



Case Study: Pennsylvania DOT Working Toward Virtual Smart Work Zone



Background

The Pennsylvania Department of Transportation (PennDOT) is responsible for nearly 40,000 miles of roadway and 25,000 bridges, which makes it one of the largest statewide road networks in the US.

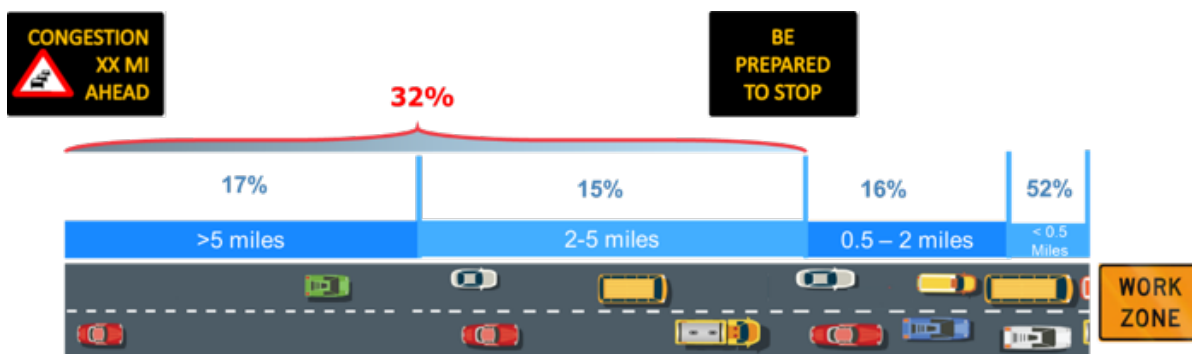
PennDOT began the 2020-21 construction season with INRIX Probe Data to explore new ways to make active work zones safer for both drivers and workers.

Challenge

Work zones are a safety problem. FHWA reports show agencies and organizations have made only slight improvements in truck and car highway crashes in the last three years.

Drivers react too slowly to speed changes, signage, lane closures, flaggers, and more in the work zone, which leads to crashes, more congestion, and secondary crashes.

PennDOT did their own study in 2019 and found 924 work zone congestion-related crashes with five fatalities and 657 injuries. 52 percent of those congestion-related crashes occurred within a half-mile of the work zone.



Outside of traditional work zone awareness tools like hardware and signs, what incremental improvements can be made to get drivers to pay attention in work zones?

The Approach

The traffic engineers took apart the work zone piece by piece to create the test case to develop congestion scans and identify speeds and queue length to pinpoint free-flow breakdown.

With this data, they could anticipate what would happen when the traffic control plan was in place—the tail of the queues and when drivers need to be alerted to reduce speed. They determined the safety breakdown speed was approximately 40 mph on interstates when brake lights come on.



They then identified a construction location to consider for a pilot, mapped it using INRIX segments and probe data, and built out a queue protection corridor within their ATMS. They tracked free flow norms and the congestion pattern to determine supporting message signs.



PennDOT Pilot Project

After the corridor was in place, they continued to track the real-time probe data speeds and simulated queue protection messaging to calibrate the changeable message signs upstream of queues with unique messages like “Congestion 2 Miles Ahead”, “Be Prepared to Stop”, or “Stopped Traffic Just Ahead”.

These are not generic messages. The distance ahead is dynamically changed based off probe speed data and automatically calculated and updated based on the message boards every minute when conditions warrant. This gives motorists warning messaging with a tangible distance to expect slowdowns or stopped traffic determined by the preset speed thresholds.

Operators do not have to type messages in at the beginning of the day. The corridor rules are embedded to associated signs, and when the speed drop hits that number, the message comes on.

Regardless of where a vehicle is on the work zone approach, whether it is a mile out, two miles out, or a half mile out, when speeds drop below 40 MPH, the DMS illuminate new messages.

The intent of these messages is to be specific and actionable. Therefore, drivers are more likely to follow the direction, reduce speed, and prevent crashes.



The Result

Currently, they are still running the pilot to determine if early queue warnings reduce work zone crashes, and it is too early to determine the outcome yet. Preliminary results are encouraging.

Will this work for every work zone?

No, not all, but many work zones that have identified queuing with supporting changeable signs can benefit. That is the conclusion from PennDOT's TSMO office. Traffic engineers should consider the solution to improve work zone safety during their traffic control planning. It may not be ideal if a project incorporates complex lane changes or has significant traffic control signage as a part of the core traffic plan overcomplicating motorist attention.

Conclusions

1. Using INRIX segments to map the corridor and identify speed and queue thresholds is a good idea for projects.
2. The virtual work zones are best for less high-profile work zones where there are fewer distractions.
3. Traffic control plan test case information can be shared with contractors to support their safety goals and be implemented as part of the safety plan.

Data and dynamic messages can also be wirelessly sent to portable message signs placed strategically in the work zone, something currently available in Arizona as well.

