Previous studies have demonstrated that the behavior of fiber reinforced polymers (FRPs) bonded to metallic utility poles are governed by the following failure modes: yielding of the metallic substrate, FRP tensile rupture, FRP compressive buckling, and debonding of FRP from the substrate. Therefore, an in situ method can be devised for the repair of utility poles, light poles, and mast arms that returns the poles to their original service strength.

This thesis investigates the effect of damage due to vehicular impact on metallic poles, and the effectiveness of externally-bonded FRP repair systems in restoring their capacity. Damage is simulated experimentally by rapid, localized load application to pole sections, creating dents ranging in depth from 5 to 45% of the outer diameter. Four FRP composite repair systems were selected for characterization and investigation due to their mechanical properties, ability to balance the system failure modes, and installation effectiveness. Bending tests are conducted on dented utility poles, both unrepaired and repaired.

Nonlinear finite element models of dented and repaired pole bending behavior are developed in MSC.Marc. These models show good agreement with experimental results, and can be used to predict behavior of full-scale repair system. A relationship between dent depth and reduced pole capacity is developed, and FRP repair system recommendations are presented.

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Approved for distribution by Kevin Mackie, Committee Chair, on March 13, 2013.

The public is welcome to attend.