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Experimental Studies on Various Different Section of Cold Formed Steel Structure in Beam and Column

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Abstract—*Cold-formed steel (CFS)made by rolling or pressing steel into semi-finished or finished goods at relatively low temperatures i.e. room temperature. CFS members have been used in roof or truss member of buildings, racks, aircraft bodies, car bodies, railway coaches, transmission towers & poles etc. CFS has highest strength-to- weight ratio, layer of zinc and other metallic coating steel provides long-term durability, it is recyclable, cost savings on a number of fronts, being light in weight it is easily transportable. The main aim is to analyze the various section of CFS with correspondence to specific hot rolled section and compare their various properties like strength- to- weight ratio. It can be done by changing the orientation of element in CFS and increasing its moment of inertia value by increasing the area on flange part. The hot-rolled steel members have been recognized as the most popularly and widely used steel group. But because of its several advantages over the hot-rolled steel sections, the use of cold-formed high strength steel structural members has rapidly increased lately.However, the structural behavior of this light gauge steel members characterized by various buckling modes such as local buckling, distortional buckling, flexural torsional buckling. It is therefore important that this buckling modes should be delayed or eliminated completely in order to increase the ultimate load carrying capacity of cold-formed steel members. Open cold formed steel sections such as C,Z ,hat sections are commonly used because of their simple forming and easy connections, but they suffer from certain buckling modes due to their mono symmetric or point symmetric nature, high plate slenderness, eccentricity of shear center to centroid and low torsional rigidity. Being several advantages over hot rolled steel section up till now it is used as beam for supporting roof truss and other light weight element it is not used as main element of structure like Beam, Column or slab. Hence there is lot of scope for future research in this area.*

1. INTRODUCTION

Cold formed steel are also called light gauge steel section which are formed by steel sheet. Cold-formed sections are produced by rolling and punching flat sheet steel at room temperatures. The thickness of sheet used in CFS is usually 1 to 3 mm. Thicker material up to 12 mm are formed if pre-galvanizedmaterial are not required for the particular application. Normally, the yield strength of steel sheets used to makeCFS is 280 N/mm2, although there is a trend to use steels ofhigher strengths, and as low as 230N/mm2. Manufacturing of CFS require steel coils of 1.0 to 1.25 m width, lay them longitudinally to the appropriate widthof required section and feed them into a series of roll forms. These rolls, containing male and female dies, which are arranged in pair and move in opposite direction so that as the sheet is feed through them andshape is gradually altered to the required profile. The number of pairs of rolls depends on the complexity of the cross section shapes. At the end of the rolling stages a flying shearing machine cuts the member into desired shape. Cold-Form Steel buildings section are a predetermined assembly of structural element that has proven over time to meet a wide range of structural and aesthetic requirements. Cold-Form Steel Structure concept originated during World War II in 1960's in the United States and made available in India in late 90's. During World War II, it is known as Pre-fabricated building. Later on which became a household need and was mass produced by hundreds of thousands to meet a requirement for inexpensive and standardized shelter. Which require no special skills, these structures are assembled with only hand tools and with no greater effort could be readily dismantled and moved and re-erected somewhere else. The scientific term Cold-Form Steel buildings came into being in the 1960's. The buildings were "Cold- Form Steel" because like their ancestors, they relied upon standard engineering designs for a limited number of off the shelf configurations. As long as the purchaser standard designs the buildings could be properly called Cold-Form Steel.

Cold forming increases the yield strength of steel, it enhance the mean yields stress by 15%-30%. The increase being the consequence of cold working well into the strain-hardening range. These increases are predominant in zones where the metal is bent by folding. For purpose of design, the yield stress may be regarded as having been enhanced by a minimum of 15%. Some of the main advantages of CFS as compared with their hot-rolled counterparts are as follows:

- CFS has high strength to weight ratio.
- Being light in weight it is easily transportable.
- Pre-galvanized or pre-coating metals are formed, so that high resistance to corrosion can be achieved.

- CFS can be employed to produce any desirable shape and size.

In 1984C.C Weng **(**Compression test on cold form steel section)

He uses 93 columns to check compressive strength out of which 68 are long and 25 are short column. He finds out the flexural buckling strength of section.The stress and strainrelationship and forming all operations while checking the proportional limits and comparing the theoretical values with experimental values.

In 2004Juile Mill (self-drillings screw joint for cold form steel channel portal**)**he studied about the joints used in CFS and done testing on them. Since U.S. sections having a lower design capacity than the Australian section. However this does not mean that the same problems will occur with the conventional joints and hence he proposed self-drilling screw joints which are a valid option to overcome this problem in both countries.

In 2008 Panagiots Frantzis (Durability of cold form steel) Sincejoints are subjected to various loads in the presence of room temperature. A graphite gauge technique is developed which is used to monitor the incubation for the time of a crack to form and measure its subsequent velocity as caused of applied failure energy. Two methods are used first is durability testing ring and second is side and end projection formation was brittle in nature compared to the model not exceed 40 J/m2.

In 2009 Gillbert H.Begain (Light gauge cold formed steel profile) for decks in housing unit'ssheet metal can provide variouscomponents with the CFSto meet the various need of the construction of components at fewerprices. A new types of channel profiles has been developed and applied for building the deck of a family house this channel profile space for heating ventilating and electrical conducts designing innovative steel light gauge component thought ingenuity of the designer .the light weight bring ducts.as regards acoustics but it reduces the load on the foundation.

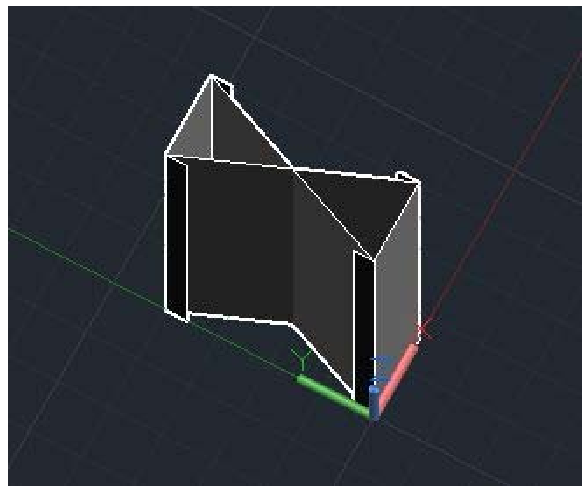
Concluding Remark on Literature Work**:** With the different studies based on the beams and columns of different CFS section increase in load carrying capacity, deflection capacity and stiffness as compare to respective hot rolled steel section.

2. RESEARCH METHODOLOGY

A forging section where punching or pressing is done comprises of die block which have two component male and female over which work piece is positioned in such a way that desired shape is obtained. Then steel sheet is feed in to die and desired shape is obtained. While forging bending is come over both the side i.e. compressive and tensile side both these forces resist the bending so the bending angle has to keep increases as compare to desired bending angle as if this is not done the residual stress which is left in material tries or let the material to regain its original shape.While bending sheet metal length isstretches. The bend deductionis the amount the sheet metal will stretch when bent as measured from the outside edges of the bend. The bend radiusrefers to the inside radius So this lead to conclusion that bending of CFS depend on material type, property and bending angle thus the bending radius depend on above conclusion.

Evaluation on strain-gauge measurements (critical load determination and post-critical behavior) for deflection angle and on factors influencing the load carrying capacity (web buckling and load application). CFS sheets of rectangular section are widely used for buildings in India.

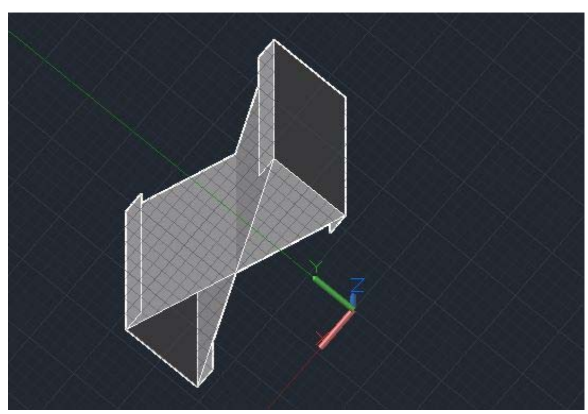
In our experiment we will take section as shown below



For column section in which lip width is 11.8mm, base and top width is 138.8mm thickness of plate used as 3mm and various other properties are as under(approximate value):-

Area	1240 mm2
Ixx	7.89*106 mm4
zzz	89.4*103 mm3
Iyy	2.36*106 mm4
Zyy	23.56*103 mm3

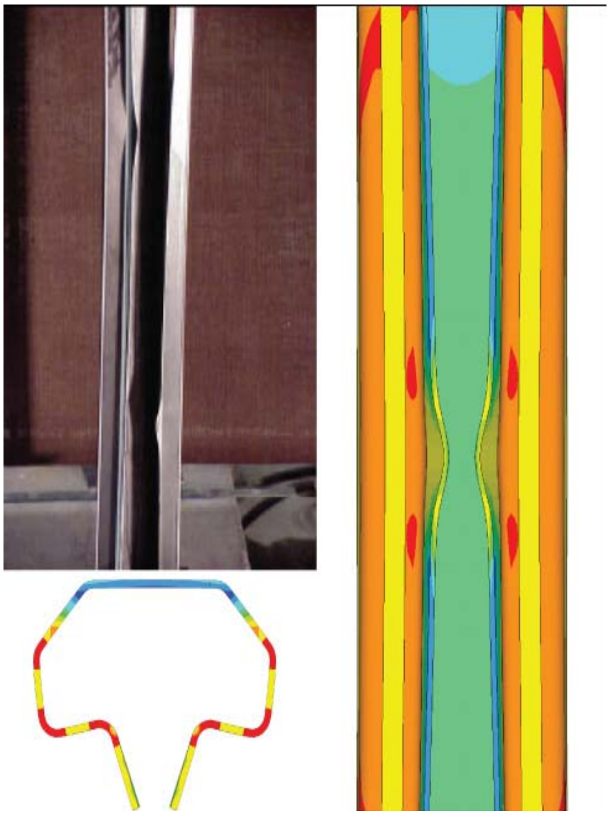
For Beam section:-



For column section in which lip width is 11.8mm, base and top width is 138.8mm thickness of plate used as 3mm and various other properties are as under(approximate value):-

Area	1240 mm2
Iyy	7.89*106 mm4
Zyy	89.4*103 mm3
Ixx	2.36*106 mm4
Zxx	23.56*103 mm3

In these two above section when loading is done buckling is shown as



Shows necking in columns when the load is applied for checking flexure strength of colums.

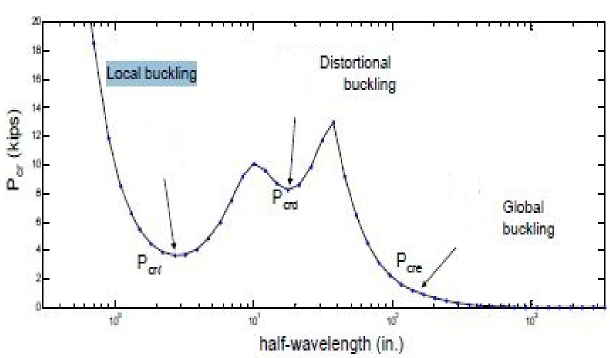


Figure shows Column elastic buckling curve generated with CUFSM

3. CONCLUSION

Open cold formed steel sections such as C,Z ,hat sections are commonly used because of their simple forming and easy connections, but they suffer from certain buckling modes due to their mono symmetric or point symmetric nature, high plate slenderness, eccentricity of shear center to centroid and low torsional rigidity. Being several advantages over hot rolled steel section up till now it is used as beam for supporting roof truss and other light weight element it is not used as main element of structure like Beam, Column or slab. Hence there is lot of scope for future research in this area.\

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