



0-6993: Work Zone Materials for Temporary Signs in High Wind Areas

Background

One of the most common problems in work zone traffic control devices is temporary signs being knocked down because of wind. Due to ineffective ballast materials and techniques, temporary signs may easily be knocked down and become invisible to the traveling public, increasing the risk of tort liability. Texas has an abundance of windy plains and coastline. In fact, wind is such a presence in Texas that the state already has more than 2,000 turbines harvesting wind for power. Thus, ensuring that temporary traffic control signs can withstand winds throughout the state's extensive road network is of high importance. The failure of traffic control sign supports has contributed to approximately 22,500 crashes each year in Texas from 2014 to 2016, resulting in a significant amount of fatalities, injuries, and economic loss. Therefore, signs in construction zones must be properly secured to prevent wind from blowing them off posts, and the conditions should be checked periodically to ensure specification compliance. This project's objectives were to understand the need for and concerns surrounding temporary traffic signs in Texas work zones, and conduct a cost/benefit analysis to evaluate the cost-effectiveness of each identified technology or materials.

What the Researchers Did

During this project, the research team undertook these tasks: (1) conducted an intensive literature review and evaluated the techniques and materials proven to reduce

toppling of temporary signs in high winds; (2) surveyed Texas engineers to understand their needs and concerns related to temporary traffic signs under high wind; (3) collected field observations in several high-wind regions in Texas; (4) performed cost-benefit analysis for different types of temporary signs; and (5) conducted finite element analysis for temporary traffic signs.

The research team reviewed and evaluated techniques and materials for ballasting temporary road signs that are reliable and effective under high winds. The survey results and interviews with TxDOT engineers were conducted to identify their needs, concerns, and expectations pertaining to temporary signs in high-wind areas. Working with engineers, the researchers observed the field performances in TxDOT districts with high wind, to evaluate new techniques and materials for ballasting temporary signs. Several functional considerations were evaluated, including wind resistance, durability, site adaptability, maintenance costs, environmental effects, and

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maintenance. The costs and other implications of alternative methods were evaluated. Detailed policy recommendations and a user-friendly standard sheet were designed, and simulation tests using finite element analysis were employed to identify the suitability of each identified temporary sign under different levels of wind speed. Finally, the map and table of recommended signs and the months to apply in all TxDOT districts and their counties were created; see these materials in Chapter 5 of the main report (0-6993-1).

What They Found

The research team found that each TxDOT district has its own most suitable temporary traffic signs for work zones during a certain time of the year. Based on the 25-year mean recurrence interval of the fastest wind velocity at 33 feet high, three types of wind zones were established: Zone 1 is 90 mph, Zone 2 is 80 mph, and Zone 3 is 70 mph. Based on the historical wind records, the following recommendations were formulated:

- For districts and counties in Zone 1 during certain specific months, the embedding signs are mandatorily recommended like the Dual Leg Perforated Square Metal Tubing with Anchor Sign and three of its updated new versions proposed in the project,

while skid signs are not recommended during those months.

- For districts and counties in Zone 2 during certain specific months, the embedding signs are highly recommended, while use of skid signs should be limited for use (including the Independent Dual Upright with Leg PSST Skid Sign, and the Dual Leg PSST Skid Support Sign).
- For the rest of the months in Zone 1 and Zone 2, and for all months of year in Zone 3, both embedding signs and skid signs can be used.
- The wooden signs (such as the Wooden Skid with Two Wooden Legs Sign, and Wooden Long/intermediate-term Single Leg (H-leg) Sign) are also good choices for non-high-wind situations.
- When extremely high wind is forecasted in any area in Texas, embedding signs should always be highly used.

What This Means

The project results indicate that the types of temporary traffic signs used for work zones should be selected based on the wind speed in the relevant area. Among the signs that can be used in a district under a certain speed of wind, cost-benefit efficiency should then be considered. Embedding signs are always superior to skid signs during extremely high wind.

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