شبكة المعلومات الجامعية

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بسم الله الرحمن الرحيم

HANAA ALY

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HANAA ALY

Ain Shams University
Faculty of Engineering
Structural Engineering Department

Study of Imperfect Connections and their Influence on the Behavior of Steel Frames

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

Doctor of Philosophy in Civil Engineering

(Structural Engineering)

By

Mostafa Nour Eldin Mohamed AbdAllah

Master of Science in Civil Engineering

(Structural Engineering)

Faculty of Engineering, Ain Shams University, 2015

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Date: / / 2021

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STATEMENT

This dissertation is submitted to Ain Shams University for the Philosophy Degree 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 February 2018 to November 2021.

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 end plate connections in steel structures are sensitive elements, they are responsible for successfully transferring internal forces and straining actions between different parts of the structure, they form an important part of virtually all steel structures, they used to assemble fabricated elements together and to transfer straining actions among different parts of the structure safely.

Bolted end plate connections have been studied thoroughly for many years with a lot of published work and building codes recommendations, despite that, it appears that minor research has been carried out on connections with initial imperfections where the plates of the faying surface are not in full contact. Connections with initial imperfections are not uncommon, although they are present in many structures, they are somewhat hard to detect and of somewhat occasional occurrence, this could be the reason that building codes have no provisions regarding connections with initial imperfections.

The current study is interested in moment resisting, extended bolted end plate connections with initial imperfections, it consists of five main parts.

The first part is literature review discussing the lack of research in the field of initially imperfect bolted connections.

The second part is an experimental program on a group of initially imperfect connections together with their ideal counterpart for comparison, where the behaviour of such connections was measured practically and a number of observations were recorded.

The third part is a finite element modelling (FEM) parametric study, where the modelling procedure was verified using experimental results, then

various groups of connections were modelled and a number of interesting results were obtained, including analytical approach to calculate the maximum moment carrying capacity of such connections.

The fourth part is a FEM numerical study on a number of full-scale portal frames with initially imperfect connections together with their ideal counterpart, where behaviours were compared, Component Method was adjusted and utilized to calculate the rotational stiffness of imperfect connections.

The final part is a brief suggestion of dealing with structures with initially imperfect connections.

Keywords: Imperfect moment connection, initially imperfect connections, extended end plate connections, defects in pretensioned bolted connections.

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