Michigan Department of Transportation
RESEARCH Administration

RESEARCH SPOTLIGHT

Project Information

REPORT NAME: Optimizing Work Zone Conditions to Maximize Safety and Mobility

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Optimizing Work Zone Designs and Operations

While work zones are necessary for new road construction and maintenance of existing roads, optimizing their design and operations can improve worker safety and traffic mobility. To achieve this, it was critical to identify the key work zone characteristics and attributes that have the greatest impact on safety and mobility. As the Michigan Department of Transportation (MDOT) is committed to maintaining safe work zone operations, this research sought to develop tools and recommendations to reach these optimization goals.

PROBLEM



Implementing work zone best practices can help decrease crash injuries and fatalities while improving mobility.

Constructing new roads and maintaining existing infrastructure are critical to an effective transportation network. However, work zones designed to protect workers also create changes in traffic patterns and driver behavior that can increase crashes and related injuries or fatalities. From 2017 to 2022, Michigan experienced approximately 5,150 work zone-related crashes per year, including an average of 17 fatal and 65 serious injury crashes. In addition, about 10 percent of congestion nationwide is related to highway work zones.

To improve safety and mobility outcomes, MDOT evaluated the performance of numerous work zone characteristics and configurations to identify best practices for reducing crash frequency and severity while improving traffic flow. This project, which received a High Value Research award from the American Association of State Highway and Transportation Officials (AASHTO), provides guidance and best practices for designing work zones as well as a data-driven tool for evaluating options within specific work zone areas.

RESEARCH

A literature review helped identify current effective strategies for optimizing highway work zone safety and mobility. Next, investigators examined Michigan work zone crash data to quantify and compare state-

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"This research has provided a method for enhancing the accuracy of work zone crash analyses as well as a tool to assess the impact of different temporary traffic control configurations on work zone safety performance."

Dawn Miller
Traffic Incident Management Specialist

wide safety trends with national work zone crash data. Modeling for 25 recent freeway work zones across Michigan evaluated the safety and mobility impacts associated with temporary traffic controls used in long-term construction projects.

The selected work zone projects represented a range of common work zone types, temporary traffic control configurations, work activities, work area types, traffic volumes, work durations and project lengths. Using the Empirical Bayes method, researchers quantified the safety impacts associated with each of the work zone types, including estimated changes in crashes within the advance warning, transition and activity areas of the work zone.

RESULTS

Compared to national trends, Michigan experiences a larger proportion of rear-end work zone crashes and a smaller proportion of single-vehicle crashes. The research also revealed a greater rate of single-vehicle crashes during the winter season (December-February) than during the primary construction season (March-November), indicating that seasonal conditions should be considered when conducting work zone safety analyses.

Analysis also showed that existing freeway conditions before construction begins have a significant influence on how work zones affect safety and mobility. For example, freeways with recurring congestion tend to experience relatively smaller impacts from work zones, while freeways with little existing congestion experience larger impacts. As MDOT continues to evaluate work zone performance for safety and mobility, these seasonal and pre-construction factors should be considered in future analyses and planning efforts.

Based on these findings, investigators developed 17 data-driven recommendations for MDOT's consideration in its efforts to improve the safety and mobility of work zones across the state. The recommendations focused on potential revisions to the MDOT Work Zone Safety and Mobility Manual, including updates to the Safety and Mobility Decision Tree. Key recommendations include developing strategies to reduce rear-end crashes in work zones, reducing conflicts between work zone traffic regulators and drivers, improving pedestrian safety in arterial work zones and improving the consistency of crash report coding by responding officers to support more accurate work zone safety analyses. Recommendations also addressed fatal and serious injury crashes in nighttime work zones with and without lighting, as well as the need to better accommodate large trucks because of the overrepresentation of truck-involved crashes.

In addition, a spreadsheet-based tool was developed to estimate work zone safety impacts during the planning and design phase of a project while also supporting safety performance evaluations during or after road construction activities. Of particular value is the tool's ability to compare the relative safety impacts of multiple work zone designs being considered for individual projects.

IMPLEMENTATION

Project findings and recommendations provide guidance for improving work zone safety and mobility outcomes across Michigan. In addition to the recommendations, a new analytical tool allows MDOT to conduct consistent, data-driven safety performance analyses for highway work zones and optimize work zone designs for specific projects. Suggested revisions to the Safety and Mobility Decision Tree retain MDOT's current engineering approach while creating opportunities for future safety and mobility improvements.

Research Administration

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The final report is available online at MDOTjboss.state.mi.us/TSSD/tssdResearchAdminDetails.htm?keyword=SPR-1752.

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