



## 0-6639: Testing of Alternative Supporting Materials for Portable Roll-Up Signs Used for Maintenance Work Zones

### Background

Portable roll-up signs are currently used by the Texas Department of Transportation for identification of short-term maintenance/work zones and emergency operations. These signs have fiberglass frames that directly support diamond-shaped and rectangular flexible sign faces. It has been frequently reported that these fiberglass frames have failed due to bending caused by natural winds or gusts generated by passing vehicles. This research project addressed three major issues:

- Understanding the nature of wind loading on portable roll-up signs.
- Identifying alternative materials for fiberglass frames.
- Developing modified/new designs of portable roll-up signs.

### What the Researchers Did

A comprehensive literature review was performed on the current practice and the patents related to the design of portable roll-up signs. Static laboratory tests, long-term field monitoring, vehicle tow tests, and roadside tests were performed to assess wind loading due to natural and passing-vehicle-generated wind. Full-scale vehicle impact tests were performed to evaluate the crashworthiness of the current and modified designs.

#### Research Performed by:

Texas Tech University Multidisciplinary  
Research in Transportation

#### Research Supervisor:

Sang-Wook Bae, TechMRT

#### Researchers:

Derrick Tate, TechMRT  
DeLong Zuo, TechMRT  
Timothy Wood, TechMRT  
Roger P. Bligh, TTI  
Wanda L. Menges, TTI

#### Project Completed:

08-31-2013

## What They Found

This research project successfully identified the failure mechanism of portable roll-up signs subjected to wind loading. Failure of the vertical frames is primarily due to progressive cracking at the fiber-matrix (resin) interfaces caused by torsion, instead of bending. Therefore, increasing the torsional stiffness of vertical frames can improve the resistance of portable roll-up signs to wind loading.

On this basis, the researchers proposed a simple yet reliable solution, which included wrapping thin, high-strength carbon fiber sheets around the existing fiberglass frames. Prototypes of the modified design showed better in-field serviceability and met the crashworthiness criteria specified in the current American Association of State Highway and Transportation Officials *Manual for Assessing Safety Hardware*.

## What This Means

The cost of the failure of portable roll-up signs is more than the marginal cost of replacing the broken frame members. The cost of failure includes the safety cost to workers and the traveling public. Considering the low cost of the new solution and the significant benefit of improved safety for workers and the traveling public, the new design should be mandated for new portable roll-up signs. It is also recommended that existing portable roll-up signs be retrofitted based on the new design.

### For More Information

**Project Manager:**

Wade Odell, TxDOT, (512) 416-4737

**Research Supervisor:**

Sang-Wook Bae, TechMRT, (806) 834-4792

Technical reports when published are available at <http://library.ctr.utexas.edu>.

Research and Technology Implementation Office  
Texas Department of Transportation  
125 E. 11th Street  
Austin, TX 78701-2483  
[www.txdot.gov](http://www.txdot.gov)  
Keyword: Research