Florida Department of Transportation Research

Development of a Test Method for Assessing the Performance of Vehicular Traffic Signal Assemblies during Hurricane Force Winds

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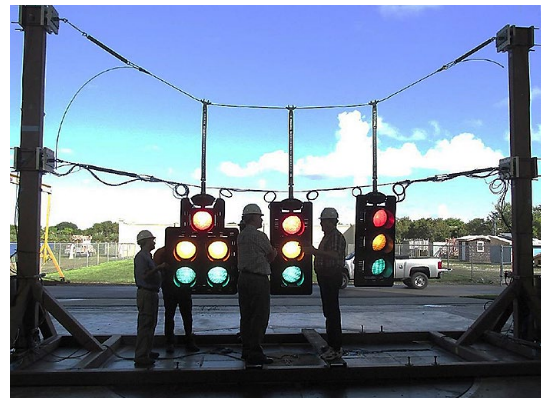
Current Situation

A standard warning during hurricane season is to secure light objects and take down suspended items, if possible. Traffic signals, however, cannot be taken down in preparation for hurricanes, and so they must be designed to withstand hurricane-force winds. In recent years, the number of traffic signals downed during powerful hurricanes like Hurricane Michael (2018) has demonstrated the need for a better understanding of how suspended traffic signals interact with high winds.



Researchers stand next to the setup in which traffic signal assemblies were tested in high winds.

Research Objectives

Florida International University researchers investigated methods for testing the behavior of traffic signals in high winds.

Project Activities

Three-section and five-section traffic signal assemblies – traffic signals plus suspending hardware – were subjected to high winds in the Wall of Wind experimental facility at Florida International University. In a series of tasks, wind speed and direction, traffic signal equipment, and hanger assemblies were varied to examine the behavior of the traffic signals and hanger assemblies when subjected to hurricane-force winds. The winds ranged in speed from 40 to 150 mph, with wind direction ranging from 0° to 180°. The signals were suspended from a common two-wire system comprising an upper catenary wire and a lower, tensioned messenger wire. The support posts were 21.9 feet apart.

Measurements of wind-induced forces, accelerations, and inclinations were carried out for each wind direction and speed. Forces on the signals due to wind were drag and lift. Results showed that for winds blowing directly at the front of the traffic signal (0°), the drag on the signals increased gradually as wind speed increased. Lift on the traffic signals increased initially with increasing wind speeds, but became nearly constant beyond 100 mph. Generally, the messenger wire experienced higher tensions than the catenary wire for a given wind speed. Similar observations were made at other wind directions. For example, in one test, the traffic signals were observed to incline up 35° at 40 mph, but beyond 70 mph, the traffic signals exhibited erratic motion and wide variation of inclinations.

For each combination of conditions and equipment, the researchers were able to make detailed observations about modes of failure. For example, inside the connector at the disconnect box, which allows the signal to be properly angled toward the traffic lane, there are teeth which lock it in place but tend to break after sufficient high-wind exposure, introducing rotation and accelerating failure. Based on this type of observation, the researchers were able to make extensive recommendations.

Project Benefits

The recommendations from this comprehensive investigation can lead to improved traffic signal suspensions, increased public safety during and after hurricanes, and reduced costs for equipment repair and replacement.

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