AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Structural Engineering Department

Behaviour of Bolted Connections for Cold-Formed Steel Frames

A Thesis submitted in partial fulfillment of the requirements of the degree of

Master of Science in Civil Engineering

(Structural Engineering)

By

Eng. Mohamed Saad Mohamed Soliman

Bachelor of Science in Civil Engineering

(Structural)

Faculty of Engineering, Higher Technological Institute, 2010

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Examiners' Committee

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Date: 14 July 2016

Statement

This thesis is submitted as a partial fulfillment of Master of Science in Civil Engineering, Faculty of Engineering, Ain shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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14 July 2016

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THESIS SUMMARY

The usage of cold-formed steel has been increased in structural frames for residential and multi-story commercial buildings. However, the structural behaviour of bolted cold-formed moment connections has been often quite different from the hot-rolled moment connections due to the higher strength of steel and thin plates used.

In this research, an overall literature review was carried out to identify the state of knowledge and to gather the required data. A three-dimensional finite element model accounting for both geometric and material non-linearities is developed using commercial software program, (ANSYS). The results of the verified finite element models were compared with previous experimental results and showed good correlation. In order to identify the effect of different components and parameters on the behaviour of the bolted beam-column connections, a parametric study was conducted using the verified finite element model on bolted moment connections. The connections configurations were two I-shape stubs bolted with two cold formed lipped channels and gusset plate strengthened by separate compression element (Post) bolted with the webs of the cold formed lipped channels. The studied parameters were: the width-depth ratios of the cold-formed channels, depth and width-thickness ratios of the web and the flange of the channel, respectively, and width-thickness ratios of the web and flange of the I-shape stub or Post. The rafter width to depth ratio as well as the column width to depth ratio are used as an additional parameter in this study. Different failure modes of the bolted moment connections are observed. As a rule, the beam-column connections are classified as rigid, semi-rigid or pin. According to the comparison between the finite element results and the design rules the connections are classified into rigid and semi-rigid. Finally, moment- rotation curves are presented for the different detail configurations.

Keywords: Cold-formed steel frame; Finite element numerical modelling; Bolted moment connections; Beam-Column connection; steel structures.

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