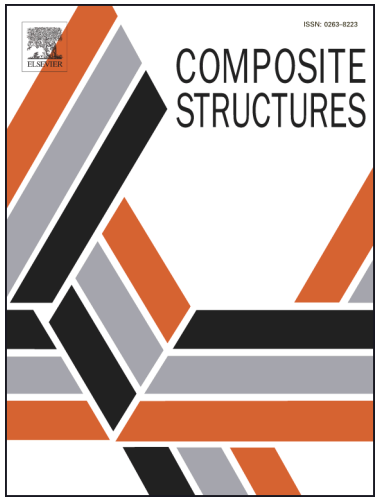

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Seismic behavior of RC columns flexurally strengthened with FRP sheets and FRP anchors

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Abstract

Existing reinforced concrete structures are frequently deemed to be prone to severe damage and/or collapse as a result of the loads that the structure is expected to experience if it were to be subjected to large intensity earthquake shaking. Among the different approaches to elevate the seismic capacity of existing reinforced concrete structures is the use of externally bonded fiber reinforced polymer (FRP) systems, which consist of fiber reinforced polymer sheets soaked in epoxy and bonded onto the concrete surface. However, premature debonding often occurs before the ultimate strength of the carbon fiber sheets is reached, compromising the reliability and/or the efficiency of the intervention. One of the methods to ameliorate premature debonding is the use of fiber reinforced polymer anchors to connect the FRP sheets to the concrete structure, ensuring continuity of the load path.

Six reinforced concrete columns were designed, built and tested to investigate the seismic behavior of the strengthened columns, with five of the columns strengthened with fiber reinforced polymer sheets and anchors. The main objective of the testing program was to experimentally verify that the moment capacity of the FRP strengthened columns was accurately calculated, when accounting for two possible failure modes (failure of the FRP sheets and failure of the FRP anchors). Additional objectives were to investigate the influence of the tension-compression cyclic loading on the capacity of the anchors, assess the influence on column behavior when using fiber reinforced polymer transverse reinforcement, and to investigate the influence on column response when implementing a bond breaking layer.