



## Florida Department of Transportation Research

Anchor Embedment Requirements for Signal/Sign Structures  
BD545-54 (11/07)

Several cantilevered sign structures twisted or broke off at their foundations during Florida's 2004 hurricane season. To develop repair and retrofit techniques and to establish design criteria to prevent future failures of this type, FDOT needed to know the cause of the failures.

Researchers at the University of Florida reviewed the design standards for cantilevered sign structures and then conducted an on-site investigation of one of the failed sign structures. They compared the investigation results to the existing design standards.



*Damaged post base*

The investigation showed that the sign foundation failed because extreme wind loading during the storm applied more torsion (or twist) to the anchor rods at the base of the support pole than the rods were designed to resist. The load on the rods caused the concrete around the pole base to crack and crumble. While the rods remained intact, they became loose when the concrete failed, which caused the structure to collapse. The anchor rods met the sign foundation design requirements for normal



*A failed cantilever sign structure*

loads. However, the design standards had not addressed the possibility of concrete failure outside the rods.

The researchers also conducted laboratory tests to develop an acceptable repair and retrofit method. The tests showed that applying a carbon fiber reinforced polymer (CFRP) wrap to the foundation will strengthen it and prevent the concrete from breaking.

This study produced recommendations for improved sign foundation concrete design specifications and for foundation retrofits.

These new techniques may be expected to improve structure durability and reduce sign damage during storms. The quality of post-storm traffic management and safety also improves when fewer signs are damaged.



*CFRP wrap applied to laboratory test specimen*

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