Ain Shams University
Faculty of Engineering
Department of Structural Engineering

Investigation of the Rotational Capacity of Various Steel Shear Connections

A THESIS
Submitted in Partial Fulfillment of the Requirements of the Degree
of
MASTER OF SCIENCE IN CIVIL ENGINEERING
(STRUCTURAL)

Submitted by

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Curriculum Vitae

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Statement

This dissertation is submitted to Ain Shams University 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, Cairo, Egypt. No part of this thesis has been submitted for a degree or qualification at any other university or institution.

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Abstract

In practice both in structural analysis and design, shear connections are always considered as pinned connections that transfer no moments between the connected elements. However, in some practical situations, this becomes non-realistic when these connections have a significant rotational stiffness which could lead to straining actions on the connection different than those taken into consideration in the design phase. Normally, design codes of practice provide qualitative descriptions for various types of connections. They are often clarified as flexible, semi-rigid and rigid connections without providing clear values for their rotational stiffness and without giving strict limits between the aforementioned classifications.

In this research, a comprehensive parametric numerical analysis is performed using the Finite Element Method (FEM). The study covered several different types of shear connections by varying their defining elements' thicknesses and lengths. The effect of several factors related to the member is also studied to identify the sensitivity of the generated end moments to these parameters.

The main outcome of this research is a set of design charts and equations relating the different investigated parameters to the rotational stiffness of the double angle and fin plate shear connections. The developed charts are intended to help the designer to accurately model

such connections in finite element modeling programs with their actual rotational stiffness. This helps in predicting the actual behavior of the structure to accurately check serviceability limit states such as deflections and drifts under lateral load actions. Moreover, several interesting observations, conclusions, and recommendations are given.

Keywords: Shear connections, Moment Rotation curves, Semi-rigid connections, Rotational Stiffness, Double Angle, Fin Plate.

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