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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION
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Research Results

Enhancing Work Zone Safety Through Work Zone Speed Limit Reduction (WZSLR)

Test and evaluation of the most effective Work Zone Speed Limit Reduction (WZSLR) Strategies

Traffic Operations

July 2026

Project Title: Work Zone Speed Limit Reduction (WZSLR) Research

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Task Manager:

Melissa Clark
Transportation Engineer (Electrical)
melissa.clark@dot.ca.gov

DRISI Division Chief:

Prakash Sah, PE
prakash.sah@dot.ca.gov

WHAT WAS THE NEED?

The work zone (WZ) is a complex driving environment for drivers due to elevated cognitive load, safety risk, and enforced speed management. Despite various efforts to improve worker and motorist safety in work zones, work zone-related fatal crashes have increased by 53% in California since 2010. Moreover, California also ranked in the top 10 states with the highest number of fatal work zone crashes and fatalities involving commercial motor vehicles from 2012 to 2017, imposing approximately $1.2 billion in societal costs.

In recent years, the California Department of Transportation (Caltrans) has marked safety as the primary goal in their 2020-2024 Strategic Plan and designed several educational programs, including (a) the California move-over law, (b) work zone alert, and (c) slow for the cone zone. Following the recommendations from the annual safety summit, Caltrans has spearheaded Work Zone Speed Limit Reduction (WZSLR) strategies and technologies in the field to improve safety. However, the effectiveness of these strategies in improving work zone safety has not been studied under variations of work zone type, traffic mix, traffic volume, time, and location of construction with extensive field data.

WHAT WAS OUR GOAL?

The project aimed to assess the effectiveness of WZSLR strategies across California based on work zone location and type, traffic volume, and classification. To achieve this, the project is divided into two phases with Phase 1 focusing on existing literature, data, and work zone safety practices in and outside of California. Phase 2 uses controlled experiments to dig deeper into the safety impact of selected WZSLR strategies through field studies in California.

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WHAT DID WE DO?

This study evaluated the impact of Dynamic Speed Feedback Signs (DSFS) on vehicle speed behavior in work zones using multiple datasets collected from different locations in California. Speed was identified as a major contributing factor to injury severity in work zone crashes. The analysis in this study focused on three key aspects: mean speed reduction, speed variability, and high-speed vehicle violations, with separate evaluations for cars and heavy vehicles. The researchers obtained datasets from the California Department of Transportation (Caltrans) and the Highway Safety Information System (HSIS), matching them with California work zone crash records from 2018 to 2021. This enabled the creation of a comprehensive dataset with over 30 relevant variables, including work zone characteristics, roadway attributes, environmental conditions, and crash specifics.

Recognizing that speeding significantly contributes to crash occurrence and severity in work zones, the researchers assessed the effectiveness of Dynamic Speed Feedback Signs (DSFS) in reducing vehicle speeds. Although initial datasets provided by Caltrans lacked essential details on work zone configurations and speed management practices, we supplemented our study by collecting high-resolution vehicle speed data using drones at selected work zones. The analysis considered mean speed reduction, speed variance, and compliance with speed limits separately for cars and heavy vehicles. The results indicated that DSFS moderately reduced mean speeds and decreased speed limit violations among cars, but had limited effectiveness on heavy vehicles, with many vehicles still exceeding posted limits. These findings highlight the limitations of DSFS as a standalone measure and underscore the necessity of additional enforcement, supplementary speed management strategies, and targeted measures for heavy vehicles.

WHAT WAS THE OUTCOME?

The research evaluated how well speed reduction measures performed across multiple sites and identified the need for additional datasets. The researchers used speed feedback signs as well as data collection efforts by gathering drone footage from several selected work zones. After analyzing the available datasets, the researchers observed that speeding and high-speed variance remain significant concerns across nearly all work zones examined. In evaluating the effectiveness of Dynamic Speed Feedback Signs (DSFS), the researchers found that while DSFS had a modest impact in reducing mean speeds and lowering the proportion of vehicles traveling at high speeds. This effect was not sufficient to achieve full compliance with posted speed limits.

Based on these findings, it is recommended that Caltrans establish requirements for contractors to systematically store and share DSFS speed data. In addition, implementing a structured, statewide approach for collecting detailed information, such as specific work zone layouts, traffic control measures, and accurate speed records, would enable more thorough evaluations and better-informed policy decisions.

WHAT IS THE BENEFIT?

By collecting, storing, and sharing detailed speed and work zone data, Caltrans can strengthen traditional safety evaluations and enhance the AI technologies currently in pilot phase. Work zone research assesses traffic control, safety gear, and smart technologies to protect workers and the traveling public. These efforts can aid in reducing crashes, easing congestion, and lowering project costs through data driven insights.

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IMAGES

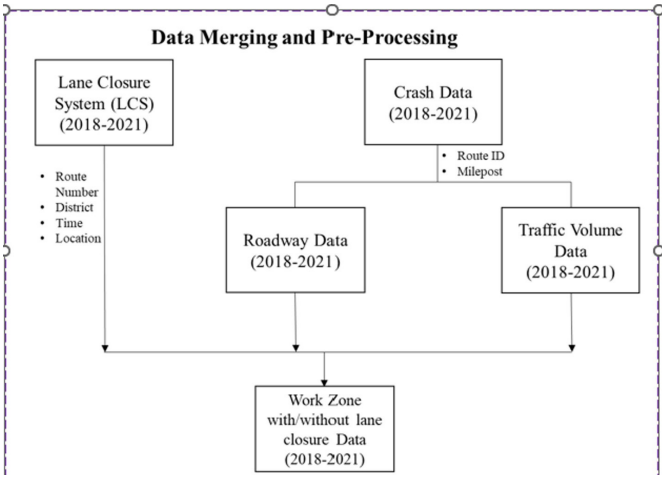


Image 1: Data Merging and Pre-processing

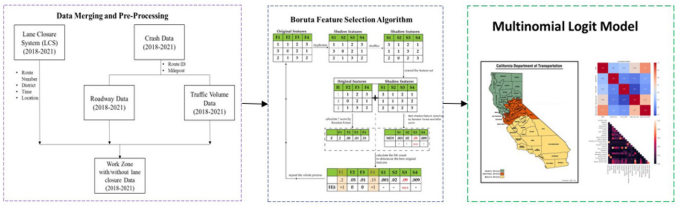


Image 2: Research Framework



Image 3: Sample video using YOLOv8 Detection and Tracking



Image 4: Raw video from drones



Image 5: Processed video including Type, Position, Speed, and Lane number

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