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Concrete Filled Carbon FRP Tube (CFRP-CFFT) Columns with and without CFRP Reinforcing bars: Axial-Flexural Interactions

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Abstract

The axial and flexural behaviors of Concrete Filled Carbon Fiber Reinforced Polymer Tube (CFRP-CFFT) columns have received significant research attention in the last two decades. One of the most attractive advantages of Carbon FRP (CFRP) tube is the high confinement which results in substantial increase in peak axial and flexural loads and deformations. Despite large research efforts, the behavior of CFRP-CFFT with and without CFRP reinforcing bars under different applied axial load eccentricity has not yet been adequately investigated. This study investigates the experimental and analytical axial-flexural ($P-M$) interactions of CFRP-CFFT columns with and without CFRP reinforcing bars. A total of 12 specimens of 204 – 205 mm outer diameter and 800 – 812 mm height were tested under concentric axial load, 25 mm and 50 mm eccentric axial loads and four-point load. The effectiveness of CFRP reinforcement (tube and bar) was observed to be reduced with the increase in the applied axial load eccentricity. Analytical $P-M$ interactions were constructed using available FRP confined concrete design codes which matched well with the experimental $P-M$ interactions. The parametric study showed that the actual confinement ratio, orientation of fibers and CFRP bar reinforcement ratio have significant influences on $P-M$ interactions of CFRP-CFFT specimens.

Keywords: A. Carbon fiber; B. Strength; C. Analytical Modeling; D. Mechanical Testing