Florida Department of Transportation Research

# Pendulum Impact Testing of Metallic, Non-Metallic, and Hybrid Sign Posts, Phase II

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## Current Situation

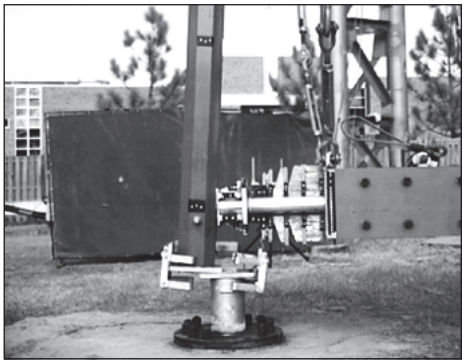
Roadside signs on Florida highways must fulfill two seemingly conflicting structural roles. First, they must withstand hurricane-force winds, and second, they must be able to breakaway when struck by a vehicle. The breakaway requirement is intended to reduce the hazardous, sudden deceleration that can occur when a car leaves the roadway and strikes a roadside sign.

## Research Objectives

University of Florida researchers studied the use of steel, fiber-reinforced polymer (FRP), and steel/FRP components in breakaway devices for roadside signs.

## Project Activities

The researchers used the pendulum impact test facility at the Florida Department of Transportation State Structures Laboratory in Tallahassee, Florida. This facility features a large pendulum facility which can be used to impact various test articles, in this case, sign breakaway mechanisms, with up to a 10,000 lbf impactor from drop heights approximately 20-25 ft.



*Just after the moment of impact, high speed video shows the simulated vehicle causing the breakaway device to separate.*

Two breakaway devices were investigated. In the first, steel cutting components were used in a "shear collar" to slice through an FRP sign post during direct vehicular impact. In the second, the FRP post was joined to steel plates that can separate when struck by a vehicle.

Each component of the experiments required extensive design and testing before it could be used. This included the suspended impactor itself, which was required to resemble the crush characteristics and mass of a vehicle of a specific class. Also, the breakaway devices had to be designed and manufactured, and the FRP post had to be selected from the range of commercial products and adapted to the breakaway mechanisms for the tests.

The pendulum facility was used to simulate collisions at 19 mph. Sensors in the surrogate vehicle monitored deceleration to determine if, along with other predetermined criteria, it was reduced to a level unlikely to cause injury to properly restrained occupants. Video from high speed cameras was used to record and investigate the impacts. Test articles and surrogate vehicles were also inspected after collision for additional insights.

The researchers concluded that the shear ring, while effective, would be expensive to manufacture and its effectiveness might decrease over time if, for example, the cutting edges became dull through corrosion. The second alternative yielded promising breakaway results; however, as a system, it failed the flexural requirement for wind loading. At this time, realizing the benefits of the lighter weight FRP may require more complex and costly systems than typical steel breakaway systems. Generally, the results of this testing answered some questions and revealed some new ones regarding integrating FRP and steel breakaway systems.

## Project Benefits

This project brings the Florida Department of Transportation closer to a deployable breakaway system to reduce injury in collisions with roadside signs.

*For more information, please see dot.state.fl.us/research-center*