

Bond Strength of Different Strengthening Systems: Concrete Elements under Freeze-Thaw Cycles and Salt Water Immersion Exposure

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Abstract : The long-term durability of fibre reinforced polymer (FRP) composites is often stated as being the main reason for the use of these materials. Indeed, structures externally or Near Surface Mounted (NSM) reinforced with Carbon Fibre Reinforcement Polymer CFRP are often in contact with temperature cycles and salt water immersion and other environmental conditions that reduce the expected durability of the system. Bond degradation is a frequent cause of premature failure of structural elements and environmental conditions are known to relate to such failures. The purpose of this study is to investigate the effect of environmental exposure on the bond for different CFRP strengthening systems. Bending tests were conducted to evaluate the bond with and without environmental exposure. The specimens were strengthened with CFRP sheets, CFRP plates and NSM CFRP rods embedded in two filling materials: epoxy resin and mortar. Then, they were exposed to up to 300 freeze-thaw cycles. One freeze-thaw cycle consisted of four stages according to ASTM or immersed in 3.5% salted tap water. A total of thirty-six specimens were prepared for this purpose. Results showed a decrease in ultimate bond strength for specimens strengthened by CFRP sheets that were immersed in salt water for 120 days, while a reduction was shown for CFRP sheet and plate bonded specimens that were subjected to 300 freeze-thaw cycles. Exposing NSM CFRP rod strengthened specimens, embedded in resin or mortar, to freeze-thaw cycles or to immersion in salt water does not affect the bond strength.

Keywords : durability, strengthening, FRP, bond, freeze-thaw

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