Sign and signal structures might be involved in the accidents leaving these structures predominately partially damaged and the ability of repairing them is possible instead of replacing them. Consequently, some trials were performed to retrofitting them with low cost and short time. Earlier researches have substantiated that the behavior of externally bonded FRP to metallic sign and signal structures are controlled by various types of failure modes like yielding of the metallic substrate, FRP tensile rupture, FRP compressive buckling, and debonding of FRP from the substrate. Additionally, a study was performed on the same structures and proved that the damage can decrease the capacity of the dented structures with increasing dent depth. Various FRP composite systems were tested through applying them on dented poles. These systems which were glass and basalt fibers with epoxy resin and polyurethane matrix proved their capability in developing the load carrying capacity of the damaged poles. To understand the mechanism of load transfer and failure of these selected systems, different wrap configuration were performed on the poles and found that the tension and transverse face wraps were effective in developing load transfer in the pole while compression face wrap was inactive as load transfer mechanism. However, this study still needs some tests to evaluate the repair systems safety performance.

This thesis investigates the behavior of dented aluminum and steel poles repaired with the mentioned repair systems as well as the behavior of the repair systems under full scale tests which are static, fatigue, and dynamic. These tests were conducted on poles whose length was 11 ft with different geometries using cantilever configuration. During static and fatigue tests, the poles were attached horizontally through anchoring their base plate to a concrete buttress, while they were installed vertically through connecting their base to a steady foundation during dynamic test.

The results of these tests show that most of the failure was located outside the dent region which indicates the effectiveness of these repair systems. Depending on the geometry of the pole, metal substrate, and dent depth and location, FRP repair system recommendations will be presented.

Major: Civil Engineering

Educational Career:
Bachelor’s of Civil Engineering, BS, 2008, university of Anabar

Committee in Charge:
Kevin Mackie, Chair, CECE
Necati Catbas, CECE
Omer Tatari, CECE

Approved for distribution by Kevin Mackie, Committee Chair, on April 10, 2015.

The public is welcome to attend.