DESIGN OF SECONDARY MEMBER OF AN INDUSTRIAL SHED BY USING CRFS AND HRFS

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Abstract : Design of individual primary member HRFS and secondary member CRFS of an industrial shed which is located in Vashi Maharashtra,India. The project study deals with the design, analysis and testing as well as comparison between respective members carried out with the help of manual calculation (conventional method) .

A different property of CRFS and HRFS is found out with the help of excel program for the cost comparison. In the testing part, the flexure test will be carried out on the beam (3 point bending test).

The industrial shed consist of different sections such as T section, C section, Z section with lip, Deck sheet, Box section, to find out the different properties for different cross sectional area of these sections. So as to make wide use of CRFS in steel structure.

Index Terms - : Case study of CRFS

I. INTRODUCTION

Cold- formed steel (CFS) is the common term for products made by rolling or pressing steel into semi-finished or finished goods at relatively low temperatures (cold working). Cold-formed steel goods are created by the working of steel billet, bar, or sheet using stamping, rolling (including roll forming), or presses to deform it into a usable product. Cold-worked steel products, such as cold-rolled steel (CRS) bar stock and sheet, are commonly used in all areas of manufacturing of durable goods, such as appliances or automobiles, but the phrase cold formed steel is most prevalently used to describe construction materials. The use of cold-formed steel construction materials has become more and more popular since its initial introduction of codified standards in 1946. In the construction industry both structural and non-structural elements are created from thin gauges of sheet steel.

Cold-formed steel members have been used in buildings, bridges, storage racks, grain bins, car bodies, railway coaches, highway products, transmission towers, transmission poles, drainage facilities, firearms, various types of equipment and others. These types of sections are cold-formed from steel sheet, strip, plate, or flat bar in roll forming machines, by press brake (machine press) or bending operations. The material thicknesses for such thin-walled steel members usually range from 0.0147 in. (0.373 mm) to about 1/4 in. (6.35 mm). Steel plates and bars as thick as 1 in. (25.4 mm) can also be cold-formed

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RESEARCH METHODOLOGY

General:

The design of an industrial shed using cold formed steel section is done. Different methods or following steps as per design standards. Planning and designing is generally adopted by using following methodology.

1. Design of Industrial Shed.

Design of shed i.e primary and secondary member of that shed. Design secondary member (purlin) by using CRFS as well as HRFS. As per IS 800-2008, the industrial shed is designed and the analysis will be done .

2. Estimation of cost of Industrial Shed.

Estimation of cost of the designed shed by using Excel Program taking the current market values

3. Cost comparison between secondary member CRFS & HRFS .

Comparing cost of secondary members and determine which is cost effective.

4. Testing

Flexure test is carried out on Channel section and Z section with lip with four point and two point loading respectively

Channel section

Z section with lip

K.J. College Of Engineering & Management Research

Sr.No.25 & 27,Pisoli Near Bopdeo Ghat Tal-Haveli Dist- Pune

Compression Test Report

Machine Model	: TUE-C-1200	Test File Name	: CRFS_Z_2019.Utm
Machine Serial No	: 2012 / 03	Date	: 08/04/2019
Customer Name	: K.J College of Engineering	Customer Address	: Sr.No.25 & 27, Near Bopdev ghat
Lot no	: 2	Test Type	: Compression
Work Order No.	: 1	Heat Number	:

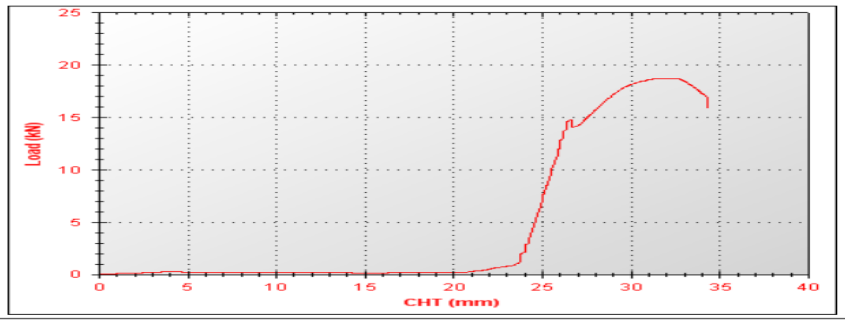
Input Data

Specimen Shape	: Solid Square	
SpecimenType	: Mild Steel	
Specimen Description	:	
Specimen Width	: 70	mm
Specimen Thickness	: 3	mm
Pre Load Value	: 0	kN
Max. Load	: 1200	kN
Max. Elongation	: 300	mm
Specimen Cross Section Area	: 210	mm2

Output Data

Load at Peak	: 18.710	kN
Elongation at Peak	: 32.490	mm
Compression Strength	: 89.095	N/mm2

Load Vs. Elongation



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K.J. College Of Engineering & Management Research

Sr.No.25 & 27,Pisoli Near Bopdeo Ghat Tal-Haveli Dist- Pune

Compression Test Report

Machine Model	: TUE-C-1200	Test File Name	: CRFS_C_2019.Utm
Machine Serial No	: 2012 / 03	Date	: 08/04/2019
Customer Name	: K.J College of Engineering	Customer Address	: Sr.No.25 & 27, Near Bopdev ghat
Lot no	: 2	Test Type	: Compression
Work Order No.	: 1	Heat Number	:

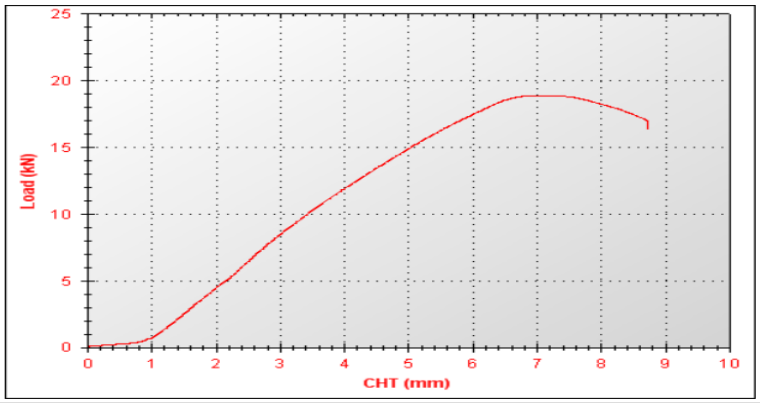
Input Data

Specimen Shape	: Solid Square	
SpecimenType	: Mild Steel	
Specimen Description	:	
Specimen Width	: 80	mm
Specimen Thickness	: 2	mm
Pre Load Value	: 0	kN
Max. Load	: 1200	kN
Max. Elongation	: 300	mm
Specimen Cross Section Area	: 160	mm2

Output Data

Load at Peak	: 18.840	kN
Elongation at Peak	: 7.290	mm
Compression Strength	: 117.750	N/mm2

Load Vs. Elongation



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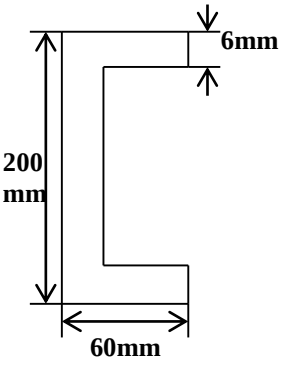
3.4.2.1 Design of purlin by Colled Rolled Formed section



1) Specification:-

Location : Pune
Utility : Industrial Shed
Building Width : 49.09m
Length : 93.72m
Number of frame: 13
Number of panel: 12
Eaves height : 10m
C/C of main frame : 7.810m
Maximum spacing of purlins : 1.45m
Slope of roof : 1: 9.5
Area covered
$\theta = 6^{\circ}$
Ridge height: 3.675m

2) LOADING

Selection of section

Select ISC200x60x6 @ 19.8 kg/m

Summary of design load:

(1) Dead load

Wd_y = 307.15 N/m

Wd_z= 32.28 N/m

(2) Live load

Wl_y = 1081.54 N/m

Wl_z = 113.67 N/m

(3) Wind load

Ww_y = -2151.27 N/m

Ww_z=0

Design shear force(V_d)

V_d = 157.45 kN

Design movement

M_d = 61.54 kN.m

Check for shear :

δ = 54.69 mm < 83 mm (L/150) ∴ ok

B) Design of Hot Roll Section

Selection of section

Select ISA 200x150x10 @ 26.7 kg/m

Design shear (γ_d)

γ_d = 435.63 kN

Design moment (M_d)

Md_z = 52.85 kNm

Md_y = 22.59 kN m

Check for shear

= 15.989<196.032 Hence ok

Check for deflection

δ limiting = L/150

= 83mm

δ = 1.47mm < 83 mm ∴ Ok

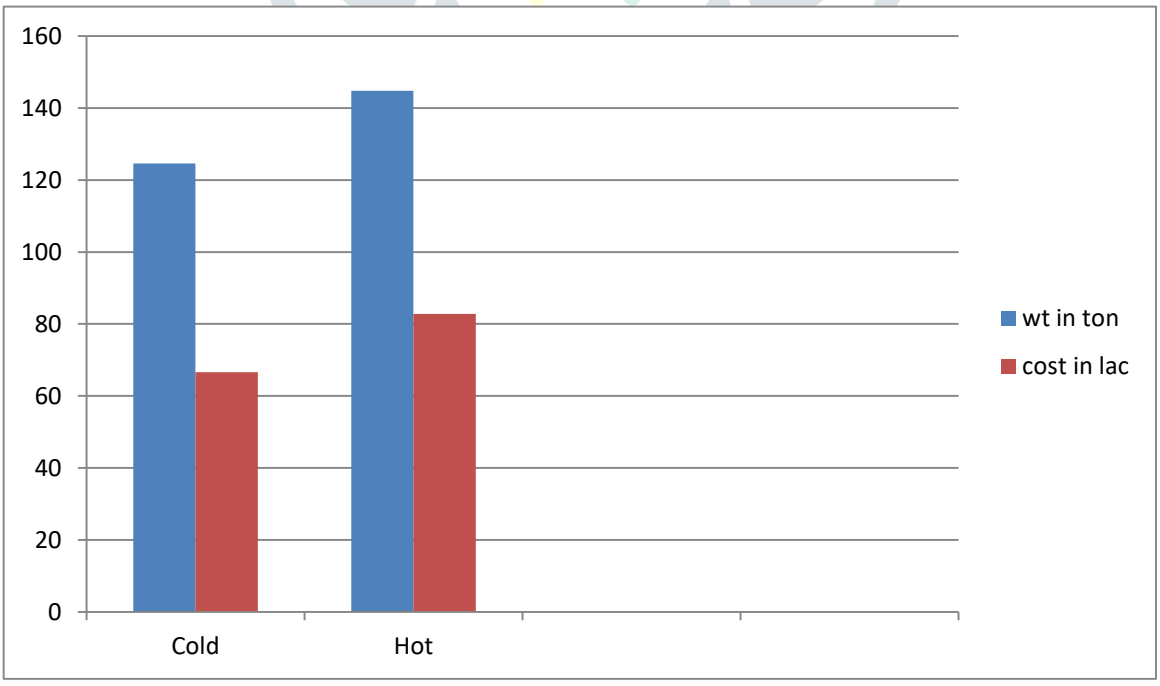
C) ESTIMATION

Sr. No	Description	No.	Shape of Section	Weight Kg/m	Length m	C/S Area	Quantity of steel in kg	Rate	Amount	Remark
1	Purlin 200x60x6	34X11=374	L-SECTION	19.8	7.81	2364	57834.612	53/Kg	3065234.436	CRFS
2	Beam ismb-600	12X2=24	I-SECTION	122.6	11.3	15621	33249.12	53/Kg	1762203.36	HRFS
3	Beam ismb550	12X2=24	I-SECTION	112.5	9.855	13211	26632.15	53/Kg	1411503.95	HRFS
4	Beam ismb-500	12	I-SECTION	77.4	7.448	11074	6917.7	53/Kg	3666.38.1	HRFS
5	Roof sheeting	1	HAT SECTION			168.87 Sqm		300/Sq m	50661	CRFS
							124633.582		6656241	

ECONOMY ANALYSIS

Sr No	Type of Section used	Amount of Steel in kg	Cost
1	Cold roll steel section	124633.582	6656240.846
2	Hot roll steel section	144788.068	8275418.39
	Saving	20154.486	1619177.544
	% Saving	13.91%	19.56= 20%

GRAPHICAL ANALYSIS



RESULT

With the analysis and design of section, it has been observed that by using cold formed steel building instead of hot rolled steel building the material is saved by using cold formed steel was 20156.486 T & cost is saved to 1619177.54lakh. The spacing of c/c main frame is 7.810m

CONCLUSION .

In this paper, we conclude that CRFS is 19.53% economical than HRFS .

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REFERENCES

1) " BEHAVIOUR OF SELF-DRILLING SCREW UPON SINGLE SHEAR LOADING ON COLD,FORMED STEEL"
By Hazlan Abdul Hamid & Mohammad Iqbal Shahm Harsad, Malaysian Journal of Civil Engineering 28(1):59-68 (2016)
2) "BUCKLING ANALYSIS OF COLD FORMED STEEL COMPRESSION MEMBERS AT ELEVATED TEMPERATURES"
byA.A.Patil, J.G. Solanki, International Journal Of Modern Engineering Research (IJMER), ISSN: 2249–6645 ,Vol. 4 , Iss.11 Nov. 2014.
3) "BUCKLING ANALYSIS OF COLD-FORMED STEEL MEMBERS USING CUFSM: CONVENTIONAL AND CONSTRAINED FINITE STRIP METHODS"
by B.W. Schafer and S. Ádány 18th International Specialty Conference on Cold-Formed Steel Structures October 26-27, 2006, Orlando, Florida.
4) "BUILDING DESIGN USING COLD FORMED STEEL SECTION"
by Mr. Roshan S Satpute, Dr. Valsson Varghese, International Refereed Journal of Engineering and Science (IRJES) ISSN 2319-183X, 2319-1821 Volume 1, Issue 2 (October 2012), PP.01-16.