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Analysis of Steel Fixed Column Bases

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B.Sc. Civil Engineering
Ain Shams University

A Thesis

Submitted in Fulfillment for the Requirements

of the Degree of Master of Science

in Civil Engineering (Structures)

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Structural Engineering.

The work included in this thesis has been carried out by the author in the Department of Structural Engineering, Ain Shams University, from March 2010 to March 2015.

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

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ACKNOWLEDGMENTS

First and foremost, praise and thanks to Almighty Allah, the Most Gracious, the Most Merciful, and peace be upon His Prophet.

I would like to express my deepest gratitude and appreciation to my supervisor, Prof. Dr. Abdelrahim Khalil Dessouki , for his invaluable guidance, support and encouragement.

I also greatly appreciate the help, guidance and support provided by Dr. Mohamed Saafan throughout all stages of research.

Finally, I would like to express my appreciation to my father, my beloved mother, my family & my friends for lots of support, specially eng. Mohamed Atia.

ABSTRACT

Column base connections in steel structures are sensitive to successfully transfer internal forces and straining actions from the structure to the foundation, they may be divided according to:-

1) Column base exposure:
   a) Exposed column bases and
   b) Embedded column base plates

2) Structural behavior:
   a) Fixed column base connection and
   b) Pinned (hinged) column base connection.

There are also classification according to steel failure mode and concrete failure mode, classification according to energy dissipation capacity but they are less common. In this thesis, we are interested in exposed fixed column base connection.

Design of fixed column base and anchors has been an approximate calculation process that depends mainly on a series of assumptions; assuming a value for concrete contact stress and assuming a shape for contact stress then assuming that stresses in anchor rods reached maximum allowable tensile stress is quite inaccurate, however, different building codes stated methods for column base design that are based on a series of assumptions as well.

This thesis presents a parametric study on design and analysis of fixed column base connection using Finite Element Modeling (FEM), as well as comparison between results obtained from FEM and results from American

Institute of Steel Construction (AISC) and from the Euro Code part 8 Design Guides.

The first part of this research is Finite Element Modeling validation using previously published papers containing experimental program, which is achieved by modeling the test specimen under the exact straining actions, then compare the results obtained from the FEM with those from experimental testing.

The second part is the parametric study, which is achieved by solving a numerous amount of fixed column base connections with several configurations of straining actions, column base dimensions & material properties using the FEM, the AISC Design Guide 1 method and the Euro Code 3 method, then having the results graphically represented will allow for easier comparison between results of all three methods.

The third part is the suggested design curves, as well as formulas, which provides the designer with more accurate results, which allows for design on the most realistic bases for a safe design in much less time.

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