Ain Shams University
Faculty of Engineering
Structural Engineering Department

STRENGTH OF CONCRETE FILLED HOLLOW STEEL SECTION CONNECTIONS

A Thesis Submitted for Fulfillment of the Degree of Master of Science
In Structural Engineering

Prepared by:

Eng. Mohamed Adel Mohamed ELHabbal
Bsc. Civil Engineering (Structures)
٢٠٠٢- Ain Shams University

Supervised by:

Dr. Hassan Ahmed Osman
Professor of Steel Structures,
Faculty of Engineering,
Ain Shams University

Dr. Emam Abd-ElMoteleb Soliman
Professor of Steel Structures,
Faculty of Engineering,
Ain Shams University

Dr. Ayman Hussein Khalil
Professor of Reinforced Concrete Structures,
Faculty of Engineering,
Ain Shams University

Cairo, ٢٠٠٩

EXAMINER COMMITE

Name, Title & Affiliation

Signature

١- Prof. Dr. Mohamed Ahmed Daboan ………………………….

Professor of steel structures

Faculty of Engineering – Tanta University

٢- Prof. Dr. Adel Helmi Salem …………………………….

Professor of steel structures

Faculty of Engineering – Ain Shams University

٣- Prof. Dr. Hassan A. Osman …………………………….

Professor of steel structures

Faculty of Engineering – Ain Shams University

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When I started master studies, I thought that master studies were the results of a single person's effort. Now I realized that a master thesis is the result of a group of people working together sharing ideas, providing experience and knowledge.

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ABSTRACT

This research is concerned with the failure behavior of Hollow Steel Section Connections (HSS) and Grouted HSS connections by comparing the ultimate capacity of hollow and grouted joints for different types of connections (T-joints and KK-Joints) and different cases of loading.

In this study, Experimental Investigation on Hollow and Grouted T-joints subjected to pure vertical load is performed to investigate the ultimate capacity of each case and compare the output of the two cases, and then non-linear finite element verification is applied afterwards using ANSYS program.

Hollow and grouted T-joints subjected to vertical and horizontal loading are investigated using ANSYS program, different ratios between Vertical and Horizontal loads to study the failure modes and compare between the ultimate capacities of the hollow and grouted joints.

Afterwards, a parametric study is performed on a true scale Typical KK-joint utilized in offshore platforms, in order to investigate the behavior of hollow and grouted KK-joints and study the grout effect on the geometry parameters that usually governs the design of HSS joints.

Considering grout of joints as a modern technique of strengthening HSS joints, Comparing grouting with conventional methods of strengthening was necessary to relate this research to practical applications in the industry, so a comparison is set between grouting technique and internally ring stiffened joints and canned joints.

Key words:

Hollow Steel Sections, HSS, Grouted, Offshore Platforms, T-joints, KK-joints.

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Notations

d	Outside diameter of brace
D	Outside diameter of chord at brace intersection
e	Joint eccentricity
F_y	Characteristic yield stress of chord member
g	Gap between braces for K and YT joints
Ka	Relative length factor
M	Moment load
M_{ci}, M_{co}	Permissible in-plane and out-of-plane moment strengths
M_{di}, M_{do}	Design acting in-plane and out-of-plane moment loads
M_i, M_o	In-plane and out-of-plane moments
M_{ki}, M_{ko}	Characteristic in-plane and out-of-plane moment strengths
P, $P_{١}$, $P_{۲}$, $P_{۳}$	Axial load
P_c	Permissible axial strength
P_d	Design acting axial load
P_k	Characteristic axial strength
Q_f	Chord load factor
Q_g	Coefficient for K joints
Q_u	Strength factor for various joint and load types