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BEHAVIOUR AND DESIGN OF CONCRETE-FILLED STEEL TUBE COLUMNS

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A Thesis

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STATEMENT

This thesis is submitted to Ain shams University, Cairo, Egypt, for the degree of Master of Science in Civil Engineering (Structural Engineering).

The work included in this thesis was carried out by the author in the Department of Structural Engineering, Faculty of Engineering, Ain Shams University, from 2010 to 2015

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

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Behaviour And Design Of Concrete-Filled Steel Tube Columns

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ABSTRACT

Concrete-filled steel tube (CFST) columns have been increasingly used in many modern structures. Their use provides high strength, high ductility, high stiffness and full usage of construction materials. In addition to these advantages, steel tubes surrounding concrete columns eliminate permanent form work, which reduces construction time. Furthermore, steel tubes not only assist in resisting axial loads, but also provide confinement to the concrete.

In this research, the behavior and design of concrete-filled steel tube columns under concentric and eccentric loads is studied. A nonlinear finite element model (FEM), using the multi-purpose FE program ANSYS 14 has been developed. The results obtained from the FEM are compared to those obtained from recent experimental results. The comparison indicated that the results of the model are evaluated to an acceptable limit of accuracy.

A parametric study has been conducted on CFST members under the effected of axial loads and combined action of axial load and bending moment. In this study, six different steel square cross-sections are used. The effects of flat width-to-thickness ratio, steel yield strength and concrete compressive cube strength have been studied.

Another parametric study has been conducted on CFST member under the effect of axial load and bending moment. Four different steel RHS are used. the effect of the same parameters previously mentioned are studied.

The results obtained from the FEM are compared to those from different design codes of practice. This compares showed that the studied results using codes are different from each other and from the FE results. Modifications on design codes equations are suggested to enhanced then accuracy.

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ABBREVIATIONS

Abbreviation	Definition
CFST	Concrete-Filled Steel Tube
AISC	American Institute of Steel Construction
ECP	Egyptian Code of Practice for steel construction and bridges
EC4	Eurocode 4, design of composite steel and concrete structures
ASD	Allowable Strength Design
LRFD	Load and Resistance Factor Design
FEM	Finite Element Model
RHS	Rectangular Hollow Sections
SHS	Square Hollow Sections