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Experimental and Theoretical Study of Large Capacity End-Plate Connections

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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 period from Jan 2011 to Feb 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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ABSTRACT

Bolted moment connections have been very popular due to their ease in fabrication and erection. However a clear understanding of the properties, interaction, and function of every single element is not clear due to their complex behavior.

In this research, an overall literature review has been conducted to identify the state of knowledge and gather the required data. An experimental program has also been conducted on five full scale specimens for rigid, large capacity, moment connections. Two specimens represent flushed end plate connections, other two specimens represent extended stiffened end plate connections and one specimen represent extended stiffened end plate connection. 3-D finite element models using ANSYS (ver.11) that accounts for both geometrical and material non-linearities are developed. Verification of the proposed finite element models has been performed by comparing their results with those of the performed experimental study as well as with the experimental work previously performed by other researches and showed good correlation. A parametric study is performed using the verified finite element model on bolted flushed and extended end plate large capacity moment connections. The studied bolt configurations in the tension side are three rows of bolts for extended and two rows of bolts for flushed end plate

connections with four bolts in one row. Three bolt configurations are studied: the first configuration represent connections without horizontal stiffeners, the second configuration represent connections with horizontal stiffeners below the first row of bolts under the tension beam flange, while the third configuration represents connections with stiffeners below the second row of bolts under the tension beam flange. The studied parameters are: end plate thickness and bolt diameter. In order to develop analytical design equations, regression analysis for the results is performed and design formulae are proposed for the connection bending capacity. Finally, a summary of the work carried out in this thesis, along with the general conclusions obtained from this study are presented.

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