Analytical and Experimental Study of Cold Formed Steel Section in Compression

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Abstract- **Cold Formed Steel Section is generally light gauge steel. The cold formed steel sections are widely used in structure because of its economy, ease of fabrication and its material availability. Fabrication and experimental setup is made to find load carrying capacity of section. For the test, length of member taken as 0.5m and thickness kept as 1.6mm of the section. For finite element analysis Abaqus Software is used. For software validation test is carried out on Universal testing machine.**

Index terms- Cold formed Channel Section, Compression, Load carrying capacity of Section, UTM, Folded Flange, etc

I. INTRODUCTION

There are mainly two types of structural steel members. Hot rolled steel and cold formed steel are the types of structural steel. There making process is in their name as hot and cold state. Hot rolled steel sections are made up in hot state of section. And on other hand cold formed sections are made up of cold state by using pressing and bending of the section. There are different buckling modes are occurred in cold formed steel section analysis. The local buckling, local-distortional buckling and overall buckling of section is occurs. For developing the new section we can make different shape of section by using various thickness of plate. As the cold formed steel is economical so there should be one aim as making different shape with high load carrying capacity.

1.1 Analytical Work

For Finite element analysis, Abaqus Software is used to get proper result. In this analysis length of member taken as 0.5 m and thickness of member is taken as 1.6 mm. As per Fig.1, Prototype is prepared. And sectional dimensions are finalized which is in Table No.1.
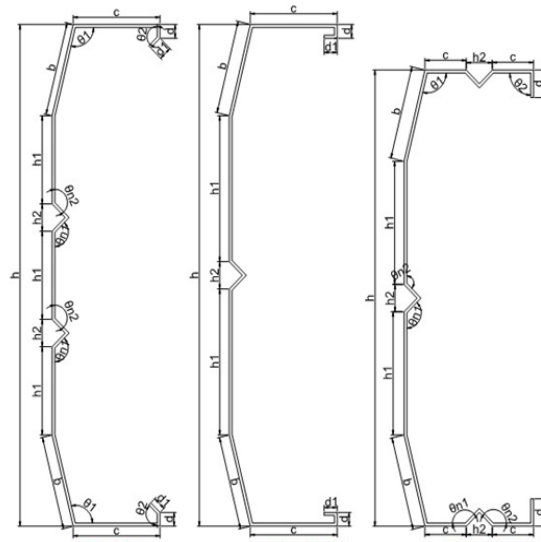

Fig.1-Prototype

As per below table, all dimensions are used in modeling of section in Abaqus. The folded flange is modeled and results are taken. Also Behaviour of section under compression is also checked out. At time of analysis all dimensions are finalized and then all parameters are defined in Abaqus. The one end hinged and one end fixed condition is applied. Also for compression axial uniform load is applied to the section and results are taken out. The load carrying capacity of section is identified in this analysis which is shown in result table.

Table No.1

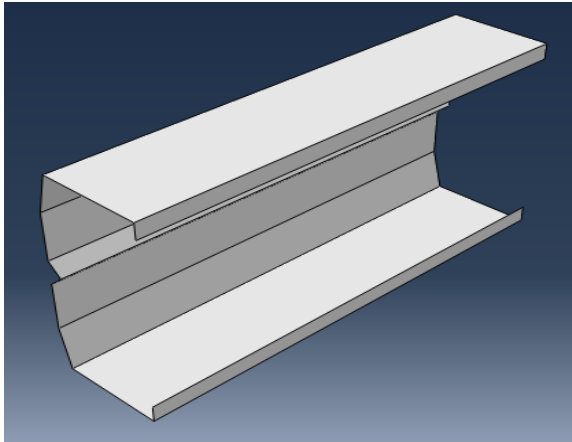| SECTION TYPE	h	h1	h2	b	c	d	d1	θ1	θ2	θn1	θn2
	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(mm)	(deg)	(deg)	(deg)	(deg)
A	250	60	30	51.45	110	20	-	103	90	135	135

Fig.2 -Analytical Model in Abaqus

The Fig.2 shows the analytical model of cold formed steel section by using Abaqus. The finite element mesh size 25x25mm is used to get results. Also buckling behavior of the section is identified. Local buckling is occurs which is at flange area. This buckling behavior is shown as follow.
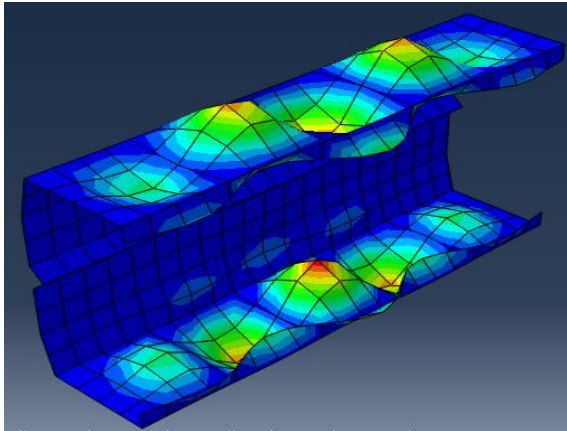

Fig.3 –Buckling Behaviour

1.2 Experimental Work

In experimental work, cold formed steel section is fabricated. For accuracy of the dimension cutting is done using CNC Machine. This fabrication is done by using finalized sectional dimension. After this one end of section is kept fixed and other end of section is kept hinged. The test is taken on Universal testing machine. On UTM compression testing is done by applying uniform load on the section. The load carrying capacity of the section is noted at time of experiment. The local failure is occur majorly on the flange of the section.
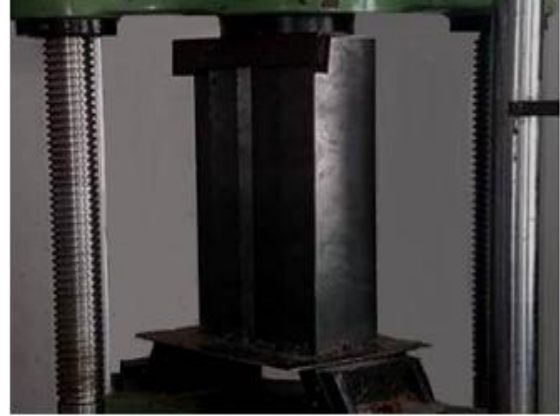

Fig.4 –Test Setup

II.RESULT

The analysis of selected section is carried out by using Abaqus and experimental work is done by using UTM. From analysis load carrying capacity of section in compression is 192KN and from experimental work load carrying capacity is 184KN given out. These results are for section height 0.5m and thickness 1.6 mm. The results for both analytical and experimental work shown as follow.

Table No.2

Results of effective section		
Height of Section(m)	Analytical(KN)	Experimental(KN)
0.5	192	184

III.CONCLUSION

The experimental and analytical work was carried out for selected specimen. Experimental and analytical results are near about same. A finite analysis result shows good correlations with experimental results of the selected section.

1. The failure is occurs on flange of section.
2. The Buckling is occurring at low stress due to the compression action.
3. The selected section is easy to fabricate.
4. Standard deviation is 3.7% from the analytical and experimental result.

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