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Behavior of Concrete Filled Steel Tube (CFST) Columns with Internal Steel Stiffeners under Axial Load

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This dissertation is submitted to Ain Shams University for the degree of Master of Science, Civil Engineering (Structural Engineering).

The work included in this thesis was carried out by the author in the Structural Engineering Department, Faculty of Engineering, Ain Shams University, from 2014 to 2017.

No part of this thesis has been submitted for a degree or a qualification at any other University or Institute.

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Abstract

The behavior of concrete filled steel tube (CFST) columns with internal steel stiffeners under axial load is presented in this thesis. The behavior of the columns is examined by the use of finite element software ANSYS. Results from nonlinear finite element analyses are compared with those from corresponding experimental tests which uncover the reasonable accuracy of the modeling. The columns are extensively developed considering three different special arrangements of the internal steel stiffeners with various number, spacing, and widths of the stiffeners. The main variables are: (1) arrangement of the steel stiffeners (C1, C2, and C3) ; (2) number of the steel stiffeners (2 and 3); (3) spacing of the steel stiffeners (50mm, 100mm); (4) width of the steel stiffeners (50mm, 75mm, 100mm ; (5) steel tube thickness (2mm, 25mm, 3mm); (6) concrete compressive strength (20 MPa, 2.5 MPa, 30 MPa); (7) steel yield stress (240 MPa, 280 MPa, 360 MPa). Effects of the variables on the behavior of the columns are assessed. Failure modes of the columns are also illustrated. It is concluded that the variables have considerable effects on the behavior of the columns. Moreover, ultimate load capacities of the columns are predicted by the Egyptian code (ECP 2007), the American code (AISC 2005), the Euro code (EC4 2004), and are compared to those obtained from finite element analyses of this thesis. It is observed that (ANSI/AISC 2005) approaches are conservative to estimate the ultimate capacities of the columns, (EC4 2004) approach overestimates the ultimate capacities of CFST columns for some models and approaches are conservative to estimate the ultimate capacities of the columns for other models, and (ECP 2007) approach conservative the ultimate capacities of the CFST columns.

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