

# INVESTIGATION OF MOMENT CONNECTION IN COLD FORMED HOLLOW STEEL SECTION WITH SOLID INFILL - A REVIEW

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## Abstract

*This paper presents a review of the experimental efforts also as modelling approaches to review An study into the response of members with square and rectangular hollow sections, made from cold-formed steel The paper review the investigation of the moment rotation behavior and failure deformation of bolted cold formed steel moment connections.. A different moment connections by using stiffener plates and angle sections in different positions of beam-column joint.*

*Keywords—ANSYS, cold formed steel, moment connection, tubular sections, thickness, strength.*

## I. INTRODUCTION

In steel construction basically two types of structural steel members are used. There are hot-rolled steel and cold formed steel . Cold formed steel is made by pressing or rolling gauges of sheet steel under room temperature. Cold formed steel members are widely used in bridges, buildings, storage racks, car bodies, railway coaches and agricultural equipments. Cold formed steel is thinner than hot rolled steel.

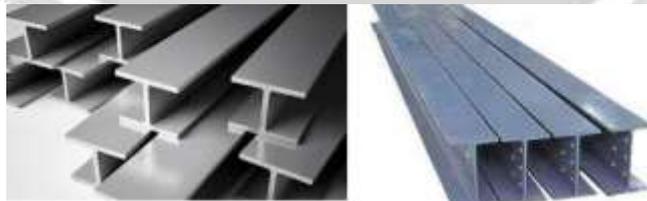


Fig.1 hot rolled section



Fig.2 cold rolled section

Cold formed steel members have strength -to- weight ratio more compared to hot-rolled steel. Cold formed steel members are easily fabricated in pre engineered buildings, because of economically transportation and easily

handling of cold –formed steel (CFS) members. Cold-formed steel members are often has wide structural applications. this sections are reduce dead load compared to constructions. cold formed steel is not susceptible to shrinkage .this material reduce site management cost and storage costs. cold formed steel members are offering durable and sustainable material. Generally in construction industry cold formed structural members are joists, studs, floor decking and built-up sections. In past two decade cold formed steel framed sections like Z and C shapes, roof purlins are practice in steel building industry.

In recent construction industry cold formed steel hollow sections simply called tubular sections are practiced in all major structural steel design standards .



Fig.3 tabular section

cold formed tubular sections are widely used as columns, beams, truss members and scaffoldings in construction industry. cold formed steel tubular members used in transport industry, agricultural equipments and highway equipments . tubular sections were offering structural efficiency and aesthetic solutions.

Connections are devices which are used to join the elements of structure together at a point such that forces can be transferred between them safely. the majority of fabrication costs are observed by the connections and choice of connection also significant influence on the speed, ease and cost of erection(1). in generally structural connections are two types i.e. shear connections and moment connections.

Moment connections are also called rigid connections. this connections carry a portion or the full moment capacity of the supported member thus preventing any end-rotation of the member. Moment connections are typically designed to also carry the shear component of the load. this connections provide continuity between the supported and supporting members. moment connections are offering Relative rotation between the supporting and supported members is negligible. The flanges of the supported member are attached to either a connection element or directly to the supporting member.

So many Literatures are available for design of moment connections in hot rolled steel sections. However less discussion about the moment connections on cold formed steel tubular sections. tubular section connections are so difficult and uneconomic compare to traditional steel connections. This paper shows better solutions for cold formed steel tubular section with moment connections.

## II. OVERVIEW OF WORK

In this research we are analyzing beam column moment connections with bolted joints. Square and rectangular tubular sections are used in this study. Total 20 Models are created in the ANSYS workbench Finite element analysis software with square columns and is connected with rectangular beam with different type of connections. The results are compared by moment rotation and load v/s deflection which indicates most suitable connection for similar loading. The results are compared by moment rotation and load v/s deflection which indicates that the beam with higher aspect ratio is more restrain than other.



Fig. 4 Sample Structure of cold form steel structure

Total 20 models are made both with rectangular and square cold formed steel hollow sections. The column beam connection is made to resist moment. Column and beam sections are connected by angle section with same material. The strong column and weak beam phenomena are considered for modelling. The length of column is taken as 1800mm and the length of the beam is taken as 1000mm. The column, beam, angle section and bolts are first built in parts and then assembled finally. M10 bolts are used as per Indian Standard IS 1364 HHB (grade A). The bolting is done with plane washer. The beam is connected at the center of the column by 4 numbers of bolts in each angle plate with a pitch distance of 40 to 60mm in the models .also , the number of bolts varies depending upon the type of bracket plate.

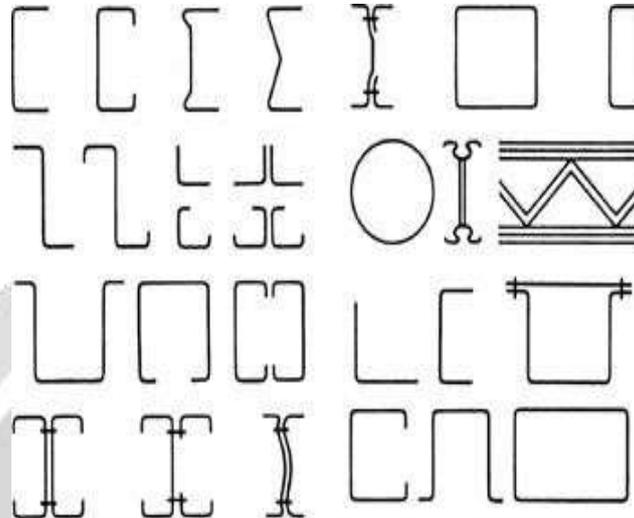


Fig.4 Various Section of cold formed steel

### III. LITERATURE REVIEW

#### **Study of hysteretic behaviors of cold-formed steel beam-columns with hollow rectangular section (2014)”**

This study examined the columns' post-buckling strength and rigidity degradation, deformation and failure modes, ductility, and energy dissipation capacity. To make full use of stable plastic development energy-dissipation capacity(the material nonlinear effect), the H/b ratio should be in range from 1.5 to 2.0

**HSS-to-HSS Seismic Moment Connection Performance and Design (2014)** In unreinforced HSS to HSS connections, increasing  $\beta$  from 0.6 to 1.0 can cause an average increase in the normalized moment capacity of 30%. A comparative study shows that reinforcing plates significantly improved the connection performance in terms of normalized moment capacity and ensure that the majority of the inelastic rotation is concentrated in the beam member.

**“Numerical modelling of lean duplex stainless-steel hollow columns of square, L-, T-, and +-shaped cross-sections under pure axial compression (2012)”** The LDSS hollow columns having equal material cross-sectional areas with thickness varying from 5 mm to 20 mm were subjected to uniform axial compression and analyzed in ABAQUS.

**M. Long shithun gpatton, konjengbam darun kumar singh** represented numerical modeling of lean duplex stainless-steel hollow columns of square, l-, t-, and  $\beta$ -shaped cross sections under pure axial compression. The LDSS hollow columns having equal material cross-sectional areas with thickness varying from 5 mm to 20 mm were subjected to uniform axial compression.

**Nayang ya'nanzhong, qing'tongmeng, haozhang** represented hysteretic behaviors of cold-formed steel beam columns with hollow rectangular section: experimental and numerical simulations. This study examined the columns' post-buckling strength and rigidity degradation, deformation and failure modes, ductility, and energy dissipation capacity

**K.f. chung a**, represented finite element investigation on the structural behavior of cold formed steel bolted connections. A finite element model with three-dimensional solid elements was made to investigate the bearing failure of cold-formed steel bolted connections under the shear in varying steel thicknesses and grades, and the clamping forces in bolt shanks, the bearing resistances of bolted connections at specific extensions with various configurations may be assessed readily Based on the results of the parametric study

**Sheng-de hu, ben ye, li-Xin li** materials properties of thick-wall cold-rolled welded tube with a rectangular or square hollow section.39 fully welded unreinforced HSS-to-HSS connections are explored through finite element analyses .In unreinforced HSS to HSS connections ,Increasing  $\beta$  from 0.6 to 1.0 can cause an average increase in the normalized moment capacity of 30%.Increasing values of  $\beta$  for the reinforced connections lead to small decreases in the moment capacity of the connection, while a  $t_b/t_c$  ratio of 0.6 is optimal in terms of maximizing the moment capacity of the reinforced connections.

**S.NarayananM.Mahendrana**: This paper describes the distortional buckling behavior of a series of innovative cold-formed steel columns. Over 15 laboratory experiments were undertaken first on these ingenious steel columns of intermediate length under axial compression. All such columns failed by distortional buckling with minimal post-buckling strength.

#### IV. NEED FOR THE PROPOSED WORK

- CFS have high strength
- Rapid mechanical work
- Light weight and easy to handle
- Predictable nature
- Non combustible
- Easy to learn

#### V. OBJECTIVE OF THE WORK

The salient objectives of the study have been identified as follows:

- TO Investigate the Moment Connections in Cold-formed Hollow Section with infill using SOLIDWORKS and ANSYS
- To find out the moment rotation behavior and failure deformation of bolted cold formed steel moment connections
- Selecting different connections and analysis for the weakest one.
- Square and rectangular tubular sections will be used in present study.
- To find out the behavior of tubular sections under various load condition.
- To provide sustainable connection details of cold formed steel tubular column beam joints

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