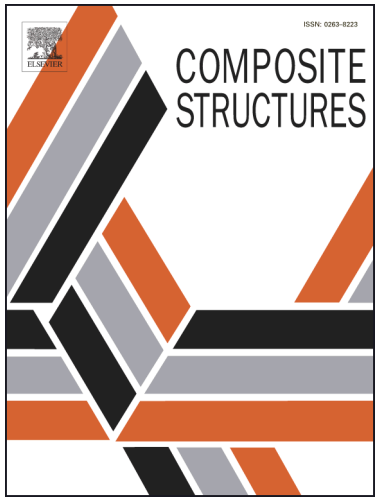

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Interfacial Behavior and Debonding Failures of Full-Scale CFRP-Strengthened H-Section Steel Beams

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Abstract: Strengthening existing steel beams with externally bonded carbon fiber-reinforced polymer (CFRP) plate has attracted many interests in the research community. Debonding of the CFRP plate is the dominant failure mode in a flexurally strengthened steel beam, and the debonding failure is controlled by the interfacial responses between the CFRP plate and the substrate steel beam. Although some experimental investigations have been conducted on CFRP-strengthened steel beams, limited test results on the interfacial stress and strain responses especially in full-scale steel beams, are available to verify the numerical modeling. This paper presents an experimental study on the flexural behavior of full-scale CFRP-strengthened H-section steel beams. The effects of different bond lengths of CFRP plates and the presence of steel stiffeners are investigated. The test results in terms of the failure modes, load-deflection responses, CFRP strains, interfacial shear stress distributions are reported in detail. A three-dimensional finite element model is proposed to predict the flexural performance of full-scale CFRP-strengthened steel beams, and it is then validated extensively by the test results.

Key words: CFRP, strengthening, H-section steel beam, debonding, interfacial stress, finite element analysis.

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