Buckling Modes and Load Carrying Capacity of Cold Formed Steel Section in Compression for Different Length

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***Abstract*- CFS Section is widely used in structural system. As we know that the CFS is light gauge steel section. Also cold formed steel sections are economic due to its low weight than the hot rolled section. There is need of checking buckling behavior of cold formed section. So, economic section can develop by considering these different conditions. For this study buckling mode is observed for different length by keeping section thickness and cross section constant. Also the load carrying capacity is calculated by using abaqus software for different length of section.**

Index terms- CFS, Compression, Load carrying capacity, Folded Flange, Buckling Mode, Abaqus, etc.

I. INTRODUCTION

There is main difficulty in design of cold formed steel which prevention of buckling of section. The Buckling is occurs due to its low thickness to weight ratio. The Buckling is major design consideration to developing economical section. There are different factors in buckling of compression section. The main factor is slenderness ratio. Also buckling is occurs due to eccentricity, material type, and its end conditions. So at time of developing the section these all parameter should be in consideration. For this software analysis should be in consideration to get good results. Finite element analysis is done in this study by using abaqus.

1.1 Analytical Work

Abaqus Software is used as finite element software to check buckling behavior and load carrying capacity of section for different length. In this entire analysis the length of section is kept as 0.5m, 1.0m, 1.25m, 1.5m, 1.75m and thickness of section is kept constant as 1.6 mm. For this analysis Prototype is developed same as per Fig.1. The dimensions of section are as per Table No.1.

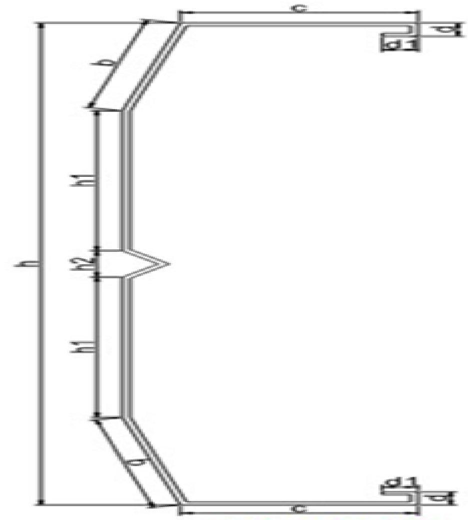

Fig.1-Prototype

As per Table.1, same dimensions are used at time of modeling in Abaqus. The buckling Behaviour of section is observed under compression. For analysis the end condition is taken as one end hinged and one end fixed. The uniform downward load is applied to the section and buckling modes are observed. The load carrying capacity of section is observed from the Abaqus and is noted. This results as shown in Table.2.The mesh size 25x25mm is used for finite element analysis. After analysis buckling behavior of the section is identified.

Table No.1

SECTION TYPE	h	h1	h2	b	c	d	d1	θ1	θ2	θn1	θn2
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(deg)	(deg)	(deg)	(deg)
A	250	60	30	51.45	110	20	-	103	90	135	135

1.2 Different Buckling Modes:

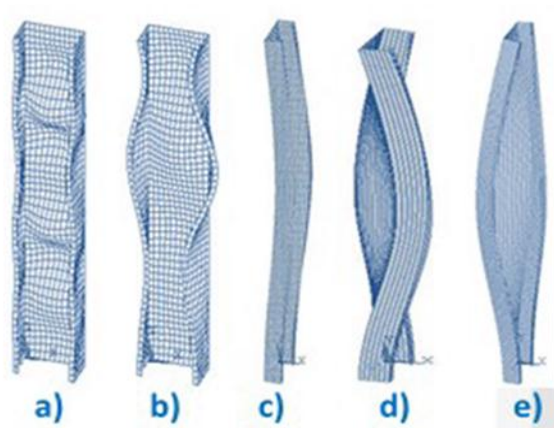

Fig.2 –Buckling Modes of Lipped Section

As per theoretical study, there are different buckling modes which are as per Fig.2. The type (a) is Local Buckling, type (b) Distortional buckling, type(c) Flexural buckling, type (d)Torsional buckling, type(e) Flexural-Torsional buckling.

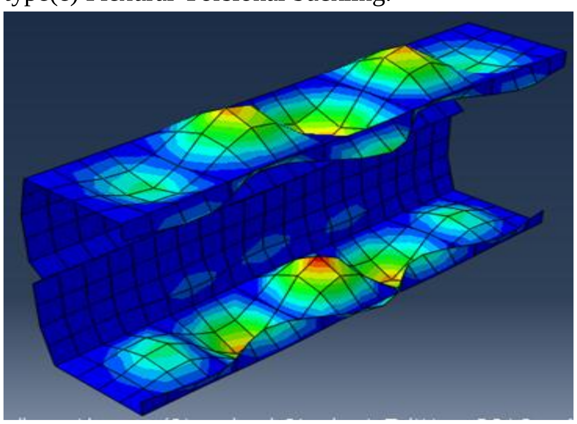

Fig.3 – Buckling of 0.5m CFS Section

From Fig.3 it shows that, 0.5m CFS section having Local buckling failure. The flange gets buckled due to compression load. It occurs at low stress area of the section.

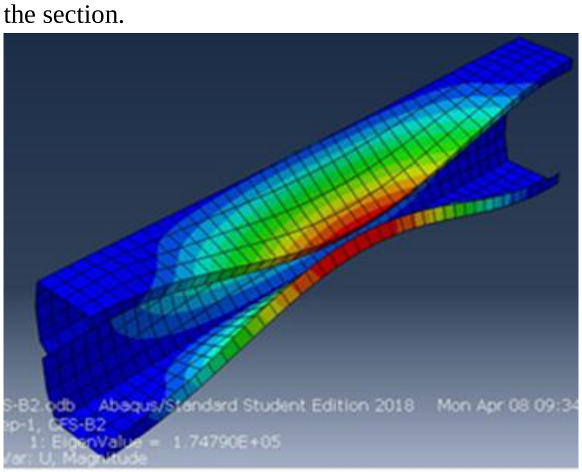

Fig.4 – Buckling of 1.0m CFS Section

From Fig.4 it shows that, 1.0m CFS section having both local buckling and distortional buckling failure. The flange gets buckled or deflected towards inside of section due to compression load.

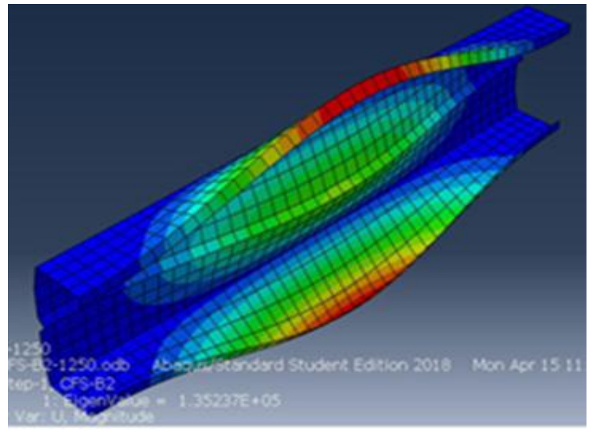

Fig.5 – Buckling of 1.25m CFS Section

From Fig.5&6 it shows that, 1.25m & 1.5m CFS sections are having both Distortional buckling and Flexural buckling failure. The flange gets buckled or deflected towards outside of section due to compression load.

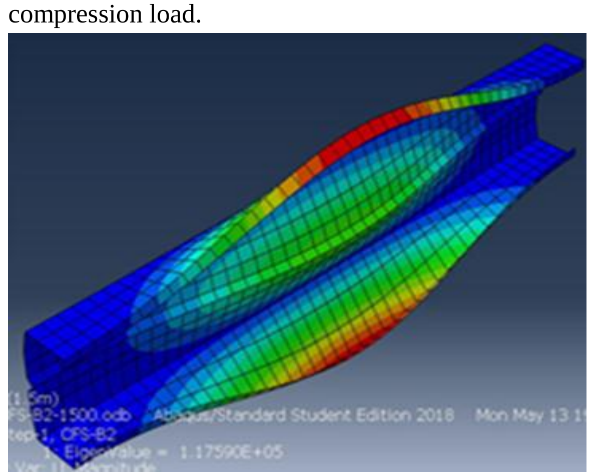

Fig.6 – Buckling of 1.5m CFS Section

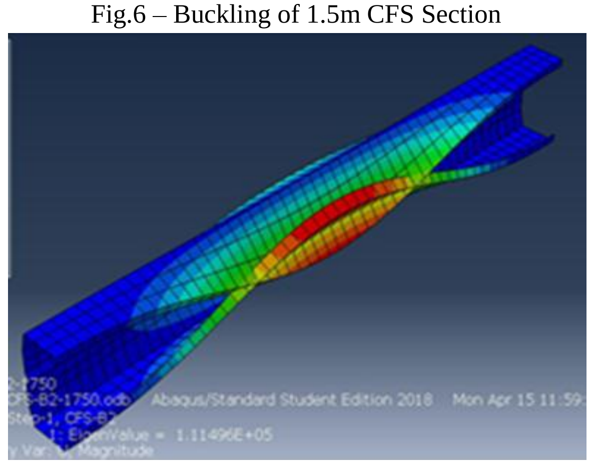

Fig.7 –Buckling of 1.75m CFS Section

From Fig.7 it shows that, 1.75m CFS section having Flexural-Torsional buckling failure. The flange gets buckled due to compression load. It occurs at low stress area of the section. The flange gets buckled and twisted due to compression load at center of section.

II.RESULT

The analysis of selected section is carried out by using Abaqus. These results are for section height 0.5m,1m,1.25m,1.5m,1.75m and thickness kept same as 1.6 mm. The results of analytical work are shown as follow. The load carrying capacity of section is observed by analysis of section. It is observed that buckling behavior changed by increasing section height. Also load carrying capacity of section in decreases by increasing section height. The results load carrying capacity of section is noted in below Table No.2.

Table No.2

Section Type	Ht. of Section(m)	Load Carrying Capacity(KN)	Sectional Weight.(Kg)
A	0.50	192.10	3.20
	1.00	174.6	6.5
	1.25	148.5	8.1
	1.50	135.2	9.7
	1.75	111.4	11.4

III.CONCLUSION

The analytical work was carried out for selected specimen with different length. The buckling behavior and load carrying capacity are identified by using Abaqus.

1. The intermediate stiffener gives high load carrying capacity of the section.
2. From analysis it shows that, Buckling is occurs at low stress due to compression action of section.
3. If length of section is increased then buckling behavior is changed.
4. By increasing height of section load carrying capacity of section is reduced due to slenderness effect.

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