

REVIEW OF COMPARISON BETWEEN CONVENTIONAL STEEL AND TUBULAR STEEL SECTION FOR MULTI SPAN INDUSTRIAL SHED WITH TRUSS AND PORTAL FRAME

MananD.Maisuri¹, HiteshK.Dhameliya², Hiten L.Kheni³

¹M.Tech(Structure), ChhotubhaiGopalbhai Patel InstitueOf Technology, mananz.maisuri@gmail.com

²Asst. prof. Civil Department, ChhotubhaiGopalbhai Patel InstitueOf Technology, hitesh.dhameliya@utu.ac.in

³Asst. prof. Civil Department, ChhotubhaiGopalbhai Patel InstitueOf Technology, hiten.kheni@utu.ac.in

Abstract—Most of the steel structures are built with different steel sections. As far as innovations in steel sections rather conventional sections there are Square Hollow Section (SHS), Rectangular Hollow Section (RHS), and Tubular Sections are available. An attempt has been made here to identify difference in weight between conventional steel sections and tubular steel sections for design of multi span industrial shed. An attempt has been made to design and analyze multi span industrial shed with truss and portal frame and all checks for both of the sections is made with draft code IS 800:2007 and IS 806 for limit state design of given problem with conventional and tubular steel sections respectively. Manually analyzed data is checked by structural software STAAD PRO V8i. The result obtained by the both types of sections is tabulated in form of consumption of steel for truss and portal frame.

Keywords- Truss, portal frame, conventional steel section, hollow steel section

I. INTRODUCTION

Industrial buildings are low rise steel structures, housing, workshops or industries are characterized by their low height and absence of interior walls and partitions. Any building structure used by the industry to store raw materials or for manufacturing products of the industry is known as an industrial building. There are two types of an industrial building normal type and special type. To cover and protect area of industrial building truss and portal frame is used. As per the configuration requirement of an industrial building the suitable type of truss and portal frame is used. There are three types of truss pitched roof truss, parallel chord truss and trapezoidal truss. Truss and portal frame are designed for dead load, live load, wind load and their combinations as given in their respective Indian Standards. An economy of any industrial building is based on the configuration of building, type of truss and portal frame used, buildings topographical condition, requirements of building, forces acted on building and selection of steel sections required as per force applied. From above all aspect the steel section selection is more effective in consumption of steel of whole building. There are two types of steel sections conventional steel section (channel, angle, rolled steel etc.) and steel hollow section (square hollow section, rectangular hollow section, circular hollow section). The selection from both above section may change in consumption of steel for same configuration and same load application for both truss and portal frame. Structural steel is easy to maintain, light weight, erected easily by bolting and welding, have high scrape value, alteration is made easily in future and highly ductile material. The disadvantage of structural steel is they require frequent painting and need fire proof treatment which increases cost.

II. LITERATURE REVIEW:

A. TRILOK GUPTA, RAVI K. SHARMA, "ANALYSIS OF INDUSTRIAL SHED USING DIFFERENT DESIGN PHILOSOPHIES" INTERNATIONAL JOURNAL OF RESEARCH IN ADVENT TECHNOLOGY, VOL.1, ISSUE 5, DECEMBER 2013

In this study, comparison of truss of three types of section has been analyzed using conventional working stress method and recently adopted limit state method. The study includes different types of industrial roof trusses by using the software. It also includes the knowledge regarding steel trusses and the design philosophies with worked examples. From the results we can observe that, the sections designed using limit state method are more economical than the sections that are designed by working stress method. It can also be observed that the tube section designed by limit state method is the most economical among the three sections which are used. The limit states provide a checklist of the basic structural requirements for which design calculations may be required. Limit states design, by providing consistent safety and serviceability, ensures an economical use of materials and a wide range of applications.

On the basis of the study author concluded that, Tube section is the most economical of the given three sections. It has the lightest weight amongst the three, when designed for same forces. Also, their aesthetical appearance is good, Angle sections are the most easily available sections as they can be easily fabricated. For same design forces, angle sections are the heaviest sections amongst the three, The weight of the pipe sections is more than the tube section and less than the angle section, when designed for same forces. Their use is not common in use because of the difficulty faced in their connections.

B. M. G. KALYANSHETTI AND G.S MIRAJKAR, "COMPARISON BETWEEN CONVENTIONAL STEEL STRUCTURES AND TUBULAR STEEL STRUCTURES", IJERA, VOL.2, ISSUE 6, NOVEMBER-DECEMBER 2012, PP.1460-1464

This study is regarding the economy, load carrying capacity of all structural members and their corresponding safety measures. Economy is the main objective of this study involving comparison of conventional sectioned structures with tubular sectioned structure for given requirements. For study purpose superstructure-part of an industrial building is considered and comparison is made. Study reveals that, up to 40 to 50% saving in cost is achieved by using tubular sections.

In this paper a case study of Solapur, Maharashtra. Modified Howe truss of span 24m with spacing of roof truss is 5m. No of trusses are 8. The sections are used both conventional and hollow sections. This study is focus to prove economy for choosing optimum steel section for given truss configuration. Only super structure part of the industrial building is analyzed and designed. Further in this study all sections required for the different members of truss is compared between conventional and hollow sections.

On the basis of the study author concluded that tubular sections prove to be economical. Total saving of almost 50 % to 60 % in cost is achieved. Out of circular, square and rectangular shapes, due to connection difficulties of circular tube sections, it is suggested to adopt rectangular or square tube sections. This study is for a given area of 800 sq. and truss of modified Howe type. Effectiveness of Tubular section can be verified for different plan areas for various types of trusses.

C. VAIBHAV B. CHAVAN, VIKAS N. NIMBALKAR AND ABHISHEK P. JAISWAL, "ECONOMIC EVALUATION OF OPEN AND HOLLOW STRUCTURAL SECTIONS IN INDUSTRIAL TRUSSES", ACI STRUCTURAL JOURNAL, MARCH-APRIL 1990

The study aims to evaluate the economic significance of the Hollow Structural Sections (HSS) in contrast with open sections. This study was carried out to determine the percentage economy achieved using Hollow Structural Sections (HSS) so as to understand the importance of cost effectiveness. The technique used in order to achieve the objective included the comparison of different profiles for various combinations of height and material cross-section for given span and loading conditions. The analysis and design phase of the project was performed using STAAD PRO V8i. The sample results of STAAD analysis were validated with the results of Manual analysis.

In this study there are two types of trusses Belegian and another random truss are analyzed and designed by STAAD PRO V8i for span of 15m, 20m, and 25m and height of 12m, 15m, 20m and 25m for open, Square Hollow section and Rectangular Hollow Section. This study is for determined for optimum span length for economy point of view for selection from three types of steel sections mentioned above.

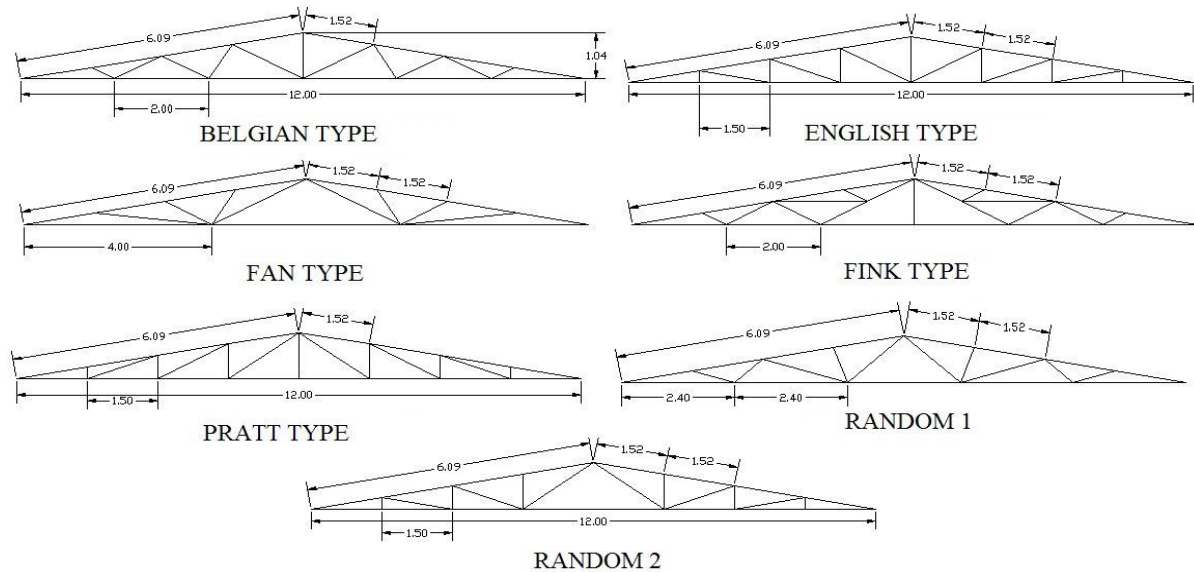


Figure 1: Different types of trusses profile

After comparison of all results obtained from all analysis of trusses, it is concluded that:

- For Belgian truss profile; the mean economy achieved for Square Hollow Section (SHS) and Rectangular Hollow Section RHS) was 10.57% and -2.08% respectively when compared to Open Section. (NOTE: Negative sign indicates uneconomical section)
- For Random-1 truss profile; the mean economy achieved for SHS and RHS was 17.82% and 4.25% respectively when compared to open section.
- The overall mean economy achieved for SHS was 14.20% with respect to Open section whereas; RHS was 0.33% uneconomical with respect to open section.
- The economy of SHS when compared to open section decreases with increase in span. This ranges from 27.26% to 5.08% for span of 15 to 25m respectively.
- It was observed that Belgian profile was more cost effective when compared to Random- 1.

III. CONCLUSION:

All the above reviews conclude that the consumption of steel of whole industrial building can be reduced by deciding appropriate geometry of truss and by using hollow steel section with compare to conventional steel section. Hollow steel sections can create large reduction of steel required of truss geometry as well as for the total geometry of structure if used. It is found that hollow steel sections saves 50% to 60% from total cost of building as per geometry of truss is used. Truss can be designed by hollow sections for the sustainable development of whole industrial building. For analysis of truss STAAD PRO V8i software is available in market to check the data of analysis which was done manually.

IV. REFERENCES:

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