



Improving Work Zone Safety Using Traffic Management and Enforcement Tools

TTI researchers have examined the applicability and effectiveness of three tools that offer the potential to improve motorist and worker safety at work zones on high-speed, high-volume roadways in Texas.

- The *CB radio traffic alert system* allows advisory traffic information to be disseminated directly to truck operators over citizen band (CB) radio channels. This system is similar to a highway advisory radio system for traditional motorist information dissemination.
- The *late merge lane closure strategy* directs motorists approaching a work zone lane closure to utilize all lanes approaching the closure and then alternate turns entering the work zone at the lane closure merge point.
- *Enforcement pullout areas in work zones* provide enforcement personnel with refuge space from which to monitor traffic and to safely issue citations for traffic violations occurring in the work zone.

These tools each address a different type of problem that is

common to work zones on high-speed, high-volume roadways.

What We Did...

For this project, the researchers reviewed past work zone safety literature, surveyed law enforcement personnel across the country, and conducted observational studies at work zones on high-volume, high-speed roadways to identify and categorize the various safety problems that commonly occur. Researchers then identified potential technologies and strategies for addressing the common problems. Finally,

researchers conducted laboratory studies, traffic simulation experiments, and field evaluations to assess the applicability of these technologies and strategies to Texas and to develop implementation criteria for their use.

What We Found ...

CB Radio Traffic Alert System

Researchers found that the CB radio alert system was able to affect both truck speeds and lane choices upstream and through various types of work zones. As [Figure 1](#) illustrates, a CB radio

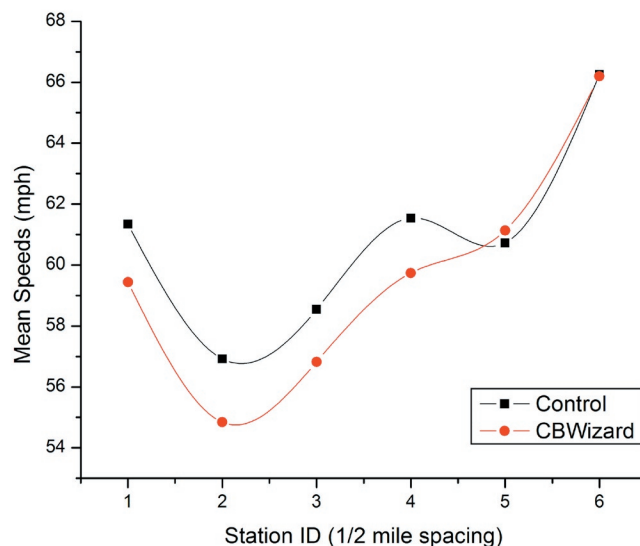


Figure 1. Effect of the CB Radio Alert on Truck Speeds



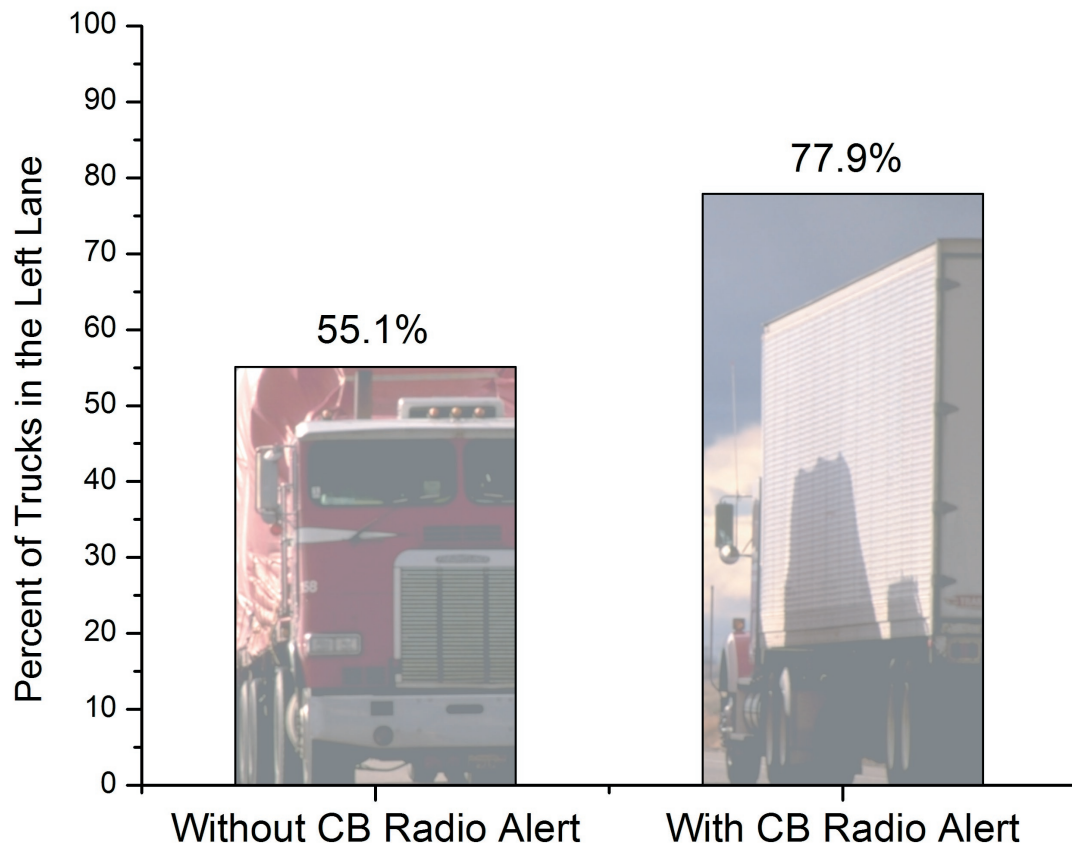


Figure 2. Effect of the CB Radio Alert on Truck Operator Lane Choice

alert notifying truck operators about the presence of a downstream work zone and a reduced advisory speed limit at this particular test location reduced mean truck speeds by about 2 mph. In [Figure 2](#), an alert message encouraging truck operators to use the left lane through another work zone (due to potential soil stability problems under the right lane) yielded significant increases in the percentage of trucks using the left lane.

Late Merge Strategy

Researchers analyzed the late merge lane closure strategy and determined that it has the potential to reduce delays and queues at temporary lane closures. Researchers also determined that the strategy could

be useful in some cases to balance traffic queues at congested freeway-to-freeway merges upstream or within work zones. However, researchers note that the strategy does not provide any benefits when traffic conditions upstream of the lane closure or merge point are not congested. Therefore, use of the strategy should be limited to short-term lane closures when congestion will be present the entire duration of work activity.

An alternative implementation approach of this strategy is in a traffic-responsive manner through the use of portable intelligent transportation system (ITS) technologies. These technologies would be used to detect when congestion is present at the lane

closure bottleneck and automatically activate portable changeable message signs that direct motorists to use all approach lanes and to take turns at the merge point.

Enforcement Pullout Areas

Researchers determined that pullout areas in work zones should be spaced approximately every three miles, based on input received from expert panels of law enforcement and highway contractor personnel convened for this research project. Pullout areas spaced closer than three miles will significantly disrupt the construction process, whereas pullout areas spaced any farther apart will negate their effectiveness from a law enforcement perspective.



Using a variety of other sources, researchers then developed a set of implementation guidelines regarding pullout area length, width, and placement. Figure 3 illustrates a typical layout of an enforcement pullout area. Researchers also identified several key factors to consider prior to making a decision to include pullout areas in a particular project.

The Researchers Recommend...

Based on the results of the project, researchers recommend the following:

- The Texas Department of Transportation (TxDOT) should consider implementing the late merge strategy at temporary lane closures where traffic demands are expected to exceed the work

zone capacity over the duration of work activity. For long-term lane closures where traffic queuing will occur during peak periods only, TxDOT should use portable ITS technologies to implement the late merge strategy in a traffic-responsive mode.

- TxDOT should consider implementing the CB radio traffic alert system at work zones on rural highways where significant commercial truck traffic will be present and where advance information about the work zone would benefit truck operators (i.e., to warn of reduced design speed features, presence of traffic queuing, etc.).

TxDOT should incorporate enforcement pullout areas into work zones where emergency shoulders will be eliminated for more than

three continuous miles of roadway and where other conditions outlined in Research Report 2137-3 are met. Consensus should be reached with law enforcement personnel regarding the need for pullout areas within the project and a willingness to use the pullout areas by enforcement personnel prior to their inclusion in the construction plans.

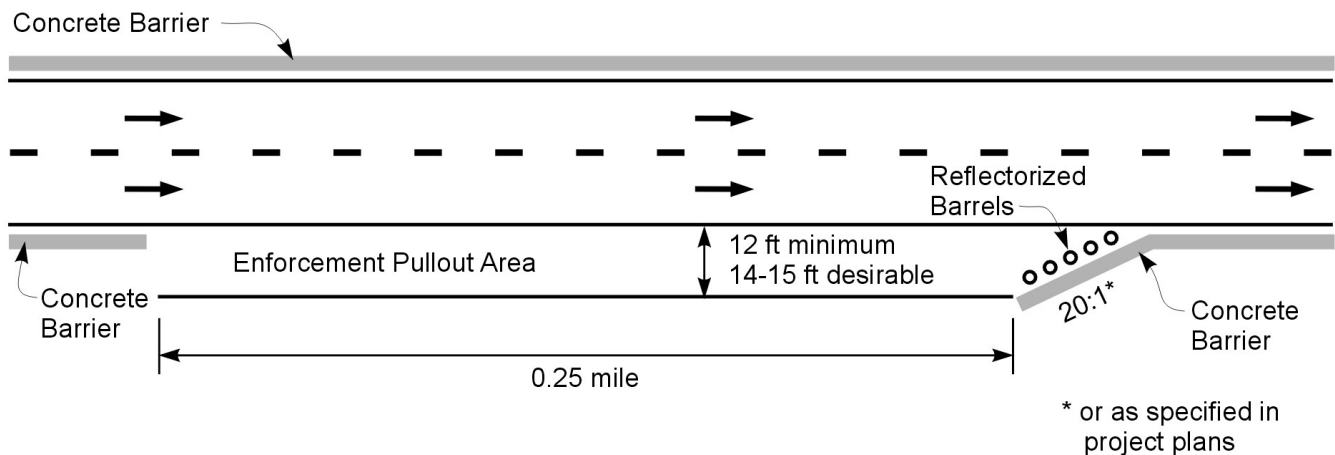


Figure 3. Typical Enforcement Pullout Area Design



For More Details . . .

The research results, recommendations, and operating guidelines are documented in the following reports: 2137-1, *A Review of Traffic Management and Enforcement Problems and Improvement Options at High-Volume, High-Speed Work Zones in Texas*; 2137-2, *Feasibility and Design of Enforcement Pullout Areas for Work Zones*; and 2137-3, *Traffic Management and Enforcement Tools to Improve Work Zone Safety*.

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TxDOT Implementation Status

July 2003

This research project involved investigation of the feasibility and effectiveness of CB Wizard technology, late-merge lane closure strategy, and implementation of guidelines for incorporating enforcement pullout areas into long work zones without shoulders. Two products were required for this project:

- 1) detailed guidelines for implementing project results, and
- 2) traffic control standard sheets, specifications, special provisions, and/or general notes, and recommended manual revisions.

The products have been incorporated into Research Reports 2137-1, 2137-2, and 2137-3. The products that were developed in this research project can be implemented for use in construction work zones where conditions are warranted.

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YOUR INVOLVEMENT IS WELCOME!

Disclaimer

This research was sponsored by the Texas Department of Transportation in cooperation with the Federal Highway Administration. The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Texas Department of Transportation (TxDOT) or the Federal Highway Administration. This report is not intended to constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes.