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**RESEARCH PROJECT TITLE**

Improving the Effectiveness of Speed Feedback Trailers in Freeway Work Zones

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Smart Work Zone Deployment Initiative  
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The Smart Work Zone Deployment Initiative (SWZDI) is a transportation pooled fund that supports research investigations into better ways to improve the safety and efficiency of traffic operations and highway work in work zones. The primary objective is to promote and support research and outreach activities that focus on innovative policies, processes, tools, and products that enhance the implementation, safety, and mobility impacts of work zones. The fund is administered by Iowa State University's Institute for Transportation, and the lead agency is the Iowa Department of Transportation.

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# Improving the Effectiveness of Speed Feedback Trailers in Freeway Work Zones

tech transfer summary

Through the use of appropriate deployment methods, speed feedback trailers have the potential to be an effective speed management strategy in freeway work zones.

## Objectives

This project assessed the effectiveness of various deployment strategies for speed feedback trailers (SFTs) in freeway work zones to inform guidelines and practices for SFT implementation. Specific objectives were as follows:

- Synthesize best practices in the use of SFTs as a work zone speed management treatment through an extensive literature review and nationwide survey of state agencies.
- Perform field studies of freeway work zones to evaluate the effectiveness of various SFT deployment strategies in reducing work zone speeds and improving compliance.
- Provide guidance and recommendations on the use of SFTs in freeway work zones.

## Background and Problem Statement

A promising strategy for enhancing work zone speed limit compliance involves the deployment of SFTs. An SFT consists of a trailer-mounted dynamic speed feedback sign that utilizes speed data from an integrated radar to display real-time speed-related messages—such as the speed of the approaching vehicle or a speed warning message—to drivers on a digital display panel.

When SFTs are deployed in work zones, their primary purpose is to alert motorists of the need for compliance with the work zone speed limit, particularly near potential conflict points such as a merging taper, work area, or lane shift.

Previous studies have evaluated the effectiveness of SFT deployments in various work zone contexts, including a 2022 Smart Work Zone Deployment Initiative (SWZDI) study conducted by members of this research team. That study investigated work zone speed limit policies and practices along with methods for improving compliance, including the use of SFTs.

However, further research was needed to determine methods for optimizing the effectiveness of SFTs as a speed management strategy in work zones.



*Speed feedback trailer in a freeway work zone lane closure in Michigan*

## Project Description and Methodology

Best practices on the use of SFTs as a work zone speed management treatment were synthesized through an extensive review of research publications and state department of transportation (DOT) policies, guidelines, and practices. State agencies nationwide were also surveyed on their use of work zone SFTs, which yielded responses from 40 DOTs.

A series of field studies was then conducted over multiple phases within five freeway work zone locations in Michigan and Missouri to evaluate the effectiveness of various SFT deployment strategies in reducing work zone speeds and improving speed compliance.

The field studies specifically assessed the impact of strategically placing SFTs at various locations within the work zones, including near the start of a lane closure, approaching a work area, approaching a lane shift, and within a freeway crossover. The effectiveness of SFTs was also assessed in combination with other strategies, such as digital speed limit (DSL) signs and police vehicle presence within the work zone.

The findings were synthesized to provide guidance and recommendations on the use of SFTs in freeway work zones.



*SFT + DSL assembly deployed in a freeway lane closure in Michigan*

## Key Findings

- The survey of state DOTs revealed that SFTs are widely implemented in work zones across the United States, most commonly for lane closures and traffic shifts. Requirements on the use of SFTs vary across states, ranging from optional to mandatory under specific conditions.
- SFTs are most commonly positioned near the work area or in advance of the lane closure taper and are often relocated as the work progresses.
- The field studies showed that SFTs were generally effective at reducing work zone speeds regardless of the deployment characteristics but tended to be more effective when positioned closer to the work area, including at ingress/egress locations. Speeds were up to 3.6 mph lower when an SFT was present and active at these locations.
- SFTs were also effective at lowering work zone speeds when positioned within 1,000 ft beyond the end of the lane closure taper, within 1,000 ft in advance of the start of the taper, and within freeway crossovers. The speed reduction effects were generally sustained for at least one-half of a mile beyond the SFT.
- When an SFT was located near a police vehicle positioned within the lane closure, speeds were reduced by an additional 1.4 mph. Additionally, when paired with DSL signs on the same trailer assembly, SFTs reduced speeds near the work area by an additional 1.8 mph.

## Conclusions and Recommendations

- If only a single SFT is used, which is common for shorter work zones, it should be positioned approximately 200 ft upstream of the start of the active work. This positioning helps ensure that motorists receive the speed feedback message in a timely manner within sight of the work area but also with adequate time to comfortably decelerate.
- Placing a single SFT at too great a distance upstream of the work area is discouraged because drivers may disregard such an early warning message.
- For work zones with multiple active work areas, an SFT should be deployed in advance of each area while workers are present.
- The use of additional SFTs at other locations within the work zone is encouraged, particularly for work zones that cover a substantial distance. If additional SFTs are available, it is recommended that one be positioned within 1,000 ft upstream of the lane closure, lane shift, or median crossover.
- Additionally, an SFT should be placed shortly beyond the end (e.g., within 1,000 ft) of any lane closure taper, preferably adjacent to the initial speed limit sign in order to draw drivers' attention to the work zone speed limit upon entering the lane closure.
- Deployment of an SFT within a median crossover is also encouraged, although this is less critical if a barrier separates opposing traffic flows.
- The spacing of successive SFTs within a lane closure should be based on the distance that the speed reduction effects are sustained beyond the SFT, which was generally found to be at least one-half of a mile beyond the SFT. However, half-mile spacing is likely impractical for most lengthy work zones, and greater spacings (e.g., two miles) are generally acceptable.

- SFTs are also encouraged for use in combination with work zone police enforcement vehicles, regardless of whether any active enforcement is being performed. While a police vehicle positioned near the end of the taper will, by itself, reduce speeds by approximately 4 mph, adding a nearby SFT provides an additional speed reduction effect.
- The combined use of an SFT and a DSL sign is also encouraged, especially near work areas, due to the incremental speed reductions provided by the SFT along with the simplicity of switching between speed limits. This combination reduces ambiguity for motorists as to which speed limit is in effect at any given time and location within the work zone.

## Implementation Readiness and Benefits

The results from this research provide insight into the optimal deployment of SFTs in freeway work zones. The recommendations may be directly utilized by state DOTs in the development or revision of guidelines, policies, standards, and practices for the implementation of SFTs within in freeway work zones.

The resulting speed reductions associated with SFTs ultimately have the potential to improve the safety of workers and motorists in work zones.