AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

STRUCTURAL ENGINEERING DEPARTMENT

STRENGTHENING OF T-JOINTS COMPOSED OF CHS USING THROUGH BOLTS

By

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A Thesis
Submitted in Partial Fulfillment for the Requirements of the Degree
of Master of Science in Civil Engineering (Structural)

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ABSTRACT

Increasing the joint capacity of tubular steel structural members has always been a challenge for designers because of their closed nature. The closed nature of these circular hollow sections does not allow conventional stiffeners welding. As such, the present numerical research investigates the efficiency of a new technique for strengthening the circular chord members of T-joints against outside deformation (ovalization) when subject to brace member's compression. The strengthening technique is based on bracing the chord member by through bolts in the radial direction which are arranged in different patterns. A parametric study is carried-out in order to investigate the effects of the number (n) and spacing (s) of through bolts, the chord diameter and the brace-to-chord diameter ratio (β) on the strength gained by the joint using through bolts strengthening technique. Two groups of specimens are chosen; the first group has a chord member of diameter (d_0) of 356 mm, and brace members diameters (d_1) of 324 mm, 273 mm and 219 mm, while the second group has a chord member of diameter (d_0) of 610 mm, and brace members diameters (d_1) of 559 mm, 508 mm and 406 mm. The study mainly revealed that the percentage gain in both strength and stiffness is directly proportional to the number of through bolts. The study indicates also that the efficiency of this strengthening technique increases with small chord diameters and large β-ratios: e.g. a gain in strength of 47% is achieved for β of 0.91 strengthened with five bolts spaced at 75 mm. The study also revealed that for large bolts' spacing, an odd number of bolts with a central one is more efficient in strengthening the CHS T-joints.

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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 dissertation has been carried out by the author in the Department of Structural Engineering, Ain Shams University, from March 2012 to October 2014.

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

Date: October 2014.

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