Florida Department of Transportation Research

Repair of Impact Damaged Utility Poles with Fiber Reinforced Polymers (FRP), Phase II

April 2015

Project Number
BDV24-977-04

Project Manager
David J. Wagner
FDOT Structures Office

Principal Investigator
Kevin Mackie
University of Central Florida

Current Situation

The aluminum and steel utility poles which support traffic signals, lighting, or mast-arm signs are vulnerable to collisions from vehicles because of proximity to roadways. Removing these poles for repair is costly and time-consuming, and removal and replacement operations can have a significant impact on traffic.

Research Objectives

Collisions with utility poles may result in irreparable damage, and they must be replaced. But in many cases, the poles can be repaired. University of Central Florida researchers investigated the use of fiber-reinforced polymers (FRP) to repair some damaged utility poles without removing them. The objective was to develop repair guidelines for economically and effectively restoring an impact-damaged utility pole to a safe working condition.

This utility pole (left) was damaged in a collision, but it was successfully repaired (right).

Project Activities

In general, the FRP repair system consisted of a filler material to restore the utility pole's circular cross-section, a primer or adhesive layer, a pre-impregnated or field-impregnated FRP laminate, and a final coating to restore the pole's appearance. Researchers began by studying the properties of constituents of several likely FRP repair systems, including examining their effectiveness for installation on vertical poles. Researchers then investigated the performance of FRP repair systems at laboratory scale, testing to failure a variety of pole and dent geometries in a standard four-point flexural test setup. Finally, selected FRP repair systems were tested using full-scale poles. The tested poles included both poles removed from service with vehicular impact damage and poles with mechanically-imparted dents. All full-scale tests were performed on poles in a cantilever configuration with integral base plates. Test poles were subjected to flexural monotonic loads to failure, cyclic fatigue loads to failure, and impact loads simulating vehicular impact using a pendulum. Irregularities in the poles and access ports (hand holes) made design of the repair systems challenging. Laminates were placed such that a primary wrap was oriented along the length of the pole encompassing the entire dent, plus additional area for bond development, followed by circumferential wraps set above and below obstructions effectively anchoring the primary wrap. Results showed the repairs to be effective at restoring capacity and resisting cyclic/fatigue load demands.

Project Benefits

The ability to repair utility poles without removing them offers significant savings of cost and time. Interruptions to traffic flow for removal and replacement operations can be eliminated, thus maintaining traffic flows and the efficiency of roadways.

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