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Finite Element Assessment on Bond Behaviour of FRP-to-Concrete Joints under Cyclic Loading

Authors : F. Atheer, Al-Saoudi, Robin Kalfat, Riadh Al-Mahaidi

Abstract : Over the last two decades, externally bonded fiber reinforced polymer (FRP) composites bonded to concrete substrates has become a popular method for strengthening reinforced concrete (RC) highway and railway bridges. Such structures are exposed to severe cyclic loading throughout their lifetime often resulting in fatigue damage to structural components and a reduction in the service life of the structure. Since experimental and numerical results on the fatigue performance of FRP-to-concrete joints are still limited, the current research focuses on assessing the fatigue performance of externally bonded FRP-to-concrete joints using a direct shear test. Some early results indicate that the stress ratio and the applied cyclic stress level have a direct influence on the fatigue life of the externally bonded FRP. In addition, a calibrated finite element model is developed to provide further insight into the influence of certain parameters such as: concrete strength, FRP thickness, number of cycles, frequency and stiffness on the fatigue life of the FRP-to-concrete joints.

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