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Analysis of Epoxy Interface Subjected to Sustained Loading and Temperature

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Extended Abstract

Concrete-epoxy interfaces (CEI) are formed in externally bonded FRP (Fiber Reinforced Polymer) system. The CEI is a region along the concrete-epoxy line, where the debonding and transition between concrete and interfacial properties occur. Experimental testing of FRP-bonded systems shows that debonding failure may occur as one of three possible modes; cohesive failure in the concrete (CC), interfacial failure (IF), and cohesive failure in the epoxy (CFE), depending on material properties of the FRP, epoxy, and concrete as well as the environmental effects the FRP-bonded system might be subjected. When the CEI is degraded by environmental conditions, IF mode is likely observed following environmental degradation. Among three failure modes, the cohesive failure mode is the most observed failure mode [1]. However, when the CEI is degraded by environmental conditions, interfacial failure mode is likely observed [2-3].

The objective of this study is to evaluate the effects of sustained loading and temperature on the time-dependent behavior of the concrete-epoxy interface and on bonding strength at room temperature after the sustained loading period. For this purpose, a series of creep tests and static tests on three-point bending specimens were carried out. The creep tests were conducted on specimens at different temperatures (21°C and 30°C) for various time periods (31 days to 182 days). After sustained loading, the specimens were loaded to failure in order to assess the residual (remaining) strength of the concrete-epoxy interface. The quantitatively characterized fracture surface analysis was conducted on tested specimens to evaluate relation between measured remaining strength and failure modes of concrete-epoxy interface (CEI). Fracture surfaces of all tested CEI specimens were examined using digital images. Based on fracture surface analysis of tested CEI specimens, shift of failure mode from CC to CFE or to IF has been observed during sustained loading period. It is inferred that the sustained loading weakens the bond strength at the CEI, which can explain the decrease in peak load.

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