STUDY OF BENDING AND SHEAR ON HOT ROLLED SECTION (HRS) AND COLD FORMED SECTION (CFS) USING ANSYS.16 AND STAAD.Pro

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ABSTRACT

The steel construction is one of the most growing industry in construction sector. Light weight and economical steel construction is the most important thing in this sector. Hot rolled sections are heavier than Cold formed sections as their thickness is more. This technique in construction reduces 25 to 28 % of total weight of structure with no compromise in the strength and durability. In this research the effect of bending stresses and shear on both hot rolled and cold formed section is studied with stiffeners and without stiffeners. Using clauses and provisions in IS 801-1975 the capacity of cold formed sections is carried out for flexure and then the member is studied in ANSYS and STAAD.Pro software. The purpose of research is to compare hot rolled section with cold formed section using software under combined effect of bending and shear.

Keywords : *Cold Formed sections, Hot Rolled Sections, Ansys.16, Staad.Pro, Analysis, Comparison, combined bending and shear effects on steel.*

1. INTRODUCTION:

There are different types and uses of steel products such as roof sheeting, girts, purlins, steel columns, steel beams etc. Generally these are made in factories and then assembled on the site in form of prefabricated frames or panels etc. The sections which are used in these processes are cold formed, cold formed sections are nothing but the sections which are formed in a cold state and there is no application of heat involved in this process. These are given title Cold Formed Steel Sections. Sometimes Light Gauge Steel Sections or Cold Rolled Steel Sections are other names used for the same. Thickness of these steel plates generally ranges from 1 mm to 3 mm and can be further increased up to 8mm by pre-galvanised method.. The hot rolled sections and cold formed sections are differentiated by process of making . The yield strength of these sections ranges from 230N/mm2 to 280N/mm2. In this research channel section is used to view behaviour of Cold formed section using stiffeners and without stiffeners. Using clauses and provisions in IS 801-1975 the capacity of cold formed sections is carried out for flexure and then the member is studied in ANSYS and STAAD.Pro software. Following procedure is adopted for project work:

- ❖ Analyzed the members using the Staad.Pro and Ansys FE software.
- ❖ Studied the failure pattern of the member in shear and bending.
- ❖ The results were compared to the experimental work carried out.

1.1 OBJECTIVES:

1) To compare HRS member and CFS member under normal and shear stress in FE software.
2) To compare HRS member and CFS member under deformation in FE software.
3) To analyze HRS member and CFS member in Ansys & StaadPro software.

2 MATERIAL AND METHODS :

A ISMB 250 which is a hot rolled section is tested under two point loading under Universal Testing Machine. The same is later checked on ANSYS.

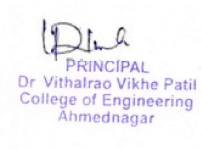

Figure1 Loading under UTM Machine

To check the failure of the member there are certainly two criteria defined. One is lower limit and other is upper limit.

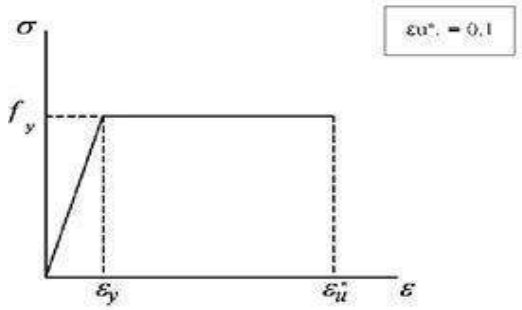

Figure 2 Steel Reinforcement Constitutive Relation

Finite elements mesh:

Different types of elements are used to form the model in the FE software such as steel beam, shear connectors and the pair of contact at the slab-beam interface. The establishment of elements was done separately, but the nodes were one by one coupled on the interface between them. The finite element mesh crated for all elements adopted the same technique and degree of refinement. Figure 3 shows mesh of finite element.

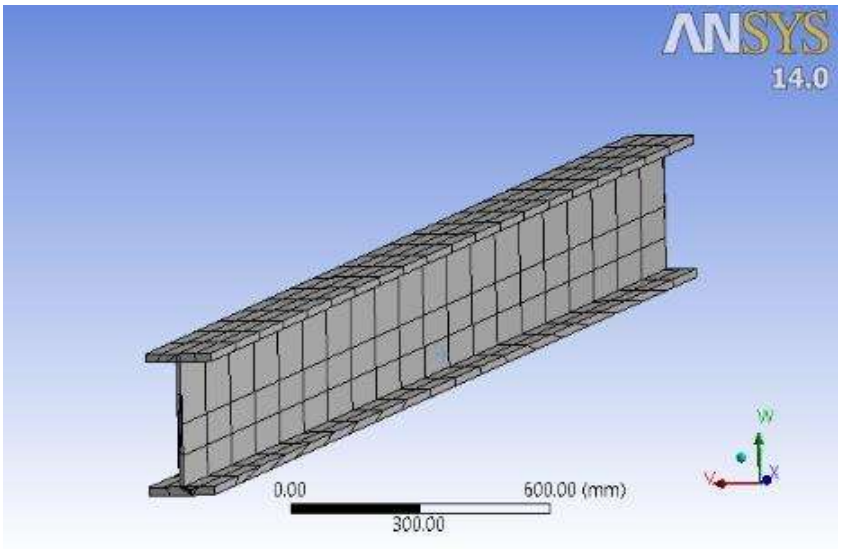

Figure 3 Finite Element Software Model of I section

2.1 Problem Statement

A beam having 2.5m length is analyzed in ANSYS for HRS and CFS.

2.1.1 HOT ROLLED STEEL SECTION

ISHB 300
Section Depth (d) =300mm
Section Width (bf) =250mm
Thickness of bottom flange (tf) =20mm
Thickness of top flange (tf) =20mm
Web thickness (tw) =20mm
Modulus of elasticity (e) =200000 mpa
Density (ρ) =7850 kg / m3
Poisson ratio (μ) =0.3
Pressure (p) =3 kN/m2

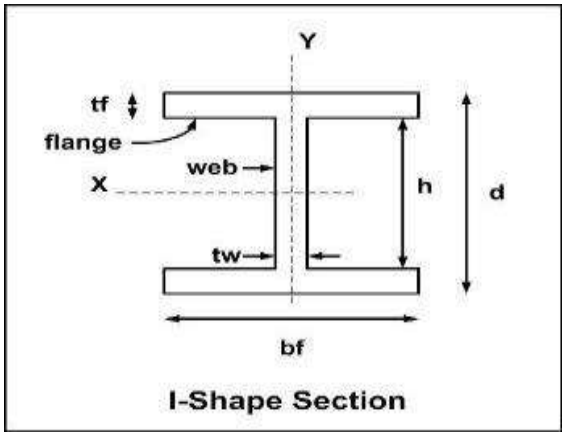

Figure 4 I Shape Section

2.1.2 COLD ROLLED STEEL SECTION

ISHB =300
Section Depth (df) =300mm
Section Width(bf) =250mm
Thickness of bottom flange (tf) =20mm
Thickness of top flange (tf) =20mm
Web thickness (tw) =20mm
Modulus of elasticity (e) =203395.33 mpa
Density (ρ) =7849.05 kg / m3
Poisson ratio (μ) =0.3
Pressure (P) =3 kN/M2

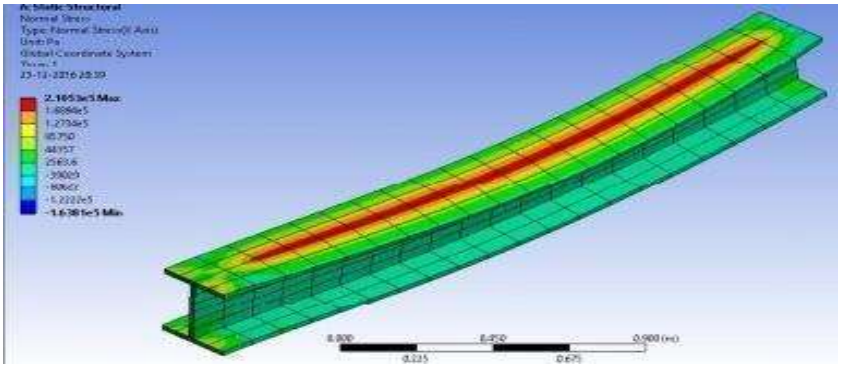

Figure 5 Normal Stresses in X-Y Plane In Hot Rolled Steel

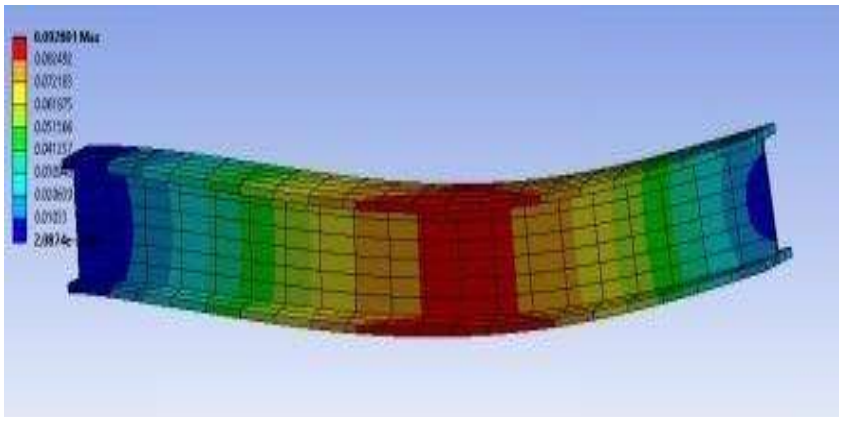

Figure 6 Mode shape No. 5 for deformation 0.19

3. RESULTS AND ANALYSIS

Following results are obtained after analysis in Staad.Pro and Ansys

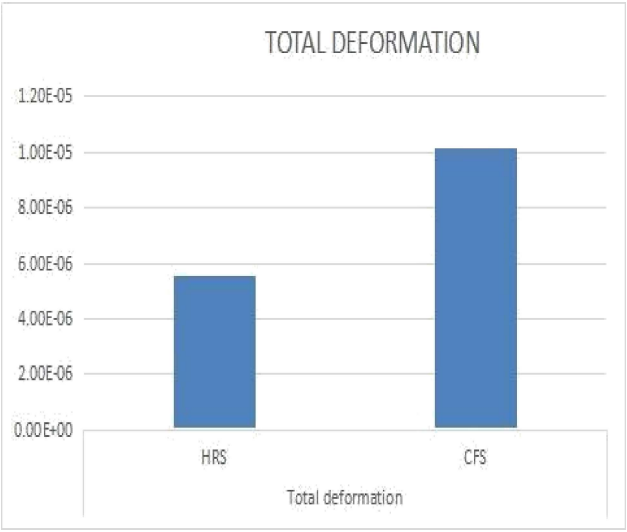

Figure 7 Total Deformation

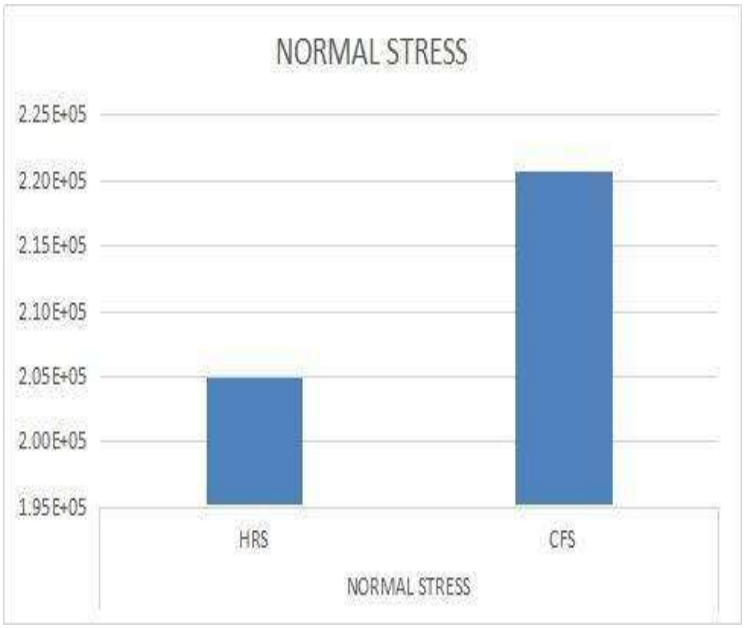

Figure 8 Normal Stress

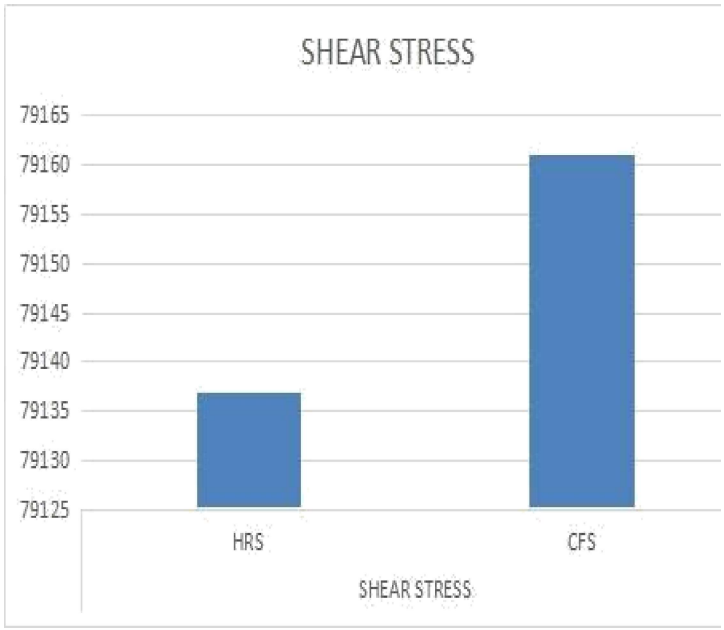

Figure 9 Shear Stress

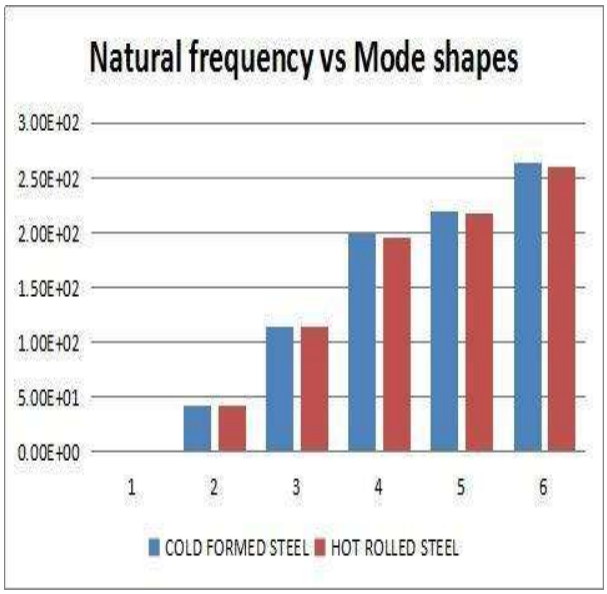

Figure 10 Natural frequency vs. Mode shapes

Table 3.1 Deflection

Load kN	**Deflection in mm**			
	Experimental	**ANSYS**	**Staad.Pro**	**Analytical**
0	0	0	0	0
18	0.48	0.5	0.48	0.45
20	0.67	0.73	0.7	0.69
25	0.8	1.05	1	0.95
30	0.9	1.3	1.2	1.15
40	1.1	1.4	1.2	1.2
50	1.3	1.6	1.5	1.45
60	1.39	1.7	1.7	1.7
70	1.6	1.72	1.7	1.71
80	1.68	1.8	1.9	1.79
100	2.1	2.5	2.5	2.49

4. CONCLUSIONS

In this research under combined bending and shear on Hot Rolled Section and Cold Formed Section, results obtained are as following:

- Total Deformation obtained in Cold Formed Steel Section is 15-20% more than that of the Hot Rolled Steel Section.
- Similar Time Period and Natural Frequency is observed in both the sections. There are no drastic changes in the same.
- Shear stress and Normal stress observed in Cold Formed Steel Section is more than that of the Hot Rolled Steel Section. So stiffeners and bracing are required in Cold Formed Section to control deformation and stresses.

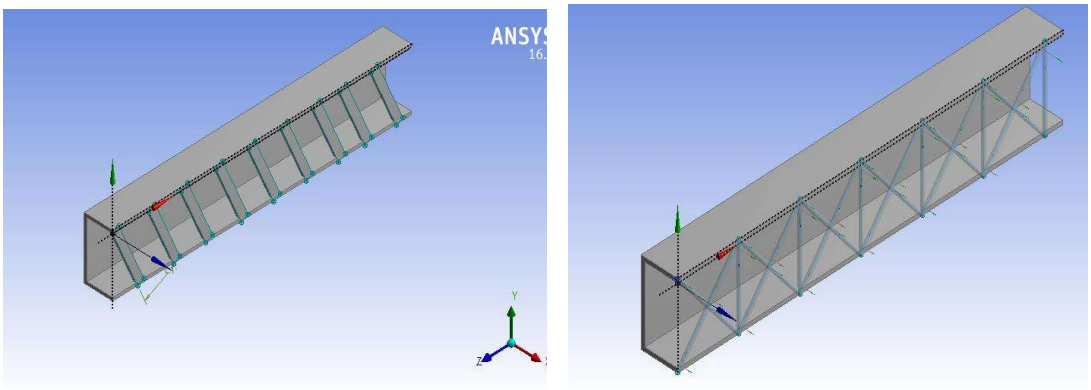

Figure 11 Diagonal and Cross Bracing

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