Florida Department of Transportation Research

Evaluation of Dual Cable Signal Support Systems
with Pivotal Hanger Assemblies
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Florida's unique exposure — to the Atlantic, the Gulf, and the Caribbean — have made it the state most likely to be struck by a hurricane. This is an unenviable record, but it has resulted in Florida's forward-thinking approach to hurricane readiness, including building codes that have spared many structures from destruction. In addition to buildings, the transportation infrastructure must be able to withstand hurricane-force winds. Specifically, the performance of dual cable traffic signal support systems during hurricanes has indicated the need to develop signal hangers and/or disconnect boxes that have an improved resistance to hurricane wind loads. In hurricanes, these failures commonly occur in the hanger nearest to the messenger cable attachment or in the connections at either the top or bottom of the disconnect box.

Dual signals are suspended from dual cables by rigid pipe hangers in this test setup. The signals are blown back to a high angle under the influence of the wind load generated by the UF Hurricane Simulator, partially visible at the right.

In this report, University of Florida engineers used the facilities of the UF Hurricane Simulator at the Powell Family Structures and Materials Laboratory to study the effectiveness of various cable-based traffic signal support systems when subjected to strong winds. Standard equipment was provided by various FDOT-approved signal and signal hanging hardware manufacturers, and the City of Gainesville provided experienced teams to assure the integrity of installations.

Several support configurations were tested for dual cable suspension: rigid pipe hanger, rigid adjustable strap hanger, adjustable strap hanger with pivoting joints, and a hanger made of ¼-inch, 7-wire strand cable material. Also tested was the direct connection of the signal to the single cable support configuration. Configurations were tested with and without the messenger cable attached to the pole. Setups were typically instrumented with load cells on signal support cables, string potentiometers mounted on a separate support tower were attached to signal hangers, and a wireless orientation sensor was installed in the signal itself. Each setup was tested with up to 120 mph winds, with oscillating wind loads at approximately 50 mph and 75 mph. Wind speed was determined with an anemometer placed six feet in front of the signal. Thirty-three full-scale wind load tests were performed to measure signal rotations, catenary and messenger cable tensions, and cable displacements.

Data from the tests were analyzed to determine the effect of signal orientation, wind angle, hanger type, and signal material on system performance during high wind conditions. An important issue was whether the signal was within visibility limits established by the Institution of Transportation Engineers.

Results from research like this are vital to making Florida's transportation infrastructure functional and effective when it is needed the most, as communities recover from disasters and return to normal daily activities.

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