The National Weather Service has partnered with ADOT and monitors weather conditions using the installed X-Band radar equipment and distributes weather data to the dust detection system in real time. Meanwhile visibility sensors in the corridor detect dust particles in the air, while additional sensors measure rainfall and wind speed to continuously feed the fully automated system with accurate real-time data. All

<1800’ = lower speed limit to 65
<1500’ = lower speed limit to 55
<1200’ = lower speed limit to 45
<900’ = lower speed limit to 35

the while, traffic detectors measure the speed of motorists and CCTVs help ADOT staff monitor and verify conditions remotely.

When the radar and sensors detect low visibility conditions, VSL signs automatically reduce the posted speed limit. The speed limit progressively decreases from 75 miles per hour, in 10 mph increments, to a minimum speed of 35 mph until the conditions improve. Meanwhile, DMS signs installed in the median or shoulder warn drivers all along the I-10 corridor from Phoenix to Tucson of impending storm conditions and provide supplemental direction for motorists to slow down.

COMMUNICATIONS PLANNING AND EXECUTION

Communication with the public has been a huge success. ADOT has used social media, blog posts, videos and traditional news releases to reach an audience that includes the media, local government officials, residents and other stakeholders. The effort to inform drivers about the project started early when design work had just begun. ADOT continued to keep its audience informed throughout the project’s development. When work on the system was complete, a news release and several social media posts were published, along with a video showing the installation that has been viewed more than 10,000 times. The communications were focused on informing the public about the new system, but also reminded the audience about safe-driving decisions and resources. Recently, an article on the dust system and its capabilities was published in the autumn issue of Public Roads magazine. Public engagement and involvement with the media have been overall successful in pushing out the recognition and awareness of dust storms and the system’s capabilities.

OUTCOME, LEARNINGS AND PUBLIC BENEFIT

As field construction was completed, ADOT brought together a team of equipment suppliers, engineers, software programmers, IT staff, and system operators to meet the challenge of integrating sensors, software, and motorist information outputs into one seamless automated system. The transition from concept, through construction, to full operation, required vision and perseverance to meet success. This project generated many challenges including procurement challenges, delivery delays, data reporting, and communications. The system is now fully operational and is responding to low visibility events. New data and a dashboard are being generated that will provide useful information for future applications. Exploring the challenges and how they were resolved offers valuable lessons learned that can be carried on to future technology projects. The overall goal is to enhance

awareness using strategies and technologies, mitigate traffic delays and reduce crashes due to low visibility dust events.

The Dust Warning System is still operationally new, and the monsoon season following its debut produced fewer than average events, making initial evaluation of its functionality difficult to determine. Even so, the system has garnered attention and accolades, including a nomination for an American Association of State Highway and Transportation Officials Operational Excellence award. In addition, the National Weather Service has named ADOT a 2020 Weather Ready Nation Ambassador of Excellence for the agency's work on this project and others. Initial data from the dust detection and warning system has shown promising results:

- In fiscal year 2020, we saw the system activate 11 different times. The longest event was 21 minutes. During this fiscal year, we saw visibility drop below the 900-foot threshold, thus lowering speeds to 35 mph.
- In fiscal year 2021, we saw the system activate 18 different times. The longest event was 15 minutes.
- In each instance listed above, the system's activation was fully automated. An activation is defined as a sensor visibility threshold of below 1,800 feet and an event lasting longer than two minutes.