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OPTIMIZATION OF LIGHT GAUGE STEEL SECTION

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Abstract: Ecological, sustainable, and earthquake-resistant steel-framed constructions have been extensively developed in America, Asia, and Europe. Romania now has the opportunity to construct houses, apartments, offices, and storage facilities using the light gauge steel (LGS) framing system. To achieve efficient and cost-effective construction, sustainable development, and meet the requirements of steel-framed construction builders in Romania, there is a need to improve some of the steel's mechanical characteristics. The metallic profile, which is the main component of a steel-framed system, is made by cold roll forming laminated low carbon steel strips that have been galvanized for corrosion protection. Improving the material's hardness and tensile strength is a challenge due to the limitations that follow, including reduced material thickness, low carbon content required for the cold deformation process, estimated profile thermal deformation, and customized profile section to harden. This research focuses on optimizing the induction process (by high frequency current) applied to the LGS material. The advantages and benefits of improving the light gauge steel profile's hardness are highlighted in this article.

Key Words:- light weight, behaviour , analysis, performance, demand.

1. INTRODUCTION

The last decade has seen a special focus in the construction market on environmentally friendly, sustainable, and earthquake-resistant buildings.

The construction industry is responsible for approximately 20% of global emissions, but with aging buildings and a growing population, the need for more buildings is inevitable. Building environmentally friendly structures and prioritizing their longevity can help reduce the environmental impact. The Building and Construction Authority of Singapore notes that the economical light gauge steel frame system is becoming increasingly popular in America, Europe, Australia, and New Zealand. The system involves skeleton constructions made of galvanized steel wall profiles, delivered individually or mounted in walls, floors, ceilings, roofs, etc. The system is designed according to the principle of do-it-yourself dry construction

This article describes the design and primary execution phases of the British Force School (BFS) of NATO in Naples, with a particular focus on the structural aspects. The building was constructed using only cold-formed steel (CFS) profiles in a dry solution, providing high structural efficiency, uniform quality of components, simplicity and speed of assembly, and recyclability of base materials..

Steel framed constructions offer several sustainability advantages. Steel is 100% recyclable, and approximately 80% of the steel used in construction comes from recycling. Additionally, steel is lightweight, which means that there is a reduced need for foundation, and construction can take place on regular or even poor soils.

One significant advantage of lightweight steel framed construction is its high safety in the event of an earthquake. Many studies have been conducted on the seismic behaviour of lightweight structure models, including simulations of structural component deformations with or without considering joints, connection elements, and non-structural components. A significant conclusion from these studies is that even if the most advanced and detailed numerical models can accurately predict test results, there is still work to be done to translate research findings into design practice guidelines..

Materials and Induction Process Experiments:

Thermochemical treatments, such as nitriding and boriding, have been considered and studied to improve the mechanical characteristics of the superficial layer of the LGS profiles. Nitriding involves introducing nitrogen into the steel surface by heating the material in a nitrogen-rich environment, while boriding involves introducing boron into the surface by heating the material in a boron-rich environment. These treatments can significantly increase the hardness and wear resistance of the steel, making it more suitable for high-stress applications such as trusses in earthquake-prone areas. However, the treatment process must be carefully controlled to avoid damaging the thin LGS profile during the treatment..

That is correct. Carburizing is not suitable for light gauge steel profiles because of their low thickness, and the process requires a special enceinte or furnace for the treatment, which may not be feasible or cost-effective for these profiles. Other thermochemical treatments, such as nitriding or carbonitriding, may be more suitable for improving the mechanical properties of light gauge steel profiles.

2. REVIEW OF LITERATURE

We studied various papers to develop our clash detection using computing methods

Name:Ajeet sharma et al. (2016) The torsional strength of lipped and non-lipped channel sections was investigated in an article published in the International Journal of Advanced Research Methodology in Engineering & Technology, Volume 1, Issue 4, December 2017, with ISSN 2456-6446. The study found that increasing the depth and stiffness of the beam improved its strength. However, failure of the entire beam was found to occur due to local buckling of the top flange. Both theoretical and numerical analysis can be used to determine the angle of twisted. Physical properties and fabrication process of back to back channel section to be determined. The graph plotted between load and strain then the buckled section to be monitored from with a help of strain gauge and proving ring.

Name: Jayaram et al. (2015) to be determined the result can explained in It appears that the author of this text is discussing different methods of analyzing the load carrying capacity, moment resistance, and deflection of built-up channel sections. The Working Stress Method was found to have lower load carrying capacity and moment resistance, as well as higher deflection, compared to the Limit State Method and Euro code. However, there were no changes in slenderness ratio and allowable stress across all codal provisions. Based on their observations, the Limit State Method (SI method) was found to be the most effective compared to the other two methods.

3. METHDOLOGY

Study of different shapes of Light Gauge Steel Section conforming to IS 811-1987.

Analysis of failure modes in Light Gauge Steel Section

Design of Light gauge channel section as per IS 801-1975

Optimization of Light Gauge steel section for web buckling and Crippling using STAAD-PRO software

Comparative study of stress distribution of optimized Light Gauge section and section conforming to IS standards

To study the modes of failure of different sections

To analyse the optimized section for its stress distribution and compare it with sections provided by codal provisions as per Indian Standards

OBJECTIVES OF STUDY

To study different types of Light gauge steel sections used in Industrial Structures.

To study the modes of failure of different sections

To analyse the optimized section for its stress distribution and compare it with sections provided by codal provisions as per Indian Standards.

The optimization of Industrial structure by maximum using light gauge steel sections in whole as a structure.

The performance of innovative optimized sections subject to shear and web crippling action must be investigated using the analysis.

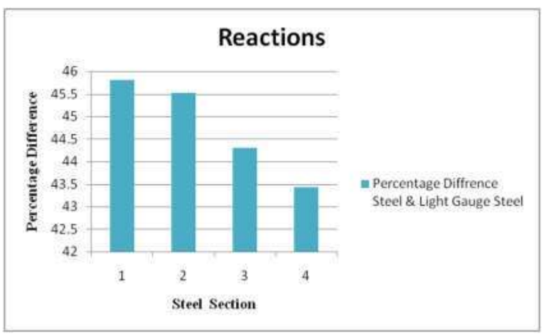
4. RESULTS AND DISCUSSION

4.1 Analytical results of Reaction of Model.

Table No 4.1:Comparison of Beam Force

Sr. No	Sections	Reaction	Percentage Difference Steel & Light Gauge Steel	Percentage Difference between Light Gauge Steel
1	ISMB500	2607.2	-	-
2	40 X20	1788.1	45.80	-
3	40 X40	1791.7	45.51	0.19
4	60 X30	1806.7	44.30	0.83
5	80 X40	1817.8	43.42	0.61

Figure No. 4.1: Percentage Difference Between Stee& Light Gauge Steel



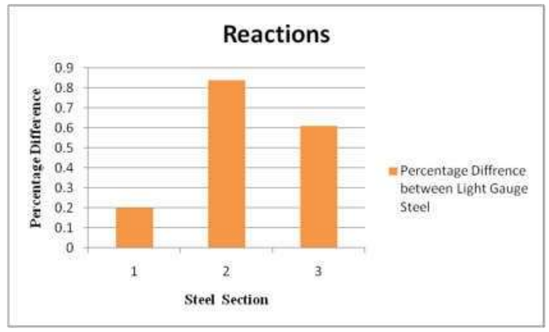


Figure No. 4.2: Percentage Difference Between Light Gauge Steel

4.2 Analytical results for Beam Force

Table No 4.2: Comparison of Reaction

Sr. No	Sections	Beam Force	Percentage Difference Steel & Light Gauge Steel	Percentage Difference between Light Gauge Steel
1	Steel	6518.99	-	-
2	40 X20	4924.50	32.38	-
3	40 X40	4925.86	32.34	0.03
4	60 X30	4998.84	30.41	1.48
5	80 X40	5035.57	29.46	0.73

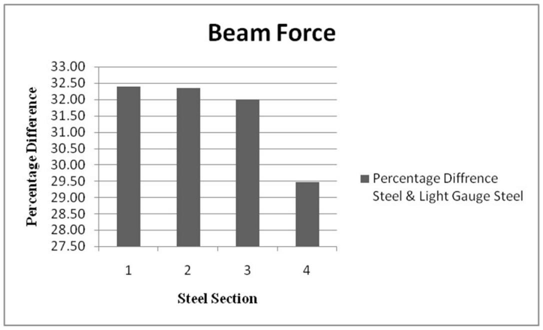


Figure No. 4.3: Percentage Difference Between Steel & Light Gauge Steel

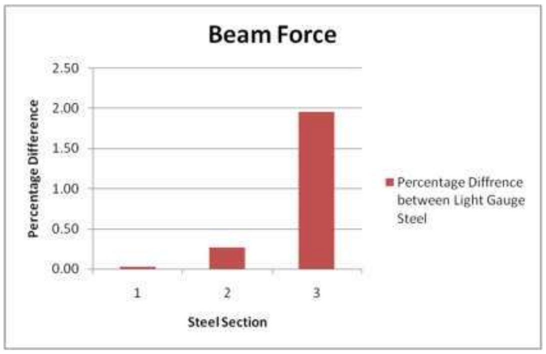


Figure No. 4.4: Percentage Difference Between Light Gauge Steel

4.3 Analytical results for Displacement of models

Table No 4.3:Displacement of Model

Sr. No	Light Gauge Steel Section	Displacement	Percentage Difference Steel & Light Gauge Steel	Percentage Difference between Light Gauge Steel
1	ISMB500	4678.6	-	-
2	40 X20	17950.9	73.93	-
3	40 X40	13320.02	64.87	34.76
4	60 X30	7387.345	36.66	80.30
5	80 X40	5514.762	15.16	33.95

Figure No. 4.5: Percentage Difference Between Steel & Light Gauge Steel

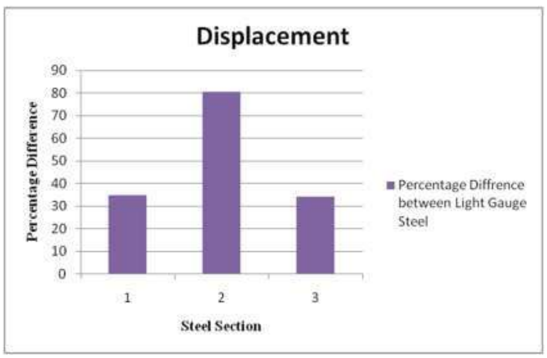


Figure No. 4.6: Percentage Difference Between Light Gauge Steel

4.4 Analytical results for Compression of models

Table No 4.4: Maximum Compression

Sr. No	Steel Section	Maximum Compression	Percentage Difference Steel & Light Gauge Steel	Percentage Difference between Light Gauge Steel
1	ISMB500	444138	-	-
2	40 X20	578148	30.17	-
3	40 X40	160436	49.07	72.25
4	60 X30	157952	63.87	39.79
5	80 X40	96598	64.43	38.84

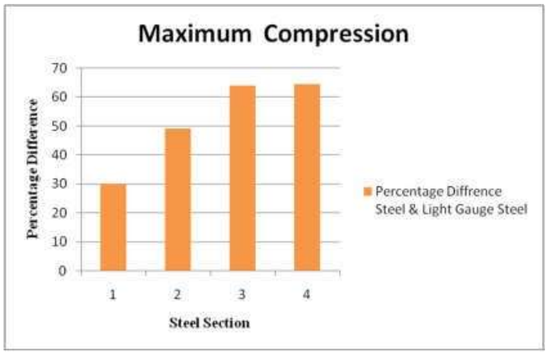


Figure No. 4.7: Percentage Difference Between Steel& Light Gauge Steel

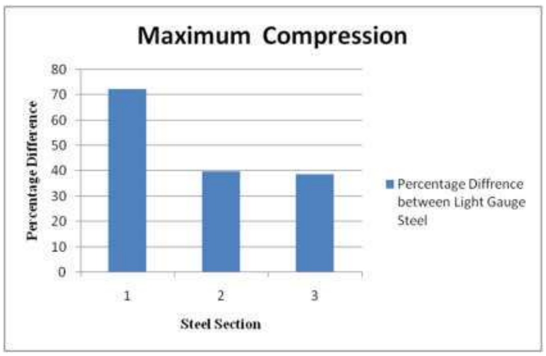


Figure No. 4.8: Percentage Difference Between Light Gauge Steel

REFERENCES

1]Ajeet Sharma, Senthil Selvan S(2016),"Experimental study on thetorsional behaviour of cold−formed steel channel section connected backto back", International Conference on Engineering Innovat ions and Solutions.

[2] Jayaram A, Athibaranan S and Mohanraj A (2014)"Behavior and Designof Light gauge Cold Formed Steel Flexural Members (Comparison ofChannel and Built up Channel Section)", ISSN 2319 - 8885 Vol.03,Issue.19.

[3] Kulkarni R B, Shweta. B. Khidrapure (2014), "Parametric study andcomparison of Indian standard code with British standard code for thedesign of light gauge cold formed flexural members", IJETR, ISSN:2321-0869, 29(11).

[4] Kakade S A, Bhandarkar B A, Sonar S K , Samare A D (2014), " Studyof various design methods for cold – formed light gauge steel sectionsfor compresive strength" International Journal of Research inEngineering and Technology, eISSN: 2319-1163 | pISSN: 2321-7308.NCETCE.,

[5] Vinayak N. Kaling, Sadanand M. Patil, Vinod I. Hosur (2015), " Study
IJSRD, Vol. 3(4), ISSN (online): 2321-0613

[6] Tatiana Nazmeeva, "Methodology of experimental research of cold-
10.7250/iscconstrs.2014.18.

[7] Hancock G J (2016), "Cold-formed steel structures: Research review2013–2014", Advances in Structural Engineering 2016, Vol.19(3),pp.393–408.

[8] Prakash M. Mohite, Aakash C. Karoo (2015),"Buckling analysis of cold
Publications, ISSN 2250-3153,Vol.5(5).

[9] Ashish Timande, Awachat P N (2015), "Comparative Analysis of Cold Form Steel and Hot Rolled steel Structure for Static Shed Type Steel

[10] Anthony Ariyanayagam, Mahen Mahendran (2016) "Numerical Modelling of Load Bearing Light Gauge Steel Frame Wall Systems Exposed toRealistic Design Fires", Article in Thin-Walled Structures.

[11] Desai P P , Shiyekar M P (2014), "Limit Strength Prediction of Light Gauge Steel I Section by Finite Element Method", P. P. Desai Int.Journal of Engineering Research and Applications ISSN : 2248-9622,Vol. 4(7), pp.111-114.

[12] Shanmuga Priya M (2014) , "Performance of In-Filled Cold Formed
Mathematical Sciences and Engineering.

[13] Alia O. M. Ahmed, Nigel D. P. Barltrop (2017), "Seismic Response Of Lightweight Steel Portal Frame Structures", International Journal of Mechanical And Production Engineering, ISSN: 2320-2092,Vol.5(2).

[14] Sreedhar Kalavagunta, Sivakumar Naganathan and Kamal Nasharuddin Bin Mustapha (2013), "Experimental Study of Axially Compressed Cold
Technology, Print ISSN: 0974-6846, Online ISSN: 0974-5645, Vol.6

[15] Cameron B. RITCHIE, Jeffrey A. PACKER ,Xiao-Ling ZHAO,Amin HEIDARPOUR, Yiyi CHEN (2017), "Dynamic material performance of cold-formed steel hollow sections: a state-of-the-art review", Vol.11(2):209–227 DOI 10.1007/s11709-017-0388-8