



Research Summary

Work Zone Alert Systems



WHAT WAS THE RESEARCH NEED?

Across the US, the deterioration of pavement due to the increase in vehicle miles traveled and a rise in adverse weather conditions, work zones have become more prevalent to complete pavement repairs and rehabilitate the transportation network, creating safety concerns for both the traveling public and highway workers. To increase the safety of drivers and work zone personnel, TDOT

wanted to explore Work Zone Intrusion Alert (WZIA) technologies. WZIA technologies are a set of emerging technologies meant to give highway workers advanced warning when an unauthorized vehicle has entered the work zone. Due to the technology still evolving, there is no existing set of best practices for DOTs to allow them to implement WZIA technologies to mitigate work zone intrusions. TDOT sought recommendations for WZIA implementation and practices by identifying and testing the most promising WZIA products.

WHAT WERE THE RESEARCH OBJECTIVES?

The objectives of the research were:

- provide a comprehensive review of previous studies and best practices on WZIA technologies,
- identify the characteristics of work zone crashes by work zone typologies,
- identify technologies for evaluation, and
- develop guidelines for implementing the identified WZIA technologies.

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WHAT WAS THE RESEARCH APPROACH?

First, a literature review was done to identify the potential technologies to be evaluated. Through the literature review, three technologies were identified: Intellicone, Advanced Warning And Risk Evasion (AWARE) Sentry system for flagging, and Worker Alert System (WAS). The identified technologies were then tested in a control environment to assess their performance, and, based on the controlled testing, the three technologies were then tested on live work zones to gauge workers' attitude towards them. After the live testing, surveys were administered to the highway workers to rate the technologies based on the following criteria: user friendliness, noticeability of alarms, low rate of false alerts, cost, and the ability to live-track work zone intrusions. Lastly, final recommendations were developed on appropriate selection of technologies based on work zone typology to aid decision making for potential implementation across Tennessee.

WHAT WERE THE FINDINGS?

The research team found all three systems had benefits and drawbacks. Intellicone benefits include good work zone coverage due to its unlimited transmission range, distinct and loud alerts, live tracking feature, and low life cycle costs, while the system drawbacks are time-consuming setup and take down and frequent false positive and false negative alarms (which may be due to unreliable network connectivity in the US). AWARE Sentry benefits include good work zone coverage (a range of approximately 400 feet), distinct and loud alerts, accurate detection of intrusions, and easy deployment, while the system drawbacks include it primarily being designed for flaggers, alerts when vehicles drive too close to the work zone at higher speeds which may be a safety issue, requires a smartphone application to configure system settings, and high life cycle costs. Lastly, WAS benefits include low life cycle costs, alerts are produced from multiple sources, and the system is portable and quickly setup, while drawbacks are the limited transmission range, a delay in the signal transmission could render it useless for highway workers, and it does not support live tracking of devices.

IMPLEMENTATION AT TDOT

For TDOT, Intellicone is recommended for use in long-term stationary work zones, AWARE Sentry for use in flagging operations, and WAS for use in short-term and mobile work zones without lane encroachment. Based on the characteristics of crashes on different work zone typologies, Intellicone may be the most beneficial due to its low life cycle cost and scope of where it can be implemented (construction work zones on major highways). AWARE Sentry, although costly, demonstrated high accuracy in detecting intrusions; AWARE is also developing a lane intrusion detection system that can be mounted on moving equipment and might be considered for testing after it is ready. As neither Intellicone nor AWARE Sentry are commercially available in the US as of April 2021, implementation of these two technologies is severely hindered.

MORE INFORMATION

Find the final report here: https://www.tn.gov/content/dam/tn/tdot/long-range-planning/research/final-reports/res2019-final-reports/RES2019-01_Final_Report_Approved.pdf.