DURABILITY OF FRP-CONCRETE INTERFACE

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Durability of FRP-Concrete Interface
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ABSTRACT

Research on ways to retrofit, strengthen and repair reinforced concrete (RC) structures using fiber reinforced polymer (FRP) materials has made significant progress in recent years. However, attention has been focused on short-term mechanical properties of retrofitted structures. One important aspect that needs to be carefully investigated to ensure the safety of this technology is evaluation of long-term durability of adhesively bonded joints. This study investigated bond characteristics of FRP-concrete joints subjected to fatigue loading and freeze-thaw cycling.

To achieve the objectives of the study, an improved double-face shear test (direct pullout test) was developed for different bonding systems under fatigue loading. The influence of the load amplitude and number of cycles of fatigue on bond performance was examined and discussed through analysis of failure mechanism, load-slip curves and strain measurements taken during fatigue, as well as monotonic tests.

Durability of the FRP-concrete bond interface under freeze-thaw cycling was investigated by single-face shear tests, with exposure condition, concrete grade and number of freeze-thaw cycles as the parameters considered. The results indicate that bond strength, bond stiffness, interfacial fracture energy and maximum slip of the joints decreased with increase in number of freeze-thaw cycles, and they were also affected by the exposure environment.
Based on experimental tests and other collected test results, bond-slip and bond strength model under normal environment are developed as these models can consider different concrete strength and FRP stiffness values. The model for predicting bond strength of long FRP-concrete joints was assessed by comparing it with experimental test data collected from extant literature. Finally, by using the proposed constitutive model of FRP-concrete interface under normal environment to analyse the experimental test data, bond-slip and bond strength models for FRP-concrete joints under freeze-thaw cycling were developed. Bond-slip and bond strength models provide an insight into the long-term performance of FRP-concrete interface subjected to freeze-thaw cycles, which is important and necessary for design and construction of FRP retrofitting systems.
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