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 AND ANALYTICAL INVESTIGATION OF BUCKLING BEHAVIOR OF CHS

S.Naveenraj B.E (M.E)
Department of civil Engineering
MAM College of Engineering & Tech
Trichy
naveenrajce@gmail.com

Mr.S.Parthiban M.E, Assistant professor
Department of civil engineering
MAM College of Engineering & Tech
Trichy
parthi799@gmail.com

Abstract*---Circular hollow sections are widely used in many of the construction works. It has many advantages of using this in buildings. The main thing for using circular hollow section is ease of carrying, placing and has higher load carrying capacity. But it has some disadvantages too, i.e it undergoes buckling failure due to the application of over load. The mainaim of this project is to analyze the capacity of steel circular hollow section tubes subjected to bending.The section used here was hot rolled welded sections.The three types of varying sections are used here. The length of the section used is 500, 550 and 600mm. The tubular steel section undergoes two types of buckling one is global and another one islocal buckling. This project presents a design method for evaluating the capacity of steel circular hollow section subjected to bending. The theoretical design calculation was done with the reference of IS 806-1957. The column used is long column. Buckling occurs mainly in Long column. The load carrying capacity of the section is calculated both theoretically and experimentally. The load deflection curve is plotted. Then comparison of theoretical and experimental load carrying capacity is done.

Key words — Circular hollow sections, buckling, global.

I. INTRODUCTION

Tubular steel structures are widely used in engineering components where light weight is required to carry prescribed loads. Due to their small wall thickness, they may be prone to local buckling failure. In this paper buckling behavior of CHS ofvarying length sections will be done experimentally by applying compressive load in UTM. Buckling is the common failure which occurs in tubular and open steel sections due to over load. Buckling depends on the thickness, length and load carrying capacity of the section. So In this project circular hollow section of three varying lengths are undergone compressive load for determining its buckling value.

A. *Buckling behavior*

Buckling is one of the common failures which occur mainly in tubular structures due to over loading 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

eccentric load. There are two types of buckling for tubular hollow sections,

- Elephant buckling
- Local buckling

B. Properties of circular hollow section

- High compressive strength
- Ease of use
- Placing and transporting is easy

II. DESIGNATION OF CIRCULAR HOLLOW SECTION

The section used is a circular hollow section (CHS), with varying lengths

They are,

CHS 1 = 500 mm

CHS 2 = 550 mm

CHS 3 = 600 mm

Type = circular hollow section

Diameter = 87mm

Area = 1032.89mm²

Moment of inertia =90.05mm⁴

Section modulus = 20.59mm³

Radius of gyration = 2.94mm

Length = 500,550,600mm

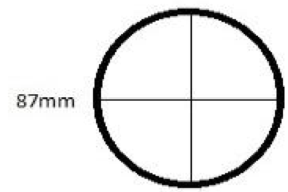

Figure 1 Circular hollow section designation

III. DESIGN CALCULATION AS PER 1161-1998

Theoretical calculation Will be done with the reference IS 1161-1998. Calculation is done for determining its properties of the section. Then also to find out the load carrying nature of the section. Experimental and theoretical values are compared later.The values obtained from design calculation is presented in Table 1.

Table 1

Design values as per IS 1161-1998

Section type	Length (mm)	Diameter (mm)	Slenderness Ratio (l/r)	Load (kN)
CHS 1	500	87	170	190.20
CHS 2	550	87	187	192.32
CHS 3	600	87	204	196.40

IV. EXPERIMENTAL INVESTIGATION

The buckling behavior of circular hollow section was experimentally done in UTM. The section are tested in normal condition. Generally short column does not undergo 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

behavior because of its shorter length. Long column only undergoes buckling failure. The elephant buckling behavior of circular hollow section is shown in Figure 2.

Buckling behavior of CHS

Figure 2 experimental buckling behavior image of the section

V. EXPERIMENTAL PROCEDURE

The circular hollow column of three varying lengths will be used in this project for determining buckling behavior of each section. The section of varying length such as 500,550 and 600 mm are placed in UTM for giving compressive strength for the column. The column is considered as fixed column by placing plates on both sides. The load values are noted on the digital monitor in UTM. Deflectometeris attached with the column to determine the deflection. Then the load deflection curve is shown in Figure 3.

Experimental evaluation for load and deflection

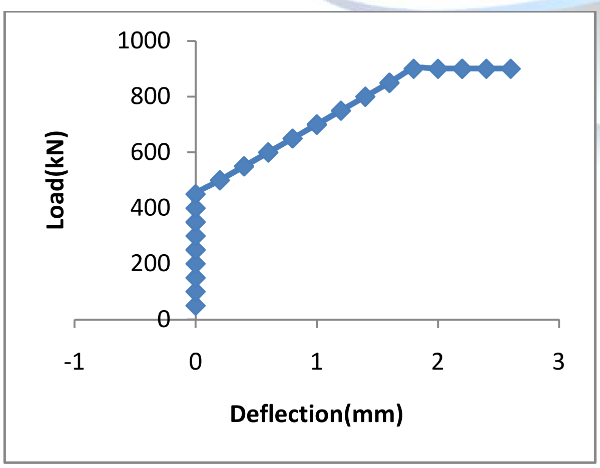

Figure 3 Experimental load Vs Deflection

VI. RESULTS AND DISCUSSION

The experimental results were obtained successfully. It was clearly identified that experimental load carrying capacity is maximum than theoretical values. Experimentally buckling behavior of circular hollow section will be determined and the result obtained is elephant buckling. The values obtained from theoretical and experimental was compared. Comparing results were shown below. The result obtained from experimental investigation will be presented in Table 2.

Table 2

Comparison of theoretical and experimental loads

specimen	Length of specimen (mm)	Theoretical values(KN)	Experimental Values(KN)
CHS 1	500	190.20	193.62
CHS 2	550	192.32	195.45
CHS 3	600	196.4	197.22

VII. CONCLUSION

From this experimental investigation the buckling behavior of circular hollow section of varying length will be identified. The buckling failure obtained is elephant buckling which is shown in above image. Main cause for buckling of section is over loading then by comparing the values of theoretical and experimental it has been identified that experimental load carrying capacity of the section is higher.

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

REFERENCES

[1] Hollaway LC, Cadei J. Progress in the technique of upgrading metallic structures with advanced polymer composites. ProgStructEng Mater 2002;4(2):131–48.

[2] Miller TC, Chajes MJ, Mertz DR, Hastings JN. Strengthening of a steel bridge girder using CFRP plates. J Bridge Eng 2001;6(6):514–22.

[3] Teng JG, Chen JF, Smith ST, Lam L. FRP-strengthened RC structures. West Sussex: John Wiley and Sons Ltd; 2002.

[4] Zhao X-L, Zhang L. State-of-the-art review on FRP strengthened steel structures. EngStruct2007;29(8):1808–23.

[5] Zhao X-L. Thin-walled structure: special issue—FRP strengthened metallic structures. Thin Walled Struct 2009;47(10):1019.