ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

EXPERIMENTAL STUDY ON FLEXURAL BEHAVIOR OF COLD FORMED HAT SECTION SUBJECTED TO TWO POINT LOADING

[1]S. Mohamed arshath, [2]A.Kanaga, [3]Dr.G.Vani

[1&2] UG Student, Department of Civil engineering, M.A.M College of Engineering & Technology, Trichy.

[3]Associate Professor, Department of Civil engineering, M.A.M College of Engineering & Technology, Trichy.

ABSTRACT--Thin walled cold formed steel members have wide applications in building structures, industries, etc. Cold formed steel has been used as the primary structure for flexural and compression members due to variety of advantages such as high strength to weight ratio (h/w), high corrosion resistance and ease of fabrication. The objective of this paper is to study the flexural behavior of cold formed hat section for various thicknesses such as 1 mm, 1.2 mm and 1.6 mm. The CFS material property has been tested by conducting tensile test for various thicknesses and the properties such as yield strength, ultimate strength and percentage of elongation are obtained. The flexural members are fabricated using press brake process and the parameters are in the range as given: b/t varies from 62.5 to 100 and b/d is 2 for the entire specimens. The specimens are subjected to two points loading with simply supported boundary condition. The predominant buckling behaviors of the flexural members are observed visually and the load –deformation behavior are also obtained. The behavior and the ultimate load carrying capacity of the members are compared for various parameters.

Key Words: Buckling, Cold formed steel, Flexural behavior, Two point loading, and Ultimate strength.

1. INTRODUCTION

Cold formed steel sections or light gauge steel sections are widely used in residential building and in factories that require large spaces. In many cases, the cold formed steel columns are used as a fire-resistant. Light gauge steel sections are cold formed into rolls by rolling the material in cold condition and bending them to steel sheets or strips in press brakes, cold rolling being used for mass production while press brakes are used for economical production of small quantities of special shapes.

In the construction industry both structural and non-structural elements are created from thin gauge steel sheet. Their manufacturing process involves forming steel sections in cold state (without application of heat) from steel sheets of uniform thickness. The thickness of steel sheets used in cold formed construction is usually 1 to 3 mm. Many literatures have been studied before analyzing this project.

- V.Jaya sheela et al., (May 2015) In this paper investigation of built up Hat section is analyzed by using ANSYS software.
- L.Krishnan et al., (May 2015) In this paper built up Hat section with triangular web at varying depth is

investigated for determining its flexural behavior.

- A.Jayaraman et al., (June 2015) In this paper various types of cold formed steel members are used and designs of those sections are compared for both EUROCODE and IS CODE.

In this paper single hat section without any built up members of varying thickness will be used for analyzing its flexural behavior.

In compression, cold formed open cross- section can exhibit three modes of instabilities: local, distortional and flexural or flexural- torsional buckling.

Cold formed steel members are more economical due to their high strength to weight ratio. As a result, they have become very popular in the construction of industrial, commercial and agricultural building

The design is governed by IS 800-2007, 801-1975 and 811-1987.

2. EXPERIMENTAL SET UP

Figure 1 Specimen before testing

Figure 2 Experimental setup

3. TENSILE COUPON TEST

The most common testing machine used in tensile testing is the universal testing machine (UTM). This type of machine has two crossheads, one is adjusted for the length of the specimen and the other is driven to apply tension to the test specimen. The strain measurements are most commonly measured with an extensometer, but strain gauges are also frequently used on small test specimen or when Poisson's ratio is being measured. Alignment of the test specimen in the testing machine is critical, because if the specimen is misaligned, either at an angle or offset to one side, the machine will exert a bending force on the specimen. So, provide punches on both sides it acts as grips on the specimen. The shape and dimensions as per recommendation of IS 1608(part I) [3]. Thicknesses of the specimens are 1.0mm, 1.2mm and 1.6mm and their values of Young modulus and yield stress are about 2 x N/ and 215 N/ .

4. METHODOLOGY

This experimental work was carried out by conducting flexural tests on 3 specimens of hat section having length 750mm with simply supported end condition. The test program consisted of three specimens with same cross sections and

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

varying thickness 1.0mm, 1.2mm and 1.6mm. The data acquisition system with load cell and analogue dial gauge.

Table 1 dimensions of specimen

Parameter	Dimension (mm)
Thickness	1.0, 1.2 & 1.6
Length	750
Compression Flange	100
Web	50
Tension Flange	25
CFHATTK10T1	Cold formed hat section thickness 1.0mm
CFHATTK12T1	Cold formed hat section thickness 1.2mm
CFHATTK16T1	Cold formed hat section thickness 1.6mm

5. RESULT AND DISCUSSION

FLEXURAL TEST

All the specimen are tested for flexural strength under two point by using two point loading arrangement in 100T UTM machine. Deflection readings from the load cell are listed below.

Table 2 Flexure Test Result

Specimen	b/t	Ultimate load in kN	Maximum deflection(mm)
CFHATTK10T1	100.00	5.65	34.70
CFHATTK12T1	83.33	7.00	26.80
CFHATTK16T1	62.50	12.50	17.00

LOAD VS DEFLECTION PLOTS

FLEXURAL CAPACITY

By Comparing the flexural test results as shown in Table 3, it is observed that the section with thickness 1.6mm has 44% higher ultimate load carrying capacity than the other specimens with lesser thickness.

The Table 3 and Figure 3 clearly show that the influence of aspect ratio increases the ultimate load.

Table 3 Flexural Capacity of section

Specimen	b/t	Ultimate load in kN	Maximum deflection (mm)	% increase in ultimate load
CFHATTK10T1	100.00	5.65	34.70	-
CFHATTK12T1	83.33	7.00	26.80	23.89
CFHATTK16T1	62.50	12.50	17.00	44.00

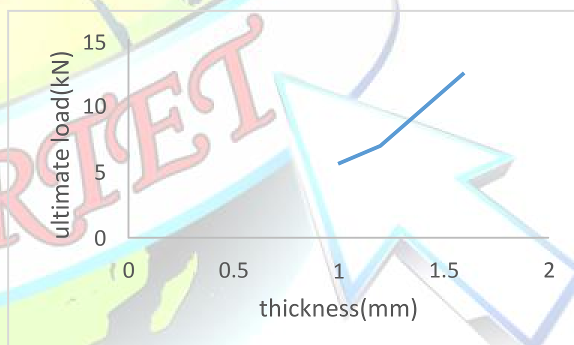

Figure 3 Flexural Capacity

Load and central lateral deflection is observed from UTM. Analog deflection gauge is used to measure the deflection for the specimen at L/ from the span length (i.e. under the point load). Figure 5, 6 & 7 shows the load vs. deflection curve

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

from the experimental results

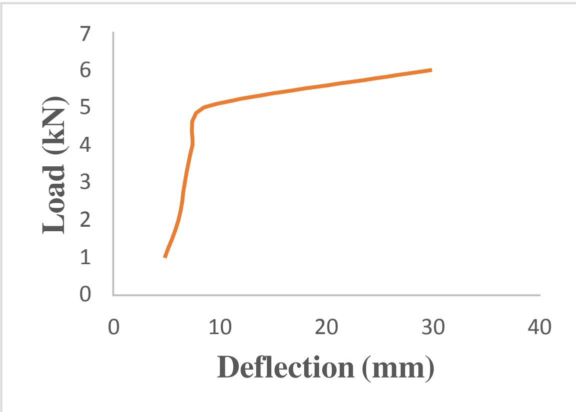

Figure5 load vs. Deflection of CFHATTK10T1

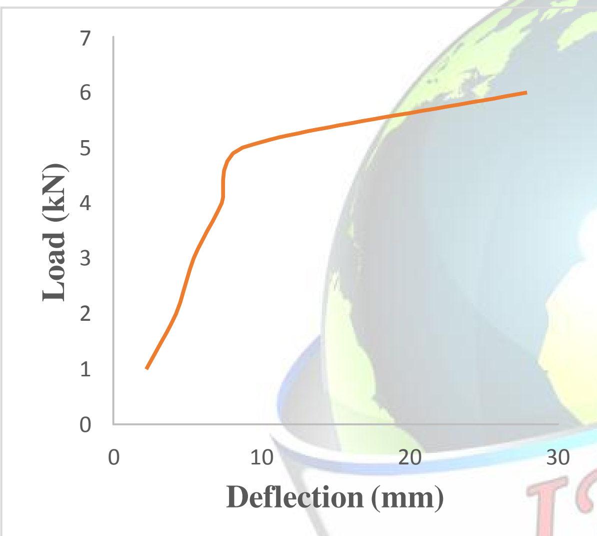

Figure 6 load vs. Deflection of CFHATTK12T1

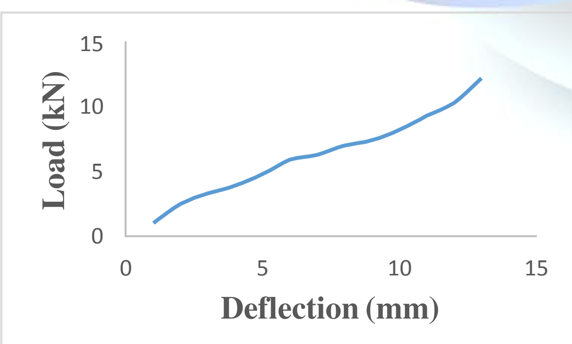

Figure 7 load vs. Deflection of CFHATTK16T1

MODES OF FAILURE

Figure 8 Specimens after flexural test

Figure 9 Specimens after flexural test

- Local buckling occurs at the compression flange under point loading.
- Central deflection occurs at the mid span of the entire specimen.
- Central deflection of the specimen CFHATTK10T1 is more when compared to the other specimens while testing.
- Failure pattern differs as the thickness of the specimen increases. Initially at lower thickness, the intensity of local buckling is high. Further increase in thickness causes lower intensity of local buckling.

ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 2, March 2016

6. CONCLUSION

- Failure modes of the specimen vary as the (b/t) ratio varies i.e. reduction in ratio causes reduction in deflection.
- Ultimate moment carrying capacity increases with increase in thickness of the specimen.
- Experimental results show that the failure of the section occurs mainly due to the buckling of flange plates and central lateral deflection.
- Decrease in (b/t) ratio will increase the load carrying capacity of the specimen.

REFERENCES

1. "Design of Steel Structures" by P.C.PUNMIA

2. https://en.wikipedia.org/wiki/cold-formedsteel

3. IS 800-2007, IS 801-1975 & IS 811-1987.

4. Jayaraman. A, S. Athibaranan & A. Mohan raj, June 2015. "Flexural behavior of light gauge cold formed members comparison of IS code and EURO code".

5. Jaya sheela.V, R.Vijayasarathy & B.Jose Ravindraraj, May2015. "Experimental study on behaviour of stiffened cold formed Steel built up hat section under flexure by varying the depth by Finite element analysis".

6. Krishnan. L, C.S. Dinesh raj & S. Prema, April 2015. "Experimental Investigation of Cold-Formed Steel Section-Flexural Member with Triangular Web"

7. Sivaprakash.V & K.Prasad Babu, April 2015 "Flexural Behaviour of Cold Formed Steel I-Beam Section with Different Corrugated Profile Sheet as Web".