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COMPRESSIVE BEHAVIOR OF HYBRID DOUBLE-SKIN TUBULAR COLUMNS WITH A RIB-STIFFENED STEEL INNER TUBE

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Abstract: Hybrid fibre-reinforced polymer (FRP)-concrete-steel double-skin tubular columns (DSTCs) consist of an outer FRP tube and an inner steel tube, with the space inbetween filled with concrete. In hybrid DSTCs, the outward buckling of the steel inner tube is constrained by the surrounding concrete and the outer FRP tube, but its inward buckling is still possible. Existing research has shown that such inward buckling can become significant in non-circular hybrid DSTCs due to the non-uniform confinement, in hybrid DSTCs with a strong FRP tube due to the large axial deformation of the columns, and/or in hybrid DSTCs with a thin steel tube. In these cases, the stiffening of the inner steel tube is necessary to prevent or delay its inward buckling and to minimize its negative consequences to the column behavior. Against this background, a variation of hybrid DSTCs (hybrid R-DSTCs), in which the inner steel tube is stiffened by a number of vertical rib stiffeners, was recently developed at the University of Wollongong, Australia. This paper presents an experimental study on the axial compressive behavior of the new form of columns. The expeirmental program included a total of 12 R-DSTC specimens and two DSTC specimens for comparison, with the test variables being the number, thickness and width of rib stiffeners as well as the number of plies of fibres in the FRP tube. The test results confirmed that the additional rib stiffeners on the steel tube are effective in delaying the local buckling of the steel tube and in improving the performance of the columns. The test results also clarified the effects of the tested parameters of the rib stiffeners.

Keywords: FRP, tubular columns, steel tube, local buckling, rib stiffener

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