

Durability of NSM FRP Flexural Strengthening Systems Subjected to Severe Environmental and Loading Conditions

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ABSTRACT

This paper presents results of testing nine reinforced concrete T-beams strengthened with Near Surface Mounted (NSM) Carbon Fibre Reinforced Polymer (CFRP) strips and CFRP rebar. The objective of this investigation is to study the durability of the s NSM CFRP reinforcements for flexural strengthening of reinforced concrete beams under the effect of severe environmental and loading conditions. Six beams were placed inside an environmental chamber for 18 months and then left for 6 months in an outdoor environment. Three of the six beams were subjected to a sustained load equivalent to 40% of the ultimate load carrying capacity of the strengthened beam. The six beams within the environmental chamber were subjected to wet/dry cycles at a rate of one cycle per week. The beams were sprayed continuously with salt water for three days at a constant temperature of 180°F (82°C) followed by four days of drying at room temperature of 72°F (22°C). All six beams were tested to failure under static loading after 24 months. The remaining three beams were tested under static loading at room temperature in which one beam was unstrengthened, and the other two beams were strengthened with NSM CFRP strips and rebar. The structural performance and modes of failure of the tested beams are presented and discussed. Test results showed degradation of the epoxy-concrete interface due to the harsh environmental conditions used in the experimental program. The tests showed that some of the failure modes have been changed due to degradation of the epoxy-concrete interface compared to the beams tested at room temperature.

KEYWORDS

Beam, CFRP strips, cycle, durability, elevated temperature, flexural, long-term, rebar, salt water, and static, strengthening, sustained, wet/dry.