Behavior of stiffened and unstiffened CFT under concentric loading, An experimental study

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Abstract

Concrete-filled steel tubular (CFST) beam-columns are widely used owing to their good performance. They have high strength, ductility, large energy absorption capacity and low costs. Externally stiffened CFST beam-columns are not used widely due to insufficient design equations that consider all parameters affecting their behavior. Therefore, effect of various parameters (global, local slenderness ratio and adding hoop stiffeners) on the behavior of CFST columns is studied. An experimental study that includes twenty seven specimens is conducted to determine the effect of those parameters. Load capacities, vertical deflections, vertical strains and horizontal strains are all recorded for every specimen. Ratio between outer diameter (D) of pipes and thickness (t) is chosen to avoid local buckling according to different limits set by codes for the maximum D/t ratio. The study includes two loading methods on composite sections: steel only and steel with concrete. The case of loading on steel only, occurs in the connection zone, while the other load case occurs in steel beam connecting externally with the steel column wall. Two failure mechanisms of CFST columns are observed: yielding and global buckling. At early loading stages, steel wall in composite specimens dilated more than concrete so no full bond was achieved which weakened strength and stiffness of specimens. Adding stiffeners to the specimens increases the ultimate load by up to 25% due to redistribution of stresses between stiffener and steel column wall. Finally, design equations previously prepared are verified and found to be only applicable for medium and long columns.

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