International Journal of Advanced Research Methodology in Engineering & Technology, ISSN 2456-6446
Volume 1, Issue 5, December 2017

# *A General Study of Light Gauge Steel Structures – A Review*

*S.Vigneshkannan*[1]
[1]*PG Student*: dept. of Civil Engineering
K.S.Rangasamy College of Technology
Tiruchengode, India
vignesh29kannan11@gmail.com

*J.Abdul Bari*[2]
*Assistant Professor*: dept. of Civil Engineering
K.S.Rangasamy College of Technology
Tiruchengode, India
ursabdul@gmail.com

*P.Easwaran*[3]
*Assistant Professor*: dept. of Civil Engineering
K.S.Rangasamy College of Technology
Tiruchengode, India
ereaswarance06@gmail.com

***Abstract*—In general, Cold-Formed Steel (CFS) sections are widely used in worldwide industrial building component construction. Because of adopting CFS, more advantages overcome in Hot Rolled Steel (HRS) Sections. The present work deals with the various CFS sections have been applicable in special features like, high fire resistance, minimum local buckling, high flexural strength, adequate seismic response and bracing performance. Especially, the CFS hollow sections are have a high loading rates and applicable of infill material (geopolymer concrete) bring best result in joints in building elements. The different characters are specified applicable in various building parts such as main walls, shear wall panels, tension member, compression members and roof elements etc., Finally CFS sections performing under good condition for finite element analysis were studied.**

***Keywords*— *Cold-formed steel, Hot Rolled steel, shear wall panel*.**

## I. INTRODUCTION

The light gauge steel members are defined as structural member cold formed to shapes in cold-rolling machines or press brakes or bending brake operations from carbon or low-alloy steel sheets or strips or flats. The thickness of such members usually range from 0.378mm to about 6.35mm, even though steel plates as thick as 25.4mm may be cold formed into structural shapes. These thin steel sections are called cold formed as their manufacturing process of forming steel sections remains in a cold state (i.e., heat is not applied). These are also known as cold rolled steel sections against hot rolled sections.

In order to provide very satisfactory protection against corrosion in internal environments, zinc coating (i.e., galvanizing) is applied. The usual standard for internal environments is to provide a coating of 275gm per square meter. It results in 0.04mm zinc coating.

The steel sheets or strips used for light gauge steel members conform to IS:1079-1973 is 232 N/mm$^2$ and the ultimate strength is 390 N/mm$^2$ . (Ramachadra and Gehlot, 2013)

## II. PROPERTIES OF LIGHT GAUGE STEEL SECTIONS

From the structural point of view, properties of materials (e.g., yield point or yield strength, tensile strength, stress-strain relationship, modulus of elasticity, tangent modulus and shear modulus, ductility, weld ability and fatigue strength) are the special things. In addition to formability and toughness are also important properties for cold formed steel members. The properties of light gauge steel section as shown in below Table 1

Table 1 Properties of the Light Gauge Section

| | |
|---|---|
| Density | 7850 kg/mm$^3$ |
| Modulus of Elasticity | 2 × 105 N/mm$^2$ |
| Poisson's Ratio | 0.3 |
| Modulus of Rigidity | 76900 N/mm$^2$ |

### *A) Advantages of light gauge steel sections*

Cold formed members have advantages being (i) light (ii) high strength and stiffness (iii) easy of pre-fabrication and mass production (iv) fast and easy erection and installation and (v) economy in transportation and handling. (Ramachadra and Gehlot, 2013)

## III. REVIEW OF LITERATURE

Ajeet sharma et al. (2016) was investigated the torsional strength of lipped and without lipped channel sections were

designed. strength of depth and stiffness of the beam are increased. Failure of the entire beam was occurred by local buckling of the top flange. Both theoretical and numerical can be obtained in their angle of twisted. Physical properties and fabrication process of back to back channel section to be determined. The graph plotted between load and strain then the buckled section to be monitored from with a help of strain gauge and proving ring.

Jayaram et al. (2015) to be determined the result can explained in Working Stress Method, the built-up channel section for their load carrying capacity, moment resistance and deflection were lower than the Limit State Method. Also compared to the Euro code, higher value of the load carrying capacity, lower value of the moment resistance and lesser value of deflection. There are no changes in slenderness ratio and allowable stress for all codal provisions. From the observation limit state methods (SI method) was the best in compared to among all other two methods.

Syed Mohammad et al. (2015) presented the taken samples are got a high strength and stiffness value. That can be satisfactory in both structurally and economically. From the comparative statement of theoretical and actual capacity results. Instead of hot-rolled section to adopted cold-formed steel section with lesser amount of steel can be used along with satisfying the economic in good stage of construction projects.

Kulkarni et al. (2014) was studied by the laterally supported beam, from the studies used in various spans according to load carrying capacity obtained. The graph shows the results in reverse parabolic curve. Design concept basis IS code are economical than the BS code. If the laterally unsupported beam, graph result shows IS code are higher for short span beams and BS code are higher for long span beam. Design concept basis BS code are economical for only smaller section in large span.

Kakade et al. (2014) can be examined in the IS:801-1975 represents Working Stress Method. So, it will not clearly mention their cross section. But IS:800-2007, can be clearly mention their cross section and fully revised to limit state method in S.I units. Comparative to Load and Resistance Factored Design Method and other two methods among it will bring higher values in load carrying capacity. So, I.S method is the best.

Vinayak N. Kaling et al.(2015) were investigated from the FEM analysis,results shows that failure occurred by buckling of bottom flange and experimental anlaysis,failure found by torsional portion of the beam. With the help of gusset plate anf column flange to observed the bearing and flexure failure. The FEM Modal factor permissible limit was derived from this investigation.

Tatiana Nazmeeva (2014) evaluated the failure beginning formed the member starts with global buckling to local buckling was developed in nature. Thus the elastic curve were travel along the length of the member. During the load applied to long member becomes web crippling takes place. With the help of coefficient of reduction used to derived the C-shaped profile created. Slenderness ratio should not exceed 150mm cross sectional height profile.

Hancock (2016) determined for the majorly focused the area of Direct Strength Method of design to followd in around the foreign countries such as North American Specification and NZS 4600.Wide commonly concentrate the fire against concept and shear walls against seismic conditions. New specifications are incorporated to edited the N AS:S100 and AS/NZS 4600.Simply cared about safely construct the shear wall under the seismic zone will be considered.

Prakash M. Mohite , Aakash C. Karoo (2015) was experimentally done the lipped channel section were designed, selected to CUFSM analysis and flexural strength found in various lip depth by the method of Direct Strength Method. Different cross sectional channels were obtained by corresponding load factor. Direct Strength Method helps to experimental analysis result are in appropriately. As per IS.801-1975 codal provision bring the reference for flexural strength to be compared it experimentally.

Ashish Timande , Awachat (2015) was analyzed the most widely common in all industrial buildings adopted in cold-formed steel section as a building components. So, greatly to minimize the cost and material usage and very important deals with customer to save in material and cost about 25% to 30% in total estimated cost of building construction.

Anthony Ariyanayagam et al. (2014) Objective of studied this paper, clear to mention the details of numerical modeling of Light gauge Steel Frame(LSF) walls configuration to realistic design fires. The test results obtained from the steady and transient state analysis. To observed the performance of load bearing LSF walls under real fire conditions and their rating. From the graphical representation was measured by the fire rating.

Desai, Shiyekar (2014) was studied, that explained the performance of elastic and plastic deformation of the taken built-up I section. In different H/t ratio and corresponding failure zone observed. The H/t ratio is lower means large elastic strength while H/t ratio is high the limit strength to elastic strength gets downward direction shows in graph.

Sudha et.al (2014) were examined all kind of mode of failures such as bearing, local, distorsional and flexural patterns to be combined available in tested specimen. Bearing failure occurred in top chord of member. In combined local and distorsional buckling occurred in compression chord. Wobbling effect was developed in sine wave obtained. The unequal flange I-section is 40% lesser than the equal flange I-section.

Shanmuga Priya (2014) investigated the rectangular tubular column has a form of hollow section, with PCC in-filled and SFRC in-filled. This are subjected to axial, uni-axial and bi-axial load applied in above mentioned three type of columns. The analysis of behavior of columns are performed by non-linear finite element analysis. Deflection can be obtained from both numerically and experimentally as same value.

Alia O. M. Ahmed, Nigel D. P. Barltrop (2017) explained in generally the light gauge steel structure will be good performed by under seismic response recommendation. Seismic forces such as horizontal forces or earthquake action are very important point while during the investigation can be done. The steel portal frame subjected to lateral loading had been tested. Slender steel can be adopted framing of portal without using shear panels, Thus the results to be proved by under the absorbing energy due to adequate ductility.

Swetha , Eapen Sakaria (2015) determined the characteristic of FlyAsh concrete increasing their load carrying capacity, ductility and ultimate strain. The failure occurred in outward folding of member at bottom of column. In the various thickness of samples of steel sections were tested by usually to get a strength about 10 to 20%. Thus the cement replacement up to 40% due to economic and environment impact reduced. Both experimental and theoretical ultimate load was same value obtained. If the reduce the steel section of size to get a more load carrying capacity.

Sreedhar Kalavagunta (2013) compared to the taken total 27 lipped channel sections were subjected to axial compression loaded at both ends. The aim of this approach developed in comparison of testing the samples were to the DSM in AISI and EWM in BS5950-5specfication to be done. The result shows that the experimental for both methods values are very near to closer.

Padma Priya (2015) studied from analysis the behavior of cold-formed steel in single and double angle were subjected to tension. The steel member cross sectional area is high means simultaneously load carrying capacity also high. To make that rigidity to the member in allocated more number of bolts. Shear lag effect develops in outstanding leg. Both case of angles were failure occurred at net section fracture. The maximum amount of stress occurred at inner most of bolts were found by experimentally and stress distribution also obtained.

Chayanon Hansapinyo (2015) evaluated the totally 12 no of physical concentric loading and 72 non-linear analysis were obtained from buckling behavior with various column thickness adopted. The 3 different types of columns are used in short, intermediate long and long column. The short, intermediate long and long column are occurred in buckling pattern in to local, combined local and distorsional and overall local buckling are respectively.

Cameron B. Ritchie et al. (2017) investigated broadly used in hollow steel section around the modern world applicable to various building components were preferred by design engineer choice. Initially, member carrying highly dynamic loading then after applied to impact or blast loading. The member behavior, characteristic material and analysis process were studied.

## IV CONCLUSION

The general information of light gauge steel section, property and advantages are discussed in the review paper. In different features can be obey for light gauge steel sections and various aspects to analysis (i.e., Finite Element Linear and Non-linear analysis) were studied. Finally, cold formed steel sections are good performing in world wide. To safe our building, our life, our environment, our society, our future generation and our globe.

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