Florida Department of Transportation Research

Assessment of the Performance of Vehicular Traffic Signal Assemblies during Hurricane Force Winds

October 2019

Project Number
BDV29-977-27

Project Manager
Jeff Morgan
FDOT Traffic Engineering and Operations Office

Principal Investigator
Ioannis Zisis
Florida International University

Current Situation

One of many iconic images from a Florida hurricane season is a wire-suspended traffic signal swinging wildly in the wind. Unfortunately, sufficient wind can cause these suspension systems to fail, resulting in fallen or dangling signals, tangled cables, and a lack of traffic control. Repairing these signals to restore traffic control or clearing them to make sure streets are safely passable places extra demands on repair crews during hurricane weather or in its aftermath. Improving the design of traffic signal suspensions is therefore a matter of ongoing interest.

Downed traffic signals add to post-hurricane hazards and require significant repair.

Research Objectives

Florida International University researchers tested traffic signals in full-scale setups using realistic wind-loading.

Project Activities

Traffic signals were tested in two setups. In the first, the test frame had a 70-ft span, and signals were subjected to winds up to 150 mph from a single direction. In the second, the test frame had a 20-ft span, and signals were subjected to wind from multiple directions. Both installations were constructed according to Florida Department of Transportation (FDOT) guidelines.

With each of the two setups, five different connection types were tested. For example, connector type 4 for setup 1 was an adjustable hanger assembly with cable dampener and reinforced disconnect hanger. Nine of the cases used traffic signals with aluminum housings, and one used the much lighter ABS plastic housing.

This was the first time that these assemblies had been tested at full-scale in a controlled and realistic environment. This allowed the researchers to study the failure mechanisms in detail. In general, the wind induced an oscillating behavior in the signals called galloping, which causes the signal to lift and twist. This eventually results in mechanical failure of the connector. For different connectors and signals, this effect can occur at different wind speeds. The researchers found that flexible connectors became susceptible to galloping at lower wind speeds, around 70 mph. Rigid hangers became susceptible at higher speeds, around 110 mph. At that speed, the rigid connector was severely bent by the wind, which sets up the system for galloping.

Based on their results, the researchers made recommendations about aspects of the connectors that should be retained, such as the continued use of aluminum alloy for signal hangers, and those that should be changed, such as reducing the possibility of rotation for certain types of hangers.

Project Benefits

The detailed understanding of the behavior of traffic signals in high wind provided by this research can help to prevent signals from becoming detached from their suspension cables in hurricane-force winds.

For more information, please see www.fdot.gov/research/.