# Structural Performance of Partially Confined Concrete-Filled Steel Tubular Columns under Combined Axial and Lateral Cyclic Loadings

Prasanta Kar (166104031)

Abstract:

In this research work, an innovative strengthening technique has been proposed for square and circular CFST columns. An experimental investigation on partially confined concrete-filled steel tubular (PCCFST) square and circular columns (i.e., short inner concrete core confinement near the support), using circular hollow section (CHS) configuration as partial inner confinement, under combined axial and cyclic lateral loadings has been performed. Hysteretic behavior of load, ultimate lateral strength, energy dissipation capacity, and ductility of the PCCFST columns were studied as a function of (a) the ratio of the height of the inner tube to the diameter of the outer tube (0-2.5) and (b) diameter/width ratio of inner tube to outer tube (0.44, and 0.53). Based on the investigation, it has been seen that the height and diameter of the inner CHS have an evident influence on the cyclic performance of the columns. Enhancement of the cyclic performance of PCCFST column with the height of inner CHS beyond 1.5D is not very significant. Based on the limited experimental results herein and code provisions (Eurocode 4 1994), a design rule has been proposed to predict the ultimate lateral strength of the square and circular PCCFST columns.

An innovative retrofitting technique has been proposed to externally retrofit the damaged square and circular CFST and partially confined CFST columns. The external retrofitting was carried out using either square or circular CFST sections. The effect of the sectional shape of the retrofitting CFST on the structural performance has been assessed under combined axial and lateral cyclic loading. Studies have been carried out to investigate the hysteretic behavior, ultimate lateral strength, and energy dissipation capacity of the retrofitted specimens. The experimental study showed that the square retrofitted columns could regain the ultimate lateral strength and energy dissipation capacity by ~ 121%-134% and ~110%-115%, respectively, for the retrofitting CFST element considered. The regain in the ultimate lateral strength, and energy dissipation capacity of the circular retrofitted columns was found to be ~ 113%-139% and ~116% to 135%, respectively.